

# Fisheries in EMS Habitats Regulations Assessment for **Amber** and **Green** risk categories

## NWIFCA-MB-EMS-UNDERSIZE MUSSEL MORECAMBE BAY HANDGATHERING AND DREDGE FISHERY

1<sup>st</sup> June 2023

### Site: Morecambe Bay and Duddon Estuary

European Designated Sites: UK0013027 Morecambe Bay Special Area of Conservation (SAC)  
UK9020326 Morecambe Bay and Duddon Estuary SPA  
UK11045 Morecambe Bay Ramsar  
UK11022 Duddon Estuary Ramsar

European Marine Site: **Morecambe Bay and Duddon Estuary**

### Qualifying Feature(s):

#### SAC and Ramsar

H1110. Sandbanks which are slightly covered by sea water all the time; Subtidal sandbanks

H1130. Estuaries

H1140. Mudflats and sandflats not covered by seawater at low tide; Intertidal mudflats and sandflats

H1150. Coastal lagoons

H1160. Large shallow inlets and bays

H1170. Reefs

H1220. Perennial vegetation of stony banks; Coastal shingle vegetation outside the reach of waves (NON MARINE)

H1310. *Salicornia* and other annuals colonising mud and sand; Glasswort and other annuals colonising mud and sand; Pioneer saltmarsh

H1330. Atlantic salt meadows (*Glaucopuccinellietalia maritima*)

H2110. Embryonic shifting dunes (NON MARINE)

H2120. Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes"); Shifting dunes with marram (NON MARINE)

H2130. Fixed dunes with herbaceous vegetation ("grey dunes"); Dune grassland (NON MARINE)

H2150. Atlantic decalcified fixed dunes (*Calluno-Ulicetalia*); Coastal dune heathland (NON MARINE)

H2170. Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae*); Dunes with creeping willow (NON MARINE)

H2190. Humid dune slacks (NON MARINE)

S1166. *Triturus cristatus*; Great crested newt (NON MARINE)

Natterjack Toad (NON MARINE)

#### SPA and Ramsar

A026 *Egretta garzetta*; Little egret (non-breeding)

A038 *Cygnus Cygnus*; Whooper swan (non-breeding)

A040 *Anser brachyrhynchus*; Pink-footed goose (non-breeding)

A048 *Tadorna tadorna*; Common shelduck (non-breeding)

A050 *Anas Penelope*; Wigeon - (non-breeding – Ramsar only)

A054 *Anas acuta*; Northern pintail (non-breeding)

A063 *Somateria mollissima*; Common eider (non-breeding – Ramsar only)

A067 *Bucephala clangula*; Goldeneye - (non-breeding – Ramsar only)

A069 *Mergus serrator*; Red-breasted merganser - (non-breeding – Ramsar only)

A130 *Haematopus ostralegus*; Eurasian oystercatcher (non-breeding)

A137 *Charadrius hiaticula*; Ringed plover (non-breeding)

A140 *Pluvialis apricaria*; European golden plover (non-breeding)

A141 *Pluvialis squatarola*; Grey plover (non-breeding)

A142 *Vanellus vanellus*; Lapwing - (non-breeding – Ramsar only)

A143 *Calidris canutus*; Red knot (non-breeding)

A144 *Calidris alba*; Sanderling (non-breeding)

A149 *Calidris alpina alpina*; Dunlin (non-breeding)

A151 *Calidris pugnax*; Ruff (non-breeding)

A156 *Limosa limosa*; Black-tailed godwit (non-breeding)

A157 *Limosa lapponica*; Bar-tailed godwit (non-breeding)

A160 *Numenius arquata*; Eurasian curlew (non-breeding)

A162 *Tringa totanus*; Common redshank (non-breeding)

A169 *Arenaria interpres*; Ruddy turnstone (non-breeding)

A176 *Larus melancephalus*; Mediterranean gull (non-breeding)

A183 *Larus fuscus*; Lesser black-backed gull (Breeding, non-breeding)

A184 *Larus argentatus*; Herring gull (Breeding)

A191 *Sterna sandvicensis*; Sandwich tern (Breeding)

A193 *Sterna hirundo*; Common tern (Breeding)

A195 *Sterna albifrons*; Little tern (Breeding)

*Phalacrocorax carbo*; Cormorant – (non-breeding – Ramsar only)

*Podiceps cristatus*; Great crested grebe - (non-breeding – Ramsar only)

Seabird assemblage

Waterbird assemblage

## Site sub-feature(s)/Notable Communities:

### **SAC and Ramsar**

**Sandbanks which are slightly covered by sