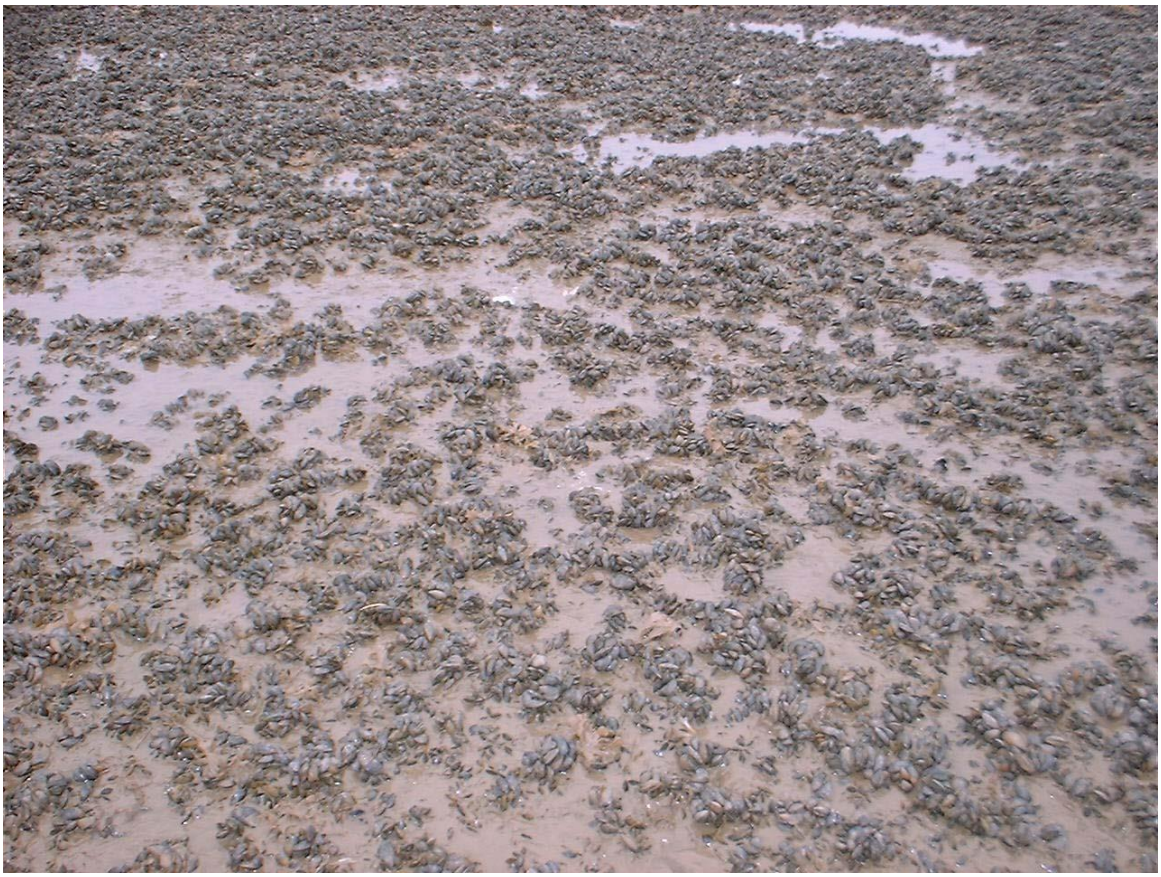
Eastern IFCA
Inshore Fisheries and Conservation Authority

The Wash Several Order (2022)

Management Plan



Contact Information:
Eastern Inshore Fisheries and Conservation Authority
Unit 6
North Lynn Business Village
Bergen Way
King's Lynn
PE30 2JG

Phone: 01553 775321
Fax: 01553 772031
www.eastern-ifca.gov.uk
mail@eastern-ifca.gov.uk

Version	Date	Changes	Officer
1 (draft)	23/07/2021	First draft	RWJ
2 (draft)	18/08/2021	Initial revisions and additions	LG
4 (draft)	08/09/2021	Draft approved at 45th Eastern IFCA meeting for initial submission to Defra and informal consultation with stakeholders.	LG
5 (draft)	04/01/2022	Additional comments and recommendations	JCS
6 (draft)	16/03/2022	Revisions following Natural England advice	RWJ
6.1 (draft)	21/03/2022	Revisions to include transition period and address comments from informal consultation	LG
7 Final for application submission	01/04/2022	Minor revisions to take into account further Natural England advice	LG
7.1 Final for application submission	05/04/2022	Addition of rationale for Several Fishery application area and other minor revisions	LG
8 Final for Formal Consultation	24/05/2023	Amendments to lay administration as informed by further informal dialogue with lay holders including a 'consolidation process'. Amendment to Order duration. Added 'Fees' section. Removed duplicate appendices and added additional appendix (application form, business plan).	LG

The Wash Several Order (2022)

Management Plan

Contents

Figures

1.0 Summary

Eastern IFCA is applying for a Several Order under the Sea Fisheries (Shellfish) Act 1967. This Order is intended to replace the several fishery aspects of the existing Wash Fishery Order 1992 (WFO) which expired on 3 January 2023.

As a grantee of an Order, the Authority is required to produce a management plan to accompany the application. The objective of this document is to outline the extent of the proposed Wash Several Order (2022) and the management of activity within this defined area.

The Wash Several Order (2022) is intended to come into force as soon as possible, to replace interim management measures which were implemented after the expiry of the WFO. The proposed Order is granted for a period of 20 years. Eastern IFCA will comply with the requirements of the Order and will also seek to ensure that lease holders comply with the same.

The Wash hosts several important Marine Protected Areas (MPAs) and fisheries supporting fleet of circa 55 vessels. Fishing opportunity is however limited to cockles, brown shrimp and to a lesser extent whelks and mussels. Aquaculture in the Wash therefore represents an opportunity to enhance resilience of Wash-based fishing businesses and to reduce the burden and reliance on other Wash based fisheries to further enhance their sustainability.

The Wash has historically supported aquaculture and most recently this has involved use of small, inter-tidal areas (lays) leased to individuals who lay mussel seed and cultivate it to sell on as adult mussel. Aquaculture can, in of itself, benefit Wash fisheries particularly in relation to wild mussel fisheries, which have been in decline in The Wash, as a means of introducing additional spawning stock into The Wash which would in turn to contribute towards wild fisheries.

Under the WFO, Eastern IFCA managed the use of lays to prevent adverse effects on the conservation objectives of the Wash MPAs and wild fisheries. This is achieved through the provisions of the WFO and lease conditions which included, for example fishing gear restrictions, reporting requirements and commitments on lay holders.

However, lays allocated under the WFO had, in recent years, become underutilised. This reflects in part the recent lack of mussel seed (juvenile mussel) from within The Wash itself and the retention of lays by persons who are no longer actively engaged in fishing. Whilst some of the lays are currently supporting active aquaculture operations, many are dormant and have not been used for a significant amount of time. Further, many are now subject to settlement of wild shellfish (cockles) which was not the intended purpose of the lay being issued and which could contribute to the public fishery. Those more active in the aquaculture operations of The Wash have tended to rely on obtaining seed from outside of The Wash. Overall, aquaculture operations have been very informal and lack more detailed planning which would be expected where lease holders were the holders of the Order themselves.

The FMP is informed by dialogue with Natural England and stakeholders (primarily current lay holders). The FMP has been developed which maintains the protective effects of existing measures (to protect will stocks and conservation objectives of the associated MPAs) and to address the shortcomings of lay allocation, which has resulted in less than optimum use of lays, over time. To this end, the plan includes a set of aspirations on how these issues will be addressed and will be actioned in three phases:

- Phase 1 (transition) will consider applications from existing lay holders and implement provisions with the intention of addressing the apparent retention and non-use of lay holdings.
- Phase 2 will seek to provide aquaculture opportunities for additional Wash fishermen.

2.0 Aim and objectives

2.1 Aim

To facilitate aquaculture activity within The Wash which is compatible with the conservation objectives of The Wash MPAs, enhances the sustainability of other Wash fisheries, and supports the economic viability of the associated industry and wider economy by using scientific evidence and a precautionary approach and generally in a manner consistent with Eastern IFCA's legislative obligations. .

2.2 Objectives

The key objectives are as follows:

1. To ensure lays are used effectively and are productive
2. To ensure Aquaculture does not adversely affect the conservation objectives of the Wash MPAs or the wild fisheries in The Wash
3. To provide business continuity for those who rely on aquaculture in The Wash
4. To allocate lays in a way that is fair and equitable whilst recognising the benefit of reducing the reliance on other Wash related fisheries

2.3 Aspirations for phase 2 of the FMP

It is intended that the fisheries management plan will be reviewed during the transitional period (phase 1) with a view to seek additional opportunities for additional lay holders.

The following aspirations and potential measures which will form the basis of the development of measures for phase 2 and will be subject to consultation:

- To prioritise the allocation of lays to persons who are actively fishing within The Wash fisheries (cockle, shrimp, whelk, mussel)
- Require applicants to demonstrate that their operations will in accordance with best practice through submitting a business plan;

- Allocate lays on a fair and equitable basis across those eligible taking into account strength of the application made given that that there is a finite resource which may be over-subscribed;
- Allocate lays only in areas of The Wash which can support such without impacting on site integrity of The Wash MPAs or the sustainability of wild fisheries resources;
- Restrict the allocation of lays to a total area not exceeding the established maximum sustainable within The Wash[1];
- Restrict aquaculture operations using lease conditions to ensure that when returned to the public fishery, the leased areas can support natural habitats and species as would ordinarily occur within The Wash;
- Monitor operations to ensure that they are compliant with lease conditions and other restrictions under the Order and the statutory responsibilities of Eastern IFCA
- Have mechanisms in place to ensure compliance with lease conditions and restrictions including sanctions on Lay holders;
- Review leases issued periodically to ensure that they are used in accordance with the application (the business plan) and reallocate where this is not the case.

2.4 Extent of the Wash Several Order (2022)

The Wash Several Order 2022 (WSO) is intended to include the entire Wash embayment except that area of the embayment covered by the le Strange Estate i.e. the area formerly managed under the Wash Fishery Order 1992 (WFO) and an area of The Wash which was formerly claimed to be part of the le Strange Estate but which, as a result of a High Court judgement[2], was determined to be part of the public fishery in 2018. Figure 1 highlights the extent of the new Order. The approximate area of the Several Order is 62,430 ha (624.3 km^2**).**

The WSO will enable Eastern IFCA to grant (effectively sub-lease) exclusive fishing rights to individuals for the purpose of aquaculture within discrete areas called “lays” to applicants as considered appropriate, in accordance with the FMP. This effectively maintains the status quo with regards to the situation under the WFO.

The WSO area would cover areas of the public fishery and areas which could not support aquaculture at present. It is intended that, as under the WFO, the majority of the Wash embayment would actually be managed as a public fishery, with no right to the shellfish therein granted to fishermen except in relation to the areas the Authority designate as lays. Instead of using a ‘hybrid Order’ (i.e. an Order granting both

[1] The current area of lays leased through the WFO 1992 is 275ha, with a moratorium in place temporarily preventing additional expansion through the creation of new lays. It is intended that the location and extent of lays will be maintained but this will be subject to review of the FMP (i.e. for phase 2 and 3 of the FMP). Prior to consenting proposals for an increase in the total area (275ha) or total number of 49 lays, or new locations of lays, Eastern IFCA will satisfy that doing so will not negatively impact site integrity of the MPAs including by consultation with Natural England and undertaking an associated HRA.

[2] judgement of Mr David Halpern QC sitting as a deputy High Court judge and handed down by the High Court on the 27th July 2018 with the reference John Henry Loose -v- Lynn Shellfish and others: Neutral Citation Number:{2018] EWHC 1959(Ch)

Regulating and Several fisheries to the Authority), the Authority intends[3] to manage the cockle and mussel fisheries within the Wash via a byelaw issued under s.155 of the Marine and Costal Access Act 2009 (c.23). Such byelaws have effect in Several fisheries where they also occur within marine protected areas (as described by s.157 of the Act) and would therefore apply over the area covered by the Several Order. The Wash Cockle and Mussel Byelaw (made by the Authority on 10 March 2021 for this purpose) will prohibit fishing without a permit, much as the WFO prohibited fishing except under a licence. Lays would in effect be operating under an exemption to that byelaw, granted under the Eastern IFCA Application and Exemptions Byelaw[4], on the condition that they operate in accordance with lease conditions issued via the Several Order.

It is considered necessary to include the entire Wash embayment within the application to enable Eastern IFCA to manage which areas will be suitable for aquaculture taking into account the interactions with wild fisheries and the conservation objectives of the Wash MPAs. The Wash embayment is a dynamic area, with channels shifting regularly and accretion elevating the height of beds, making them unsuitable for aquaculture. In addition, wild shellfish settlements and beds shift over time as do the relative importance of areas for over-wintering birds and seals. A similarly dynamic system for managing lays is therefore also required, which would allow such to potentially be relocated, which is possible under the proposed FMP where the Several order covers the entire embayment. Ultimately, the application maintains the situation for managing lays in the Wash as was the

[3] Papers and minutes for Action Item 10 of the 39th Eastern IFCA meeting, 11th March 2020

[4] http://www.eastern-ifca.gov.uk/applications-exemptions-byelaw-2016/

case under the WFO in this sense.

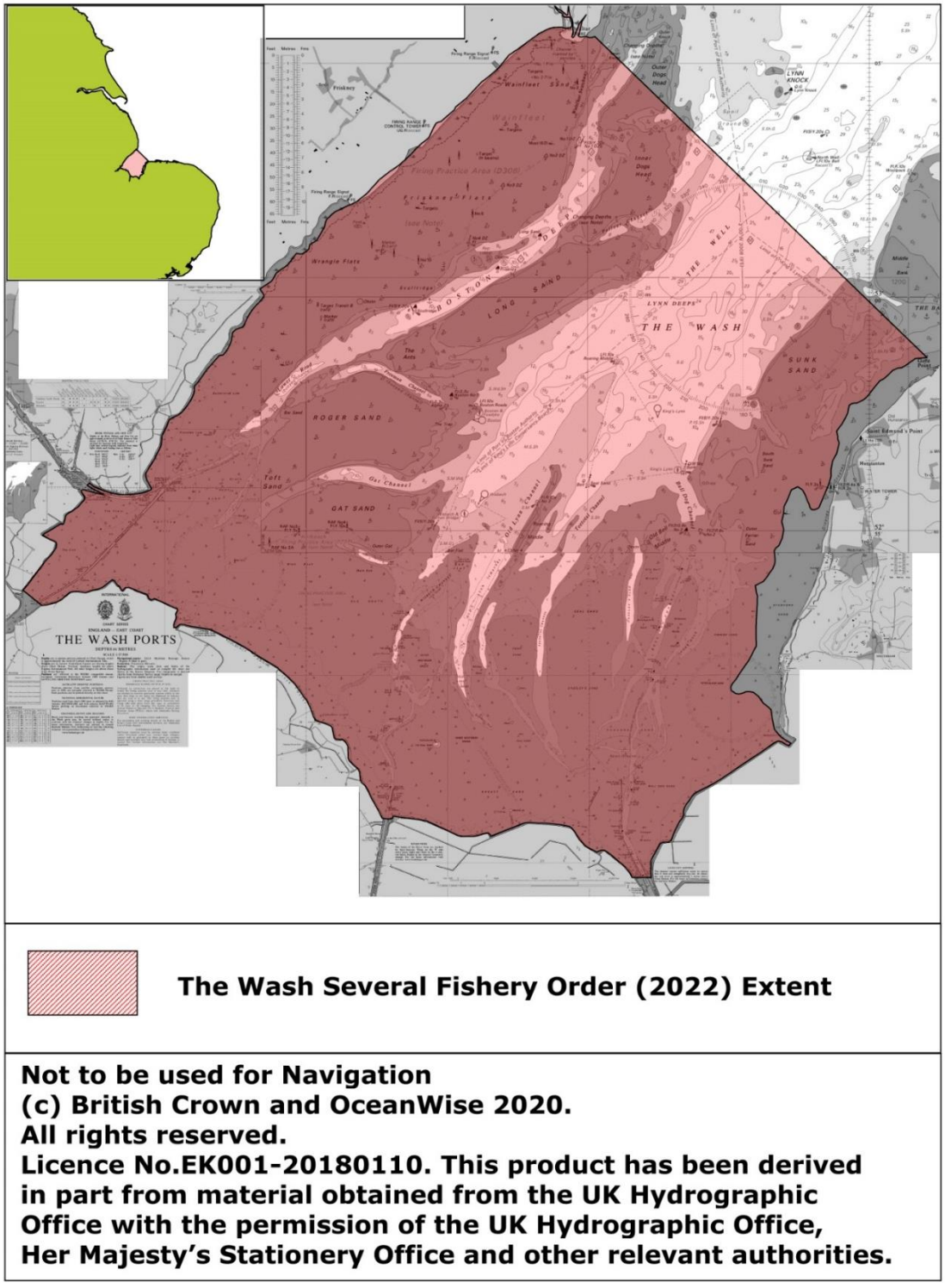


Figure 1 – Chart showing the extent of the Wash Several Order (2022)

2.5 Species covered by the Order

The “prescribed species" (those allowed to be cultivated) included by the Order are:

- Blue mussel, *Mytilus edulis*
- Common Cockle, *Cerastoderma edule*
- Native Oyster, *Ostrea edulis*
- King Scallop, *Pecten maximus*
- Queen Scallop, *Aequipecten opercularis*
- Carpet shell clams, *Tapes rhomboides, Venerupis spp, Ruditapes spp*,

Due to concerns associated with the spread of Invasive Non-Native Species, Pacific oyster, *Magallana gigas*, will not be included as a prescribed species of the Wash Several Order (2022).

For every lay application, Eastern IFCA will consider the appropriateness of the species to be cultivated, including its potential to become established in the area as an invasive, non-native species.

3.0 Background

3.1 The Wash

The Wash is situated on the east coast of England, where it separates Norfolk from Lincolnshire. It is the largest embayment in the UK, covering an area of approximately 667 km², roughly 45% of which is intertidal sand and mudflats, interspersed by small creeks and navigable channels. Most of the embayment is fringed by some of the most extensive salt marshes in the UK, with stretches of sand dunes at the north-west corner (Gibraltar Point) and shingle banks on the eastern edge at Heacham to Snettisham. The deeper, central parts of The Wash, contains extensive subtidal sandbanks that serve as important fish nursery grounds, and biogenic reefs of Ross worm (*Sabellaria spinulosa*).

Four main rivers - the Witham, Welland, Nene and Great Ouse – flow into The Wash, providing a hydrological catchment area of 15,920 km² (Cefas, 2013). While The Wash has a 19 km mouth connecting it to the North Sea, these four rivers provide it with estuarine characteristics and a rich supply of nutrients. These nutrients mean The Wash mudflats are highly productive and rich in invertebrate life, including abundant populations of polychaete worms, small crustacea and bivalve molluscs – most notably the cockle and mussel beds that support commercial fisheries. These invertebrate populations in turn provide a food source for internationally important populations of migratory and resident wildfowl and wading birds that frequent the site. The Wash is also an important site for common seals, *Phoca vitulina*; the edges of the sandbanks and mudflats providing key habitat for breeding and hauling-out.

In addition to its ecological importance, The Wash provides access to commercial shipping using the ports of Boston, Sutton Bridge, Wisbech and King’s Lynn and supports some major fisheries. These include some of the most important cockle (*Cerastoderma edule*), mussel (*Mytilus edulis*) and brown shrimp (*Crangon* spp)

fisheries in the UK and locally important stocks of brown crab (*Cancer pagurus*), lobster (*Homarus gammarus)* and whelks (*Buccinum undatum*).

3.2 The Wash Fisheries

By the 1890s, there were approximately 300 boats and over 800 fishermen targeting the Wash shellfish stocks (pers coms Ron Jessop, Senior Marine Science Officer, Eastern IFCA). Manpower shortages caused by the two world wars caused these fisheries to decline in importance until they began to recover again in the 1960s. In the 1980s, during a period of modernisation, most of the old wooden boats from Boston and King's Lynn were replaced with larger steel vessels, resulting in a modern fleet of circa 55 boats, each capable of efficiently targeting all the local fisheries. Among them, some have been designed with aquaculture specifically in mind, having large holds and through-hull flushing systems to facilitate the bulk relaying of mussel seed.

During the past twenty years, the main fisheries targeted by the boats from King's Lynn and Boston have been for brown shrimp, cockle and mussel, while in the past ten years the whelk fishery has become increasingly important. The deeper parts of The Wash also support important brown crab and lobster fisheries, mainly targeted by boats from Wells-next-the-Sea and Brancaster. Fisheries for pink shrimp (*Pandalus montagui*) and sprat (*Sprattus sprattus*) were both important until the 1990s, but have subsequently declined, mainly due to declining market values and/or quota restrictions.

Until its decline, The Wash supported one of the largest mussel fisheries in the UK. Traditionally, mussels were fished from natural beds, but over-exploitation led to a collapse in stocks that resulted in Eastern Sea Fisheries Joint Committee introducing stringent management measures. The increased protection of natural mussel stocks led to a new emphasis on mussel cultivation, in place of direct harvesting from natural beds.

3.3 Historic importance of aquaculture in The Wash

Barring a few isolated initiatives to cultivate Pacific oysters (*Magallana gigas*) in The Wash, aquaculture has focused on mussels. Mussel cultivation has been carried out in The Wash for at least 100 years. This cultivation entails partially-grown juvenile mussels being deposited directly on to rented areas of the seabed, known as "lays", for growing on to a harvestable size. These lays provide the fishermen with a reserve of mussels that help reduce their reliance on the fluctuations of the wild stocks. Lays situated on the sheltered edges of sandbanks, close to the river mouths, traditionally provided a source of mussels when the weather was too rough to venture as far as the wild beds. The introduction of larger, more sea-worthy vessels in the 1980s enabled boats to venture further afield in rougher weather than had previously been safe to. As a consequence, mussel cultivation on the lays grew in importance. This is because mussels grown on lays are better quality than those from the wild beds. The fishermen's management of the lays also provides a monoculture of uniform size mussels that are easier to process when harvesting. , Since the 1990s, landings of cultivated mussels have greatly exceeded those landed directly from the wild beds which in part reflects the decline of the wild mussel stocks.

Traditionally, lays were stocked with juvenile mussels sourced from the wild intertidal beds. Since the 1990's, however, the increasing demand for mussel seed, coupled with declining wild stocks on the intertidal beds and conservation measures limiting quota, mean the wild beds have not been able to satisfy the several fishery's requirement for seed. Occasionally seed is purchased from other mussel fisheries in the UK, but with the price of mussel seed exceeding £120/tonne, the cost is often prohibitive, or too much of a risk for many fishermen to invest in. Since 2000, fishermen have trialled relaying mussel seed collected from ephemeral sublittoral beds found along the Lincolnshire and Norfolk coasts and from The Wash. Between 2000 and 2012 this proved a relatively cheap source of seed that didn't threaten the sustainability of the wild intertidal beds. At its peak, some years over 10,000 tonnes were relayed from sublittoral beds into the several fishery. However, since then, windfarm construction site exclusion zones and Marine Protected Area conservation measures (for example, areas closed to fishing with bottom towed gear under the Marine protected Areas Byelaw 2018[5]) have restricted fishermen from prospecting for sublittoral beds (using trial dredge tows) in many of the sites where sublittoral beds had previously settled. In the past ten years, the difficulties of identifying new sublittoral beds and the restricted access to the intertidal beds has starved the several fishery of seed, causing landings from it, and the whole mussel fishery in general, to badly decline.

2.4 Wash Fishery Order 1992 Several Fishery

The Wash Fishery Order 1992 (WFO) was a hybrid Regulating and Several Order that grants Eastern IFCA the right of several fishery, and of regulating a fishery for certain (prescribed) molluscan shellfish species (oysters, mussels, cockles, clams, scallops and queens) in The Wash. This allowed Eastern IFCA to manage a public fishery on the natural shellfish stocks (the "Regulated Fishery") through a licensing scheme, and to allow the cultivation of shellfish within The Wash on private, leased areas, collectively referred to as the "Several Fishery".

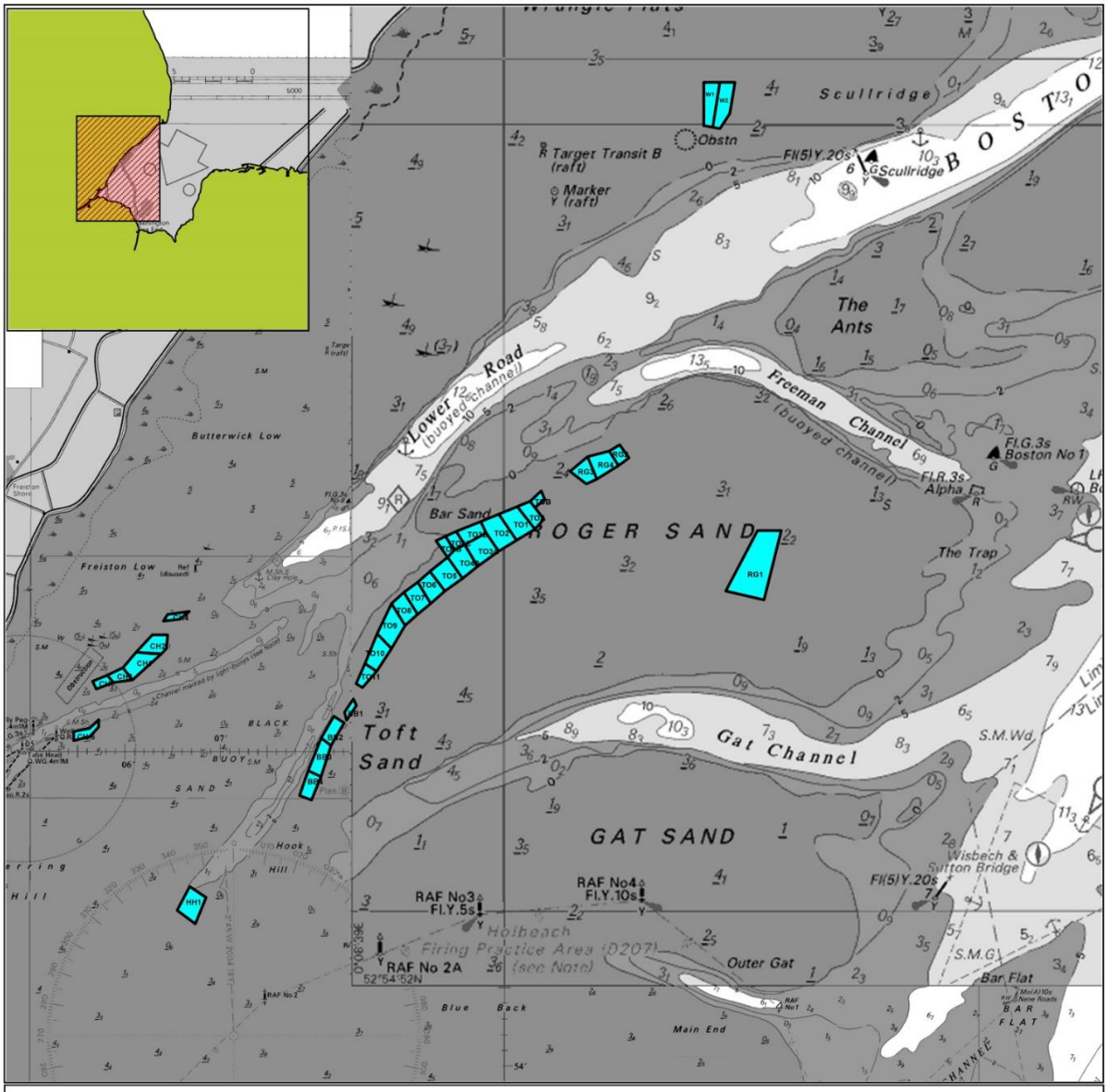
Through the WFO 1992, the Authority sets regulations (for example daily catch restrictions and minimum landing size), which apply only to the Regulated Fishery. The Several Fishery is managed using lease conditions – conditions on which a private lay is provided, and which must be adhered to in order to maintain the right to that lay. Restrictions include technical gear requirements and as well as more administrative conditions.

Following a Review of WFO consents conducted in 2008, Eastern Sea Fisheries Joint Committee agreed to apply a set of additional measures to its management of WFO lays. These relate to the protection of particular biotopes (distinct habitats and their biological communities) on some of the sands; the risk of Pacific oyster invasion across the site; shellfish productivity in The Wash; and data sharing.

Without ministerial consent, the WFO 1992 limited individual lay allocations to 10 hectares. Currently there are 49 WFO leases within the Several Fishery, covering a total of 275 hectares. Figures 2 and 3 show the current extent of these lays. Since

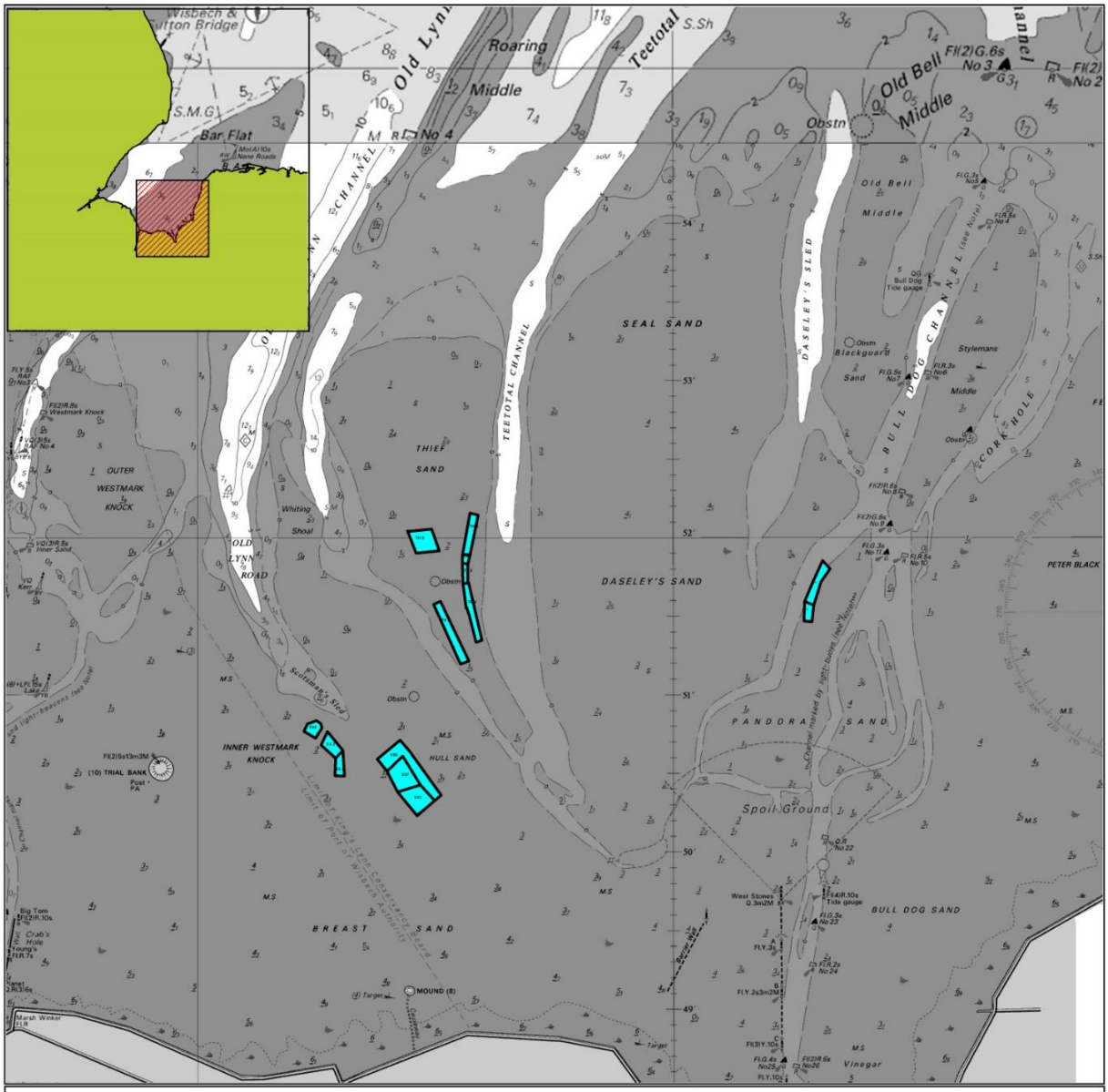
[5] https://www.eastern-ifca.gov.uk/wp-content/uploads/2020/05/2018-MPA-Byelaw-Guidance.pdf

2010 there has been a moratorium on new lays being issued, (the only new lays that have been issued were those for which applications were already being processed at the time of the moratorium's introduction). This extent of lays will be maintained as the maximum which can be issued under this FMP.



Not to be used for Navigation
(c) British Crown and OceanWise 2020.
All rights reserved.
Licence No.EK001-20180110. This product has been derived in part from material obtained from the UK Hydrographic Office with the permission of the UK Hydrographic Office, Her Majesty's Stationery Office and other relevant authorities.

Figure 2 – Chart showing the position of the lay ground leased through the WFO 1992 on the west side of The Wash



Not to be used for Navigation
(c) British Crown and OceanWise 2020.
All rights reserved.
Licence No.EK001-20180110. This product has been derived in part from material obtained from the UK Hydrographic Office with the permission of the UK Hydrographic Office, Her Majesty's Stationery Office and other relevant authorities.

Figure 3 – Chart showing the position of the lay ground leased through the WFO 1992 on the east side of The Wash

3.5 Current methods of aquaculture in The Wash

The majority of aquaculture in The Wash has traditionally been the cultivation of mussels from part-grown seed to harvestable size. Seed mussels, whether sourced from the wild intertidal beds, sublittoral beds or purchased from other UK fisheries, are relayed directly onto the seabed within the leased lays. No structures such as poles, suspended ropes, tables or rafts have historically been used in The Wash for mussel cultivation. Relaying from the wild intertidal beds usually occurs during April and May but can be carried out at any time of the year when sourced from elsewhere. The seed mussel is usually carried loose, or in 1 tonne bags, on the decks of the fishing boats from which it is washed or shovelled overboard while the boat is afloat. Several of the more modern boats now have a “through-hold flushing system” that enables mussels stored in the hold to be pumped directly from the hold into the sea. While discharging the mussel seed, the boat slowly circles so that the seed is scattered across the lay rather than being deposited in heaps. During low water periods following relaying, fishermen will often dry their boats out on their lay to inspect the coverage of seed that has been relayed, ensuring an even distribution by levelling out any heaps and identifying bare areas where further seed can be deposited.

Depending on the size of the seed that was relayed, it can take between one and two years for it to reach harvestable size. During this time fishermen will occasionally inspect their lays to determine how well the mussels are growing, to check the mussels are healthy and to ensure they aren’t being poached by other fishermen.

Fishermen harvest mussels from their lays when they have reached marketable size. Harvesting usually takes place between September and April, with peak activity usually between December and March. The majority of harvesting is conducted during high-water periods using a single or a pair of 1m wide Baird dredges. These dredges have a shallow metal blade along the base of the front opening. As the dredge is pulled forward, the blade cuts through the psuedofaeces (mussel mud) that naturally builds up under cultivated mussels, and scoops the mussels into the cage of the dredge. The presence of the psuedofaeces prevents the blade from penetrating the underlying substratum. When full, the dredge is lifted and emptied on board the fishing boat. The mussels are usually cleaned, riddled and bagged in situ, so any under-sized mussels are returned immediately to the lay. The number and size of dredges permitted for use on the lays is restricted under WFO conditions. However, there is no restriction on how much mussel can be harvested at a time, nor on the size of the mussels that can be landed from lays. Towards the end of the fishing season when the stocks on the lays have become depleted, making dredging for them inefficient, some fishermen will handwork the remaining patches during low water periods. This tends to be a low-level activity, involving 2 or 3 fishermen on any particular lay.

Although the majority of aquaculture under the WFO had been mussel bottom-culture, there has been a very low level of relaying of cockles and of cultivation of Pacific Oysters. The latter has entailed growing the oysters in net bags supported above the seabed on steel-framed tables or trestles. Although Pacific oysters are a non-native species in the UK, it was originally believed that UK waters were too cold for them to breed so farming them was allowed. This proved not to be the case, however, and

naturalised breeding populations have since invaded many areas, including small populations in The Wash. In most UK areas where Pacific oysters are now farmed, the oysters are grown from triploid gametes which have much lower fertility than wild Pacific oysters that have diploid gametes.

4.0 Statutory responsibilities relating to Aquaculture

When considering the management of a Several Fishery, Eastern IFCA has specific legal responsibilities through the Fisheries Act 2020, the Marine and Coastal Access Act (MaCAA) 2009 and the Sea Fisheries (Shellfish) Act 1967. As the Wash Several Order (2022) will overlap with several Marine Protected Areas, the Authority also has responsibilities under the Conservation of Habitats and Species Regulations 2017 (Habitat Regulations) and the Countryside and Rights of Way Act 2000 to ensure the Several Fishery is managed in a manner that does not have a significant adverse impact on the integrity of marine protected areas. In addition, the Aquatic Animal Health (England and Wales) Regulations 2009 and WCA include provisions relating to the spread of disease and invasive non-native species which are relevant to management of aquaculture operations.

4.1 The Fisheries Act 2020

The Fisheries Act 2020 has eight objectives that UK fisheries should aim to achieve. These objectives are:

a) Sustainability – Whereby fisheries management plans should promote fisheries and aquaculture activities that are economically viable and contribute to the economic, social and employment benefits, while remaining environmentally sustainable and not overexploiting marine stocks.
b) Precautionary – A precautionary approach to fisheries management must be applied, whereby populations of harvested species are maintained above biomass levels capable of producing maximum sustainable yield.
c) Ecosystem – Whereby fish and aquaculture activities are managed using an ecosystem-based approach so as to ensure that their negative impacts on marine ecosystems are minimised and, where possible, reversed. This also includes minimising (or where possible, eliminating) incidental catches of sensitive species.
d) Scientific evidence – Whereby the management of fish and aquaculture activities is based on the best available scientific advice. This requires scientific data relevant to the management of fish and aquaculture activities to be collected (and where appropriate shared with other fisheries policy authorities)
e) Bycatch – Whereby the catching of fish that are below minimum conservation reference size, and other bycatch, is avoided or reduced and that catches are recorded and accounted for.
f) Equal Access – Whereby access to a particular fishery is not affected by the location of the fishing boat's home port or connection of the fishing boat, or any of its owners, to any place in the United Kingdom.

g) National benefit – Whereby the planned fishing activities bring social or economic benefits to the United Kingdom.
h) Climate change – Whereby the adverse effect of fish and aquaculture activities on climate change is minimised, and fish and aquaculture activities adapt to climate change.

The various management measures described in this Management Plan seek to further all eight of these objectives.

4.2 The Marine and Coastal Access Act, 2009

IFCAs' main duties and responsibilities are defined in sections (153) and (154) of the Marine and Coastal Access Act (MaCAA) 2009:

(153) Management of inshore fisheries

1. The authority for an IFC district must manage the exploitation of sea fisheries resources in that district.
2. In performing its duty under subsection (1), the authority for an IFC district must—
    a. seek to ensure that the exploitation of sea fisheries resources is carried out in a sustainable way,
    b. seek to balance the social and economic benefits of exploiting the sea fisheries resources of the district with the need to protect the marine environment from, or promote its recovery from, the effects of such exploitation,
    c. take any other steps which in the authority's opinion are necessary or expedient for the purpose of making a contribution to the achievement of sustainable development, and
    d. seek to balance the different needs of persons engaged in the exploitation of sea fisheries resources in the district.

By definition, in sub paragraph (10) of Section (153) "sea fisheries resources" means any animals or plants…that habitually live in the sea, including those that are cultivated in the sea. By definition in sub paragraph (12) of Section (153) any reference to the "exploitation" of sea fisheries resources is a reference to any activity relating to the exploitation of such resources, whether carried out for commercial purposes or otherwise, including…introducing such resources to the sea or cultivating such resources.

IFCAs can apply for the right of a Several Order under the Sea Fisheries (Shellfish) Act 1967 for the establishment, improvement and for the maintenance and regulation of a fishery for shellfish. The Wash Several Order 2022 is an example of this.

4.3 Marine Protected Areas (MPAs)

Eastern IFCA is a Relevant Authority in the management of MPAs designated under the Habitats Directive and the Wild Birds Directive. These European regulations are in place to protect and support wildlife and/or habitats that are of European importance. Eastern IFCA has a statutory responsibility to ensure activities do not damage or disturb to the extent that site integrity is adversely affected. Management should

contribute to furthering the conservation objectives of designated sites, so ensuring the integrity of the site is maintained and the site makes a full contribution to achieving the aims of the Directives. Activities conducted under the new Wash Several Order would need to be managed in accordance with the conservation interests of The Wash and North Norfolk Coast Special Area of Conservation (SAC) and The Wash Special Protection Area (SPA). The interests of other MPAs close to The Wash (including the Greater Wash SPA, Gibraltar Point SPA and North Norfolk Coast SPA)_also need to be considered. .

Eastern IFCA is also a “section 28G authority” under the Wildlife and Countryside Act (WCA) 1981 (as amended). This imposes upon such authorities a duty to “take reasonable steps, consistent with the proper exercise of their functions, to ensure compatibility of activity with the conservation and enhancement of Sites of Special Scientific Interest and to further the conservation and enhancement of the flora, fauna or geological or physical features by reason of which the site is of special scientific interest”. Eastern IFCA, therefore, must consider the conservation and enhancement of The Wash SSSI when managing aquaculture within The Wash, to include any proposals for leased grounds under ‘The Order’.

4.4 Spread of disease and invasive, non-native species

Under the Aquatic Animal Health (England and Wales) Regulations 2009, Eastern IFCA, as the grantee of the Wash Several Order, must apply for authorisation from the Fish Health Inspectorate (the competent authority) in order to operate an ‘aquaculture production businesses.’ Such operations must meet any conditions imposed under that authorisation including keeping accurate records, following good hygiene practice and complying with any surveillance requirements.

The same regulations also require those undertaking aquaculture operation, in the case of the Wash Several Order 2022 being the lay holders, to take steps to report suspicion of a listed disease or increased mortality. Eastern IFCA has responsibility under s.23(3)(d) of the Aquatic Animal Health Regulations to ensure that any reports made to them are provided immediately to the Fish Health Inspectorate.

In addition, the WCA requires that persons must not release into the wild any animals which are not ‘ordinarily resident in and is not a regular visitor to Great Britain in a wild state’ or any animal listed under Schedule 9 of the Act.

5.0 Marine Conservation Designations in The Wash

The ecological importance of The Wash habitats their biological communities and the species they support has been recognised with the area being designated a Site of Special Scientific Interest (SSSI), a Special Area of Conservation (SAC), a Special Protection Area (SPA) and a Ramsar site. Within and surrounding The Wash there are also National Nature Reserves (NRR), Royal Society for the Protection of Birds (RSPB) reserves, and an Area of Outstanding Natural Beauty (AONB) designation.

5.1 The Wash & North Norfolk Coast Special Area of Conservation

Covering a total area of 1,078 km², the Wash and North Norfolk Coast Special Area of Conservation (SAC) encompasses The Wash embayment and the north Norfolk coast as far as Weybourne. It contains extensive intertidal sand and mudflats, subtidal sandbanks, biogenic and geogenic reef, saltmarsh and a unique barrier beach system (Natura, 2000).

The following Annex I habitats are a primary reason for selection of this site under Article 4(4) of the Directive (92/43/EEC) (JNCC website):

- H1110. Sandbanks which are slightly covered by sea water all the time; Subtidal sandbanks
- H1140. Mudflats and sandflats not covered by seawater at low tide; Intertidal mudflats and sandflats
- H1160. Large shallow inlets and bays
- H1170. Reefs
- H1310. Salicornia and other annuals colonising mud and sand; Glasswort and other annuals colonising mud and sand
- H1330. Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
- H1420. Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*); Mediterranean saltmarsh scrub

Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site are:

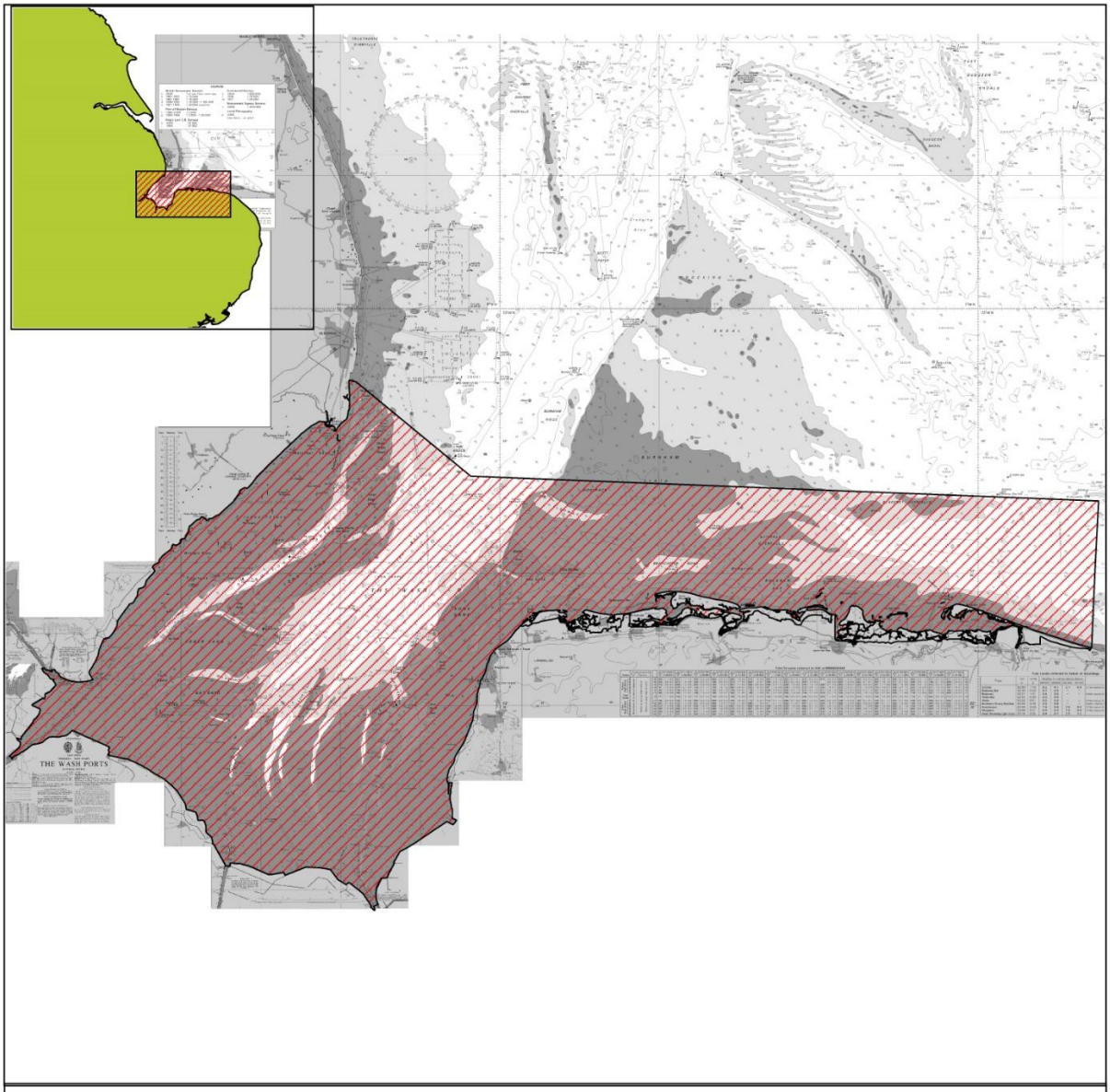
- H1150. Coastal lagoons

Annex II species that are a primary reason for selection of this site:

- S1365 Harbour seal (*Phoca vitulina*)

Annex II species present as a qualifying feature, but not a primary reason for site selection:

- 1355 Otter (*Lutra lutra*)



Not to be used for Navigation
(c) British Crown and OceanWise 2020.
All rights reserved.
Licence No.EK001-20180110. This product has been derived in part from material obtained from the UK Hydrographic Office with the permission of the UK Hydrographic Office, Her Majesty's Stationery Office and other relevant authorities.

Figure 4 – Chart showing the extent of the Wash & North Norfolk Coast SAC

5.2 The Wash Site of Special Scientific Interest

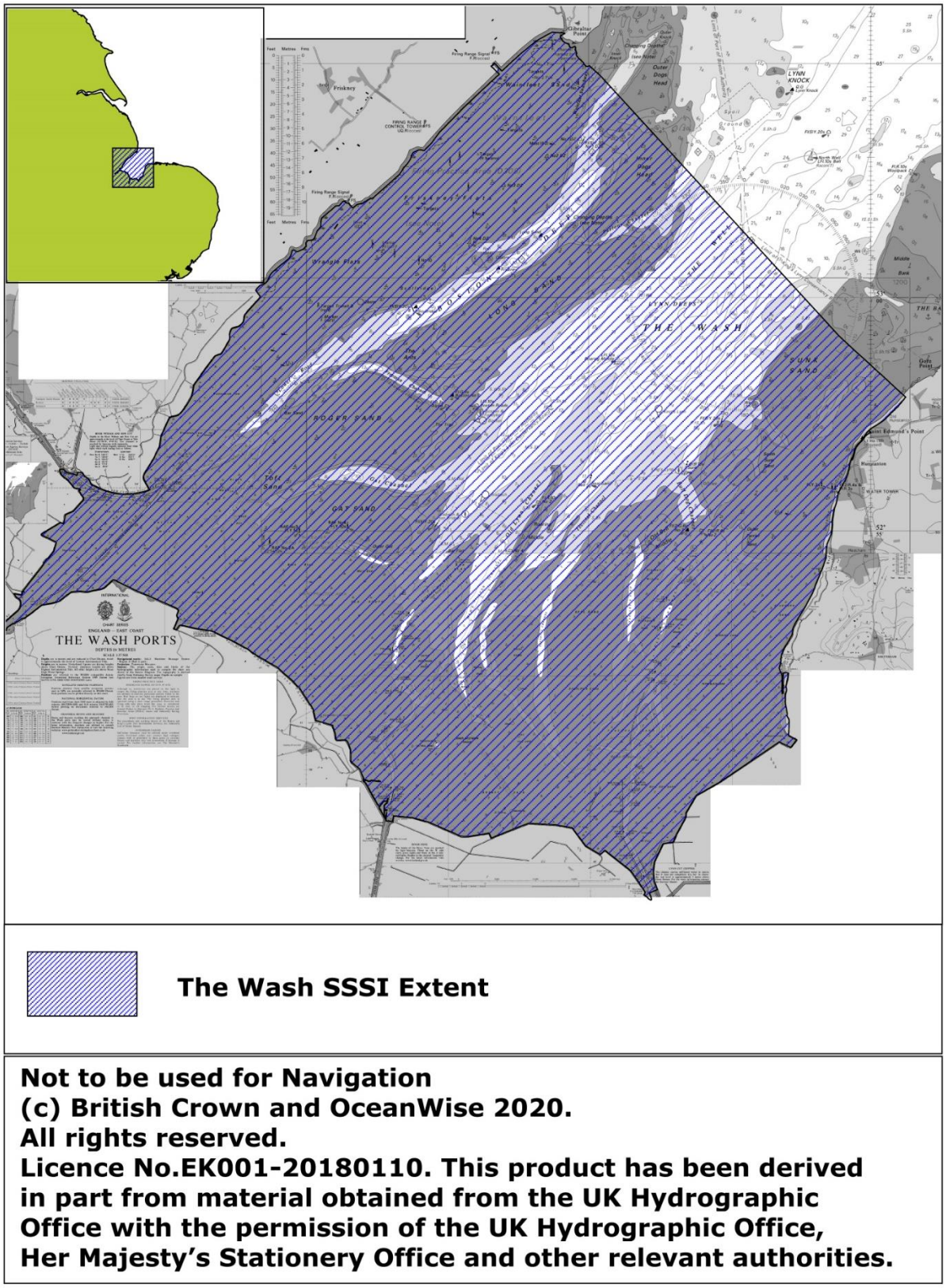


Figure 5 – Chart showing the extent of the Wash SSSI

The whole of The Wash is of exceptional biological interest, for which it has been designated a Special Site of Scientific Interest (SSSI). The SSSI is wholly coincidental with the boundary of The Wash SPA/Ramsar, overlaps in part with the Greater Wash SPA and is wholly contained within The Wash and North Norfolk Coast Special Area of Conservation (SAC) (English Nature, 2005).

The intertidal mudflats and saltmarshes within The Wash represent one of Britain's most important winter-feeding areas for waders and wildfowl outside of the breeding season. Enormous numbers of migrant birds, of international significance, are dependent on the rich supply of invertebrate food found on the intertidal mudflats, while the saltmarshes are important breeding zones. In addition, The Wash is also very important as a breeding ground for Common Seals (Natural England. Reasons for designating the SSSI).

The Wash SSSI has 43 notified features, including:

- 3 species of breeding birds
- 15 species of non-breeding birds
- Common seal (*Phoca vitulina*)
- 4 broad habitats of the designated site
- 21 specific habitats of the designated site

All but one of the above (non- breeding whooper swan) are also designated under one or more of the other European designations (Natural England, 2020).

5.3 The Wash Special Protection Area

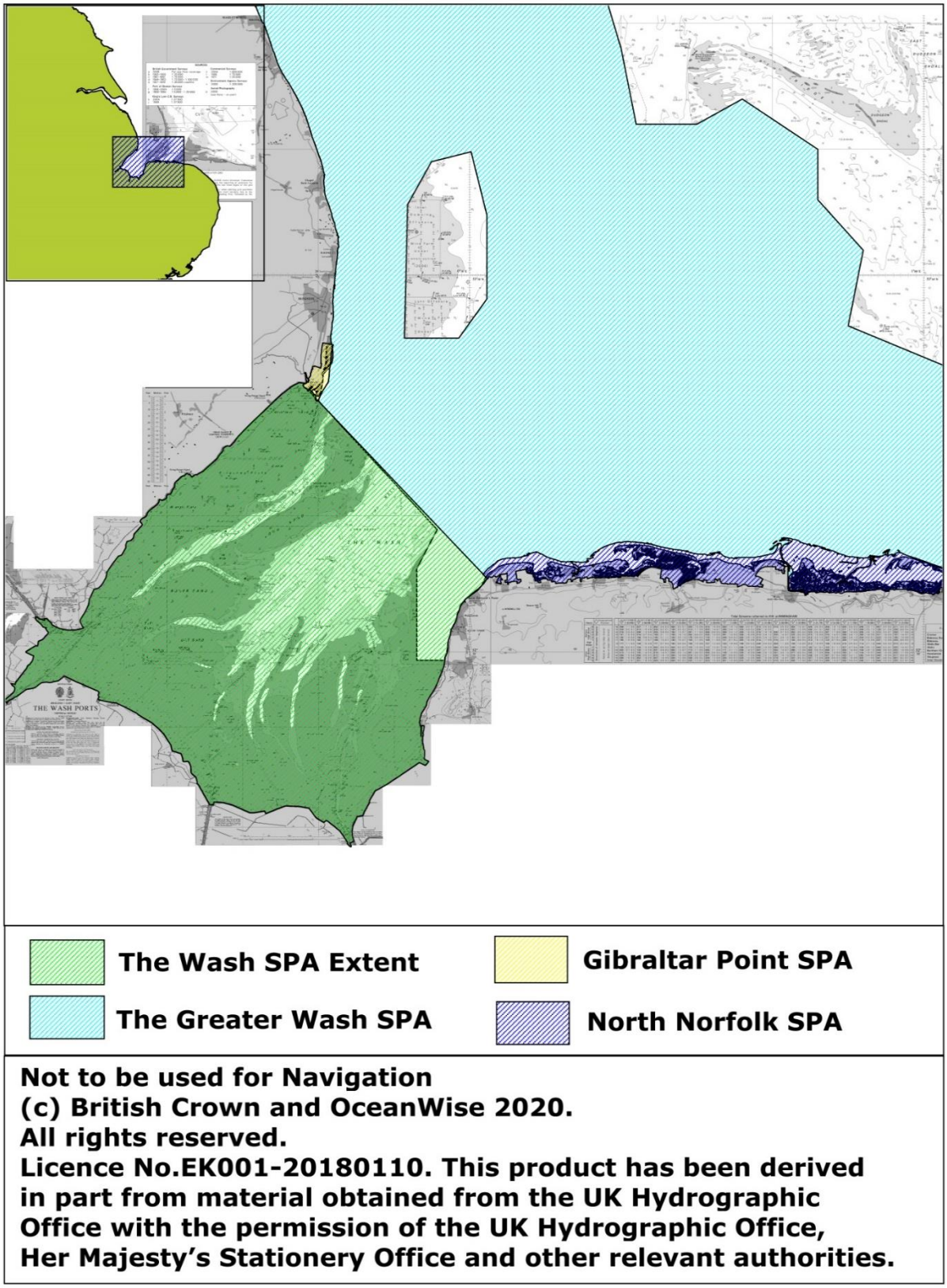


Figure 6 – Chart showing the extent of the SPAs in the proximity of The Wash

The 2014 Wash SPA Citation for EC Directive 79/409 on the conservation of wild birds: Special Protection Area, The Wash (Norfolk & Lincolnshire), describes The Wash as being numerically the most important area in Britain for wintering waterfowl, taking waders and wildfowl together. It is also the most important area in Britain in early autumn for moulting waders and also important to certain wintering passerines, to breeding waders and terns, and to certain seabirds.

The Wash qualifies under Article 4(1) of the Directive 2009/147/EC because it supports:

- 30 breeding pairs of little terns, *Sterna albifrons* (2% of the British population),
- 220 pairs of common terns, *Sterna hirundo* (2%),
- 130 Bewick's swans, *Cygnus cygnus* (3%), in winter.

The Wash qualifies under Article 4(2) as an internationally important wetland by supporting in winter an average of 163,000 waders and also 51,000 wildfowl; and because it supports on average the following internationally important numbers of individual species:

- 17,000 dark bellied brent geese, *Branta bernicla bernicla* (12% of the European wintering population),
- 7,300 pink-footed geese, *Anser brachyrhynchus* (7%),
- 16,000 shelducks, *Tadorna tadorna* (12%)
- 1,700 pintails, *Anas acuta* (2%),
- 24,000 oystercatchers, *Haematopus ostralegus* (3%),
- 5,500 grey plovers, *Pluvialis squatarola* (7%),
- 500 sanderlings, *Calidris alba* (3%),
- 7,500 knots, *Calidris canutus* (21%),
- 29,000 dunlins, *Calidris alpina* (1%),
- 8,200 bar-tailed godwits, *Limosa lapponica* (1%),
- 3,700 curlews, *Numenius arquata* (1%),
- 4,331 redshanks, *Tringa totanus* (5%),
- 980 turnstones, *Arenaria interpres* (2%),

In addition, the site qualifies because of its national importance to other migratory birds. Wintering birds include:

- 3,900 wigeon, *Anas penelope* (2% of the British wintering population),
- 220 goldeneye, *Bucephala clangula* (1%),
- 130 gadwall, *Anas strepera* (3%),
- 830 common scoters, *Melanitta nigra* (2%),
- 260 black-tailed godwits, *Limosa limosa* (6%),
- Several gull species (*Larus*).

The saltmarshes support a diverse breeding bird population, including over 4,000 pairs of black-headed gulls, *Larus ridibundus* (2%), shelducks and numerous wader species. Breeding redshanks occur at exceptionally high densities, and the breeding population of this species is of national importance (The Wash SPA Citation, 2014).

5.4 The Greater Wash Special Protection Area

Covering an area of 3,536 km^2, the Greater Wash SPA is located in the mid-southern North Sea between Bridlington Bay in the north and the Outer Thames Estuary SPA in the south. In the vicinity of The Wash, this SPA's boundary abuts that of The Wash SPA, except where they overlap on the north eastern side of The Wash to encompass the foraging area of Sandwich tern (The Greater Wash SPA Citation, 2018)

The site qualifies under Article 4.1 of the Directive 2009/147/EC by regularly supporting populations of national importance of the Annex I species:

- 1,407 Red-throated diver, *Gavia stellata* (8.3% GB nonbreeding population)
- 1,255 Little gull, *Hydrocoloeus minutus* (No current GB population estimate)
- 3,852 pairs Sandwich tern, *Sterna sandvicensis* (35.0% of GB breeding population)
- 510 breeding pairs Common tern, *Sterna hirundo* (5.1% of GB breeding population)
- 798 pairs Little tern, *Sternula albifrons* (42.0% of GB breeding population)
- 3,449 Common scoter, *Melanitta nigra* (0.6% biogeographic population)

5.5 Gibraltar Point Special Protection Area

Covering an area of 422 hectares, the Gibraltar Point SPA is situated on the Lincolnshire coast, just outside of The Wash SPA.

The site qualifies under Article 4.1 of the Directive 2009/147/EC by regularly supporting a nationally important breeding population of:

- 40 pairs little terns, *Sternula albifrons*.(1.7% of the GB breeding population)(The Gibraltar Point SPA Citation, 1992)

It also qualifies under Article 4(2) by regularly supporting internationally or nationally important wintering populations of the following species of migratory wildfowl:

- 8,800 Bar-tailed godwit, *Limosa lapponica*
- 1,140 Sanderling, *Calidris alba*
- 3,980 Grey plover, *Pluvialis squatarola*

5.6 North Norfolk Coast Special Protection Area

Extending 40km from Holme to Weybourne, the North Norfolk Coast SPA covers an area of 7,887 hectares and is the fourth most important wetland site for waterfowl in Britain. The site includes a variety of coastal habitats including intertidal mudflats and sandflats, coastal waters, saltmarshes, shingle, sand dunes, freshwater grazing marshes and reedbeds.

The intertidal mud and sand flats support high densities of invertebrates, important for breeding avocet and supporting high numbers of wading birds and wildfowl throughout the year. The shallow coastal waters support large populations of small fish, including sand eel and sprat, which provide vital food for the tern populations that breed in the vegetated and unvegetated shingle spits, bars and beaches. The saltmarsh supports

breeding populations of skylark and meadow pipit, which in turn support internationally important breeding populations of marsh harrier *(Circus aeruguinosus)*. Large numbers of waterbirds use the site throughout the year. In summer the site is important for breeding populations of waders and terns, while in winter the site becomes important for large numbers of geese, sea-ducks, other ducks and waders using the site for roosting and feeding.

The site qualifies under Article 4.1 of the Directive 2009/147/EC by regularly supporting breeding populations of national importance of the Annex I species:

- Avocet, *Recurvirostra avosetta*, (30% GB Breeding population)
- Bittern, *Botaurus stellaris*, (10% GB Breeding population)
- Common tern, *Sterna hirundo*, (9% GB Breeding population)
- Little tern, *Sternula albifrons*, (20% GB Breeding population)
- Marsh harrier, *Circus aeruginosus*, (30% GB Breeding population)
- Montagu's harrier, *Circus pygargus*, (0% GB Breeding population)
- Sandwich tern, *Thalasseus sandvicensis*, (12% GB Breeding population)

The site also qualifies under Article 4.2 of the Directive 2009/147/EC by regularly supporting over-wintering populations of:

- Dark-bellied brent goose, *Branta bernicla bernicla*, (7% of GB Non-breeding population)
- Knot, *Calidris canutus*, (2% of GB Non-breeding population)
- Pink-footed goose, *Anser brachyrhynchus*, (6% of GB Non-breeding population)
- Wigeon, *Mareca penelope*, (1% of GB Non-breeding population)

The site also qualifies under Article 4.2 for supporting an internationally important over-wintering assemblage of birds. (NATURA, 2000)

For each of the Special Protection Areas listed above, the European Site Conservation Objectives for classified species are:

“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,
- The distribution of the qualifying features within the site.” (Ref)

5.7 The Wash Ramsar Site

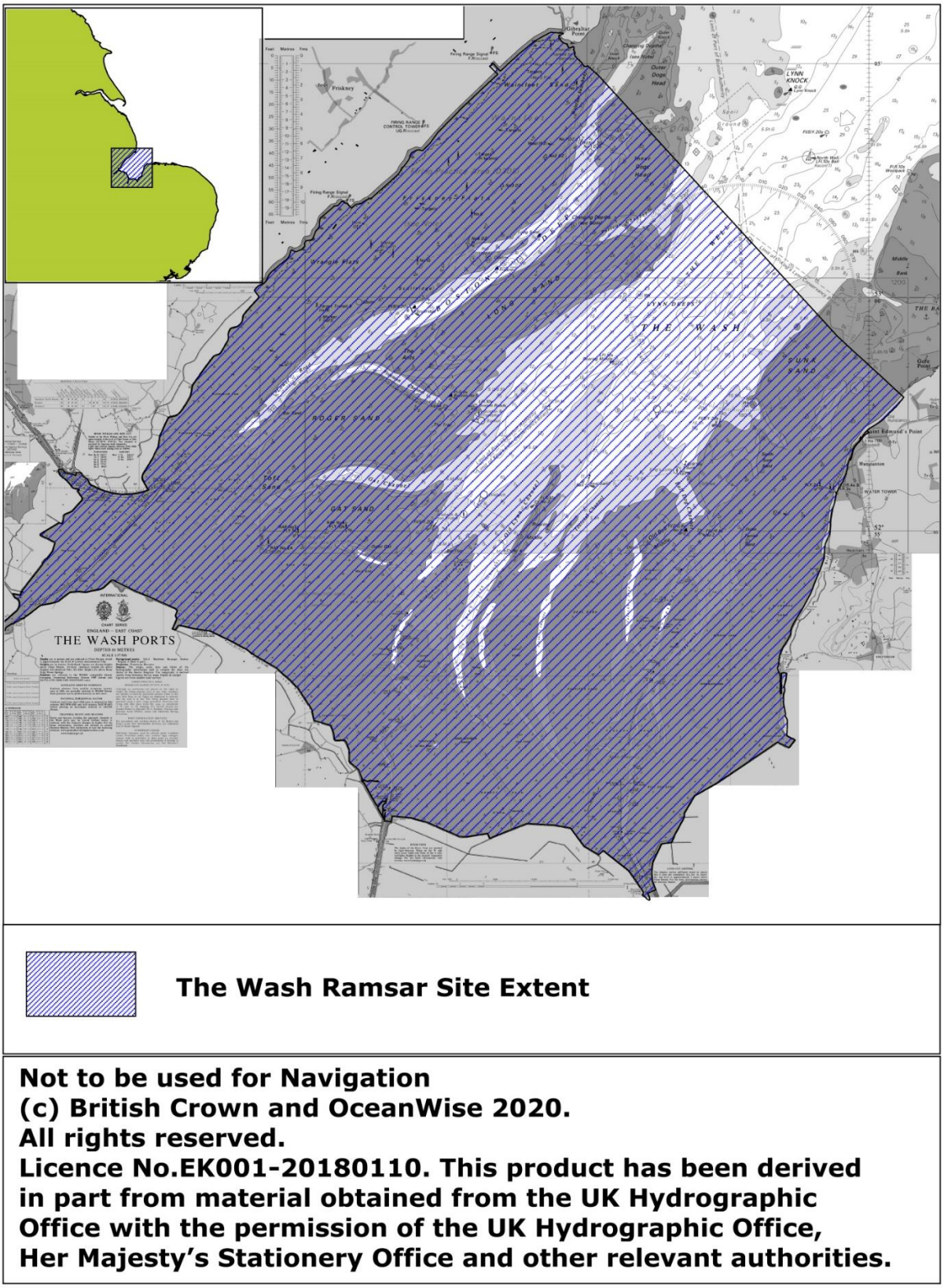


Figure 7 – Chart showing the extent of the Wash Ramsar Site

Ramsar sites are wetlands of international importance designated under the Ramsar Convention. Although they are not officially included in the national sites network, the UK government has advised they should be given the same level of protection. As the provisions on the Habitats Regulations relating to Habitat Regulations Assessments extend to Ramsar sites, Natural England considers the Conservation Advice packages for the overlapping European Marine Site designations to be, in most cases, sufficient to support the management of the Ramsar interests.

The Wash Ramsar site covers the same extent as The Wash SPA and is encompassed within The Wash and North Norfolk Coast SAC. However, it should be noted that the qualifying features of The Ramsar site include coastal vegetated shingle, coastal sand dunes, and an important assemblage of wetland invertebrates that are not qualifying features of either the SPA or the SAC (Natural England, 2020).

6.0 The Wash Several Order (2022) Management Considerations

Eastern IFCA was the grantee of the WFO since 1992 under which a management scheme was established. The proposed management plan seeks to build on the existing measures to enhance the productivity of the Several Fishery whilst ensuring the statutory responsibilities are still met. The management plan is at Section 8 and considerations informing the plan are set out in the sections below.

6.1 Ensuring compatibility between aquaculture and MPA designations

Eastern IFCA produced a Habitats Regulation Assessment (HRA), assessing the potential impacts of the proposed aquaculture activities and any mitigating measures, to demonstrate compatibility with the overlapping MPA's. The HRA for the Wash Several Order (2022) considered both the direct impacts that the aquaculture will have on the site's MPA features through such things as displacement, smothering and/or disturbance of protected habitats and species, and also indirect impacts such as potential impacts on the prey of the protected bird species and food availability for the wild shellfish stocks. Section 7.1 of this document provides a description of management measures which will be implemented under a Several Order to mitigate against impacts on site integrity from aquaculture operations. The broad interactions identified in the HRA are described below.

The Wash supports the second largest expanse of intertidal flats, and their associated populations of polychaetes, bivalve molluscs and crustaceans, in the UK. As the leased lays are predominantly situated along the sheltered eulittoral zones of intertidal sandbanks and mudflats, there is inevitable interaction between the aquaculture and the Wash and Norfolk Coast SAC Annex I habitat - Mudflats and sandflats not covered by seawater at low tide, in which the natural habitats and supported communities can be smothered by the cultured species. Mitigation is, therefore, in place to limit the total extent of the lays leased through the Order, and to prevent existing lays from being reissued if they are found to contain sensitive features. Future applications for new lays outside of the current 275ha extent, which are currently prohibited by the temporary moratorium, would need to undergo a Habitats Regulations Assessment

prior to be being granted. These would need to demonstrate they would not cause a significant adverse impact to any of the site's conservation features.

Littoral sediments (mud and sand flats) are also protected under the Wash SSSI as a broad habitat feature, for the various aggregations of breeding and non-breeding bird species that utilise the mud and sandflats for feeding and roosting. These birds are vulnerable to disturbance from human activities, including shellfish gathering, which could lead to reduced time spent feeding, or individuals being restricted to areas with a poor food supply. Vulnerability is increased when bird populations may be stressed, such as during severe winter weather. Mitigation is, therefore, in place to ensure the distribution, extent and species composition of marine invertebrate communities which birds feed upon are maintained within Conservation Objective target thresholds. The key mitigation is ensuring that the extent and distribution of lays does not impact on the area available to designated bird species for feeding, and restricting cultivation methods (primarily gear restrictions and prohibition on installing structures) such that, where lays are returned to the 'public fishery' they are in a state that can still support naturally occurring habitats.

Direct disturbance between the Several fishery and the listed bird species of the Wash SPA has been assessed. This concluded that activities associated with the Several fishery would not cause significant disturbance because the majority of fishing activities on the lays occur over high water periods, not coinciding with the time when birds use the intertidal flats. Those activities undertaken at low water (including fishermen occasionally inspecting their lays and/or conducting a small amount of hand worked harvesting) are small scale, infrequent, and would not cause a significant disturbance.

The assessment also considered the impact of the fishery on the associated prey species for the birds listed for the Wash, Greater Wash, Gibraltar Point and North Norfolk SPA's, to ensure the *supporting processes on which the habitats of the qualifying features rely (*e.g. the wild shellfish stocks on the intertidal beds) are not adversely impacted. Mitigation includes ensuring leased ground does not encroach over the wild shellfish beds, thereby reducing their natural extent or cause them to be smothered with sediment. Mitigation is also in place to monitor potential issues of food availability for the wild shellfish stocks resulting from competition for resources with the Several fishery.

Harbour seals are an Annex II species of the Wash and Norfolk Coast SAC. The Several fishery is unlikely to have an impact on their prey species, but as the leased lays tend to be situated along the edges of intertidal sand and mudflats, the Several fishery activities could disturb their haul-out sites. The majority of fishing activities on the lays occur over high-water periods; those undertaken at low water (including fishermen occasionally inspecting their lays and/or conducting a small amount of hand worked harvesting) are small-scale, infrequent and would not cause a significant disturbance.

Although the Several Fishery Order lays are situated on the edges of intertidal sand and mudflats rather than subtidal sites, possible interactions with their neighbouring Annex I habitat - Sandbanks which are slightly covered by sea water all the time, have

also been assessed because sediment disturbed during harvesting mussels from the lays could settle in adjacent subtidal areas and result in localised smothering.

6.2 changes to the MPAs

Whilst the measures proposed are considered sufficient to mitigate the risk of adverse effects on the conservation objectives of The Wash MPAs, it is acknowledged that the situation may change during the 20-year duration of the Several Order.

Under the WFO, lay leases are issued annually and include a break clause which enables Eastern IFCA to revise lease conditions or revoke leases with three-moths notice. Under these provisions, Eastern IFCA has the ability to revise management of the lays, including through the termination of a lease, in response to changes to the condition of the conservation features of the MPAs or changing advice from Natural England on fishing activities within the MPAs.

6.2 Ensuring compatibility between aquaculture and other fisheries

The benefits of aquaculture, particularly regarding mussels, has long been recognised in The Wash. Aquaculture creates a better-quality product than can be harvested from the wild beds, and provides the fishermen with a reserve of stock that can be used to satisfy orders without the dependency on the fluctuations of the public fishery.

Lays leased through the Wash Several Order (2022) are “severed” from the public fishery and are placed in private ownership for the duration of the lease. As the creation of these leased areas reduces the extent of the fishing grounds available to other fishermen and users of the site, Eastern IFCA must carefully balance the individual benefits provided by the Several fishery with the loss of public access to those areas. To minimise the loss of potential fishing opportunities within the public fishery, lays can only be leased in areas that do not support commercially viable wild stocks of cockles or mussels at the time of their issue. Historic survey data are used to ensure ground is not leased that has historically supported wild beds of these species which would indicate that they could do so again in the near future.

Before issuing new lays, Eastern IFCA needs to consider whether there will be any impacts on general navigation for other fishermen and users of The Wash. In most cases, the aquacultural practice is to lay mussels directly on the seabed, which does not affect most traffic. However, the presence of relayed mussel beds on the edges of sheltered channels has the potential to interfere with fishermen trawling in those channels when targeting the brown shrimp fishery. Prior to issuing new lays, Eastern IFCA consults with the local fishers who can raise any concerns they may have about the placement of a new lay.

Although the majority of the aquaculture in The Wash involves relaying mussels onto the seabed, there have been occasions when tables or trestles have been placed on lays for growing oysters. At other locations in the UK and abroad, mussels are frequently grown on suspended ropes, poles or rafts. Such structures, if used in the Several fishery, could have an impact on trawl fisheries, have a significant effect on site integrity of the protected sites and/or be a navigational hazard. Prior to consenting the use of such structures, Eastern IFCA would consult widely with all other users of

the site, including Natural England, to highlight any concerns. Additionally, the placement of such structures would also require a Marine Licence from the Marine Management Organisation (MMO), the application for which would consider the navigational hazards caused to other users of the site.

As the wild beds within the public fishery can be used as a source of mussel seed for the Several fishery, Eastern IFCA needs to consider and minimise the impact that the removal of this seed has on those wishing to fish the public mussel fishery. In recent years, this has not presented a problem because the harvestable-sized (>/=45mm) mussels on the wild beds are of insufficient quality for direct sale to the market. Instead, the general practice for most mussel fishermen in The Wash is to relay seed from the public fishery onto their lays, where a better-quality product can be grown. However, because both the cockle and mussel stocks in the public fishery contribute towards the bird food requirements, the removal of mussel seed from the public fishery could impact on the size of the cockle fishery. Eastern IFCA, therefore, only open the public beds for seed relaying when specific stock target thresholds have been achieved.

To limit the physical impact of harvesting, Eastern IFCA applies three management measures to the Several fishery:

- maximum dredge width,
- maximum number of dredges, and
- maximum vessel length that may be used.

These measures mirror those applied to the Regulated fishery within the same area and are assessed as not likely to impact the habitats or species (either designated or supporting) under The Wash MPAs. These are:

6.3 Food availability

In 2008 high proportions of the adult cockle stocks throughout The Wash suffered high mortality rates in what was the start of a prolonged period of annual mortality events that has continued to present times. In 2007, prior to the first die-off, the biomass of shellfish in The Wash, including wild cockles and mussels on the intertidal beds combined with the cultivated mussels on the lays, were at an historic peak. When initial sampling found no pathogens in the cockles that could explain the die-offs, it was considered whether shellfish feeding requirements could have exceeded the food availability – i.e. whether the carrying capacity of The Wash for shellfish populations had been exceeded.

Eastern Sea Fisheries Joint Committee (ESFJC) undertook a review of the existing lay consents in 2008[6]. This review suggested that when at full capacity of 100t/ha, cultivated mussels could be responsible for up to 28% of filter feeding in The Wash. In 2009 ESFJC commenced a long-term programme to monitor phytoplankton levels in The Wash. ESFJC deployed a data buoy in the Central Wash to collect continuous

[6] Eastern Sea Fisheries Joint Committee, Mussel Cultivation in The Wash: Review of Consents granted under the Wash Fishery Order 1992 to Assess Impacts on the Conservation Features of the Wash and North Norfolk Coast European Marine Site (W&NNC EMS), July 2008,

readings of chlorophyll-α (a proxy for phytoplankton levels) and water temperature, salinity and turbidity. In addition, the same metrics were collected monthly from various sites around The Wash and mussel meat yield samples were assessed monthly from four stations in The Wash. Phytoplankton levels were also measured on a finer scale around the Toft lays, where the highest volume of mussel cultivation was undertaken. These studies identified a localised depletion in chlorophyll-α levels directly over the lays, compared with the upstream measurements, but that the high levels of mixing throughout the waters in The Wash help to ensure that despite localised depletion of chlorophyll levels directly over the cultivated mussel beds, phytoplankton availability away from the lays is not restricted[7]. The study recommended that further monitoring be undertaken of chlorophyll-α levels over natural shellfish beds, but cautiously concluded that mussel cultivation at current levels was unlikely to be impacting natural cockle and mussel populations by limiting their food supply. Further studies conducted by Cefas (ref) on phytoplankton assemblages in The Wash also cautiously concluded that at current levels the cultivated mussels in the Several fishery was not having an impact on phytoplankton assemblages.

Subsequent to the phytoplankton monitoring programme commencing, further moribund samples of cockles from The Wash were found to be infected with three species of *Haplosporidian* parasites. While these have not been conclusively proven to be the cause of the cockle die-offs, the samples provided strong circumstantial evidence that the *Haplosporidian* infections may be a major contributory factor in the observed mortalities. Since 2010, the mussel stocks in The Wash have also suffered unusually high mortalities. These were initially attributed to the presence of the intestinal copepod parasite, *Mytilicola intestinalis*, but subsequent studies have found no correlation between the incidence of this parasite and mortalities. Further studies are presently being conducted with Cefas to better understand both the cockle and mussel die-offs, but it is suspected there may be a number of factors that could be contributing towards the problem. As food availability could be among them, Eastern IFCA continues to monitor phytoplankton and mussel meat yields in The Wash and maintains the moratorium introduced in 2010 of new lays being issued. Should phytoplankton and mussel meat yields fall below target thresholds, mitigation described in Appendix 2 (Annex 3) of this plan shall be implemented to reduce grazing pressure from mussels on the Several fishery lays.

6.4 Ensuring compatibility between aquaculture and biosecurity

As the Several fishery lays can be stocked from other fisheries outside of The Wash, there is a significant risk of introducing disease and locally absent species into The Wash through this movement of live shellfish. Eastern IFCA has produced a Biosecurity Plan covering the full extent of the Wash Several Order (Eastern IFCA Biosecurity Plan, 2020). This identifies the biosecurity risks associated with the Several fishery and describes the mitigation in place to prevent the spread of diseases and non-native invasive species into The Wash.

[7] Eastern IFCA, Mussel Cultivation in The Wash: Review of Consents granted under the Wash Fishery Order 1992 to Assess Impacts on the Conservation Features of the Wash and North Norfolk Coast European Marine Site (W&NNC EMS), September 2013

It is prohibited to relay shellfish from outside The Wash onto the lays without prior consent from Eastern IFCA. Applications to move shellfish into The Wash are considered on a case-by-case basis and consider the following:

- The disease status and history of the area the shellfish originate from;
- Monitoring mortality and what to do if shellfish disease is suspected;
- Known invasive non-native species in the area the shellfish originate from;
- Whether the supplier of the shellfish operates a biosecurity plan.

Eastern IFCA will withhold consent where there is a biosecurity risk which has not been mitigated by the applicant.

Under the lease agreements, all lay holders will be required to monitor shellfish mortality on their lays within six weeks of having relayed new mussel onto a lay (or at least once per year if no new seed has been added in that time). Any suspicion of mortality or shellfish disease within lays will be reported to the Fish Health Inspectorate (FHI). This includes reports of any sign of infection in shellfish, if shellfish are dying in larger numbers or more than normal and/or if shellfish are affected by unusual deaths. To encourage reporting of suspicions, Eastern IFCA has produced a standard form to monitor and report mortality incidents and provide some advice of signs and symptoms for lay holders to be aware of.

Although most of the aquaculture in The Wash has involved mussels, elsewhere Pacific oysters (*Magallana gigas*) are a commonly farmed species, which on a few occasions have also been grown in The Wash. The Pacific oyster, however, is defined as an invasive non-native species and is categorised as a 'medium risk' under the Water Framework Directive by the UK Technical Advisory Group and a 'moderate risk' by the GB Non-Native Species Secretariat. Pacific oyster, therefore, will not be included as a prescribed species of the Wash Several Order (2022).

As part of the application process, Eastern IFCA will assess the risks associated with the species to be cultivated. For species not native to the UK, consideration will be given as to whether cultivation can be done in such a way so as to mitigate risk of the species spreading to or invading from the lay. Ordinarily, a lay will not be granted where a risk exists.

6.5 Socio economic considerations

The Wash hosts a relatively stable fleet of around 55 vessels which rely primarily on the cockle and brown shrimp fisheries. Historically, the same fleet was also reliant on mussel fisheries which have since declined. Since 2015, a limited number of vessels have also participated in Wash whelk fisheries and a very limited number of vessels also participate in crab and lobster fisheries within The Wash. The interdependencies of these fisheries are crucial to maintaining sustainability, particularly in relation to the shrimp fishery which has the potential to be fished too early and with too much effort at times when the cockle fishery is less productive.

Over the last decade, lays activity has reduced significantly due to a number of factors including availability of seed (particularly mussel seed) nationally and within The Wash

and more recently economic and trade barriers (ie.. the high price of seed from outside of The Wash, the cost of living crisis and prohibition on exporting certain live shellfish to European markets).

It is intended that the lays will support additional income to Wash-based fishermen who operate within the Wash cockle and Mussel fisheries to reduce the burden on these wild stocks. Under the WFO, a 10ha maximum lay holding limit was in effect to prevent monopolisation of the area by any single interest, such that aquaculture was available to several Wash fishermen so use to supplement their income. This principle is carried forward to the 2022 Order and the intention is to retain a 10ha limit. However, several lays issued under the WFO are effectively held on behalf of another person and led, in effect, to some lay holdings well in excess of 10ha. Such lay holdings were considered as appropriate and received specific consent from the Minister (as was required under the WFO). Whilst excessive lay holding risk monopolisation of the Several Fishery, those in existence as well established and represent is significant proportion of historical lay activity. Given that the matter has previously been considered, and the current barriers to effective aquaculture in The Wash, it is considered that these are consolidated in the first instance to provide clarity and transparency of the current situation. Measures are included in the lay allocation process to accommodate this).

The operation of lays that are being used regularly includes use of partnerships between lay holders. Many lay holders entered into partnerships under the WFO and consider such to be an important element of successfully operating lays. However, such can also lead to monopolisation and could be used to effectively circumvent allocation of lays by the Authority at the expense of those who do not have lays. Leases will contain provisions which prohibit the formation of such partnership without the consent of the Authority which will consider the total lay holding (area) of those involved in any partnership or cooperation agreement with consent being withheld where such results in a total area exceeding the current maximum.

In recent years, widespread settlement of wild cockle spat has included settlement on otherwise dormant lays. This has resulted in the lay holders benefiting from some cockle stocks which would have ordinarily benefited the public (regulated) fishery. There is some concern within industry that some lays are being maintained only on the chance that such wild settlements occur and become the ‘absolute property’ of the lay holder, as per the Sea Fisheries (Shellfish) Act 1967. This is contrary to the intention of the Several Fishery and leases under the 2022 Order will contain provisions which mitigate this as follows:

- The cultivated species will be named on the lease and any rights conferred to the lessee will be restricted to those;
- The lease will include a break clause which will cause the lease to be cancelled where wild shellfish settlement has been detected in three consecutive years;
- Any cultivated shellfish within the lay will be protected for at least 1 year by issuing a temporary lease to enable cultivation and relocation of the lay will be considered by the Authority on application.

Issuing lays severs the associated area form the public fishery. It is important therefore that the area is actively used for the purpose of aquaculture. To ensure that lays are issued to those who intend to use it, lay allocation criteria will be set to limit allocation to those with a vessel capable of operating the lays and those with a permit (or eligibility for a permit) under the Wash Cockle and Mussel Byelaw 2021. More recent Several Orders have Fisheries Management plans which require a greater investment in the planning and use of private fisheries. For example, the Poole Harbour Fishery Order 2015 requires lay applicants to submit business plans setting out how the applicant intends to undertake aquaculture operations. On considering whether to renew a lay lease, the grantee (Southern IFCA) considers the extent to which lease holders achieved the intentions of those plans. Lay leases will therefore be reviewed every 5 years against the business plan provided on application to inform a decision as to whether the lay will be renewed. Such review will consider the following:

- Compliance with lease conditions;
- Achievement of the business plan associated with the lease;
- Any factors which have reasonably contributed to not meeting the achievement of the business plan;
- Representation from the Lay holder with respect to the above;
- The outcomes of any previous reviews.

6.6 Implementation

Management under the Wash Several Order 2022 is intended to have two main phases. Phase one will commence on the confirmation of the order and will address existing lay holdings through a transition process and implement new lease conditions which reflect this plan. The implementation of Phase 1 is described in the next sub-section.

Phase 2 will commence once Phase 1 finishes and will seek to implement the aspirations described in section 2.3 and particularly with regards to seeking further opportunities for a wider range of Wash fishers. The implementation process for phase 2 will be developed in consultation with stakeholders.

6.6.1 Lay Allocation Process

Lays will be allocated at the discretion of the Authority, including with respect to consolidating existing lays (see below). Applications for lays must meet the associated criteria described in this plan to be considered. Applications will be considered on their own merits and in accordance with the aim and objectives of the FMP (Section 2), the Authority's statutory duties (section 4), the provisions of the Wash Several Order 2022 and any criteria outlined in this section.

Lay allocation will be undertaken in two phases:

- Phase 1 (transition) is intended to address the transition from lays issued under the Wash Fishery Order 1992 to those issuable under the Wash Several Order 2022. The associated criteria and considerations are described below.

- Phase 2 is intended to take place after Phase 1 is completed. Criteria and considerations for Phase 2 will be determined after Phase 1 is completed as part of a review of the FMP in accordance with the Wash Several Order.

Phase 1 – Transition

Under Phase 1 the Authority will consider applications from people who meet the following criteria:

- The applicant was a Lay holder at the time the Wash Fishery Order 1992 (WFO) expired on 4 January 2023;
- Owns a vessel capable of operating within the lay applied for;
- Has received notification that they are eligible for a Wash Cockle and Mussel Permit from Eastern IFCA.

Application must be made by completing the Phase 1 (transition) application form provided by the Authority and must be supported by a business plan which may be submitted using the business plan pro forma provided by the Authority. A business plan must include the following:

- The target species to be cultivated and harvested;
- The methods for cultivation and harvesting including specification of the fishing gear or any other equipment to be used;
- The intended origin of shellfish seed;
- Forecasts of anticipated seed/year;
- Details of any arrangements, agreements, partnerships or cooperation between the applicant and other lay holders, and their contact details.

It is acknowledged that aquaculture in The Wash is often largely dependant on mussel seed fisheries from within The Wash of which there have been relatively few and such have had low TACs. It is also acknowledged that there are several economic barriers to effective aquaculture in The Wash including the current cost of living crisis and barriers to exporting love shellfish. These factors will be factored into consideration of lay applications and any subsequent review of lay use against a business plan.

<u>Consolidation of existing lays</u>

As a result of practices established under the WFO, several lays are known to be held by people on behalf of others. For example, lays are in the name of a spouse or other family member who does not actually operate or otherwise manage the aquaculture operations on that lay. Lay allocation under Phase 1 (transition) is intended that lay holders consolidate their lays into a single lay holding as appropriate. Documentation to apply to consolidate such is required and this will include a signed declaration from the person currently named on the lease to that effect. Lays will only be consolidated if they were held by a person who, with respect to the applicant, would be considered a ‘person’ under Article 6(5)(b)(ii) to (iv) of the Wash Fishery Order as follows:

- the person having control of any company and all the companies controlled by that person;
- spouses;
- parents and children.

6.6.2 Lease conditions

The management measures described within this FMP (section 9) will be implemented through lease conditions issued to lay holders.

6.6.3 Compliance monitoring

Eastern IFCA will integrate The Wash Several Order 2022 within its risk-based, compliance framework.

Section 166(1) of MaCAA (2009) sets out that an IFCA officer has the powers to enforce any Order made under the Shellfish Act (1967) and whilst enforcing the Order an IFCA officer has common enforcement powers (under Part 8, Chapter 2).

6.6.4 Sanctions

Any rights holder under the Order who contravenes any conditions set out in the lease issued by Eastern IFCA may, at the discretion of the Authority, have the lease revoked and any lays shall return to the possession of the Authority as detailed in the lease.

7.0 Fees

7.1 cost to the Authority

Management of shellfish fisheries as the grantee of a Several Order places significant costs on the Authority. For example, Eastern IFCA undertakes site visits and a Habitat Regulation Assessment when considering lay applications, monthly monitoring and general administration including considering lay applications and reviews for re-allocation. The estimated costs to the Authority as set out in table 1 (below).

The financial cost to the Authority for the general administration of the Several Order, at current annual costs (see table 1 below), is estimated to be significant; between £1.15m and 2.1m over the 20-year lifespan of the Order (taking into account a 3.5% inflation rate). The main ongoing costs relate to monthly monitoring of phytoplankton levels and meat yields as required to mitigate the risk posed by lays to general food availability in The Wash and of this, vessel operating costs represent the most significant part. It is likely that these costs will reduce once the replacement to *RV THREE COUNTIES* is operational. In addition, the financial burden can, to an extent, be mitigated by charging fees of lay holders although such would need to balance against the limited viability of operating lays at present given significant barriers (e.g. limited seed availability, high price of seed, increased fuel costs, prohibitions on exporting live shellfish into European markets etc.). It is also noteworthy that, whilst the monitoring described above is a requirement of managing the lays, not pursuing a Several Order would not remove these costs as the activity is currently carried out

alongside sample collection on behalf of the district and borough councils (for which some there is some cost recovery) to inform water classification in The Wash to enable the public and private fisheries therein.

Table 1: Projected Range of Annual Costs

Annual Costs		
Item	Min Annual Cost	Max Annual Cost
HRAs of existing Lays	£ 584.03	£ 778.70
SWEEP Surveys	£ 37,086.48	£ 37,086.48
Yearly Admin Costs	£ 528.47	£ 528.47
Processing Business Plans	£ 204.65	£ 204.65
FMP Yearly Review	£ 2,118.99	£ 2,118.99
Physical Monitoring of Lays (Compliance, Enforcement)	£-	£ 33,567.21
Annual Total	£ 40,522.61	£ 74,284.50
Annual Cost Per Hectare	£ 147.35	£ 270.13

The main cause of variance between the minimum and maximum costs are down to vessel usage; trips have a cost that varies between vessel, and so the monitoring of lays, for example, is based on a minimum potential of no such trips to a maximum potential of 8 trips (enough to physically visit every lay) aboard Three Counties, the most expensive vessel. This may be required in the case of any compliance inspection, be that for lease compliance in the case of non or mis-usage of the lay, or for enforcement actions in the case of theft from lays.

By a very large margin, the major cost here is the cost of SWEEP surveys, but there are two points that should be borne in mind regarding them. Firstly, the surveys take place during the monthly EHO exercise, which require two days at sea, of which SWEEP constitutes about 30% of the time required. The EHO exercise needs to be undertaken regardless of whether a Several Order is pursued, and would still require two days at sea: this cost can therefore be considered to be somewhat baked in to Authority finances, especially given that cost recovery mechanisms are in place regarding EHO. The main risk in this case is that if future SWEEP surveys were to take place independently of EHO, this cost would then emerge as a major independent expenditure. This is somewhat mitigated by the second point, which is that the cost of EHO and SWEEP is so high because they are run from Three Counties, which is highly expensive to maintain on account of its operational lifespan having been stretched so far. The replacement vessel should be more efficient to run, bringing these costs down once it comes into action.

Table 2 shows the costs of opening lays and those involved in the purchase of seed for relaying. Neither of these are common costs, as there has been a moratorium on new lays and there have been very few applications to purchase seed recently, so they have not been included in the core projected costs.

Table 2: Projected Irregular Costs

Ad Hoc Costs				
Item	Min Cost		Max Cost	
Seed Purchase Application Handling	£	100.09	£	100.09
Visual Inspection of Purchased Seed	£	52.94	£	52.94
Opening New Lays	£	2,197.19	£	5,217.68

Finally, Table 3 shows the projected cost over the lifetime of the Several Order at the estimated costs in Table 1.

Table 3: 20 year costs at 3.5% inflation

Total Cost After 20 Years		
Min	£	1,145,966.57
Max	£	2,100,742.02

Under the WFO, lay holders were charged fees on a per-hectare basis with a charge that scaled with the availability of mussel seed in accordance with table 2 (below).

Table 2. the WFO lays fee structure.	
Seed mussel available within The Wash	**Fee (£/ha)**
Less than 1000 tonnes	10
1001 – 2000 tonnes	11
2001 – 3000 tonnes	12.50
3001 – 4000 tonnes	14
4001 – 5000 tonnes	15.5
Over 5000 tonnes	17.5

In addition, there was a £10 admin charge for administering a new lay lease.

However, these fees were provided to the Crown Estate as renumeration for the Crown Estate lease. The Authority did not cost recover for managing the WFO lays.

Whilst the Authority is obliged to manage exploitation of sea fisheries resources within the district, this does not necessitate doing so as the grantee of a Several Order which could be considered as going beyond out obligations. It is noteworthy that lay holders can apply for their own Several Order for a private fishery and that all the associated costs would be borne by them (as is the case in the Menai straight (East) Mussel and Oyster Fishery Order 2022). As such, a degree of cost recovery is considered appropriate.

Fees charged within the Wash Cockle and Mussel public fisheries seeks 50% cost recovery via permit fees. This reflects that significant cost burden of undertaking

necessary surveys, assessments and compliance activity associated with this fishery.

7.2 Consideration of appropriate fees

There are significant barriers to aquaculture operations in The Wash at present including prohibitions on exporting live shellfish, the cost-of-living crises and a lack of available seed to stock lays. It appears to be the case that lay holders often rely on the detection of a sublittoral mussel bed in order to stock lays, which has become increasingly rarer as a result of grounds being lost to other marine developments (e.g. the Race Bank wind farm) and areas closed to trawling for the protection of MPAs. As such, several la holders are likely to seek to retain lays solely to enable prosecution of an ephemeral bed and leave lays unused for some time.

It is likely therefore that 50% cost recovery within the Several Order would be prohibitively expensive for the majority of existing lay holders. Ultimately, the Authority intends to enable aquaculture as a viable means of supplementing income generated from the wild capture fisheries of The Wash and so an appropriate balance is sought between responsible management of our public resource and creating additional barriers to the detriment of our aim.

Therefore, a reasonable degree of cost recovery is sought which increases in line with available mussel seed is considered appropriate.

The annual fee is £20 per hectare, which represents circa 16% cost recovery in relation to the minimum estimated cost. This is considered to be an appropriate level of cost recovery initially on the basis that it represents a 100% increase in the present minimum fee, because the costs to the Authority are anticipated to reduce on the replacement of RV THREE COUNTIES and because of the significant barriers to lay holders operating their lays at present. It is also noteworthy that, under the WFO, no cost recovery was achieved (except a £5 admin charge each year) and all fees gathered were paid to the Crown Estate. Therefore, the fee will represent a significant increase in cost recovery to the Authority.

The fee will reviewed within a reasonable timeframe of the confirmation of the Order to reconsider the appropriate level of cost recovery and particularly if lays become more active.

8.0 consultation

Stakeholders were consulted on the draft FMP (version 4) between 18 January 2022 and 25 February 2022. WFO Lay holders, wildfowler associations, the Crown Estate, the le Strange Estate, the Ministry of Defence, the Wash and North Norfolk Marine Partnership and the Royal Society for the Protection Of Birds (RSPB) were contacted directly in addition to material being posted on the Authority's social media accounts and website. The Authority has been in dialogue with Natural England separately in seeking their formal advice as informed by the associated HRA. Five responses were received in total, three from fishing interests, one from a wildfowlers association and one from the RSPB. One of the responses designated as 'fishing

interests' was reported as representing the response from 'the majority of the holders of all licences and lays under the Wash Fishery Order'.

Subsequent dialogue with lay holders was held during May of 2023 to consider some of the key objections from previous consultations. 12 respondents provided feedback on key areas including the process for reviewing lay use, seeking to provide business continuity and fees for lays.

8.1 Key objections from current lay holders

The key objections to the original FMP related to measures for reviewing leases and in particular, that having a 'guarantee' to a lay for only five years did not provide the security of tenure to facilitate investment in operating the lay (seed, purification systems etc.).

In discussing the matter, there was general agreement that lays issued should be reviewed and a five-year review period was generally considered acceptable. But most respondents were of the view that non-use of a lay should not lead to the removal of the lease where there was limited seed availability. There are notable barriers at present to getting seed, including national and local availability issues (e.g. the Eastern IFCA seed mussel fisheries have not yielded large fisheries for more than a decade), barriers to exporting products to European markets and a reportedly weak national market for mussels in particular. This is in addition to rising operating costs generally. Yet many lay holders would seek to retain their lays to facilitate potential future opportunities for mussel aquaculture.

The outcome report for the May 2023 consultation are available online[8]. The consultation led to several refinements in the FMP as follows:

- Specific reference is made in the FMP (Section 7, above) to consideration during reviews to the availability of seed when undertaking reviews and any other factors which would have reasonably led to the lay not being used;
- The issuing of a 2-year 'limited lease' where a lay holder has not successfully secured re-allocation of the lease on review to protect shellfish stock therein and to enable such to be removed but prohibit further re-laying of stock; and
- Issuing species specific leases to reduce the conflict between those retaining lays during periods where seed is unavailable by enabling the removal of wild shellfish (not named on the lease) from empty lays.

In addition, concerns were raised regarding the lay application process and specifically with the requirement to submit a business plan, which lay holders were concerned would be onerous to complete. A simple *pro forma* has been developed to aid applicants in completing this element which will be made available to applicants.

8.2 Other responses

[8] [insert reference once online]

The response from a wildflower association raised no concerns and was in support of the application.

The RSPB provided some detailed feedback, particularly in relation to the conservation objectives for numbers of birds present within the MPA. The response did however set out that the respondent was “mostly satisfied” with the mitigation measures set out in the FMP.

8.3 Natural England advice

Natural England have provided support in principle for the application subject to further dialogue.

Dialogue with Natural England identified an additional requirement relating to mitigating the impact of litter (as a result of using recycled plastic items such as milk bottles) to mark our lays. This has been included in this version of the FMP.

The formal advice letters from Natural England, and Eastern IFCA response, is at Appendix 1 of the FMP.

8.4 conclusions from the stakeholder responses

A number of stakeholders contacted directly did not reply to the consultation however, it is likely to reflect the fact that a Several Order has been in place for a number of years and potentially affected stakeholders are not concerned by its effective renewal.

Fishing industry raised significant objections to the manner in which a Several Order would be managed, rather than in relation to the application for a Several Order in and of itself. Therefore, it is adjudged that the revision of the plan, to provide what is in effect and extension to the WFO is sufficient to resolve these objections.

Version 8 of the FMP has taken the responses received into account and various changes have been made throughout. A full summary the consultation responses and our consideration is available on the Eastern IFCA website.

9.0 The Wash Several Order (2022) Management Measures

9.1 Marine Protected Area designations

The following is a summary of the outputs of the considerations for all pressures considered via an appropriate assessment under the Habitats regulation Assessment (which is at Appendix 2).

Objective	Pressure(s)	HRA outputs (impacts and Mitigation)
To prevent the Several fishery causing adverse effects on the integrity of The Wash & North Norfolk Coast Special Area of Conservation (Annex I habitats)	1. Abrasion/disturbance of substrate on the surface of the seabed; and 2. Penetration and/or disturbance of the substratum below the surface of the seabed including abrasion	Two features are identified as sensitive to the pressures: • Intertidal mud; and • Intertidal sand and muddy sand Mitigation is required to conclude no adverse effect as follows: • Undertake biotope surveys and grant lays only in areas which are less sensitive to the pressures (**Lay allocation** for Phase 2); • Gear restrictions which limit penetration and areas covered by fishing activity (**Lease conditions**) as follows: ○ Maximum dredge width of 1.0m ○ Maximum of 2 dredges ○ Maximum vessel length of 14.0m (oal) The small spatial scale of the lays compared to the total extent of the features throughout the SAC, coupled with the above mitigation enable a conclusion of no adverse effect.
	Changes in suspended solids	One feature / attribute was identified as potentially being impacted by the pressure – ‘Water column’ The following factors were considered in the appropriate assessment;

		• the small extent of Several Fishery compared with the size of The Wash; • the low frequency and short duration of shellfish stocking / harvesting activity; • very high background suspended sediment levels; • the tolerance of biological communities in The Wash to high sediment loads and the absence of more sensitive receptors such as marine plants or algae; • the high-energy hydrodynamics across the site meaning local increases in suspended sediment are short-term and are rapidly dispersed. It was concluded that the scale of the operation was not likely to cause an adverse effect on site integrity.
	Smothering and siltation rate changes	The following factors were considered in the appropriate assessment; • the small extent of Several Fishery compared with the size of The Wash; • the low frequency and short duration of shellfish stocking / harvesting activity; • very high background suspended sediment levels; • the tolerance of biological communities in The Wash to high sediment loads and the absence of more sensitive receptors such as marine plants or algae; • the high-energy hydrodynamics across the site meaning local increases in suspended sediment are short-term and are rapidly dispersed. It was concluded that the scale of the operation was not likely to cause an adverse effect on site integrity.
	Nutrient depletion (phytoplankton availability)	Although phytoplankton reduction is not listed as a potential pressure in Natural England's conservation advice relating to bivalve aquaculture, Eastern IFCA and Natural England have agreed it should be considered as part of The Wash Several

		Order 2022 HRA because of the potential mechanism for impacting the designated features. The appropriate assessment could not rule out adverse effects. The potential for adverse impacts on site integrity are mitigated through food availability monitoring and the associated action which brings into effects restrictions to reduce the pressure as follows: • Monitoring of chlorophyll and mussel condition at three sites in The Wash (Eastern IFCA monitoring): • Assessment of grazing pressure taking into account current stocking density of mussel lays (Eastern IFCA Monitoring); and • Reduction in permitted stocking density of lays based on an assessment of grazing pressure, including the removal of mussel where stocking densities are already too high (**Lease condition**). It was concluded that with the above mitigation in place, the operation was not likely to cause an adverse effect on site integrity.
	1. Genetic modification & translocation of indigenous species; 2. Introduction of microbial pathogens and; 3. Introduction or spread of invasive non-indigenous species (INIS)	These potential pressures have been considered together in this section of the assessment because of their similarities. Features considered sensitive to these pressures: • Intertidal mud • Intertidal sand and muddy sand • Water column SPA assemblage The appropriate assessment identified that mitigation is required to conclude no adverse effect on site integrity. The following mitigation is required (**Lease conditions**).

		• Requirement to obtain consent from the Authority to relay seed from outside of The Wash; • Requirements for Eastern IFCA to carry out checks on the seeds origin to determine level of risk • Requirements for lay holders to produce a biosecurity plan for the proposed activity (pro forma provided by Eastern IFCA) • Requirement as part of consent for lay holders to take such steps as may be necessary to reduce the risk and or decline consent as required • Requirement for lay holders to monitor lays once per year and within 6 weeks of relaying seed to monitor for signs of die-off or INNS In addition, Eastern IFCA has published a Wash Biosecurity plan and engages with lay holders to inform them of biosecurity risks on a regular basis. It was concluded that with the above mitigation in place, the operation was not likely to cause an adverse effect on site integrity
	Removal of non-target species	Features considered sensitive to this pressure are listed below with their sensitivity rating taken from conservation advice: • Intertidal mud (low sensitivity) • Intertidal sand and muddy sand (low to medium sensitivity) • Water column (not relevant for shellfish aquaculture but high sensitivity for fishing using dredges) • Harbour seal (high sensitivity) • SPA assemblage (not relevant for fishing using dredges but high sensitivity for shellfish aquaculture). The appropriate assessment concluded that removal of non-target species from within lays would not have an adverse effect on site integrity due to the small scale of the operations and because the areas are used to cultivate other species and therefore bycatch is low.

	Visual disturbance	Features sensitive to this pressure are: • Harbour seal So as to mitigate the potential for impacts on the Harbour seal, it shall be prohibited (via **Lease condition**) to set any markers for lays, including the use of recycled items (such as plastic milk cartons, empty oil drums etc.). Instead, all lays shall be marked out using Geographic Information Software and coordinates published on the Eastern IFCA website and provided to fishermen operating in the Several Order area. The appropriate assessment concluded that there is minimal overlap between areas which support the Annex ii feature and that the scale of the activity is sufficiently low to conclude no adverse impact on site integrity.
	Changes to site condition and / or aquaculture operations including number and location of lays	Where changes in the status of the site (or associated features) are identified, the activity would be assessed through a HRA. To accommodate the findings of any such HRA, a mechanism is required which enables changes to lay areas or lease conditions to mitigate identified impacts. This is included in **lease conditions** which will be issued at phase 1 of the FMP and will be included in lease conditions at subsequent phases of lay allocation (to be addressed in review of this plan). There is currently a moratorium on further lays being issued which will prevent the overall extent increasing beyond current level (**Lay allocation**). Should new lays be issued in the future, the resulting disturbance impacts and loss of habitats would be individually assessed for alone with bespoke HRAs.
To prevent the Several fishery causing adverse	Visual disturbance	The appropriate assessment identified interaction between the operation and SPA assemblages was small in scale and was not likely to cause an adverse impact on site integrity.

effects on the integrity of The Wash Special Protection Area, Site of Special Scientific Interest and Ramsar Site.		

9.2 Sustainability and Social Economic Considerations

Management objective	Mitigation	Description
Seek to balance the different needs of persons engaged in the exploitation of sea fisheries resources in the district.	**Lay allocation Criteria (Phase 1)** • Application from existing lay holders only • Application must include a Business Plan • Requirement to own a vessel and be eligible for a Wash Cockle and Mussel Byelaw 2021 Permit • Leases allocated with respect to specified species only and	During phase 1 of the FMP, existing lay holders will be eligible to apply for leases under the Wash Several Order 2022. Application must include a business plan which must adhere to the measures in this FMP. To be allocated a lay, applicants under phase 1 must: • Have a business Plan which is compatible with this FMP; • Have a vessel capable of operating the lays in accordance with the business plan and the FMP; • Hold, or be eligible to hold, a Wash Cockle and Mussel Byelaw 2021 permit

	not in relation to cockle unless the Authority is satisfied that the associated business plan has addressed gathering of cockle seed.	These measures are intended to ensure lays are allocated to persons who intend to and are capable of using the lays allocated to them, and function as a means of reducing pressure on the wild capture, Wash-based fisheries.
	Lease conditions • Leases issued for five years • Requirement to operate lay in accordance with the associated business plan • Requirement to notify Authority and seek consent for any changes to planned operations which differ from the associated business plan • Prohibition on sub-letting, assigning of lays or forming partnership or cooperation agreements without the consent of the Authority • Requirement to provide returns for all movement of shellfish on and off of the lays including economic information	Leases will be issued for 5 years and re-issued thereafter subsequent to review (see below for re-allocation). To ensure lay operations are appropriate, all such activity must be in accordance with the business plan and any deviation without consent from the authority will be considered a breach of the lease conditions. This will mitigate the potential for lay holders to seek to retain lays for the purpose of securing portions of the public fishery which settle onto lays. A prohibition on sub-letting, assigning or partnerships without the consent of the Authority is intended to ensure the Authority's discretion is not fettered with respect to lay allocation and in particular, to prevent monopolisation or retaining lays where there is no intention of using them at the expense of others. Providing return forms will enable assessment of lay use (during reviews) but primarily enable compliance with reporting requirements under the Wash Several Order 2022.
	Lay allocation (re-allocation of leases on review) • Leases re-issued on review taking into consideration activity against the business plan provided on application	Leases will be issued for lays for up to five years, with the assumption being that such will be reissued where, on review, lay activity has been undertaken in accordance with the associated business plan. Such a review will consider reasonable factors which have prevented lay use, including but not limited to, the availability of seed referred to in the business plan. It is noted that seed is generally unavailable at present but that many lay holders seek to

	• Requirement to own a vessel and be eligible for a Wash Cockle and Mussel Byelaw 2021 Permit • Where a review results in the cancellation of a lease, a 'limited lease' will be issued for 2 year which will	retain lays to use in the event an ephemeral bed of sublittoral mussels is detected. Where a lay holder has not utilised a lay in accordance with the business plan and the Authority is not satisfied with the reasoning as to why, or the lay holder no longer owns a vessel capable of operating a lay or a Wash Cockle and Mussel Permit the lease may be cancelled. Where a lay is not re-allocated as a result of a review, a limited lease will be issued which permits only extraction of existing stock on the Lay, if such exists, and will be issued for a period of 2 year.
Minimise loss of fishing opportunities to public fishery	**Lay allocation (Phase 1)** • Lays will not be leased on ground that supports wild beds of cockles or mussels • Leases will provide rights over specified species only – other wild shellfish therein will not form part of the right and can be removed by the public fishery (to the extent that they do not disturb any stock on the lay) • Leases will not be issued for cockle aquaculture unless the Authority is satisfied that the associated business plan has adequately addressed gathering of cockle seed.	Existing lays (under the WFO) will not be issued under the Wash Several Order 2022 on ground that supports, or historically supported, commercially viable wild beds of cockles or mussels. This is determined by: • Conducting an examination of historic survey GIS data to determine whether the area historically supported wild stocks that might currently be absent. • Consultation with all the local fishers to highlight concerns they may have that the lay will encroach on wild beds. • Conducting biotope surveys within and surrounding any proposed lays to confirm the absence of wild stocks prior to the new lay being issued (if historic survey data identifies recent cockle settlements). Where wild stock settles on lays other than those which are the subject of the lease, these will be accessible to the public fishery to the extent that the stocks on the lays are not disturbed. Where wild stocks are detected to have settled within lays for three years out of any five, this will trigger a review and the Authority will consider

		whether the lay is no longer suitable as a private fishery. Relocation of the lay may be considered as a result.
	Lease conditions • Lay holders visit lays at least once per year and report any settlement of wild stocks	Lease holders must visit lays at least once per to and inspect to laying for settlement of wild shellfish. Where such is detected, this may necessitate additional site visits by officers.
Minimise any navigational impacts the activities in the Several fishery could cause	Several fishery lays must not cause a navigational hazard or significant navigational impact to other users of The Wash	Because the general aquacultural practice is to lay mussels directly on the seabed along the edges of inter-tidal sandbanks, the risk of causing a navigational hazard is considered to be minimal due to them being a low-elevation soft surface. The presence of the mussels could, however, have a navigational impact on other fishermen wishing to access a sandbank with limited water clearance, or for fishermen trawling for brown shrimps along the edge of sandbanks. Prior to issuing new lays, Eastern IFCA consults with the local fishermen's associations, providing an opportunity for such concerns to be highlighted.
	Placement of structures such as poles, suspended ropes, tables, trellises and rafts within Several fishery lays will require formal consent	There have been occasions when tables or trellises have been placed on lays for growing oysters and, elsewhere, mussels are frequently grown on suspended ropes, poles or rafts. Such structures, if used in the Several fishery, could have an impact on trawl fisheries, have a significant effect on site integrity of the protected sites and/or be a navigational hazard. Prior to consenting the use of such structures, Eastern IFCA would consult widely with all other users of the site, including Natural England, to highlight any concerns. Additionally, the placement of such structures would also require a Marine Licence from the Marine Management Organisation (MMO), the application for which would consider the navigational hazards caused to other users of the site.

9.3 Other measures

Management requirement	Mitigation	Description
Prevention of introduction of disease and/or invasive non-native species with shellfish acquired from fisheries outside of The Wash	The Wash Fishery Order and The Wash Restricted Area Biosecurity Plan (2020 – 2025)	The Biosecurity Plan identifies the risks of introducing disease or non-native species associated with the movement of shellfish from outside of The Wash and details measures aimed at preventing these from occurring.
	Lay allocation • Prohibition on culturing Pacific Oysters (*Magallana gigas*)	Pacific Oysters (*Magallana gigas*) will not be a listed species of the Wash Several Order (2022), so their culture will be prohibited.
	Lease conditions • Prohibition on relaying shellfish from outside The Wash onto the Several Fishery Order lays without prior consent from Eastern IFCA. • Requirement for lay holders to complete a biosecurity plan when bringing seed into the Wash, which must be provided to Eastern IFCA prior to commencing activity • Requirement on lay holders to visit lays at least once per year, and within 6 months of re-laying seed onto a lay and complete a mortality inspection form (provided by Eastern IFCA)	When determining whether consent shall be granted, Eastern IFCA consider the following: • The disease status and history of the shellfish origin area; • Known invasive non-native species in the shellfish origin area; • Whether the supplier of the shellfish operates a biosecurity plan. Lay holders will be required to complete a biosecurity plan using a pro forma provided by the Authority as part of seeking consent to relay the seed. Under the lease agreements, all lay holders are required to monitor shellfish mortality on their lays within six weeks of having relayed new mussel onto a lay (or at least once per year if no new seed has been added in that time). Any suspicion of mortality or shellfish disease within lays will be reported to the Fish Health Inspectorate.

		Eastern IFCA has produced a standard form to monitor and report mortality incidents and provide some advice of signs and symptoms for lay holders to be aware of.

10.0 References

Cefas, 2013. Sanitary survey of The Wash. Cefas report on behalf of the Food Standards Agency, to demonstrate compliance with the requirements for classification of bivalve mollusc production areas in England and Wales under EC regulation No. 854/2004.

Eastern-IFCA Biosecurity Plan, 2020. The Wash Fishery Order and The Wash Restricted Area Biosecurity Plan 2020 – 2025 https://www.eastern-ifca.gov.uk/wp-content/uploads/2020/03/2020-2025_The_Wash_Biosecurity_Plan.pdf

Eastern-IFCA, 2019. Wash Fishery Order 1992 COCKLE FISHERY MANAGEMENT PLAN. https://www.eastern-ifca.gov.uk/wp-content/uploads/2021/03/2019_07_WFO_cockle_fishery_management_plan1.5_Final.pdf

English Nature, 2005. The Wash. Views About Management, Countryside and Rights of Way Act 2000, Schedule 11(6). Version date: 22/09/05

ESFJC, 2008. Eastern Sea Fisheries Joint Committee Fisheries Management Policies, 2008. https://www.eastern-ifca.gov.uk/wp-content/uploads/2016/03/WFO_Shellfish_management_policies_2008.pdf

JNCC Website. The Wash and North Norfolk Coast. Designated Special Area of Conservation (SAC). https://sac.jncc.gov.uk/site/UK0017075 (accessed 06/07/2021)

MaCCAA, 2009. Legislation.gov.uk. Marine and Coastal Access Act 2009. Section 153. https://www.legislation.gov.uk/ukpga/2009/23/section/153 (accessed 06/07/2021)

MaCCAA, 2009. Legislation.gov.uk. Marine and Coastal Access Act 2009. Section 154. https://www.legislation.gov.uk/ukpga/2009/23/section/154. (accessed 06/07/2021)

NATURA, 2000. – STANDARD DATA FORM. Special Areas of Conservation under the EC Habitats Directive (includes candidate SACs, Sites of Community Importance and designated SACs).

Natural England, 2020. Assessment of Coastal Access Proposals between Hunstanton and Sutton Bridge on sites and features of nature conservation concern. November 2020

Natural England. Reasons for designating the SSSI. Natural England website. Designated Sites View. The Wash SSSI. https://designatedsites.naturalengland.org.uk/PDFsForWeb/Citation/1002591.pdf (accessed 06/07/2021)

Natural England. Views about management. Natural England website. Designated Sites View. The Wash SSSI. https://designatedsites.naturalengland.org.uk/PDFsForWeb/VAM/1002591.pdf (accessed 06/07/2021)

The Greater Wash SPA Citation, 2018. Directive 2009/147/EC on the Conservation of Wild Birds Special Protection Area (SPA). The Greater Wash SPA.

The Gibraltar Point SPA Citation, 1992. EC Directive 79/409 on the conservation of wild birds: Special Protection Area. Gibraltar Point, (Wash Phase 2)

The Wash SPA Citation, 2014 - EC Directive 79/409 on the conservation of wild birds: Special Protection Area The Wash (Norfolk & Lincolnshire).

The Wash SPA Conservation Objectives, 2019. - European Site Conservation Objectives for The Wash Special Protection Area Site Code: UK9008021.

10.0 Appendices

10.1 Appendix 1 – Formal Advice from Natural England

Date:31 March 2022

Our ref: 387175

Your ref:
The Wash Several Order Fisheries Management Plan (FMP) v6.3 and Habitats Regulation Assessment (HRA) v5

NATURAL ENGLAND

Eastern Inshore Fisheries & Conservation Authority
6 North Lynn Business Village
Bergen Way
King's Lynn
Norfolk
PE30 2JG
BY EMAIL ONLY

Dragonfly House 2 Gilders
Way Norwich, NR3 1UB

Dear Judith,

Thank you for your resubmission of the Wash Several Order (2022) Fisheries Management Plan and Habitats Regulation Assessment on the 25/03/2022 in response to NE comments provided on the 11/03/2022. Natural England would like to thank Eastern IFCA for working closely with us to clarify and address many of our original comments and questions.

Natural England support Eastern IFCA's Several Order Application in principle, on the understanding that the total number of lays does not exceed 49 and that the total area covered by the Several Order does not exceed 275 ha. If Eastern IFCA decide to open a lay in the future, in an area that is not specified in the current Fisheries Management Plan or Habitats Regulation Assessment, then Natural England should be consulted again.

Although Natural England supports the Several Order application in principle, there are a number of points relating to both the FMP and the associated HRA on which we require further clarification before we can issue our final advice letter. These are outlined below:

The Wash Several Order - Habitats Regulations Assessment v5 Comments:

New Lays:

- NE suggests for clarity around creating new lays the bold text should be added to this paragraph on page 8:

"Currently there are 49 WFO leases within the Several Fishery. These leases allow for cultivation plots (lays) covering a total of 275 hectares. There is a limit of a maximum of 10ha per lay. It is planned that this number of leases and their extent will be the maxima continued under the replacement Wash Several Order. Since 2008 there has been a moratorium on new lays being issued, barring applications that were already being processed at the time of the moratorium's introduction. Figures 2 and 3 show the current location of the Several Fishery lays leased under the WFO 1992, in the west and east sides of The Wash respectively. **While the total area (275ha) or total number of 49 lays will not increase, new locations for lays may be considered. If this occurs Eastern IFCA will consult with Natural England, and an HRA specifically for these new lay locations will be produced".**

Appendix 1:

- NE suggests for clarity around the text referring to Appendix 3, the text below in bold should be added to introductory paragraph. (It's a very minor detail but without it, it appears to be a formatting errors where the document skips from Appendix 1 to Annex 3.):

  "At an Eastern-IFCA Full Authority meeting in January 2015, the members were asked to agree to adopt mitigation measures relating to food availability associated with the Several fishery lays. The following report **(titled 'Annex 3 - Mitigation measures')**, describing those measures, was appended to the meeting papers."

- Footnote number 9 in Appendix 1 states 'Ref research report', but it is unclear as to what research report this refers to. Could Eastern IFCA please provide NE with the details of the research report reference in footnote number 9 of Appendix 1.

The Wash Several Order Fisheries Management Plan v6.3 Comments:

New Lays:

- NE suggests for clarity around creating new lays the text should be amended and the bold text added (and strikethrough text removed) to the footnote on page 8:

  "The current area of lays leased through the WFO 1992 is 275ha, with a moratorium in place temporarily preventing additional expansion through the creation of new lays. **Lays being consider for relocation to** ~~Future expansion of~~ new ground would be subject to their own Habitats Regulations Assessments. **New/relocated lays will not exceed the total number of 49 lays or increase the total lay area of 275ha."**

- The FMP mentions possibly increasing the lay area beyond the 275ha (pg 29). NE had understood from conversations with Eastern IFCA that lays would perhaps be relocated (and NE consulted under a separate HRA), but that the total number and area of lays would remain at its current total.

Lays – Lease Term

- NE's understanding from a phone call with Eastern IFCA to clarify why 5 and 10 year leases were mentioned interchangably, was that the lease would be for the duration of the several order and run for 30 years.

- Table 1: Lay allocation measures and their rationale (pg 36) states that 'Lease periods will be for no more than 5 years, and subsequent renewal considered by the Authority'. Similarly Section 8.2 of the FMP states:

  "Lays can be applied for and issued to any person, but without written consent from the minister, the total area and duration of leases is restricted: Maximum total area of leases – 10 hectares. Maximum duration of any lease – 5 years".

  NE requests clarification on the duration of the lease and the process needed to renew a lease. If a lease runs for 30 years, would there be a process in place to review whether the leaseholder continues to operate in accordance with best practice throughout this time, and would the HRA be reviewed at all during this time period?

Public Fishery Interactions:

- The original FMP (6.2 Aquaculture and public fisheries interactions) stated:

'Shellfish shall not be relayed from the public fishery in quantities that will have a detrimental impact on the public mussel fishery'.

This statement appears to have been removed from the corresponding section in the latest version (8.2 Interactions with public fisheries). NE had requested some further details on the source for the stock thresholds for these shellfish, this information has also been removed.

NE requests clarification as to why the above information has been removed.

For any queries relating to the content of this letter please do not hesitate to contact me.

Yours sincerely
Tracy O'Shea

Marine Lead Advisor
E-mail: Tracy.OShea@naturalengland.org.uk
Telephone: 0208 026 4923

10.2 Appendix 2 – Habitat Regulation Assessment

N.B. references in this Appendix refer to version 7 of the FMP. This is available on the Eastern IFCA website.

Eastern Inshore Fisheries & Conservation Authority

Record of Habitats Regulations Assessment (Conservation of Habitats and Species Regulations 2017)

Notification (Wildlife & Countryside Act 1981 (as amended by the Countryside & Rights of Way Act 2000))

For

The Wash Several Order 2022

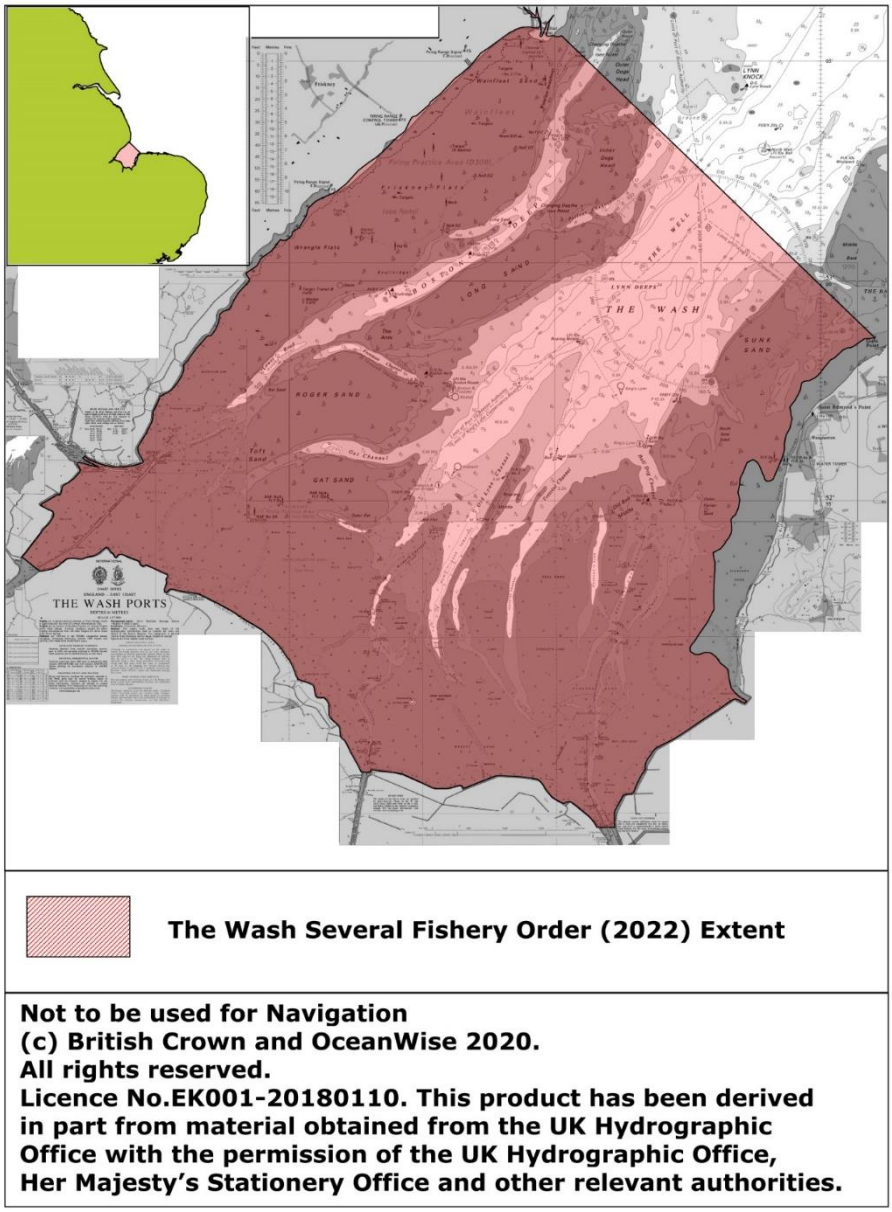


Figure 1. Extent of The Wash Several Order 2022

Revision History			
Version	**Date**	**Revision**	**Editor**
v.1	23/06/2021	Document created	RT, TB
v.2	4/01/2022	Extensive formatting changes; some content updated	JCS
v.3	11/2/2022	Extensive content updates	SH, JCS, ST
Submitted	14/2/2022	Finalised version submitted to Natural England	JCS
v.5	17/3/2022	Phytoplankton availability section and Appendix 1 added following Natural England feedback. Appendix 2 added (guidance to layholders on invasive non-native species).	JCS

		Accepted NE's minor track changes; added clarification where sought by NE.	

This document should be viewed in conjunction with Eastern IFCA's: The Wash Several Fishery Order (2022) draft Fisheries Management Plan. The plan includes more detailed information about management to be applied to the proposed Wash Several fisheries under the new Wash Several Order.

Contents:

List of Figures

List of Tables

Plan or Project Title: The Wash Several Order 2022

Assessment Date & Version: March 2022 v5

Test of Likely Significant Effect

1.1 Type of Plan or Project

Replacement Several Fishery Order for The Wash

Eastern IFCA is seeking Natural England's assent under the Wildlife & Countryside Act 1981 (as amended by the Countryside & Rights of Way Act 2000) for the Wash Several Fishery Order (2022).

This is a record of the Appropriate Assessment, required by Regulation 63 of the Habitats Regulations 2017, undertaken by the Eastern Inshore Fisheries and Conservation Authority, in respect of the above plan/project, in accordance with the Habitats Directive (Council Directive 92/43/EEC).

1.2 Location

The Several Order will apply to the majority of the embayment of The Wash, Eastern England. A chart of the Several Order area is given at Figure 1.

1.3 Brief description of proposal

1.3.1 The Wash

The Wash is a large, shallow embayment on the east coast of England. With an approximate area of 60,000ha (600km^2), the embayment is fringed with undeveloped saltmarsh and mudflats, and contains extensive intertidal sandflats and mudflats, covering approximately 27,000ha (270km^2), most of which are only accessible by boat. Between the drying flats there are shallow channels that allow for navigation to the Wash Ports of Boston, Sutton Bridge, Wisbech and King's Lynn, and which change course regularly through natural hydrodynamic processes. The outer central area of The Wash is the deepest region (up to 50m below chart datum) and is characterised by sheltered muddy and mixed sediment habitats.

For generations, The Wash has supported the harvesting and cultivation of bivalve shellfish. Extensive subtidal native oyster beds were recorded in the outer Wash and its approaches in the 19th Century. In the 20th Century, mussels and cockles were the dominant shellfish, growing in abundance on intertidal flats across the Wash. Significant declines in mussels have occurred in the first part of the 21st Century, but cockle beds continue to be productive.

The embayment is an internationally important conservation area, most notably for the expansive mudflats and sandflats harbouring invertebrate communities, which in turn support vast flocks of overwintering wading birds. The blue mussel (*Mytilus edulis*) is a common, indigenous molluscan bivalve species, widespread around European coasts and occurring in a range of habitats from shallow subtidal sandbanks to exposed rocky shores. Natural (or "wild") mussel beds are distributed across the intertidal mudflats and sandflats of The Wash. Subtidal mussel beds occur periodically within The Wash and further offshore. Intertidal cockle and mussel beds in The Wash provide a critical food resource for shellfish-eating birds – most notably oystercatcher *Haemotopus ostralegus* and knot *Calidris canutus*.

Eastern Inshore Fisheries and Conservation Authority (Eastern IFCA) is the local fisheries regulator for The Wash, responsible for managing viable fisheries and ensuring they align with conservation targets. This assessment considers the effects of permitting shellfish cultivation on the features of two designated sites: The Wash and North Norfolk Coast Special Area of Conservation (SAC) and The Wash Special Protection Area (SPA). By default, because of their co-location and same features, it also considers The Wash Ramsar Site (a designation reflecting the site as internationally important wetland) and The Wash Site of Special Scientific Interest (SSSI) (a nationally important conservation area). Additional marine protected areas have also been considered because of their proximity to The Wash. These are: Greater Wash Special Protection Area, Gibraltar Point Special Protection Area, North Norfolk Coast Special Protection Area, and Inner Dowsing, Race Bank & North Ridge Special Area of Conservation.

1.3.2. A new Wash Several Order

Eastern IFCA is seeking to establish a new Several Order for The Wash to replace the existing Wash Fishery Order 1992 (WFO) that is due to expire on 3rd January 2023. The existing Order is a hybrid Regulating and Several Order. It grants Eastern IFCA the right of several fishery, and of regulating a fishery for prescribed molluscan shellfish species (oysters, mussels, cockles, clams, scallops and queens) in The Wash. This Order allows Eastern IFCA to manage a public fishery on the naturally occurring shellfish stocks (the "Regulated Fishery") through a licensing scheme, and to allow the cultivation of shellfish within The Wash on private, leased areas, informally referred to as "lays" and collectively referred to as the "Several Fishery". Although a very small amount of native oyster and cockle cultivation has been undertaken, the vast majority of aquaculture in The Wash has been bottom-culture of mussels.

Eastern IFCA's aim for the new Wash Several Order is:

> "*To enable and facilitate aquaculture within The Wash which furthers the conservation objectives of The Wash marine protected areas, enhances sustainability of other Wash fisheries and supports economic viability for associated industry"*.

Through the WFO 1992, Eastern IFCA sets regulations (for example daily catch restrictions and minimum landing size), which apply only to the Regulated Fishery. The Several Fishery is exempt from these regulations except where activities in the Several Fishery are deemed capable of impacting the Regulated Fishery – in such cases, the Authority can apply management measures to the Several Fishery. Three WFO Regulations apply to the Several Fishery: those dictating the maximum dredge width (1m), the maximum number of dredges per vessel (2), and the maximum length of vessel (14m) that may be used.

Eastern IFCA is developing The Wash Cockle and Mussel Byelaw to enable continued management of the Regulated fisheries, and is applying for a replacement Several Order to enable continued management of the private Several fishery. [This will not affect the existing private Le Strange fishery in The Wash, which will remain entirely outside Eastern IFCA's jurisdiction.]

This proposal and assessment is focused solely on proposed The Wash Several Order (except where in-combination pressures are considered).

Eastern IFCA has set out proposed management measures for the new Several Order in the Wash Several Order 2022 – Fisheries Management Plan (draft) (Eastern IFCA 2021).[9]

[9] Eastern IFCA has consulted stakeholders on the draft Wash Several Order 2022 Fisheries Management Plan and intends to submit the Plan with the Several Order application and this Habitats Regulations Assessment to Defra.

1.3.3. Bivalve aquaculture

The intertidal mussel stocks in The Wash have traditionally provided a valuable resource for the local fishing industry; either being harvested directly for market or relayed from slow-growing beds within the regulated fishery onto leased lay ground within the several fishery. Until recent years, The Wash supported one of the largest mussel fisheries in the UK. Despite stringent fishing restrictions, stocks on natural mussel beds have declined significantly. This trend has also been seen in mussel populations in other parts of the UK, including north-east England. The option to cultivate mussels on private lays provides an important alternative to relying on unpredictable natural stocks for mussel fishermen, and encourages a steadier fishing pattern instead of a "boom-bust" fishery response to natural stock fluctuations.

Aquaculture is a growing industry that has been identified in the East Marine Plan as a "key area for development" due to its "potential to contribute to the sustainability and security of the United Kingdom food supply which, in turn, may encourage growth in small and medium enterprises supporting the industry" (HM Government, 2014). The East Marine Plan area reportedly accounts for approximately 40% of English shellfish production via aquaculture, including over half of English mussel production via aquaculture[10]. The Plan specifically refers to the private lays in The Wash and along the North Norfolk Coast as nationally significant aquaculture. In the past two years, Eastern IFCA has been made aware of proposals to develop seaweed farms off coastal waters of Norfolk and Suffolk, but none in The Wash embayment.

1.3.4 Several Order activities

The new Wash Several Order would enable Eastern IFCA to permit and control shellfish cultivation activities in The Wash. Such activities could include the deposition of shellfish seed onto prescribed lay ground, on-foot inspections of lays at low water and harvesting of cultivated stocks.

The fishing of natural or wild mussel beds to obtain seed for relaying will be managed outside of the new Several Order via The Wash Cockle and Mussel Byelaw. Such activity currently is, and will continue to be, assessed under separate Habitats Regulations assessments.

Recent several fishery activity in the current Wash Fishery Order has not involved the use of tables or trellises for the cultivation of shellfish, although historically (over 15 years ago) this method was used for native oyster cultivation. This assessment will not consider the use of such structures, but should an applicant wish to use them under the new Wash Several Order, Eastern IFCA will consider impacts on designated sites before granting permission.

1.3.5 Description of Activity considered in this assessment:

The Wash Several Order will allow two activities that are listed in Natural England's advice on operations[11]: shellfish aquaculture – bottom culture, and fishing – using dredges. Mussel cultivation by bottom culture has been carried out in The Wash for at least 100 years. Mussel farmers (fishermen) deposit partially grown mussels on rented intertidal areas known as "lays", for growing

[10] The relative importance of the East Marine Plan area for mussel cultivation has declined (in terms of production levels) since publication of the Plan in 2014.

[11] Conservation advice for The Wash & North Norfolk Coast SAC, accessed online January 2022: https://designatedsites.naturalengland.org.uk/Marine/FAPMatrix.aspx?SiteCode=UK0017075&SiteName=The+Wash+and+North+Norfolk+Coast&SiteNameDisplay=The+Wash+and+North+Norfolk+Coast+SAC&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=&NumMarineSeasonality=2

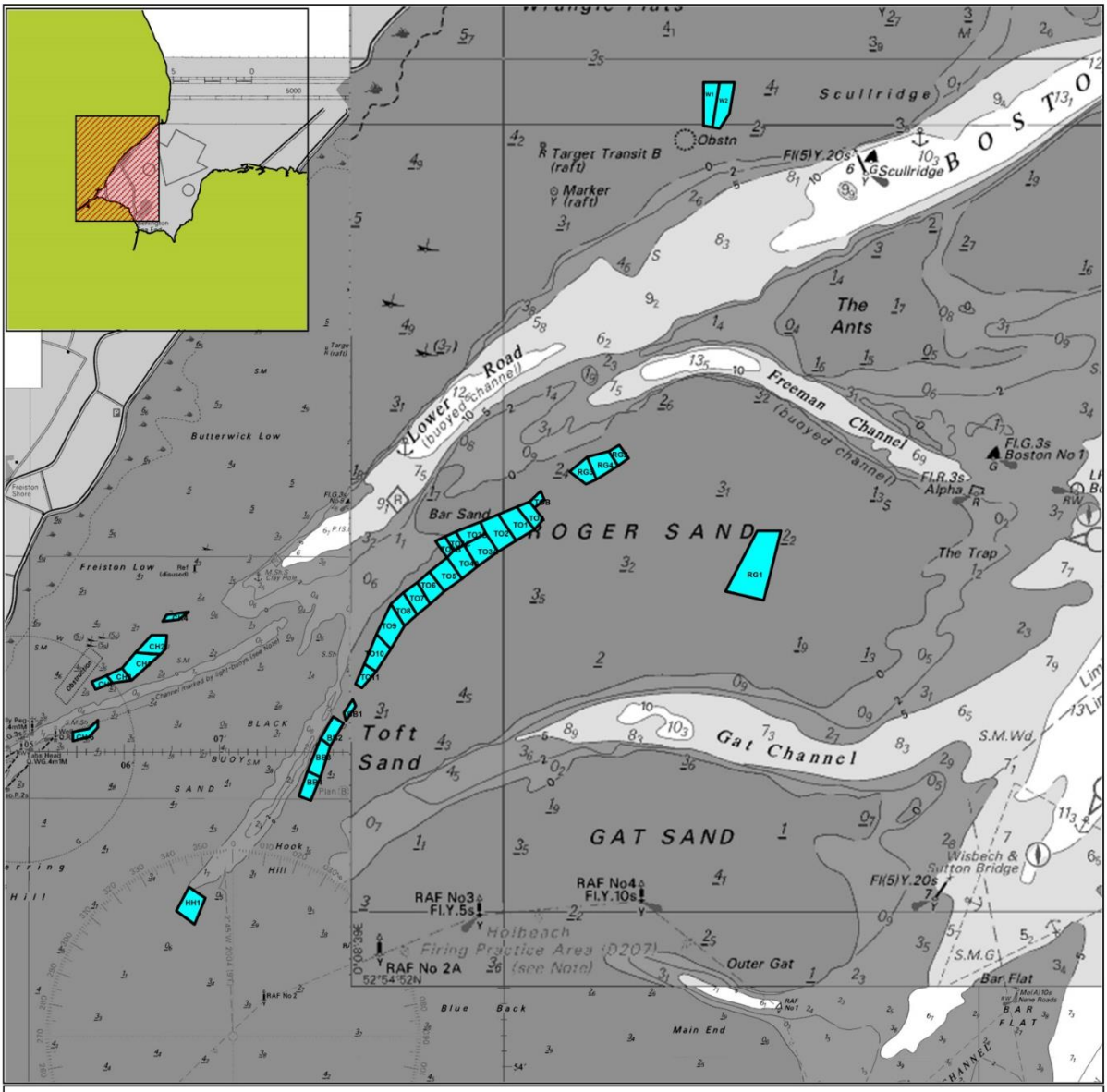
on to a harvestable size. Traditionally, the lays were stocked with juvenile mussels that had been collected from the wild intertidal beds within The Wash. However, the increasing demand for mussel seed, coupled with declining wild stocks on the intertidal beds and conservation measures limiting quota, mean the wild beds have not been able to satisfy the several fishery's requirement for seed so often seed is purchased from other mussel fisheries in the UK. The harvesting of mussels for relaying and cultivation is not included in this assessment, since harvesting of wild mussels is not a Several Order activity; it is a "public fishery" activity and is considered in separate fisheries assessments.

Fishermen place or "re-lay" seed mussel onto lays from a vessel during high water periods. They inspect the lays on foot over low water periods, after relaying and at intervals during the growing process. This type of bottom culture does not require frequent or intensive intervention; the relayed mussels can be spread using rakes if considered to be too densely laid; otherwise there is no treatment or intervention until the grown mussels are harvested. Once the mussels have reached harvestable size (typically a minimum of 45mm length) the stock is harvested from the lays using a maximum of two, 1m wide dredges deployed from a vessel over high water periods. Occasionally fishers will harvest by hand during low water periods, for example after dredging has reduced the stock density to a level that makes further dredging inefficient.

Currently there are 49 WFO leases within the Several Fishery. These leases allow for cultivation plots (lays) covering a total of 275 hectares. There is a limit of a maximum of 10ha per lay. It is planned that this number of leases and their extent will be the maxima continued under the replacement Wash Several Order. Since 2008 there has been a moratorium on new lays being issued, barring applications that were already being processed at the time of the moratorium's introduction. Figures 2 and 3 show the current location of the Several Fishery lays leased under the WFO 1992, in the west and east sides of The Wash respectively. It is intended that the location and extent of lays will be maintained but this will be subject to review of the FMP. Prior to consenting proposals for an increase in the total area (275ha) or total number of 49 lays, or new locations of lays, Eastern IFCA will satisfy that doing so will not negatively impact site integrity of the MPAs including by consultation with Natural England and undertaking an associated HRA.

Despite 49 leases being issued, they have not been fully utilised; many leased areas are not being used for shellfish cultivation or are being used at a small proportion of their capacity. This under-use of the lays means the level of activity on the lays has been lower than the theoretically possible level. The 49 leases are owned by 22 individuals; in recent years there have been fewer than 10 vessels observed working on the lays at any one time (Eastern IFCA IFCOs, *pers. comm.*). There are no indications at the time of this assessment that the maximum level of activity will increase; however, in case the Several fishery becomes fully operational with all lays fully utilised, a maximum concurrent usage of 22 vessels will be considered for the purposes of the assessment.

Eastern IFCA does not set harvesting limits for the Several fishery, because the stock is not a public resource and therefore does not need to be managed for fisheries sustainability or bird food purposes that apply to the public mussel beds. Fishers may theoretically harvest stock from their lays on seven days per week, at any time of year. The actual level of harvesting will depend on stock biomass and size composition, markets, interactions with other local fisheries, and weather conditions. Typically, the maximum harvesting activity is three days per week per vessel, within the September – March harvesting season – although in practice each layholder will only be harvesting during a small proportion of this season, depending on the factors listed above. In some cases, fishermen do not visit their lays for periods over a year. Mussel seed can be relayed onto lays throughout the year, although this is typically practised in the spring. The relaying process (depositing mussels on lays from fishing vessels) takes up to one hour each day.



Not to be used for Navigation
(c) British Crown and OceanWise 2020.
All rights reserved.
Licence No.EK001-20180110. This product has been derived in part from material obtained from the UK Hydrographic Office with the permission of the UK Hydrographic Office, Her Majesty's Stationery Office and other relevant authorities.

Figure 2 – Chart showing the position of lays leased through the WFO 1992 on the west side of The Wash

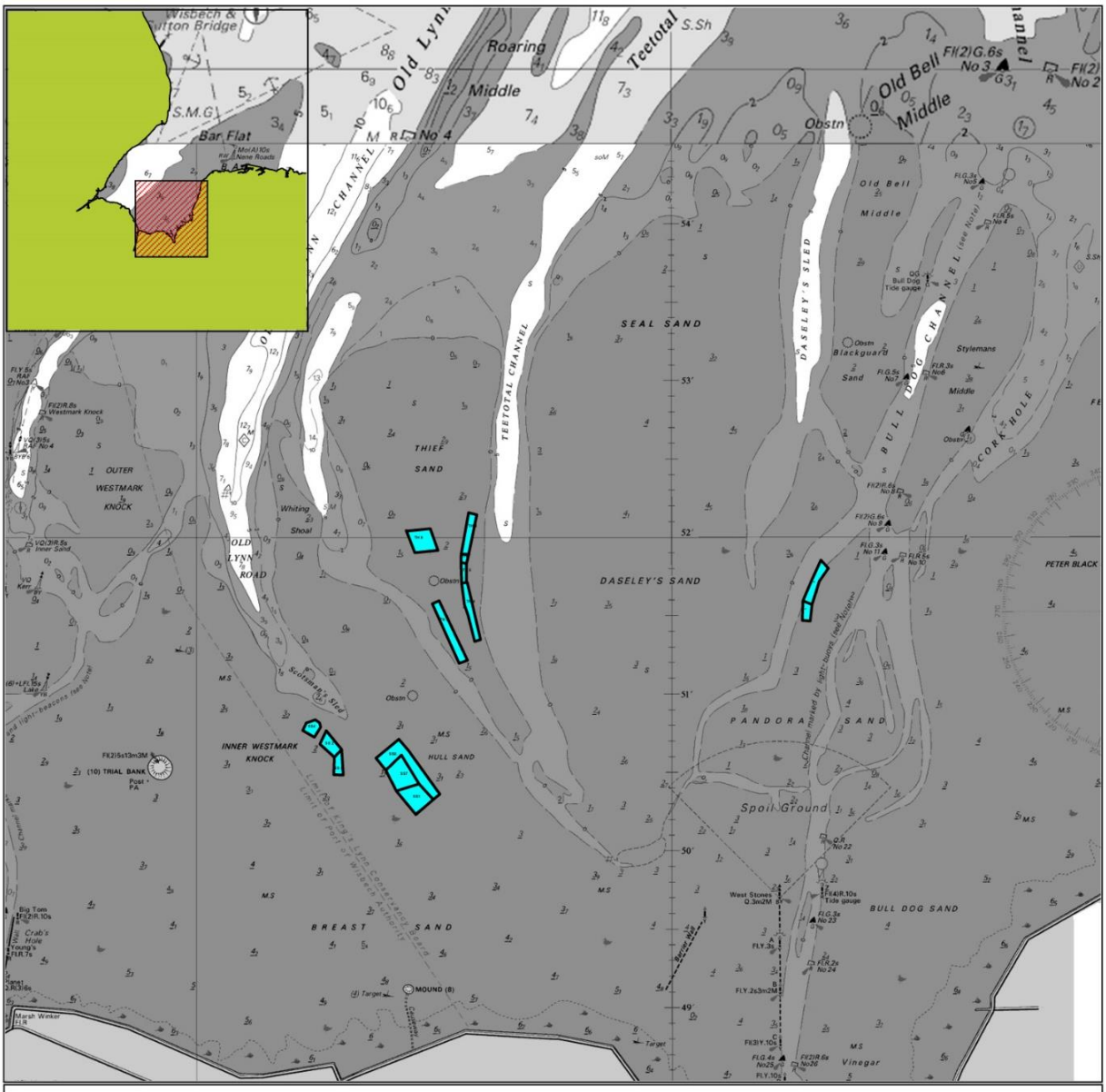


Figure 3 – Chart showing the position of lays leased through the WFO 1992 on the east side of The Wash

1.4 Timing and duration of proposal

The new Wash Several Order would commence in January 2023 and expire in December 2052 (i.e. 30 year duration). The timing and duration of activities authorised under this Several Order are described in section 1.3.. This assessment considers the effects of granting this 30-year Order, thereby catering for the realistic worst-case scenario. The assessment is not focused on individual leases that would be granted under the Order. Eastern IFCA would, however, be granted powers under the new Several Order to review or revoke individual leases if required, for example for conservation purposes.

1.5 Nature conservation management test

The proposal is for a fisheries management mechanism. Although management for nature conservation is an integral part of Eastern IFCA's fisheries management, for the purposes of this assessment, the proposal is not considered to be directly connected with or necessary to the management of the site for nature conservation.

1.6 Marine protected areas

The proposal will allow activities within the following marine protected areas:

- The Wash and North Norfolk Coast Special Area of Conservation
- The Wash Special Protection Area
- The Wash Site of Special Scientific Interest
- The Wash Ramsar site.

The following marine protected areas are within 5km of the proposed Wash Several Order area:

- Greater Wash SPA,
- Gibraltar Point SPA,
- North Norfolk Coast SPA,
- North Norfolk Coast SAC
- Inner Dowsing, Race Bank & North Ridge SAC.

1.6.1 European site interest features (habitats and species) and sub-features relevant to proposal

Table 1 sets out which interest features and sub-features have been screened in as relevant to the proposal, which have been screened out, and rationale for this screening decision.

Table 1: Screening of site features and sub-features for each marine protected area

Orange - features potentially affected by Several Order activities. These features have been scoped into the assessment
Blue - sub-tidal features for which there is no potential interaction with Several Order activities. These have been scoped out (not relevant to this assessment)
Green – intertidal features for which there is no potential interaction with Several Order activities. These have been scoped out.
Yellow - no interaction with feature because of known behaviour or management measures.

Site name	Feature	Sub-feature	Screened in?	Screening rationale
Wash and North Norfolk Coast SAC	Sandbanks which are slightly covered by sea water all the time	Subtidal mixed sediments	No	There is no interaction between the activity and this subtidal feature
		Subtidal coarse sediments	No	There is no interaction between the activity and this subtidal feature
		Subtidal sand	No	There is no interaction between the activity and this subtidal feature
		Subtidal mud	No	There is no interaction between the activity and this subtidal feature
	Mudflats and sandflats not covered by seawater at low tide	Intertidal coarse sediments	No	Based on the distribution of intertidal habitats and mussel lays, there is no interaction between the activity and this feature
		Intertidal mixed sediments*	No	Based on the distribution of intertidal habitats and mussel lays, there is no interaction between the activity and this feature
		Intertidal mud	Yes	Activities associated with the Several fishery interact with this feature
		Intertidal sand and muddy sand	Yes	Activities associated with the Several fishery interact with this feature
		Intertidal seagrass beds	No	Based on the distribution of intertidal habitats and mussel lays, there is no interaction between the activity and this feature
	Coastal lagoons	Coastal lagoons	No	Based on the distribution of intertidal habitats and mussel lays, there is no interaction between the activity and this feature
	Large shallow inlets and bays	Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	No	Based on the distribution of intertidal habitats and mussel lays, there is no interaction between the activity and this feature
		Circalittoral rock	No	There is no interaction between the activity and this subtidal feature
		Intertidal biogenic reef: mussel beds	No	Any activity associated with the Several fishery that affects intertidal mussel beds is currently managed by Eastern IFCA through the Wash Fishery Order 1992, to be replaced by The Wash Cockle and Mussel Fisheries Byelaw. This feature is also protected by Eastern IFCA's Marine Protected Areas byelaw 2018, to be replaced by the Closed Areas Byelaw 2021.

Site name	Feature	Sub-feature	Screened in?	Screening rationale
		Intertidal biogenic reef: *Sabellaria* spp.*[12]	No	Based on the distribution of intertidal habitats and mussel lays, there is no interaction between the activity and this feature. This feature will also be protected by Eastern IFCA's Closed Areas Byelaw 2021.
		Intertidal coarse sediment	No	Based on the distribution of intertidal habitats and mussel lays, there is no interaction between the activity and this feature
		Intertidal rock	No	Based on the distribution of intertidal habitats and mussel lays, there is no interaction between the activity and this feature
		Intertidal mud	Yes	Activities associated with the Several fishery interact with this feature
		Intertidal sand and muddy sand	Yes	Activities associated with the Several fishery interact with this feature
		Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*)	No	Based on the distribution of intertidal habitats and mussel lays, there is no interaction between the activity and this feature
		Subtidal biogenic reefs: *Sabellaria* spp.	No	There is no interaction between the activity and this subtidal feature. This feature is protected by Eastern IFCA's Marine Protected Areas byelaw 2018, to be replaced by the Closed Areas Byelaw 2021.
		Subtidal coarse sediment	No	There is no interaction between the activity and this subtidal feature
		Subtidal mixed sediments	No	There is no interaction between the activity and this subtidal feature
		Subtidal mud	No	There is no interaction between the activity and this subtidal feature
		Subtidal sand	No	There is no interaction between the activity and this subtidal feature
		Subtidal stony reef	No	There is no interaction between the activity and this subtidal feature. This feature will also be protected by Eastern IFCA's Closed Areas Byelaw 2021.
	Reefs	Circalittoral rock	No	There is no interaction between the activity and this subtidal feature. This feature will also be protected by Eastern IFCA's Closed Areas Byelaw 2021.
		Intertidal biogenic reef: mussel beds	No	Any activity associated with the Several fishery that affects intertidal mussel beds is currently managed by Eastern IFCA through the Wash Fishery Order 1992, to be replaced by The Wash Cockle and Mussel Fisheries Byelaw. This feature is also protected by Eastern IFCA's Marine Protected Areas byelaw 2018, to be replaced by the Closed Areas Byelaw 2021.
		Intertidal biogenic reef: *Sabellaria* spp.*	No	Based on the distribution of intertidal habitats and mussel lays, there is no interaction between the activity and this feature. This feature will also be protected by Eastern IFCA's Closed Areas Byelaw 2021.
		Intertidal rock	No	Based on the distribution of intertidal habitats and mussel lays, there is no interaction between the activity and this feature

[12] * Intertidal mixed sediments and intertidal biogenic reef: *Sabellaria* spp. were not included in the habitat extent data provided to EIFCA by Natural England (August 2017). However, NE clarified that the features are present in the site but their extent is not mapped. Eastern IFCA has applied local knowledge on the location of these features to assess whether the Several fishery is likely to interact with them.

Site name	Feature	Sub-feature	Screened in?	Screening rationale
		Subtidal biogenic reef: *Sabellaria* spp.	No	There is no interaction between the activity and this subtidal feature. This feature is also protected by Eastern IFCA's Marine Protected Areas byelaw 2018, to be replaced by the Closed Areas Byelaw 2021.
		Subtidal stony reef	No	There is no interaction between the activity and this subtidal feature. This feature will also be protected by Eastern IFCA's Closed Areas Byelaw 2021.
	Salicornia and other annuals colonising mud and sand		No	Based on the distribution of intertidal habitats and mussel lays, there is no interaction between the activity and this feature
	Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)		No	Based on the distribution of intertidal habitats and mussel lays, there is no interaction between the activity and this feature
	Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*)		No	Based on the distribution of intertidal habitats and mussel lays, there is no interaction between the activity and this feature
	Otter (*Lutra lutra*)		No	Based on the distribution of intertidal habitats and mussel lays, there is no interaction between the activity and this feature
	Harbour (common) seal (*Phoca vitulina*)		Yes	Activities associated with the Several fishery interact with this feature
	Water column		Yes	Activities associated with the Several fishery interact with this feature
The Wash SPA	Bar-tailed godwit (Limosa lapponica), Non-breeding		Yes	Activities associated with the Several fishery could interact with this feature
	Bewick's swan (Cygnus columbianus bewickii), Non-breeding		Yes	Activities associated with the Several fishery could interact with this feature
	Black-tailed godwit (Limosa limosa islandica), Non-breeding		Yes	Activities associated with the Several fishery could interact with this feature
	Common scoter (Melanitta nigra), Non-breeding		Yes	Activities associated with the Several fishery could interact with this feature
	Common tern (Sterna hirundo), Breeding		Yes	Activities associated with the Several fishery could interact with this feature
	Curlew (Numenius arquata), Non-breeding		Yes	Activities associated with the Several fishery could interact with this feature
	Dark-bellied brent goose (Branta bernicla bernicla), Non-breeding		Yes	Activities associated with the Several fishery could interact with this feature
	Dunlin (Calidris alpina alpina), Non-breeding		Yes	Activities associated with the Several fishery could interact with this feature
	Gadwall (Anas strepera), Non-breeding		Yes	Activities associated with the Several fishery could interact with this feature
	Goldeneye (Bucephala clangula), Non-breeding		Yes	Activities associated with the Several fishery could interact with this feature
	Grey plover (Pluvialis squatarola), Non-breeding		Yes	Activities associated with the Several fishery could interact with this feature
	Knot (Calidris canutus), Non-breeding		Yes	Activities associated with the Several fishery could interact with this feature
	Little tern (Sternula albifrons), Breeding		Yes	Activities associated with the Several fishery could interact with this feature
	Oystercatcher (Haematopus ostralegus), Non-breeding		Yes	Activities associated with the Several fishery could interact with this feature

Site name	Feature	Sub-feature	Screened in?	Screening rationale
	Pink-footed goose (Anser brachyrhynchus), Non-breeding		Yes	Activities associated with the Several fishery could interact with this feature
	Pintail (Anas acuta), Non-breeding		Yes	Activities associated with the Several fishery could interact with this feature
	Redshank (Tringa totanus), Non-breeding		Yes	Activities associated with the Several fishery could interact with this feature
	Sanderling (Calidris alba), Non-breeding		Yes	Activities associated with the Several fishery could interact with this feature
	Shelduck (Tadorna tadorna), Non-breeding		Yes	Activities associated with the Several fishery could interact with this feature
	Turnstone (Arenaria interpres), Non-breeding		Yes	Activities associated with the Several fishery could interact with this feature
	Wigeon (Anas penelope), Non-breeding		Yes	Activities associated with the Several fishery could interact with this feature
The Wash SSSI	Coastal saltmarsh		No	Based on the distribution of intertidal habitats and mussel lays, there is no interaction between the activity and this feature
	Saline lagoon		No	Based on the distribution of intertidal habitats and mussel lays, there is no interaction between the activity and this feature
	Vegetated shingle		No	Based on the distribution of intertidal habitats and mussel lays, there is no interaction between the activity and this feature
	Littoral sediment		Yes	Activities associated with the Several fishery interact with this feature
	Sub-littoral sands and gravels		No	There is no interaction between the activity and this subtidal feature.
	Sabellaria reefs		No	Based on the distribution of this feature and mussel lays, there is no interaction between the activity and this feature
Inner Dowsing, Race Bank & North Ridge SAC	*Sabellaria* reefs		No	Based on the distribution of this feature and mussel lays, there is no interaction between the activity and this feature
	Subtidal sanddbanks		No	Based on the distribution of this feature and mussel lays, there is no interaction between the activity and this feature
Gibraltar Point SPA	Bar-tailed godwit (Limosa lapponica), Non-breeding		No	Based on the distribution of this feature and mussel lays, there is no interaction between the activity and this feature
	Grey plover (Pluvialis squatarola), Non-breeding		No	Based on the distribution of this feature and mussel lays, there is no interaction between the activity and this feature
	Little tern (Sternula albifrons), Breeding		No	Based on the distribution of this feature and mussel lays, there is no interaction between the activity and this feature
	Sanderling (Calidris alba), Non-breeding		No	Based on the distribution of this feature and mussel lays, there is no interaction between the activity and this feature
Greater Wash SPA	Red-throated diver *(Gavia stellata),* Non-breeding		No	Based on the distribution of this feature and mussel lays, there is no interaction between the activity and this feature
	Common scoter *(Melanitta nigra)*, Non-breeding		No	Based on the distribution of this feature and mussel lays, there is no interaction between the activity and this feature

Site name	Feature	Sub-feature	Screened in?	Screening rationale
	Little gull *(Hydrocoloeus minutus)*, Non-breeding		No	Based on the distribution of this feature and mussel lays, there is no interaction between the activity and this feature
	Sandwich tern *(Sterna sandvicensis)*, Breeding		No	Based on the distribution of this feature and mussel lays, there is no interaction between the activity and this feature
	Common tern *(Sterna hirundo)*, Breeding		No	Based on the distribution of this feature and mussel lays, there is no interaction between the activity and this feature
	Little tern *(Sternula albifrons)*, Breeding		No	Based on the distribution of this feature and mussel lays, there is no interaction between the activity and this feature
North Norfolk Coast SPA	Avocet (*Recurvirostra avosetta*), Breeding		No	Based on the distribution of this feature and mussel lays, there is no interaction between the activity and this feature
	Bittern (*Botaurus stellaris*), Breeding		No	Based on the distribution of this feature and mussel lays, there is no interaction between the activity and this feature
	Common tern (*Sterna hirundo*), Breeding		No	Based on the distribution of this feature and mussel lays, there is no interaction between the activity and this feature
	Dark-bellied brent goose (*Branta bernicla bernicla*), Non-breeding		No	Based on the distribution of this feature and mussel lays, there is no interaction between the activity and this feature
	Knot (*Calidris canutus*), Non-breeding		No	Based on the distribution of this feature and mussel lays, there is no interaction between the activity and this feature
	Little tern (*Sternula albifrons*), Breeding		No	Based on the distribution of this feature and mussel lays, there is no interaction between the activity and this feature
	Marsh harrier (*Circus aeruginosus*), Breeding		No	Based on the distribution of this feature and mussel lays, there is no interaction between the activity and this feature
	Montagu's harrier (*Circus pygargus*), Breeding		No	Based on the distribution of this feature and mussel lays, there is no interaction between the activity and this feature
	Pink-footed goose (*Anser brachyrhynchus*), Non-breeding		No	Based on the distribution of this feature and mussel lays, there is no interaction between the activity and this feature
	Sandwich tern (*Thalasseus sandvicensis*), Breeding		No	Based on the distribution of this feature and mussel lays, there is no interaction between the activity and this feature
	Waterbird assemblage, Non-breeding		No	Based on the distribution of this feature and mussel lays, there is no interaction between the activity and this feature
	Wigeon (*Mareca penelope*), Non-breeding		No	Based on the distribution of this feature and mussel lays, there is no interaction between the activity and this feature
North Norfolk Coast SAC	Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*)		No	Based on the distribution of this feature and mussel lays, there is no interaction between the activity and this feature
	Coastal lagoons		No	Based on the distribution of this feature and mussel lays, there is no interaction between the activity and this feature
	Embryonic shifting dunes		No	Based on the distribution of this feature and mussel lays, there is no interaction between the activity and this feature

Site name	Feature	Sub-feature	Screened in?	Screening rationale
	Fixed dunes with herbaceous vegetation ("Grey dunes")		No	Based on the distribution of this feature and mussel lays, there is no interaction between the activity and this feature
	Humid dune slacks		No	Based on the distribution of this feature and mussel lays, there is no interaction between the activity and this feature
	Shifting dunes along the shoreline with *Ammophila amenaria* ("White dunes")		No	Based on the distribution of this feature and mussel lays, there is no interaction between the activity and this feature
	Otter (*Lutra lutra*)		No	Based on the distribution of this feature and mussel lays, there is no interaction between the activity and this feature
	Perennial vegetation of stony banks		No	Based on the distribution of this feature and mussel lays, there is no interaction between the activity and this feature
	Petalwort (*Petalophyllum ralfsii*)		No	Based on the distribution of this feature and mussel lays, there is no interaction between the activity and this feature

Please note:

(i) Supporting habitats for The Wash SPA species are covered in The Wash & North Norfolk Coast SAC designated features, and

(ii) Interest features of The Wash Ramsar site have not been listed in Table 1 as the SAC, SPA and SSSI features already cover them.

1.7 Interest feature sensitivity to potential pressures arising from proposed activity

The sensitivities of interest features to potential pressures arising from the proposed activity, as identified in Natural England's conservation advice, are shown below in Tables 2, 3, 4 and 5. The first pair of tables relates to the activity "shellfish aquaculture" and the second pair relates to "fishing using dredges".

Table 2: pressures from shellfish aquaculture – The Wash and North Norfolk Coast SAC
Table 3: pressures from shellfish aquaculture – The Wash SPA
Table 4: pressures from fishing using dredges – The Wash and North Norfolk Coast SAC
Table 5: pressures from fishing using dredges – The Wash SPA.

Table 2: Table showing the sensitivity of scoped-in features of The Wash and North Norfolk Coast SAC to pressures potentially arising from the proposed Several Order activities: Shellfish aquaculture: bottom culture (Natural England Advice on Operations, accessed 29/06/21).

(Sensitivity key: NS – Not sensitive, L – Low sensitivity, M – Medium sensitivity, H – High sensitivity, NR – Not relevant, IE – Insufficient evidence, NA – Not assessed)

Pressure risk rating for bottom culture	Pressure	Intertidal mud	Intertidal sand and muddy sand	Harbour seal	Water column
Medium-High (pressure commonly induced by activity at a level that needs further consideration in an assessment)	Abrasion/disturbance of substrate on surface of seabed	L	NS – M	NR	NR
	Changes in suspended solids (water clarity)	L	NS - L	NR	M
	Genetic modification & translocation of indigenous species	NR	NR	NR	H
	Introduction of microbial pathogens	NS – L	NS-M	H	NS
	Introduction or spread of invasive non-indigenous species (INIS)	H	NS-H	IE	H
	Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion	L	NS – H	NR	NR
	Removal of non-target species	L	L-M	H	NR
	Removal of target species	NR	NR	NR	NR
	Smothering and siltation rate changes (Light)	NS - L	NS – L	NR	NR
	Visual disturbance	NR	NS	H	L
Low (unless there is site-or case-specific evidence of increased risk, or uncertainty on pressure levels, this pressure does not generally occur at a level of concern and should not require consideration as part of an assessment)	Above water noise	NR	NR	H	NR
	Collision BELOW water with static or moving objects not naturally found in the marine environment.	NR	NR	H	NR
	Deoxygenation	NS	NS – L	NR	H
	Hydrocarbon & PAH contamination	NA	NA	NA	NA
	Introduction of light	NS	NS – L	IE	L
	Litter	NA	NA	M	H
	Nutrient enrichment	NS	NS	NR	H
	Organic enrichment	NS	NS	NR	H
	Physical change (to another seabed type)	NR	NR	NR	NR
	Physical change (to another sediment type)	H	M-H	NR	NR
	Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)	NA	NA	NA	NA
	Transition elements & organo-metal (e.g. TBT) contamination	NA	NA	NA	NA
	Underwater noise changes	NR	NR	H	H

Table 3: Pressure table showing the sensitivity of the SPA species designated under The Wash SPA to pressures potentially arising from Several order activities: Shellfish aquaculture: bottom culture, (Natural Englandd's Advice on Operations, accessed 30/06/2021).

(Sensitivity key: NS – Not sensitive, L – Low sensitivity, M – Medium sensitivity, H – High sensitivity, NR – Not relevant, IE – Insufficient evidence, NA – Not assessed)

Pressure risk rating for bottom culture	Pressure	SPA Assemblage sensitivity
Medium-high (pressure commonly induced by activity at a level that needs further consideration in an assessment)	Abrasion/disturbance of substrate on surface of seabed	NR
	Changes in suspended solids (water clarity)	NS-H
	Genetic modification & translocation of indigenous species	NR
	Introduction of microbial pathogens	H
	Introduction or spread of invasive non-indigenous species (INIS)	NS-H
	Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion	NR
	Removal of non-target species	H
	Removal of target species	NR
	Smothering and siltation rate changes (Light)	NR
	Visual disturbance	H
Low (unless there is site-or case-specific evidence of increased risk, or uncertainty on pressure levels, this pressure does not generally occur at a level of concern and should not require consideration as part of an assessment)	Above water noise	M-H
	Collision BELOW water with static or moving objects not naturally found in the marine environment.	NS-H
	Deoxygenation	NR
	Hydrocarbon & PAH contamination	NA
	Introduction of light	IE-M
	Litter	IE
	Nutrient enrichment	NR
	Organic enrichment	NR
	Physical change (to another seabed type)	NR
	Physical change (to another sediment type)	NR
	Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)	NA
	Transition elements & organo-metal (e.g. TBT) contamination	NA
	Underwater noise changes	IE-NS

Table 4: Table showing the sensitivity of relevant SAC features designated under The Wash and North Norfolk Coast SAC from the pressures potentially arising from the new Several Order activities: Fishing: dredging, (Natural England's Advice on Operations, accessed 30/06/21).

(Sensitivity key: NS – Not sensitive, L – Low sensitivity, M – Medium sensitivity, H – High sensitivity, NR – Not relevant, IE – Insufficient evidence, NA – Not assessed)

Pressure risk rating for fishing using dredges	Pressure	Intertidal mud	Intertidal sand and muddy sand	Harbour seal	Water column
Medium-high (pressure commonly induced by activity at a level that needs further consideration in an assessment)	Abrasion/disturbance of substrate on surface of seabed	L	NS – M	NR	NR
	Changes in suspended solids (water clarity)	NS-L	NS – L	NR	M
	Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion	L	NS – H	NR	NR
	Removal of non-target species	L	L-M	H	H
	Removal of target species	L	L-M	H	NR
	Smothering and siltation rate changes (Light)	NS - L	NS – L	NR	NR
	Visual disturbance	NR	NS	L	L
Low (unless there is site-or case-specific evidence of increased risk, or uncertainty on pressure levels, this pressure does not generally occur at a level of concern and should not require consideration as part of an assessment)	Above water noise	NR	NR	H	NR
	Collision BELOW water with static or moving objects not naturally found in the marine environment.	NR	NR	H	NR
	Deoxygenation	NS	NS – L	NR	H
	Hydrocarbon & PAH contamination	NA	NA	NA	NA
	Introduction of light	NS	NS – L	IE	L
	Introduction of microbial pathogens	NS-L	NS-M	H	NR
	Introduction or spread of invasive non-indigenous species (INIS)	H	NS-H	IE	NR
	Litter	NA	NA	M	H
	Nutrient enrichment	NS	NS	NR	H
	Organic enrichment	NS	NS	NR	H
	Physical change (to another seabed type)	NR	NR	NR	NR
	Physical change (to another sediment type)	M-H	M-H	NR	NR
	Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)	NA	NA	NA	NA
	Transition elements & organo-metal (e.g. TBT) contamination	NA	NA	NA	NA
	Underwater noise changes	NR	NR	H	H

Table 5: Pressure table showing the sensitivity of relevant SPA features designated under The Wash and North Norfolk Coast SPA from the pressures potentially arising from the new Several Order: Fishing: dredges, (Natural England's Advice on Operations, accessed 30/06/21).

(Sensitivity key: NS – Not sensitive, L – Low sensitivity, M – Medium sensitivity, H – High sensitivity, NR – Not relevant, IE – Insufficient evidence, NA – Not assessed)

Pressure risk rating for fishing using dredges	Pressure	SPA Assemblage sensitivity
Medium-high (pressure commonly induced by activity at a level that needs further consideration in an assessment)	Abrasion/disturbance of substrate on surface of seabed	NR
	Changes in suspended solids (water clarity)	H
	Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion	NR
	Removal of non-target species	NR
	Removal of target species	NR
	Smothering and siltation rate changes (Light)	NR
	Visual disturbance	H
Low (unless there is site-or case-specific evidence of increased risk, or uncertainty on pressure levels, this pressure does not generally occur at a level of concern and should not require consideration as part of an assessment)	Above water noise	M-H
	Collision BELOW water with static or moving objects not naturally found in the marine environment.	NS-H
	Deoxygenation	NR
	Hydrocarbon & PAH contamination	NA
	Introduction of light	L-M
	Introduction of microbial pathogens	H
	Introduction or spread of invasive non-indigenous species (INIS)	NS-H
	Litter	L-M
	Nutrient enrichment	NR
	Organic enrichment	NR
	Physical change (to another seabed type)	NR
	Physical change (to another sediment type)	NR
	Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)	NA
	Transition elements & organo-metal (e.g. TBT) contamination	NA
	Underwater noise changes	NS

1.8 Test of Likely Significant Effect (Possible impact pathways[13])

This section sets out the consideration of likely significant effects on sensitive site features, as a result of the pressures potentially resulting from shellfish aquaculture: bottom culture and fishing using dredges (please see Tables 3-6 above). Following Natural England's advice to Eastern IFCA (5/10/2017), this assessment of significant effect is a very precautionary consideration of whether there is a "possible pathway for effect" for each pressure, rather than whether a "significant effect" is "likely".

Pressures potentially arising from the proposed Several fishery activities have been considered in terms of possible impact pathways for the scoped-in features.

1.8.1 Abrasion/disturbance of substrate on surface of seabed, and penetration/disturbance below the surface of seabed

Shellfish cultivation by bottom culture has the potential to cause a low level of localised abrasion and/or disturbance to the substrate on the surface of intertidal habitats, or shallow penetration/disturbance below the surface of the seabed, through the laying-on of fishing vessels on the intertidal flats (to allow fishermen to access lays on foot for inspections) and walking on the intertidal flats. Fishing by dredging (harvesting mussels from lays) could also cause a low level of localised abrasion and or disturbance to the substrate on the surface of the seabed.

These pressures are considered further in the appropriate assessment below.

This pressure is not relevant to the Harbour seal, water column or SPA features.

1.8.2 Changes in suspended solids (water clarity)

The Wash is a highly dynamic estuarine environment, with naturally high levels of turbidity because of the large amount of sediment suspended by the constant water movement. The placement and harvesting of mussels onto and from lays will result in some localised and temporary increase in suspended solids in the water column, and therefore this pressure will be considered further in the appropriate assessment below.

1.8.3 Genetic modification & translocation of indigenous species

No genetic modification is undertaken in relation to shellfish cultivation in The Wash. Shellfish cultivation does often rely on translocation of indigenous species – e.g. mussel seed from north Wales or north-west England can be used to supply mussel lays in The Wash. Translocation of indigenous species is therefore considered further in the appropriate assessment below.

1.8.4 Introduction of microbial pathogens

There is a risk that importing shellfish seed (e.g. juvenile mussel) for cultivation can introduce pathogens or parasites to an area where they were not previously present. This risk is therefore considered in the appropriate assessment below.

1.8.5 Introduction or spread of invasive non-indigenous species (INIS)

[13] Following Natural England's advice (5/10/2017) that it is more appropriate to question whether there is a possible pathway for an impact to occur than whether a significant effect is "likely".

Like the risks of introducing pathogens or parasites, there is a risk that importing shellfish seed could result in the introduction or spread of INIS. This risk is assessed in the appropriate assessment below.

1.8.6 Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion

Please see 1.8.1.

1.8.7 Removal of non-target species

Cultivated mussel beds contain very few non-target species, which means there is very low risk of removal of non-target species during harvesting. However, as a precaution, this pressure is not scoped out at this stage, but is considered in more detail in the appropriate assessment below.

1.8.8 Removal of target species

This pressure is considered not relevant to this activity in this site since the target species is one that has temporarily been introduced to the area but does not form a part of the natural (wild) mussel beds. Eastern IFCA does not permit lays to be located in areas where natural shellfish beds occur, so there is no loss of natural stocks. Eastern IFCA restricts public fisheries (on natural mussel and cockle beds) to ensure sufficient biomass remains (subject to natural change) to maintain stock sustainability of the wild beds, as well as to support dependent SPA bird populations. Stocks cultivated on lays in the Wash Several Order are not included in the stock totals because they are effectively private property and can be fished at any time without Eastern IFCA authority. Cultivated mussels are likely to be targeted by natural predators (predominantly oystercatchers and eider ducks) but harvesting lay mussels will not deprive birds of a critical food source, so long as Eastern IFCA continue to ensure fisheries do not deplete stocks on natural beds below “bird food model” thresholds. Removal of target species from Several Order lays is therefore not considered to pose a risk to conservation targets. This pressure is therefore not considered further in this assessment.

1.8.9 Smothering and siltation rate changes (Light)

Subtidal and intertidal habitats can be affected by smothering if particulate matter suspended in the water column settles onto the seabed, or when material is placed directly onto the seabed. This could have a significant effect if settlement or placement occurs in densities that affects the functioning of those habitats. Harbour seals and SPA species are not vulnerable to this pressure, because as mobile species they are able to move away from activities that could cause smothering.

The placement of mussels onto lays for cultivation will caused localised smothering. This pressure is therefore considered in more detail in the appropriate assessment section below.

1.8.10 Visual disturbance

Visual disturbance is only relevant to Harbour seals and SPA bird species in this assessment. [A low sensitivity is suggested for water column, but the conservation advice suggests this would relate to activities that could create shadows in the water column, for example cranes or wind turbines, so not relevant to this assessment.]

Visual disturbance can negatively impact seals and birds if it causes them to react and use energy that would otherwise be vital for survival, if it flushes them away from food sources that are not available elsewhere, or if (for seals) their reaction causes separation of mothers and pups, which can lead to mortality of pups. Birds are most vulnerable to visual disturbance impacts during severe

weather periods, i.e. when limited energy is most vital for survival. The presence of fishermen on intertidal flats during low water periods, for example when inspecting mussel lays or harvesting mussels by hand, can result in disturbance to birds, although anecdotal and video evidence show that many birds habituate quickly to non-intrusive, pedestrian activity on intertidal flats. Harbour seals are most vulnerable to visual disturbance impacts during the summer pupping, moulting and breeding season (June to August). Although seals can also habituate to human presence, people moving close to seals on intertidal flats can disturb the seals and could cause them to flee into nearby channels. Because of the importance of intertidal flats in The Wash for Harbour seals and SPA species, and the potential disturbance from Several order activities, this pressure is considered further in the appropriate assessment below.

1.8.11 Above water noise

This pressure is only relevant for Harbour seal and the SPA assemblage. Harbour seals have a high sensitivity to the pressure, but the risk of interaction is assessed to be low, because of the limited frequency, extent and duration of Several fishery activities and the extensive space available to seals in the site. The sensitivity of SPA bird species to this pressure has been identified as medium to high, but the risk is also considered low for the same reasons. Several fishery activities will take place at high tide (placement and harvesting of mussels) and low tide (lay inspections) within or immediately adjacent to the lays (total 275ha). Some above water noise will inevitably be created by vessels' engines during high water periods as they manoeuvre over lays, but the predicted level of activity (maximum 49 vessels at any one time, but likely to be much less than this) is low, and seals and birds are known to habituate to the presence of fishing vessels transiting and working within The Wash, meaning that no significant above water noise disturbance effect is predicted. The low water activities are not predicted to generate above water noise. This pressure is therefore not considered further in this assessment.

1.8.12 Collision BELOW water with static or moving objects not naturally found in the marine environment

This pressure is categorised as low risk in the conservation advice, and the only feature sensitive to the risk is Harbour seal. Despite a large population of Harbour seals living in The Wash, there are no known records of collisions between seals and fishing vessels engaged in Several fishery activities in The Wash, and no evidence of seals with injuries that could have resulted from seals colliding with fishing vessels here. Seals are unlikely to collide with small fishing vessels operating slowly during Wash Several fishery activities, because they are likely to swim away from the vessels. This pressure is therefore not considered further in this assessment.

1.8.13 Deoxygenation

Several fishery activity could result in localised deoxygenation via smothering of habitats where mussels are relayed (see 1.8.2.9), but any such impacts are assessed as negligible because of their very small scale and reversibility. There is not considered to be a realistic risk of deoxygenation of the water column resulting from the Several fishery, because the high-energy environment ensures water is well-mixed both vertically and horizontally. This pressure is not considered further in this assessment.

1.8.14 Hydrocarbon & PAH contamination

This pressure is the subject of existing legislation, which is considered as adequate mitigation against potential impacts, e.g. for the prevention of accidental release of oil or fuel into the marine environment. It is considered there is no realistic risk of these contamination pressures resulting from the proposed fishery. They are not considered further in this assessment.

1.8.15 Introduction of light

The activity will not result in this pressure; thus it is not considered any further in this assessment.

1.8.16 Litter

Although relevant to Harbour seal, Water column and SPA species (not assessed for intertidal mud and intertidal mud and muddy sand), this pressure is low risk. Several fishery activities (laying and harvesting of mussels, and lay inspections) do not generate waste that could create litter. Fishermen have in the past sometimes marked their lays by re-using plastic containers to act as small buoys, but this practice is not universal. Eastern IFCA will include a condition in leases issued under the new Several Order to prohibit use of plastic containers to mark lays, to avoid the risk of such markers becoming litter if detached and lost into the sea. There is no history of dredges used during mussel harvesting being lost in the existing Wash Several fishery, so there is judged to be no risk of litter arising from lost fishing gear.

1.8.17 Nutrient enrichment

This pressure is characterised by an increase in levels of nutrients such as nitrogen and phosphorus in the water column, for example via the application of fertilisers or food. There are no identified pathways for this pressure to result in The Wash from either aquaculture: bottom culture or fishing using dredges. Nutrient enrichment is therefore not considered further in this assessment.

Conversely, in the past concerns have been raised about the potential for farmed mussels to reduce rather than increase nutrient levels in the surrounding waters, which could potentially limit food available for wild shellfish in The Wash. Eastern IFCA (and before them, their predecessor Eastern Sea Fisheries Joint Committee) routinely monitor chlorophyll-α levels (as a proxy for plankton, which reflects nutrient levels) close to mussel lays in the current Several fishery, to ascertain whether there are reduced nutrient levels around farmed mussels. Results to date have not indicated such issues but monitoring will continue. However, because of the potential for farmed shellfish to limit food availability for wild shellfish populations in The Wash, it is assessed that Several Order activities could have a significant effect on nutrient levels. This pressure is therefore considered further in the appropriate assessment below.

1.8.18 Organic enrichment

The water column is the only feature identified as sensitive to this low-risk pressure. Strong hydrodynamic currents in The Wash mean any organic matter (e.g. faeces) released from shellfish cultivation plots is likely to be rapidly dispersed to negligible densities. It is not predicted that organic enrichment will occur because of Several fishery activities. This pressure is not considered further in this assessment.

1.8.19 Physical change (to another seabed type)

None of the scoped-in features are recorded as being sensitive to this pressure as a result of bottom culture or fishing using dredges, so it is not considered further in this assessment.

1.8.20 Physical change (to another sediment type)

Intertidal mud and intertidal sand and muddy sand have a medium-high sensitivity to this low risk pressure. Shellfish cultivation (bottom culture) is likely to result in a local change in sediment type immediately underneath the placed shellfish. Typically, this will be a gradual increase in finer

sediments (silt/mud) on top of the original sand or muddy sand. As set out at 1.8.2.9, this change in sediment character occurs on top of the underlying substratum, rather than being a change to that original feature. It would only affect the immediate lay area (maximum 275ha) compared with approximately 27,000ha of intertidal sand, muddy sand and mud. Some finer sediment can remain on mussel lays after mussels are harvested, but this is likely to gradually be removed by natural water movement, meaning there is not likely to be a long-term change to another sediment type as a result of Several fishery activities. This pressure is therefore not considered further in this assessment.

1.8.21 Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)

This pressure is the subject of existing legislation, which is considered as adequate mitigation against potential impacts. There is not considered to be a realistic risk of these pressures resulting from the proposed Several fishery, so they are not considered further in this assessment.

1.8.22 Transition elements & organo-metal (e.g. TBT) contamination

This pressure is the subject of existing legislation, which is considered as adequate mitigation against potential impacts. There is not considered to be a realistic risk of these pressures resulting from the proposed Several fishery, so they are not considered further in this assessment.

1.8.23 Underwater noise

Harbour seal and water column are both listed as having a high sensitivity to this low risk pressure. The actual risk of underwater noise created by Several fishery activities (limited to noise generated by vessels transiting to and from the lays, and manoeuvring over the lays) affecting Harbour seals is assessed to be low, because of the limited frequency, extent and duration of Several fishery activities and the extensive space available to seals in the site, as well as evidence of their widespread usage of the site (e.g. Thompson D 2018). Similarly, risk to water column (and by extension, diving seabirds that predate within the water column) is assessed to be low. Fishing vessels routinely work in The Wash (primarily from the ports of Boston and King's Lynn) and there is no evidence of impacts to Harbour seal and water column resulting from underwater noise generated by them; the current Several Fishery proposal would not result in any significant change in current levels or patterns of activity. It is therefore predicted that the proposal will not result in any significant underwater noise disturbance effect. This pressure is therefore not considered further in this assessment.

Appropriate Assessment

Table 6 (below) lists the pressures scoped out at the likely significant effect (pressures pathway) stage (section 1.8) and those taken forward to appropriate assessment.

Table 6. Pressures scoped out and in for further assessment

Pressures scoped out at "likely significant effect" stage
Smothering and siltation rate changes
Above water noise
Removal of target species
Deoxygenation
Hydrocarbon and PAH contamination
Introduction of light
Litter
Nutrient enrichment (but nutrient depletion scoped in)
Organic enrichment
Synthetic compound contamination (including pesticides, antifoulants, pharmaceuticals)
Transition elements and organometal (e.g. TBT) contamination
Collision below water with static or moving objects not naturally found in the marine environment
Physical change (to another seabed type)
Physical change (to another sediment type)
Underwater noise
Pressures to be considered further in appropriate assessment
Abrasion / disturbance of surface of substrate
Penetration/disturbance below surface of substrate
Changes in suspended solids
Smothering and siltation rate changes
Genetic modification and translocation of indigenous species
Nutrient depletion (phytoplankton availability)
Introduction of microbial pathogens
Introduction or spread of invasive non-indigenous species
Removal of non-target species
Visual disturbance

2.1 Abrasion/disturbance of substrate on the surface of seabed; and

2.2 Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion

Two features are identified as sensitive to abrasion and penetration pressures:

- Intertidal mud; and
- Intertidal sand and muddy sand.

Intertidal mud biotopes are identified as having *low sensitivity* and *high resilience* to both pressures. Intertidal sand and muddy sand biotopes are identified as being *not sensitive* or having *low sensitivity* and *high resilience* to the pressure, except for the biotopes: *Macoma balthica and Arenicola marina in muddy sand shores* and *Cerastoderma edule and polychaetes in littoral muddy sand*. The former biotope has been assessed as having *medium sensitivity* and *medium resilience* to *Abrasion/disturbance of substrate on surface of seabed* and *high sensitivity* and *low resilience* to *Penetration and/or disturbance of the substratum below the surface of the seabed, including*

abrasion. The latter biotope is identified as having *medium sensitivity* and *medium resilience* to the pressure: *Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion.*

Activities associated with the Several fishery include fishing vessels drying out on intertidal flats, fishers walking on the intertidal flats to inspect the lays, and fishers harvesting cultivated mussels using dredges or occasionally hand-working. Each of these has the potential to cause some abrasion or disturbance of substrate on the surface of seabed[14]. The magnitude of the effect depends on the hardness of the substrate (hard surfaces being less prone to abrasion/disturbance and penetration) and the fragility/recoverability of biological communities living within or upon the surface (communities adapted to high-energy environments are typically less fragile than those in more sheltered habitats).

Mitigation is embedded into the proposed Fisheries Management Plan in the same way that it has been applied to the Wash Fishery Order: Eastern IFCA does not permit lays to be granted in sensitive biotope areas. Prospective lay areas are surveyed before being allocated: areas containing beds of cockles (*Cerastoderma*), mussels or lugworm (*Arenicola*) and Baltic tellin (*Macoma*) are not leased. This ensures that intertidal habitats (and specific communities or biotopes within those habitats) that could be more sensitive to abrasion and penetration impacts are protected.

It is common practice in The Wash for fishers to use their vessels to access their mussel lays over high water periods, then allow the vessel to settle onto the seabed as the tide ebbs (referred to as "drying out" the vessel). The process is reversed as the tide returns and the vessel lifts off the seabed. Drying out and re-floating can result in minor abrasion/disturbance of the surface of the seabed and some penetration by the keel. Such effects are small-scale, limited to the immediate vicinity of the vessel, of short duration (occurring during short periods of time before the vessel settles on the seabed and after it re-floats), and are assessed to be of low significance in the context of the natural churning of sediments at the surface of the seabed resulting from tidal currents. Vessel keel-marks can remain visible in intertidal flats for a period of days – particularly in sediments that are muddier rather than sandier – but because of the very limited extent and short duration, this results in negligible impacts to intertidal sediment habitats and their communities.

On-foot inspections of lays and harvesting stocks by hand could both result in surface abrasion / penetration through trampling. Sediment composition varies across the intertidal flats. Several order mussel lays are typically located on sand and muddy sand areas of intertidal flats. Intertidal mud has a low sensitivity to abrasion through trampling, and intertidal sand and muddy sand can have a medium sensitivity to abrasion. The level of abrasion or penetration resulting from walking across the intertidal flats in The Wash for Several fishery purposes is assessed to be minimal given the small scale and low intensity of the activity. Some localised disturbance will occur in the footprint of the activity, more so in muddy than in sandy sediments, and this could lead to localised mortality or displacement of epifauna or fauna in the top few centimetres of the substrate. Fishers' footprints could last a few days in muddy sediment areas but are not likely to be observed in harder sand sediments. Given the naturally dynamic conditions in The Wash, it is assessed that any physical abrasion/disturbance or penetration from walking on the intertidal flats would be insignificant in relation to natural physical disturbance to these habitats, and would not cause changes to the overall extent, distribution, sediment composition or stability of intertidal habitats, nor any significant changes to the extent, distribution, abundance or species composition of biological communities.

Mussel harvesting gear used by vessels in the proposed Several Order fishery will be limited (as in the current WFO) to two dredges per vessel, each of which must not exceed one metre in width.

[14] Eastern IFCA lay inspections could also cause this pressure, but these impacts have been considered separately in Eastern IFCA's 2017 Intertidal Activities HRA but will be considered in combination with the several fishery below.

This will allow for a maximum total shearing edge path width of 2m per tow. Dredging for mussels will typically take place at towing speeds of up to 4 knots on the mussel beds in The Wash (Senior IFCO, pers. comm.). Dredging mussels using a vessel-towed dredge could cause localised disturbance to the substratum. Dredges used in The Wash mussel fishery typically penetrate between 2.5 cm and 5 cm into the underlying substratum (Senior IFCO, pers. comm.), but this could increase to a maximum of 10 cm under certain conditions. Fishers aim to minimise penetration to harvest the target species without bringing up large amounts of mud and sediment. Physical impacts are limited and often prevented, because the process involves separating superficial mussel clumps from the underlying mussel mud (a combination of sediment and pseudofaeces) without fully breaking down the structure of the mussel hummocks. The mussel mud, built up naturally underneath the beds of cultivated mussels, is in effect a physical buffer preventing the dredges from abrading the underlying sediment of the intertidal flats. It is therefore assessed that this activity will not result in impacts to the underlying intertidal flats or their biological communities that could affect their extent, distribution, abundance or species composition.

All fishers, regardless of intention to dredge or hand rake, will be advised to follow best practice to minimise disturbance to the seabed from the keel and hull of the vessel to ensure that the vessel is adequately afloat before steaming off the intertidal beds on the incoming tide.

The location of intertidal beds in an open embayment results in appreciable natural seabed energy from tide and wave action, resulting in an infauna which is pre-adapted to disturbance pressures. Furthermore, there is effectively no sessile epifauna (e.g. sponges or corals) in the location of the fishery, because of the lack of attachment surfaces, shelter or screening from predators.

The proposed several fishery will be operated under the same management parameters as it has been for many years during which officers have not observed any evidence to suggest that activities cause levels of abrasion that could result in adverse effects on site features.

Abrasion and penetration pressures are listed as “not relevant” for harbour seal, water column and SPA assemblage. SPA supporting habitats (invertebrate-rich intertidal sandflats and mudflats) are considered above.

The small temporal and spatial footprint of the Several fishery resulting in very limited abrasion and penetration effects, coupled with embedded mitigation preventing use of the more sensitive intertidal habitats and the resilience of the indigenous communities, means the potential impacts of the Several fishery will be minimal, and will not threaten achievement of the conservation objectives of the site. **It is therefore concluded that the pressures *Abrasion/disturbance of substrate on the surface of seabed* and *Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion* will not have an adverse effect on site integrity.**

2.3 Changes in suspended solids (water clarity)

Features considered sensitive to the above pressure:

- Water column

Harvesting cultivated shellfish using dredges disturbs sediment, releasing it into the water column. This could affect visibility and light levels, leading to impacts on feeding behaviour, respiration and algal growth (Stokesbury *et al* in Shumway (ed) 2011) if the change in suspended solids (seston) is extensive and/or long term. The extent and duration of changes in seston depends on the amount of sediment disturbed, the size and type of sediment particles, and amount of water movement (hydrodynamics). Larger sediment particles (e.g. sand grains) re-settle out of the water column more quickly and closer to source than finer particles (e.g. silt).

Whether negative impacts result from this pressure will depend on the physical and biological environment. The Wash is a highly dynamic estuarine environment; its physical and biological characteristics are strongly influenced by the inputs of four major rivers (the Witham, Welland, Nene and Great Ouse) as well as the twice-daily influx and release of massive volumes of tidal water. The waters of the Wash have naturally high loads of suspended solids (sand and muddy sediment) derived from riverine sources as well as that introduced and circulated with tidal flows (Ke *et al* 1997). Most estuarine species are tolerant of high, and variable, sediment loads. While marine plants and algae such as eelgrass and seaweed could be negatively affected by reduced light levels, neither of these are found in or close to Several fishery lays, so there is no mechanism for them to be affected by Several fishery activities.

It is predicted that there will be a small-scale, localised release of fine sediment (mud particles) into the water column during harvesting of mussels from lays. A smaller release could occur when mussels are placed onto lays. However, it is assessed that even if all the Several Order lays were harvested at the same time (a possible but highly unlikely scenario), the increase in suspended sediments will not result in significant changes to visibility or light levels, and therefore will not result in negative impacts on feeding behaviour or respiration. This judgement is based on the following:

- the small extent of Several Fishery compared with the size of The Wash;
- the low frequency and short duration of shellfish stocking / harvesting activity;
- very high background suspended sediment levels;
- the tolerance of biological communities in The Wash to high sediment loads and the absence of more sensitive receptors such as marine plants or algae;
- the high-energy hydrodynamics across the site meaning local increases in suspended sediment are short-term and are rapidly dispersed.

It is concluded that the pressure: *Changes in suspended solids (water clarity)* will not have an adverse effect on site integrity.

2.4 Smothering and siltation rate changes

This pressure is not relevant to Harbour seal, water column and SPA assemblage. Intertidal mud and intertidal sandy and muddy sand are recorded as “not sensitive to low sensitivity” to this pressure.

Placement of mussels onto lays for cultivation will cause an incomplete, localised smothering of the underlying habitat. In contrast to disposal of dredge spoil, where material entirely covers the surface of the receiving habitat, placement of mussels for cultivation results in a loose, patchy layer of aggregated mussels on the surface. Typically, relayed mussels are “clean” batches of juvenile mussels without large quantities of sediment. This means the underlying surface is not likely to be entirely smothered by the placement of mussels. As mussels grow they excrete faeces and pseudofaeces (mucus and undigested particulate matter), which typically builds up layers of fine “mussel mud” on the surface of the underlying sediment, giving mussel beds their characteristic raised profile. This increases the localised smothering effect but is limited to patches of mussels within the extent of the lays in use. The effect lasts for the duration of the mussels being present but is reversed when mussels are harvested.

Eastern IFCA prevents smothering impact on more sensitive habitats, e.g. cockle beds, wild mussel beds, or beds of *Limecola balthica* (Baltic tellin), *Lanice conchilega* (sand mason worm) or *Arenicola marina* (lugworm), by prohibiting leasing of lays in such areas. This is embedded mitigation in the current Fishery Order and will be carried forward into the new Several Order. The small scale of mussel cultivation under the Several Order, limited to the current extent of 275ha, means that even if all the lays were fully stocked, this medium-term smothering effect will be limited to a very small proportion (<1%) of intertidal flats in The Wash. The effect is reversible, in that after mussels are

removed from a lay, mussel mud is removed over time through natural hydrological processes (movement of water). Because of the naturally high levels of material within the water column in The Wash (please see 2.2), and the high energy conditions in The Wash, any smothering of surrounding habitats by mussel mud washed off harvested lays is assessed to be negligible.

It is assessed that the Several fishery will not cause significant smothering effects because of:

- the limited extent of the area potentially affected;
- the low sensitivity of the receiving habitats;
- the reversibility of the impact;
- naturally high suspended sediment levels and
- the high energy conditions in The Wash.

It is therefore concluded that the Several fishery will not adversely affect site integrity through either direct or indirect smothering of habitats.

2.5 Nutrient depletion (phytoplankton availability)

Although phytoplankton reduction is not listed as a potential pressure in Natural England's conservation advice relating to bivalve aquaculture, Eastern IFCA and Natural England have agreed it should be considered as part of The Wash Several Order 2022 HRA because of the potential mechanism for impacting the designated features. As set out in section 1.8.17, it is possible that wild shellfish populations could be impacted by Several Order activities if those activities resulted in nutrient depletion.

Natural populations of bivalve shellfish are attributes of the *Intertidal mudflats and sandflats* feature of The Wash & North Norfolk Coast Special Area of Conservation (WNNC SAC). They also form a significant part of the invertebrate biomass that supports the vast populations of breeding and overwintering birds protected in The Wash Special Protection Area (The Wash SPA), Ramsar site and Site of Special Scientific Interest.

Bivalve shellfish feed on phytoplankton and organic detritus, although the latter has relatively poor nutritional value (MMO 2019). In order to thrive, bivalve shellfish rely on appropriate levels of phytoplankton being available in the water column. If phytoplankton levels fall below a minimum threshold, this could result in reduced growth and ultimately mortality in the dependent bivalve populations. If this were to occur at a significant level, it could prevent conservation objectives for The WNNC SAC and/or The Wash SPA from being achieved.

Declines in cockle and mussel biomass in The Wash throughout the 2010s, and atypical mortality in the same observed since 2008, raised questions about the potential for farmed mussels to be out-competing natural populations for food. Other mooted causes of the declines/mortality included disease, parasitic infection and changes in plankton composition. Several studies have been conducted to investigate the cause of the die-offs since then, but to date, no causal factor has been identified. Cefas[15] scientists are currently conducting a more thorough holistic investigation, incorporating pathology, histology and bio-chemistry into identifying the potential causes. Over-fishing has been ruled out because Eastern IFCA's measures to prevent stocks being overfished (measures relating to stock density, biomass (daily and seasonal quota) and size composition, minimum landing size, and vessel/gear limitations) maintain the sustainability of the fisheries in relation to stock and conservation targets. There is also widescale physical evidence of cockles and mussels dying in situ, irrespective of fishing activity, showing the population declines do not relate to removal of mussels by fishing but mortality within the mussel beds.

[15] Centre for Environment, Fisheries and Aquaculture Science

In response to concerns about cockle and mussel declines, in 2009 Eastern IFCA's predecessor, Eastern Sea Fisheries Joint Committee, initiated a research programme to monitor chlorophyll-α levels (as a proxy for phytoplankton) and mussel condition, (measured as the proportion of flesh compared to overall body weight) in The Wash. A sonde was deployed in the central Wash to provide continuous temperature, turbidity and chlorophyll-α measurement. A second, mobile sonde was used to take monthly readings of the same parameters at three shellfish beds. Mussel condition was recorded monthly wherever possible from samples taken at the three shellfish beds. Eastern IFCA has continued this monitoring to date, although there have been some notable data gaps because of operational factors preventing sampling taking place.

In 2015 Eastern IFCA agreed a process (EIFCA 2015) to implement measures that would reduce the feeding capacity of mussels farmed under The Wash Fishery Order 1992, should this be deemed necessary to ensure farmed mussels do not out-compete natural populations for food. The measures would be triggered if monitoring identified chlorophyll-α levels and mussel condition to be below agreed thresholds in two out of three monitoring sites over three consecutive months, and if a grazing assessment identified food availability could be compromised. Should these criteria be reached, WFO 1992 lay-holders would be required to reduce the density of mussels on their lays below an agreed threshold.

This mitigation process is detailed in Appendix 1 of The Wash Several Order 2022 draft Fisheries Management Plan (Eastern IFCA 2021).

It is not proposed that the mitigation described above would change when The Wash Several Order 2022 is introduced to replace The Wash Fishery Order 1992. It is therefore regarded as embedded mitigation in the proposal.

With the mitigation in place, as described, it is assessed that The Wash Several Order 2022 will not result in significant reductions in phytoplankton availability for natural filter feeders. Further, it is assessed that there are no other plans or projects in or close to The Wash that could reduce phytoplankton availability for filter feeders in The Wash, so no in-combination effects are predicted in relation to this potential pressure.

It is therefore concluded that The Wash Several Order 2022 will not result in changes to phytoplankton availability that would have adverse effects on the integrity of The Wash & North Norfolk Coast SAC or The Wash SPA.

2.5 Genetic modification & translocation of indigenous species;
2.6 Introduction of microbial pathogens and;
2.7 Introduction or spread of invasive non-indigenous species (INIS)

These potential pressures have been considered together in this section of the assessment because of their similarities. Features considered sensitive to these pressures:

- Intertidal mud
- Intertidal sand and muddy sand
- Water column
- SPA assemblage.

Harbour seal were considered relevant to this pressure but with *insufficient evidence* to assess the sensitivity to the pressure. There is no known pathway identified whereby the activity of mussel harvesting would introduce or spread invasive non-indigenous species which could pose a threat to Harbour seals.

Risks associated with genetic modification are scoped out because no genetic modification is undertaken in Several fishery activities (the pressure is more associated with finfish aquaculture). The translocation of indigenous species, introduction of microbial pathogens and the introduction or spread of INIS could all occur as a result of Several fishery activities and are therefore considered further below.

The proposed Several Order will allow for cultivation of the following prescribed bivalve species: blue mussel (*Mytilus edulis*), cockle (*Cerastoderma edule*), native oyster (*Ostrea edulis*), king scallop (*Pecten maximus*), queen scallop (*Aequipecten opercularis*) and carpet shell clams (various species; any applications involving non-native clams would be carefully considered and not permitted if there was significant risk of spread of INIS). These species are native to Great Britain and their cultivation in The Wash would not constitute an introduction or spread of INIS. Eastern IFCA would consult Natural England if it was considering permitting the cultivation of a non-native species to the Several fishery. Eastern IFCA has ruled out including Pacific oyster (*Magallana gigas*) as a prescribed species, because it is a non-indigenous species that has the potential to spread to the detriment of indigenous bivalve populations (e.g. in Brightlingsea, Essex, dense beds of *M. gigas* have developed over former *M.edulis* beds).

Shellfish aquaculture has the potential to introduce and/or spread pathogens resulting in disease, and introduce or spread INIS, through the movement of stocks – i.e. the sourcing of mussel seed from areas outside The Wash and subsequent relaying into Wash lays. In shellfish cultivation, two potential diseases include Marteilisosis (spread by the parasite *Marteilia refringens*) and Bonamiosis (spread by *Bonamia ostreae*), which can cause high mortalities in cultivated stocks and spread to native shellfish populations. To date, neither of these has been prevalent in The Wash.

The key INIS of concern in The Wash is the slipper limpet, *Crepidula fornicata*, which was introduced to the UK in the 19th Century but is now well established and widespread. *C. fornicata* is known to be present in The Wash in low densities and has previously been reported on mussel lays. This bivalve can be inadvertently spread through Several fishery activities including the translocation of contaminated stock and the harvesting of stocks using dredges. Once present, non-native species can be difficult if not impossible to eradicate so emphasis is placed on preventing introduction rather than removal.

Eastern IFCA has developed The Wash Fishery Order and Wash Restricted Area Biosecurity Plan (Eastern IFCA 2020) to help minimise the risks of introducing and spreading pathogens and INIS. Measures in that plan include:

- layholders must obtain Eastern IFCA authorisation to import stock from outside The Wash;
- consideration of disease status and history in source area;
- consideration of INIS in source area;
- consideration of supplier's biosecurity measures;
- requirement for layholders to monitor stocks for signs of disease/mortality and report to Eastern IFCA.

Eastern IFCA has issued formal guidance to layholders on preventing the spread of disease and INIS (Eastern IFCA, 2019) (see Appendix 2).

Furthermore, as grantee of a Several Order, Eastern IFCA will be required to obtain an Aquaculture production business authorisation from the Fish Health Inspectorate (FHI), which sets out conditions to reduce risks of spreading pathogens/disease or INIS. These measures include the keeping of accurate records, promotion of good hygiene practice and compliance with surveillance requirements. If lay holders report a suspected listed disease or high stock mortality, Eastern IFCA must immediately pass this on to the FHI.

Although biosecurity risks cannot be eliminated, with the above measures in place it is concluded that the risks of introduction or spread of pathogens and INIS are reduced to a level that will not have an adverse effect on the habitats and native communities of The Wash and North Norfolk Coast SAC or the supporting habitats for The Wash SPA.

It is concluded that the proposed Several Order activities will not cause an adverse effect on site integrity as a result of the pressures: *Genetic modification & translocation of indigenous species and Introduction of microbial pathogens and Introduction or spread of invasive non-indigenous species (INIS).*

2.8 Removal of non-target species

Features considered sensitive to this pressure are listed below with their sensitivity rating taken from conservation advice (please also see Tables 3 to 6):

- Intertidal mud (low sensitivity)
- Intertidal sand and muddy sand (low to medium sensitivity)
- Water column (not relevant for shellfish aquaculture but high sensitivity for fishing using dredges)
- Harbour seal (high sensitivity)
- SPA assemblage (not relevant for fishing using dredges but high sensitivity for shellfish aquaculture).

The removal of non-target species (referred to as bycatch) is a common effect of many fisheries, particularly finfish fisheries using gear with low selectivity (such as certain types of trawl or net). Improving the selectivity of fishing gear is a key area of work for gear technologists. Fishing using pots and dredges is generally more selective but can still result in bycatch. The ecological consequences of bycatch can be severe and widespread, if it occurs to the extent that it changes population abundances, demographics, species assemblages or trophic structures.

Mussel fisheries targeting either wild or bottom-cultivated mussel stocks harvest their catch using mussel dredges or by hand working. Removal of non-target species in hand-worked fisheries is very unlikely as this type of fishing is highly selective and fishers can avoid this pressure almost entirely. Mussel dredging from lays also results in very low bycatch rates, primarily because there is little species diversity on cultivated mussel beds, and the light dredges used do not penetrate the seabed so will not result in bycatch of infauna. It is suggested that the sensitivities of the SAC and SPA features listed above to this pressure relate more to pressures arising from fishing wild (naturally occurring) shellfish using heavy dredges (the operations category “fishing using dredges” in the conservation advice would include heavy toothed dredges designed to penetrate the seabed which could result in removal of non-target infauna).

Harvesting mussels from lays using dredges could result in bycatch of the starfish *Asterias rubens*, a common predator of *M.edulis* in The Wash, if it is present on the lays. Experience in The Wash Fishery Order suggests the occurrence of starfish on mussel lays is low. This species is more commonly found predating beds of subtidal mussels. If found in their mussel catch, fishers typically return starfish to the sea immediately after emptying the mussel dredges onto their vessels. Based on high survival rates (>93%) of trawled starfish (e.g. Boussarie *et al* 2020), the mortality of dredged and returned starfish is predicted to be low.

The invasive slipper limpet can establish within cultivated mussel beds. Removal of this species is seen as beneficial to supporting the conservation objectives of The Wash as it helps reduce the biomass of a non-native invasive species.

Overall, the incidence of bycatch in mussels harvested from the Several order fisheries is predicted to be very low. It is assessed that removal of non-target species is will not have any significant effect on the population abundance or demographic of affected species, on species assemblages or on food web structures.

The low diversity of species within the areas where the fishery will occur coupled with the high selectivity of the fishing method support the conclusion of no adverse effect on site integrity from the pressure: *Removal of non-target species.*

2.9 Visual disturbance

Features sensitive to this pressure are:

- Harbour seal
- SPA assemblage

Harbour seal

Harbour seal is a protected, Annex II species in The Wash & North Norfolk Coast SAC. This species is commonly found "hauled out" on the edges of intertidal mudflats and sandflats. Although observed to be habituated to the infrequent presence of low numbers of humans in The Wash (primarily fishers, but also Eastern IFCA officers and occasional bait collectors or recreational boaters), seals can be sensitive to visual disturbance. Such disturbance can cause significant effects to seals if disturbance causes them to flee – and, if this results in mothers and pups becoming separated and the pups unable to feed. It has been advised that Harbour seals are most sensitive to disturbance during the summer pupping, moulting and breeding season (June, July and August), with June and July being more sensitive than August (Thompson, Sea Mammal Research Unit, pers. comm.).

In 2019 and 2020 a significant decline in the Harbour seal population in The Wash was reported (Natural England, pers. comm.). This decline has reportedly continued in 2021 (Natural England, pers. comms.) leading to concerns about the Harbour seal population. Eastern IFCA have held discussions with Natural England and Sea Mammal Research Unit; expert opinion is that fishing activities are not causing adverse effects to the Harbour seal population in The Wash, and that the decline in the population is most likely to be the result of a huge increase in the Grey seal population in the Southern North Sea – a natural competitor to and predator of Harbour seals. Despite fishing activities not causing the Harbour seal declines, the significant threat to the Harbour seal population from grey seals does need to be considered in fisheries management; competent authorities need to ensure activities they authorise will not have an in-combination effect on protected habitats and species.

The presence of fishers inspecting their lays or hand-harvesting stocks at low water could cause disturbance to seals. A spatial analysis of the relative locations of mussel lays and known seal haul-out areas (with precautionary 600m buffers around the haul-out areas) (Figure 4) has shown that there is a potential overlap of mussel lays with a buffer around just one out of the 48 recorded haul-out sites, in an area known as Pandora Sand. The latest available figures (2018 survey) recorded 86 adult and 23 seal pups using this haul-out, corresponding to 2.3% and 1.5% of the total count of adult and pup Harbour seals in The Wash. Local knowledge (two senior Eastern IFCA officers, both with over 20 years' experience in The Wash) informs that seals haul out on a bank on the opposite side of the channel from where the Pandora lays are located. It is precautionarily estimated that fishers working on the Pandora lays could be a minimum of approximately 100m from seals hauled out on the opposite bank. A disturbance reaction (e.g., increased scanning by seals) could be expected at this distance (e.g., Wilson (undated)), but critically the seals have a natural buffer (the channel) between their haul-out site and the lays. Although there is a line of sight from the Pandora

lays to the haul-out site, the seals are less likely to flee from pedestrian disturbance than if there was no channel between them and the activity, because they feel protected by the presence of the channel (Thompson, SMRU, pers. comm.). Furthermore, there are several alternative haul-out sites available relatively close by, which seals could use in the unlikely scenario that they were flushed off the haul-out close to the Pandora lays. Two are within two kilometres, two within three kilometres and two more within 5 kilometres (Thompson, 2018). This means that seals would not need to travel significant distances (greater than 5 kilometres) to find alternative haul-outs, so the energy expended during a flight response would be significantly lower than if no alternative haul-outs were available close by.

The relatively low usage of the haul-out site by seals, the low and infrequent level of pedestrian activity on the lays, the presence of the channel between the lays and the haul-out site and the availability of other haul-out sites close by support a judgement that the Several order activities will not cause significant disturbance to Harbour seals at this location.

The minimal overlap between lay areas and haul-out buffers means there is a very low likelihood of fishers involved in Several fishery activities causing disturbance to Harbour seals in The Wash. Moreover, the level of human activity on the lays is low in general, and is likely to be at its lowest in the summer months that are the most sensitive time for Harbour seals. **These factors enable the conclusion that, if continued as currently practised, Several fishery activities will not have a significant visual disturbance effect on Harbour seals in The Wash.**

Notwithstanding this conclusion, it is suggested that because of the recent declines in the Harbour seal population in The Wash, and possibility that usage of haul-out sites will change over time, the potential for interactions between Harbour seals and Several Order activities change during the 30-year duration of the Several Order. Therefore, where there are changes in seal haul-out location and usage, Eastern IFCA will review the potential for interactions and consider whether mitigation is required to prevent adverse effects on the Harbour seal population, in discussion with Natural England. .

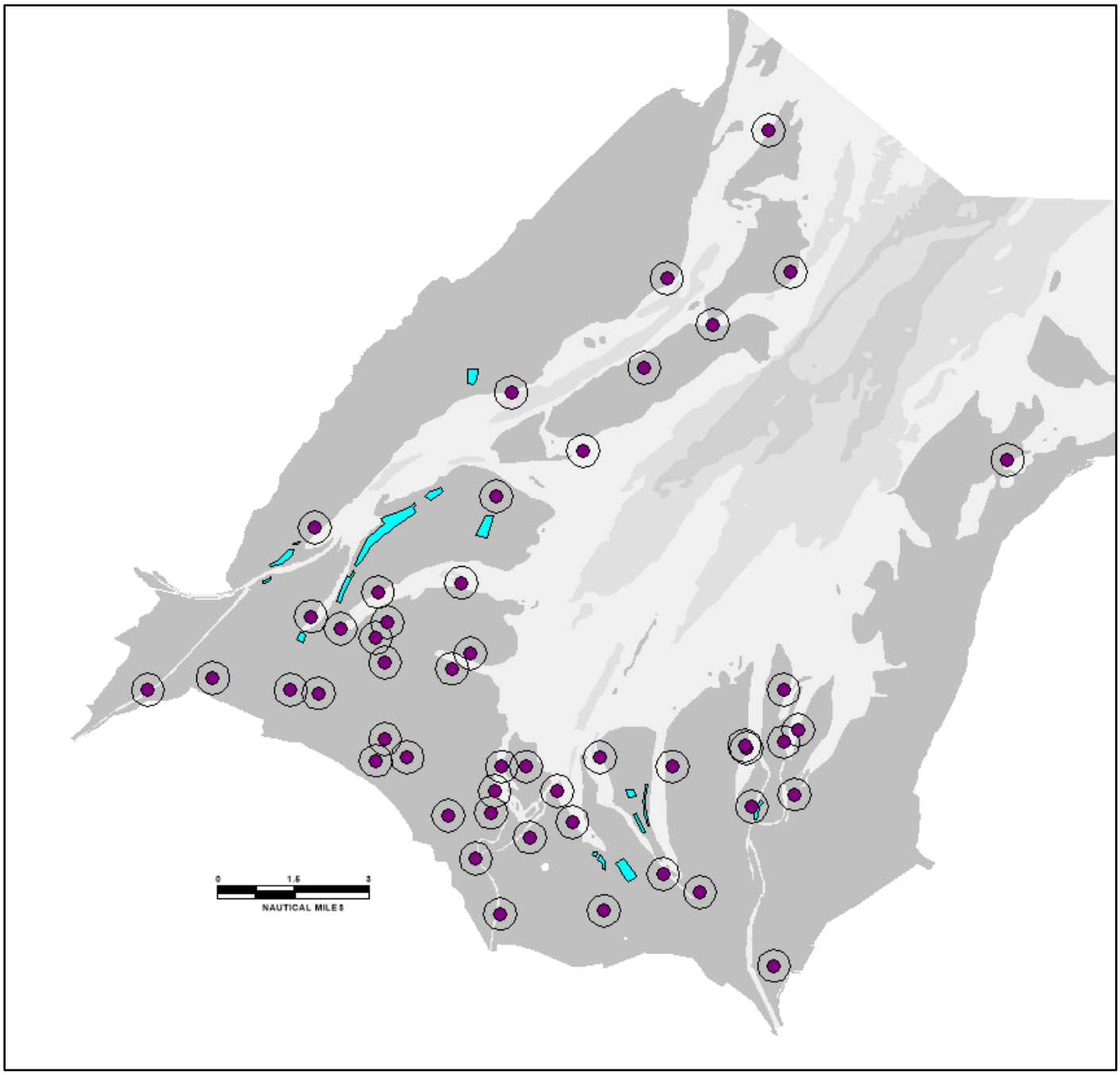


Figure 4: Seal haul-out sites (purple dots) with buffers and location of Wash Fishery Order lease areas (turquoise polygons)

SPA assemblage

Like Harbour seals, SPA bird species could be affected by visual disturbance from humans present in The Wash. Observations of the reactions of waders around people walking and working on the intertidal sandflats and mudflats in The Wash show that the birds often habituate to the presence of people and carry out their natural behaviour (for example feeding on invertebrates upon or within the mudflats) despite humans being present nearby (Eastern IFCA IFCO, pers. comm.). However, it is noted that some species are more sensitive to disturbance than others, and that birds can be vulnerable to adverse impacts relating to disturbance, for example mortality can result if birds utilise limited energy on flight away from disturbance stimuli rather than on foraging for food, particularly in severe cold conditions when energy expenditure is already high and food can be difficult to find.

This section of the assessment examines the likelihood of birds being adversely affected by disturbance from human activities associated with the proposed Several fishery activities.

Eastern IFCA considered the location of Several order lays alongside the core bird feeding areas described by Garbutt *et al* 2020 (unpublished). The usage of particular intertidal areas by bivalve-feeding SPA species and those associated with mussel beds (oystercatcher, knot, bar-tailed godwit, curlew, dunlin and turnstone) and shelduck (included because of concerns about its population decline rather than an association with mussel beds) has also been taken account, by examining the results of the Centre for Ecology and Hydrology's (CEH) 2019-20 low tide bird survey of The Wash (Garbutt *et al,* unpublished) (Table 7 below).

This analysis has shown that all the lay areas coincide with or are close to core feeding areas for birds, but that the birds utilise extensive intertidal areas across The Wash. None of the transects or outer banks containing lays supported more than 5% of the total numbers of birds of each species, but collectively the transects and outer banks containing lays supported between 0.04% (knot) and 5.84% (bar-tailed godwit) of the seven species assessed. The Roger/Toft outer bank, which includes the Roger and Toft lays and all the rest of the bank, supported the highest number of birds out of all the outer banks or transects containing lays, including 4.39% of bar-tailed godwit, 2.74% oystercatcher and 2.29% dunlin recorded across the entire Wash.

These figures indicate that the Several order lays and areas surrounding them are utilised by low numbers of SPA species at low water. Human activity on the Several order lays has the potential to cause a low level of disturbance to low numbers of birds, but there is an abundance of alternative intertidal area for birds to utilise in The Wash, even within the same transect or outer bank areas. If fishers were active on all the leased Several order lays (275ha) at any one time, and all the birds present in those areas were flushed away by human disturbance, this could lead to small proportions of each species being affected. However, it is assessed that Several fishery activities will not adversely affect The Wash SPA populations for a number of reasons:

- Most activity related to the Several fishery takes place from vessels, when the lays are submerged, so there is no potential for disturbance to birds using intertidal areas;
- When intertidal activities do take place on the lays, it is highly unlikely that fishermen will be active on all the lays at any one time (particularly since some fishers own multiple lays);
- Site-specific observations of bird behaviour (Eastern IFCA IFCO, pers.comms.) show it is very unlikely that all birds will be flushed away by humans working on the lays. The quiet, slow nature of activities on the lays (walking and stationary activity using a hand rake to fill a net) mean it is probable that the majority of birds will not be scared away from people in these areas;
- The Wash is a very large area and the lays cover less than 1% of the intertidal flats in The Wash. The areas of each transect and outer bank are much larger than the area of mussel lays within each transect or outer bank; by applying the bird usage figures for the whole transect or outer bank, this analysis is highly precautionary.
- Even when birds are flushed away by human disturbance, the vast extent of The Wash intertidal flats (including extensive beds of shellfish and other invertebrates) mean that birds are likely to find suitable alternative areas close to where they were disturbed, and will therefore only expend low levels of energy locating to these alternative areas;
- Fishers are not likely to undertake activities on their lays during periods of severe cold weather, when birds are most vulnerable to adverse effects from disturbance.

It is therefore concluded that Several order activities will not result in adverse effects on SPA populations as a result of visual disturbance.

Table 7. Bird counts in transects or offshore areas that contain Several Order lays (from Garbutt *et al* 2020, unpubl.).

Inner transect or offshore area*	Location of mussel lays	CORE BIRD AREA	BIRD USAGE (2019-2020)													
			Oystercatcher		Knot		Bar-tailed godwit		Curlew		Dunlin		Turnstone		Shelduck**	
			no.	% total	no.	% total	no.	% total	no.	% total	no.	% total	no.	% total	no.	% total
49-51	SCOTSMAN'S SLED	Yes	123	0.42	12	0.02	20	0.25	12	0.61	0	0.00	0	0.00	55	0.98
Outer	THIEF	Yes	92	0.32	0	0.00	95	1.17	0	0.00	0	0.00	0	0.00	0	0.00
Outer	ROGER/TOFT	Yes	800	2.74	0	0.00	355	4.39	30	1.52	503	2.29	1	0.42	0	0.00
Outer	PANDORA	Yes	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
12, 13	WRANGLE	Yes	200	0.68	0	0.00	2	0.02	7	0.35	0	0.00	2	0.83	0	0.00
20-22	BUTTERWICK	Yes	26	0.09	15	0.02	0	0.00	7	0.35	17	0.08	0	0.00	0	0.00
30-32	BLACK BUOY	Yes	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	3	1.25	0	0.00
All lays	ALL LAYS		1241	4.25	27	0.04	472	5.84	56	2.83	520	2.36	6	2.50	55	0.98
	Grand total		29201		75047		8088		1976		21998		240		5596	
SPA status ***			Fav		fav	40%	fav	77%	fav	13%	fav	-13%	fav	-49%	unfav	-58%

The usage figures have been colour coded to highlight risk level. Blue denotes no risk, i.e. less than 5% total Wash population of a species using the stated area; green denotes low risk: i.e. 5-9.9% total Wash population of a species using the stated area for species in favourable condition, or 0-4.9% total Wash population of a species using the stated area for species in unfavourable condition.

Notes:

1. Bird count data were collected during winter 2019/2020 CEH low tide bird surveys and provides the best available evidence.
2. Bird count numbers are presented for entire transects or outer banks (counts for outer banks were made for the whole banks rather than separated into transects, so cover a larger extent than the inner transects do). The Several Order lays cover a small proportion of each transect or outer bank area, making this assessment very precautionary.

2.10 In-combination assessment

The potential for in-combination effects on protected features of The Wash & North Norfolk Coast SAC and The Wash SPA from other consented activities is considered in this section.

Table 8: In-combination assessment

Plan or project	Potential pressure(s) arising from licensed activities	Affected feature(s)	Mitigation	Adverse effect in combination with Several Order activities?
Wash Fishery Order cockle and mussel fisheries	Abrasion and penetration; Change in suspended sediments; Visual disturbance; Removal of target species	Intertidal mudflats and sandflats; Water column; SPA assemblage; Harbour seals	Multiple measures applied including spatial restrictions, gear specification, effort limitation and seasonal restrictions to ensure fisheries do not result in adverse effect on site integrity	No. Unlikely to be concurrent with Several Order activities as same fishers involved. Mitigation for these fisheries and for Several fishery activities will ensure that in-combination effects will not adversely affect site integrity.
Private (Le Strange) cockle and mussel fisheries	Abrasion and penetration; Change in suspended sediments; Visual disturbance; Removal of target species	Intertidal mudflats and sandflats; Water column; SPA assemblage; Harbour seals	Management measures agreed by Natural England with landowner to ensure fisheries do not result in adverse effect on site integrity	No. Private fishery is extremely limited in scale. Mitigation for these fisheries and for Several fishery activities will ensure that in-combination effects will not adversely affect site integrity.
The Wash brown shrimp fishery	Abrasion and penetration; Change in suspended sediments; Removal of target species; Removal of non-target species	Intertidal mudflats and sandflats; Subtidal sandbanks; Water column; SPA assemblage	Multiple measures applied including spatial restrictions, gear specification and effort limitation to ensure fishery does not result in adverse effect on site integrity	No. No spatial overlap between shrimp fishery and Several Order activities. Mitigation for shrimp fishery and for Several fishery activities will ensure that in-combination effects will not adversely affect site integrity.
Eastern IFCA intertidal activities (survey work, sample collection and fisheries enforcement)	Abrasion/penetration; Removal of target species; Visual disturbance	Intertidal mudflats and sandflats; SPA assemblage; Harbour seals	Limited extent and duration of activities. Restrictions on activities in severe weather to avoid disturbance to birds	One water monitoring location coincides with a mussel lay on Toft Sand. Nature and scale of activities, plus the severe weather restriction, will ensure that in-combination effects will not adversely affect site integrity.
Natural England and Environment Agency surveys	Abrasion / penetration; Removal of target species, Visual disturbance	Intertidal mudflats and sandflats; SPA assemblage; Harbour seals	Very limited extent and duration of activities	No significant in-combination effects predicted.

Plan or project	Potential pressure(s) arising from licensed activities	Affected feature(s)	Mitigation	Adverse effect in combination with Several Order activities?
England Coast Path	Visual disturbance	SPA assemblage	Intertidal areas excluded from public access	No significant in-combination effects predicted.
Navigational dredging and disposal	Change in suspended sediments; Smothering	Subtidal sandbanks; Intertidal mudflats and sandflats	Disposal limited to licensed spoil ground assessed to avoid sensitive habitat.	Mitigation applied to this activity will ensure its impacts are limited. No spatial overlap with Several Order areas. No significant in-combination effects predicted.

Conclusion:

Upon consideration of these other licensed or permitted activities, their potential pressures and mitigation applied, it is assessed that there will not be an adverse effect on site integrity in combination with the proposed Several fishery activities.

2.11 Appropriate assessment conclusion

It is assessed that granting of the proposed Several Order will not have an adverse effect on the integrity of the sites considered in this assessment, either alone or in combination with other licensed activities.

References

Boussarie G , Kopp D, Méhault S, & Morfin M, **2020** High survivability of discarded invertebrates from bottom trawling fisheries. IFREMER. Accessed at: : https://www.sciencedirect.com/science/article/pii/S235248552030671X, 10th February 2022.

Dolmer, P., Kristensen, T., Christiansen, M.L., Petersen, M.F., Kristensen, P.S. and Hoffmann, E., **2001**. Short-term impact of blue mussel dredging (*Mytilus edulis* L.) on a benthic community. *Coastal shellfish - a sustainable resource.* 115-127.

Eastern Inshore Fisheries & Conservation Authority (2015) EIFCA 15/14 in Minutes of the 17th Eastern IFCA meeting, 28th January 2015. http://www.eastern-ifca.gov.uk/wp-content/uploads/2016/03/Jan-2015-Minutes.pdf Accessed 2 March 2022.

Eastern Inshore Fisheries & Conservation Authority (2019) Preventing the spread of invasive and non-native species: Guidance for Wash Fishery Order 1992 Shellfish Lay holders. Unpublished, Eastern IFCA.

Eastern Inshore Fisheries & Conservation Authority (2021) *draft* The Wash Several Fishery Order 2022 Fisheries Management Plan. Unpublished, Eastern IFCA

Eastern Inshore Fisheries & Conservation Authority (2022) Habitats Regulations Assessment for The Wash Several Order 2022. Unpublished, Eastern IFCA

Garbutt *et al* (unpublished) Low tide bird counts in The Wash, winter 2019-2020. Centre for Ecology and Hydrology.

Ke , X, Evans, G, & Collins, M.B **1997** Hydrodynamics and sediment dynamics of The Wash embayment, eastern England. *Sedimentology* 43, 157-174.

Mainwaring, K., Tillin, H.M. and Tyler-Walters, H., **2014**. Assessing the sensitivity of blue mussel beds to pressures associated with human activities. *Joint Nature Conservation Committee Report*, 506.

Marine Management Organisation (2019) MMO1184: Identification of areas of aquaculture potential in English waters. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/854128/MMO1184_AquaPotential_forPub_191210.pdf accessed 2 March 2022.

Thompson D (2018) Harbour seal survey of The Wash, **2018.** Sea Mammal Research Unit.

Wilson, S. C. (undated) “The impact of human disturbance at seal haul-outs.” Available at: https://www.pinnipeds.org/attachments/article/199/Disturbance%20for%20SCS%20-%20text.pdf

Appendix 1 – Food availability mitigation measures

At an Eastern-IFCA Full Authority meeting in January 2015, the members were asked to agree to adopt mitigation measures relating to food availability associated with the Several fishery lays. The following report (titled 'Annex 3 – Mitigation measures'), describing those measures, was appended to the meeting papers.

Annex 3 - Mitigation measures

Eastern IFCA will use its monitoring program SWEEP[16] to detect changes in two indicators of grazing pressure – chlorophyll and meat yields (see box 1). It is proposed that if these metrics reach a certain level over a certain time period it will trigger management action in the form of a reduction in stocking density of lays.

The rationale is that, should natural variability of primary production reach certain low levels whereby it is unlikely to be able to sustain the biomass of shellfish in The Wash; a reduction of the biomass of cultivated shellfish would be enforced proportional to the amount required to make up the shortfall in primary production.

There is considerable potential cost of removing mussels from lays prior to them having reached marketable size and a large degree of uncertainty regarding the potential for cultivated mussels to have an impact on wild shellfish through competition of food resource. As such, trigger levels will reflect only a significant decrease in food availability.

Box 1. Indicators

Chlorophyll – measured as Relative Florescence Units. RFU can infer chlorophyll concentrations with additional analysis. Most of the literature regarding carrying capacity refers to Chlorophyll concentration in the unit Chla ug L^{-1} however accurate estimates of chlorophyll concentrations are not obtainable in the field using a sonde. Cefas process water samples taken from sites where sonde data is collected. Chlorophyll concentrations can be inferred from RFU if regression provides a significant correlation. It is suggested that initially, RFU will be used as an indicator of chlorophyll concentration as sonde data is available immediately after the deployment in the field, allowing a more immediate reaction to changes in chlorophyll levels. The potential use of laboratory derived chlorophyll concentrations will be assessed.

Meat yield – mussel samples are processed (by boiling and removing meats) and an estimate of the proportion of meat to total weight is recorded. This is used as a proxy for condition – higher meat yields infer a greater condition. Methods used in the available literature involve drying meats to obtain a dry weight however Eastern IFCA does not have the capacity to process mussels in this way.

[16] Study of the Wash Embayment Environment Productivity

There are three elements to this process;

1. Monitoring of chlorophyll and mussel condition at three sites in The Wash (fig.1);

2. Assessment of grazing pressure taking into accountconsidering current stocking density of mussel lays; and

3. Reduction in permitted stocking density of lays based on an assessment of grazing pressure, including the removal of mussel where stocking densities are already too high.

1 - Monitoring

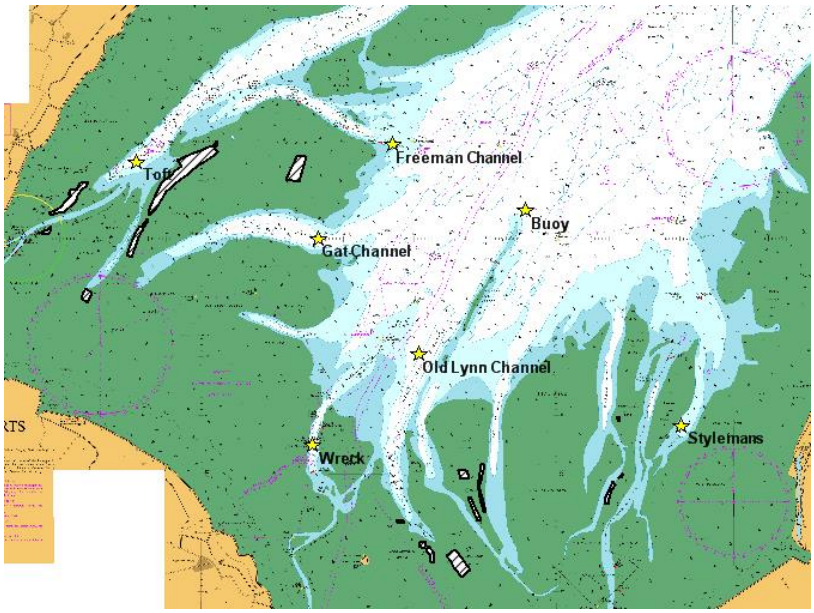


Figure 1. Distribution of water sampling sites across The Wash as per the SWEEP. Mussel samples are also taken at three of the sites to assess mussel condition; the Wreck, Toft and Thief sample sites.

Chlorophyll and mussel condition data are collected monthly. Data is input into a database which assesses if thresholds have been reached according to the following rules.

Phase 1 – Thresholds

The data collected through SWEEP thus far (from 2010 to 2013) has been assessed. Meat yields vary across the three sites – generally the mussels collected from the Wreck site have a greater meat yield than the Toft and Thief site. Growth rates and condition of mussels will vary across The Wash due to natural variability and factors such as immersion time and temperature (which are also likely to vary across sites). With regard to mussel condition, it is proposed that sample site specific trigger levels should be imposed to reflect this variability.

There is no available literature applicable to the method used to indicate condition as per SWEEP. As such, the trigger levels are solely based on the SWEEP data which

has been collected by Eastern IFCA. Minimum recorded values of meat yield at each site are the current trigger level.

With regards to chlorophyll related trigger levels, there is no available literature which relates carrying capacity or food availability with Relative Fluorescence Units (RFU). Inglis *et al* (2000) suggests chlorophyll concentrations in the range of <0.5ug L^{-1} represents very poor growing conditions which can result in a loss of condition. RFU values of 0.2 equate to chlorophyll concentrations of circa 0.5 to 0.9 chl ug L^{-1} (according to 2014 hand sonde data).

The suggested trigger levels are as follows:

Site	RFU	Meat yield
Wreck	<0.2	<11.5%
Toft	<0.2	<9.0%
Thief	<0.2	<8.7%

Table 1. monthly trigger levels for the three monitored sites

Should RFU and meat yield reach these levels at two or more sites in the same month of monitoring an assessment of the grazing pressure (see below) will be carried out. If this assessment concludes grazing pressure is greater than primary production, lay holders will be informed that initial trigger levels have been reached.

If the trigger levels are reached again in the following month, another grazing pressure assessment will be undertaken and the proportion reduction required to balance estimated primary production and grazing pressure will be estimated. Lay holders will be informed that, they may need to reduce stocking density in a maximum of two months' time.

If trigger levels are reached for a third consecutive month lay holders will be given a final notice to reduce stocking density to reflect the findings of the grazing pressure assessment.

Justification

<u>Mussel condition</u>

Mussels are known to feed on a range of seston including both algal and non-algal organic matter. Non-algal organic matter has been shown to make up a significant part of the diet of mussel (ref) and the significance of non-algal organic matter in the diet of mussels is thought to show a strong relationship with the 'quality' of that matter (ref). To fully understand food availability in The Wash, measurements of non-algal organic matter would need to be factored in. However, there is no scope for the inclusion of this type of assessment as part of existing monitoring.

As such, including mussel condition (meat yield) as one of the two indicators of food availability provides for a more robust method for describing the risk to the wider shellfish stocks. Where both chlorophyll and mussel condition are below agreed thresholds, there is a greater risk that food is at least in part having an impact on shellfish within The Wash.

Shellfish condition, usually inferred from the relationship between the weight of the 'meat' and total weight, is known to vary spatially and temporally and particularly in relation to environmental factors – for example in relation to changes in current velocity (Strohmeier *et al* 2008), temperature and food availability.

In the field, mussel condition has been shown to exhibit seasonal trends in condition (Orban et al 2002, Okumus & Stirling 1998 and Dare & Edwards 1975). Temperature and food availability are thought to have strong influences on condition (Dare & Edwards 1975).

Mussels have been shown to lose condition after spawning (Okumus and Stirling 1998). However, this is more pronounced in larger individuals. Mussels in the size range 45-50 mm do not show such a pronounced reduction in condition – this is reflected in the data from sampling in The Wash where no trends have been observed (Jessop *et al* 2021), for size range for samples is 45-50mm. In addition, mussel condition is thought to reduce in relation to both temperature and food availability between October and March – mussels losing 30-50% of their flesh weight (Dare & Edwards 1975).

From the data collected through SWEEP, no distinct seasonal trends can be seen. In addition, mussel condition has not shown any statistical relationship with chlorophyll levels (Jessop *et al* 2012). This is most likely a reflection of the limited sampling effort and high degree of variability in condition. As such there is no predictable condition (meat yield) against which a trigger level can be bench marked. Instead, the minimum recorded meat yield for each site is initially being used as the threshold for each sample site.

Mussels will lose 30-50% of flesh weight through the seasonal variations and as a result of spawning (Dare & Edwards 1975) and can survive a loss of flesh weight (through starvation) of up to 78% (Kautsky 1982). Therefore, trigger levels for each site reflect a reduction in meat yield in the range of 78-50%. Currently, the minimum recorded meat yield at each site represent values within this range (Wreck = -50.9%, Toft = -66.8%, Theif = -63.6%) when compared to the highest recorded meat yield – thus producing a precautionary threshold. For all the sites, reductions in meat yields represent a loss of condition greater than that which is considered 'normal' but can be recovered from if these conditions are not prolonged.

<u>Phytoplankton concentration</u>

There is a wide range of literature which explains the relationship between bivalve mollusc populations and phytoplankton – particularly with regard to bivalve controlled systems (i.e. primary production is limited by grazing pressure). Food depletion through grazing pressure can have wider ecosystem level effects if removal (grazing pressure) is greater than tidal exchange or primary production. Chlorophyll concentration in The Wash shows a 'normal' double peak trend i.e. a spring and autumn bloom indicative of a healthy system. Light attenuation (lower in higher turbidity), temperature and nutrient levels are likely to have a limiting effect on primary production to greater or lesser extents over the year showing seasonal trends.

Monitoring phytoplankton within The Wash has taken place since 2009 using a combination of a stationary sonde (the buoy sonde) and spot samples using a hand sonde deployed at various locations once per month. Sonde data records phytoplankton in terms of Relative Florescence Units which are not easily comparable to chlorophyll concentration in terms of Chl a ug L^{-1} which is the standard used in all available literature.

The sonde itself has a built in algorithm which estimates Chl a ug L^{-1} which can provide more instantaneous data than using laboratory based estimates (using water samples) but with less accuracy. According to data collected by the hand sonde in 2014, an RFU of 0.2 relates to an approximate chlorophyll concentration (chl a ug L^{-1}) of 0.5 – 0.9, the relationship between RFU and chl a ug L^{-1} is not linear. Hand sonde data for 2010 and 2011 for (the two most complete data sets) show RFU values dropping below 0.2 only during December.

Growth rates of bivalve molluscs are dependent on several environmental factors; immersion time, water temperature and turbidity in addition to food availability. That said, generic guidelines produced by Inglis *et al* (2000) indicate that, chlorophyll in the range of 1-2ug L^{-1} (i.e. greater than an RFU of 0.2) represent moderate growing conditions if spring blooms are present during the year. Concentrations between 0.5 and 1ug L^{-1} are unlikely to result in a loss of condition but represent poor growing conditions, concentrations <0.5ug L^{-1} can result in a loss of condition if prolonged.

A trigger level of 0.2 RFU is proposed as this represents the threshold below which growing conditions are poor but crucially, if not prolonged, mussels will recover condition.

Summary

Reaching either of the trigger levels at a single site is unlikely to be a reflection of a genuine issue relating to food availability as a result of food depletion. In both cases, reaching the above explained trigger levels is within the realms of natural variation and, given the limited sampling effort could also be a reflection of sampling errors.

If a combination of trigger levels for RFU and meat yield is reached at two sites then there is the potential that food is limiting growth and condition of mussels - prolonged

exposure to these conditions could have wider ecosystem level impacts on the shellfish populations in The Wash.

The extent to which reductions in the stocking density of shellfish lays is required is determined through an assessment of grazing pressure in The Wash.

2. Grazing pressure assessment

A simple model is used to determine the extent to which stocking density is reduced.

The model considers how long it would take (in days) for the quantifiable biomass of filter feeders in The Wash (i.e. mussels, lay mussels and cockles) to remove the standing stock of phytoplankton. This is quantified as follows:

Feeding rates in terms of chlorophyll per individual per hour have been estimated in the field by Kotta and Molhenberg (2002) – a range is presented which is likely to reflect other environmental conditions such as temperature and seston concentration including a proportion intake of non-algal organic matter. Feeding rates are adjusted to take into account the mean length of mussel and cockle in The Wash using the following formula:

$G_L = G_{20} x l^2 / 20^2$

Where G_L = Grazing rate at length and G_{20} = grazing rate at a length of 20mm. Grazing rate estimates as per Kotta and Molhenberg were also used for estimates of cockle grazing.

The standing stock of phytoplankton is estimated by scaling up the concentration of chlorophyll (using a mean from field samples) by the estimated volume of water within 2 meters depth.

Taking into account feeding rates, an estimate of the time taken to remove the standing stock of phytoplankton is then estimated. This number (days) is then compared to an estimated cell doubling time (3-14 days) depending on the season (see table 2).

The quantified biomass of cockles and mussels in The Wash will make up only a portion of grazing pressure – other bivalves (*Maccoma* etc), polycheates and zooplankton will also graze on phytoplankton (although zooplankton will likely graze on phytoplankton within a smaller size range than other filter feeders). The contribution of the quantified shellfish within The Wash to the total grazing pressure is unknown – it is currently set at a cautious 50%.

Where the grazing pressure (represented in days) is less than 50% of the estimated cell doubling time for the season (table 2), reductions in the stocking density of mussels on private lays will be adjusted. The change in biomass which results in the grazing pressure aligning with 50% cell doubling time will represent the proportion reduction in stocking density across all lays in The Wash.

Mechanics of this model is presented below.

Table 2 – indicative parameters for grazing pressure model

Season	Chlorophyll concentration* (Chla ug L^{-1})	Grazing rate (ug chl ind^{-1} h^{-1})	Cell doubling time (days)
Winter	0.5 (low)	Low	14 (low)
Spring	5 (high)	High	3 (high)
Summer	0.5 (low)	Med	14 (low)
Autumn	2 (medium)	Med	9 (med)

** Chlorophyll concentrations from field samples will be used – the concentrations presented above are indicative of what is found in The Wash and aligned with Inglis et al (2000) thresholds for mussel growth.*

Table 3 – Indicative outputs using the proposed model for estimating grazing pressure

All quantified shellfish within The Wash (43,640 tonnes of mussel and 19,319 tonnes of cockle)			
Concentration of chlorophyll (Chl ug L^{-1})	Estimated standing stock of phytoplankton (ug)	Time (hrs) to reduce standing stock of phytoplankton to zero	
		Grazing rate of shellfish* chl ug ind^{-1} $hour^{-1}$	
		Low	High
0.5	6.25E+11	2372.954	196.6707872
2	2.5E+12	9491.817	786.6831487
5	6.25E+12	23729.54	1966.707872

** Grazing rate ranges vary for species; mussel = 0.10125 (low) to 2.025 (high) chl ug ind^{-1} hr^{-1}, cockle = 0.0008 (low) to 0.0156 (high) chl ug ind^{-1} hr^{-1}. Estimates on the number of individuals within The Wash were calculated using an average weight for the 2014 cockle survey (cockles) and the average weight of mussels (perrs comms R. Jessop).*

Using the above outputs from the grazing pressure model a comparison can be made between the grazing pressure and doubling time of phytoplankton in The Wash.

Assuming constant grazing rates and an immersion time of 16 hours, the scenario highlighted in table 3 would result in depletion of the standing stock of phytoplankton in 593 (low grazing rate) to 49 (high grazing rate) days. Grazing rates will vary by season, estimates will be used as per table 2.

Compared to even the slowest cell doubling time (14 days), grazing pressure in this scenario would not be considered limiting.

Limitations

The approach outlined above is a very simplistic model. The key limitations to this approach are outlined below. Overall, this approach could be considered cautious.

Nutrient recycling – Bivalve beds are thought to have a nutrient recycling role which is likely to stimulate primary production. Asmus and Asmus (1991) found that potentially significant increases in primary production were the result of nutrient recycling by filter feeding molluscs. In addition, Cugier et al (2010) suggests that understanding the feedback due to the mineralisation of biodeposits is crucial to fully evaluate the role of filter feeders on primary production. By not including this in the model presented above, the estimated impact on the standing stock of phytoplankton is likely overestimated.

Spatial variations in phytoplankton and seston quality – the model above assums uniform phytoplankton concentrations based on a relatively small sample size of sonde readings. Cranford et al (date) indicate that, in determining standing stocks of phytoplankton in large areas, many spot samples are required – it was concluded that satellite data would actually only provide the required spatial coverage. Satellite derived data would not allow for a reactive enough system in this case – with data taking several months to become available and process.

The quality of non-algal organic matter will likely vary across The Wash also, effecting both feeding rates and mussel condition. Tidal and riverine inputs will affect this in addition to rainfall and changes in anthropogenic inputs of nutrients. Phytoplankton concentrations, turbidity and seston quality will also vary within mussel beds, particularly dense aggregations such as those found in cultivation beds (Strohmeir et al 2008 and Kamermas 1993).

The Wash is thought to be well mixed horizontally and vertically with high current velopcties conducive of a productive system. Despite this, not being able to reflect the spatial variability in plankton and seston is potentially a significant limitation in this simple model.

Grazing pressure in The Wash – Eastern IFCA has a limited understanding of the current grazing pressure of organisms in The Wash outside of those which are quantified during surveys (i.e. cockle and mussel surveys). Of potential significance are the razor clams (*Ensis* sp), slipper limpets and polycheates. Determining the contribution of the quantifiable bivalve stocks to grazing pressure is an important element to determining the overall grazing pressure. At present, an cautious estimate of 50% is used when comparing to cell doubling time. This is potentially an overestimate.

Given the above noted limitations, outputs from the model – particularly when being used to determine the proportion decrease in stocking density of the lays - should provide only a starting point for discussions to determine a figure. A final proportion decrease will be agreed with Natural England. The model as presented above represents the use of the current best available evidence.

3. Limiting stocking density of lays

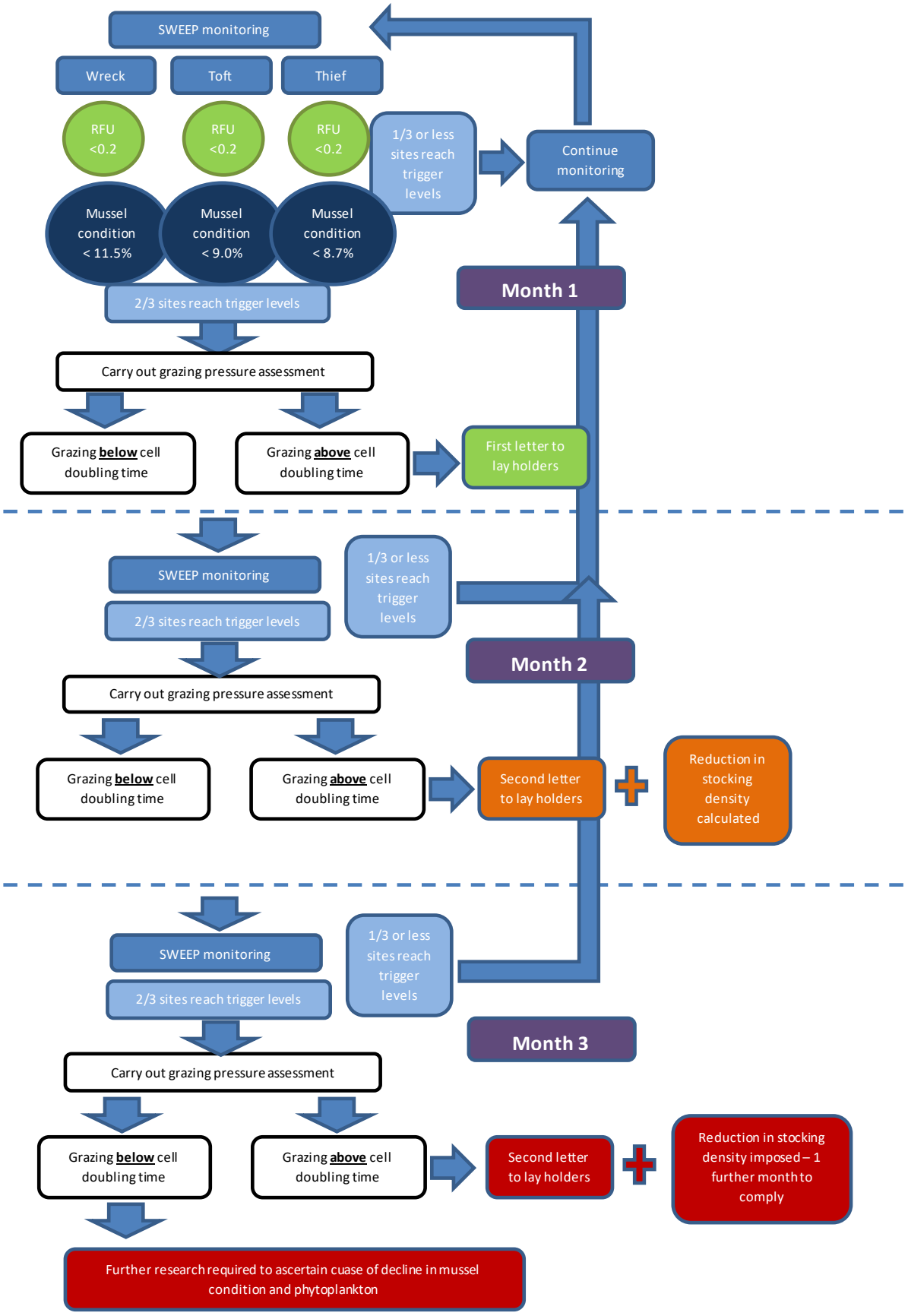
Where trigger levels have been met consecutively for three months and grazing pressure calculations have determined a shortfall in primary production against the grazing pressure assessment, stocking density will be reduced in accordance with the shortfall.

The procedure for this is presented in figure 2. The process is explained below.

When trigger levels are met at two or more sites (as detected by monthly SWEEP monitoring), a grazing assessment is carried out. Where there is a shortfall in chlorophyll standing stock relative to grazing pressure a letter is sent to lay holders indicating that trigger levels have been met and stocking densities may need to be limited. Reaching trigger levels for a single month will not result in actual reductions. If the grazing pressure assessment finds that there is not a shortfall in phytoplankton biomass, reductions in stocking densities will not have an effect and will not be suggested.

If trigger levels are reached at two sites for a second month, a further grazing assessment is carried out. Where the grazing assessment finds a shortfall in phytoplankton biomass (regardless of it this was true the previous month) a letter will be sent out to lay holders indicating that a reduction in stocking density will commence in two months' time if trigger levels are met for a third consecutive month. If the grazing assessment finds no shortfall, reducing stocking density will have no effect and no reductions in stocking density will be required.

If trigger levels are met for a third month, a grazing pressure assessment will be carried out. Findings will be used to impose a stocking density limit for lay holders who will be given a further month to comply.


SWEEP monitoring
Wreck
Toft
Thief
RFU <0.2
RFU <0.2
RFU <0.2
Mussel condition < 11.5%
Mussel condition < 9.0%
Mussel condition < 8.7%
1/3 or less sites reach trigger levels
Continue monitoring
Month 1
2/3 sites reach trigger levels
Carry out grazing pressure assessment
Grazing below cell doubling time
Grazing above cell doubling time
First letter to lay holders
SWEEP monitoring
2/3 sites reach trigger levels
1/3 or less sites reach trigger levels
Month 2
Carry out grazing pressure assessment
Grazing below cell doubling time
Grazing above cell doubling time
Second letter to lay holders
Reduction in stocking density calculated
SWEEP monitoring
2/3 sites reach trigger levels
1/3 or less sites reach trigger levels
Month 3
Carry out grazing pressure assessment
Grazing below cell doubling time
Grazing above cell doubling time
Second letter to lay holders
Reduction in stocking density imposed – 1 further month to comply
Further research required to ascertain cuase of decline in mussel condition and phytoplankton

References for Appendix 1

Asmus R M, Asmus H,. 1991 Mussel beds: limiting or promoting phytoplankton? Journal of Experimental Marine Biology and Ecology: 148, 215-232

Bayne B L, Iglesias J I P, Hawkins A J S, Navarro E, Heral M, Deslous-Paoli J M,. 1993 Feeding behaviour of the mussel, *Mytilus Edulis*: Responses to variations in quality and organic content of the seston. Journal of the Marine Biological Association UK: 73, 813-829

Cugier P, Struski C, Blanchard M, Mazurié J, Pouvreau S, Olivier F, Trigui J R, Thiébaut,. 2010 Assessing the role of benthic filter feeders on phytoplankton production in a shellfish farming site: Mont Saint Michel Bay, France. Journal of Marine Systems: 82, 21-34

Inglis G J, Hayden B J, Alex H R,. 2000. An overview of factors affecting the carrying capacity of coastal embayments for mussel culture. National Institute of Water and Atmospheric Research Ltd: Report: CHC00/69.

Kamermans P,. 1993 Food limitation in cockles (*Cerastoderma edule* (L.)): Influences of location on tidal flat and of nearby presence of mussel beds. Netherlands Journal of Sea Research: 31, 71-81

Kotta J, MØhlenberg F,. 2002 Grazing impact of *Mytilus edulis* L. and *Dreissena ploymorpha* (Pallas) in the Gulf of Riga, Baltic Sea estimated from biodeposition rates of algal pigments. Annales Zoologici Fennici: 39, 151-160

Newell C R, Wildish D J, MacDonald B A,. 2001 The effects of velocity and seston concentration on the exhalant siphon area, valve gape and filtration rate of the mussel *Mytilus edulis*. Journal of Experimental Marine Biology and Ecology: 262, 91-111

Riisgård H U, Kittner C, Seerup D F,. 2003 Regulation of opening state and filtration rate in filter-feeding bivalves (*Cardium edule, Mytilus edulis, Mya arenaria*) in response to low algal concentration. Journal of Experimental Marine Biology and Ecology: 284,105-127

Riisgård H U, Poulsen L, Larsen P S,. 1996 Phytoplankton reduction in near-bottom water caused by filter-feeding *Nereis diversicolor* - implications for worm growth and population grazing impact. Marine Ecological Progress Series: 141, 47-54

Shulte E H,. 1975 Influence of algal concentration and temperature on the filtration rate of *Mytilus edulis*. Marine Biology: 30, 331-341

Smaal A C, & Haas H A,. 1997 Seston Dynamics and Food Availability on Mussel and Cockle Beds. Estuarine, Coastal and Shelf Science: 45, 247-259

Smaal A C, Prins T C, Dankers N, & Ball B,. 1997 Minimum requirements for modelling bivalve carrying capacity. Aquatic Ecology: 31, 423-428

Strayer D L, Caraco N F, Cole J J, Findlay S, Pace M L,. 1999 Transformation of freshwater ecosystems by bivalves. BioScience: 49, 19-27

Strohmeier T, Dunker A, Strand Ø, Aure J,. 2008 Temporal and spatial variation in food availability and meat ratio in a longline farm (*Mytilus edulis*). Institutional Repository of the Institute of Marine Research.

Theisen B F,. 1977 Feeding rate of *Mytilus edulis* L. (Bivalvia) from different parts of Danish waters in water of different turbidity. Ophelia: 16, pg-pg

10.3 Appendix 3 – Administrative forms

The following forms will be provided to enable application under Phase 1. The Authority retains the right to amend these forms as may be required to facilitate the application process and consideration of applications.

Wash Several Order 2022

Phase 1 Lay Application: Application Form

This application form is intended for Phase 1 applications for a shellfish Lay under the Wash Several Order 2022. For more information on Phase 1 applications and the associated lay allocation process, please see section 6.6.1 of the Fisheries management plan or contact us.

1. Personal details (applicant)

Full Name:	
Address:	
Tel / Mob:	
Email:	

I am applying for a lay to be held in the name of a business / company (please tick).

Yes	No

If '**Yes**' – please provide business details below

Trading name	
Registered business address	

DRAFT

2. Lays

Please list the lays you are applying for in the table below. If you are applying to consolidate lays previously held on your behalf, you must include a completed 'consolidation form' for each lay with you application.

Lays which you (applicant) <u>are</u> the named lay holder

Lays which you (applicant) <u>are not</u> the named lay holder

DRAFT

Wash Several Order 2022

Phase 1 Lay Application: Business Plan *pro forma*

This document should accompany an application for lays under the Wash Several Order 2022.

Eastern IFCA
Inshore Fisheries and Conservation Authority

Business Plan

This business plan will be assessed along with the application form to inform a decision on your application. If you intend to apply for a renewal of your lease, this business plan will also inform a review of lay use to inform a decision on such a renewal.

1. Target Species to be cultivated

Please name the species which will be cultivated on the lay (e.g. mussels).

The Fisheries Management Plan prohibits the cultivation of any non-native species. Please refer to the FMP or contact the office for more information.

2. Methods for cultivation

Fishing gear and any other equipment including gear specification (*e.g. two mussel dredges with an inside opening of 1m*)

DRAFT

Methods of operation – please describe how you intend to use the lay area to grow mussel including: • Use of different parts of the lay; • Length of time anticipated for growing.

Please provide the name and the Port Letter Numbers (PLN) for any vessels you intend to use in operating in the lays. Please also indicate if you are the owner of the vessels named. If you are not the owner of the vessels named, please refer to these in section 5.

Vessel Name	**PLN**	**Applicant is vessel owner? (y / n)**

DRAFT

3. Origin of seed

Please provide details on where you intend to get seed to stock your lay. If you intend to source stock from a supplier, you must include details of that supplier (business address and contact details).

4. Forecasts

Please provide forecasts for stocking and harvesting over at least the next five years.

Year	Stocking (tonnes of seed to be re-laid)	Harvesting (tonnes of stock anticipated to be harvested)
2023		
2024		
2025		
2026		
2027		
Beyond 2027		

DRAFT

5. Partnerships, arrangement etc.

With other lay holders: Please provide contact details for any other lay holders you intend to work with in partnership in operating your lays and explain the nature of the arrangement.

Name	Address	Role in operating the lays

DRAFT

With persons other than lay holders: Please provide contact details for any other persons who will operate within the lay on your behalf and explain the nature of their involvement.

Name	Address	Role in operating the lays

DRAFT

6. Declaration

Please print your name, sign and date if you agree with the following statement:

I hereby declare that the information I have provided is true and correct and I understand that any wilful dishonesty may render for refusal of this application, or subsequent cancellation of a lease granted as a result of this information.

I further declare that, in the event that my application is granted, I intend to undertake aquaculture operations in accordance with this business plan, and that I must seek consent from Eastern IFCA if I intend to operate my lay other than in accordance with this business plan.

Name (please print):	
Signature:	
Date:	

DRAFT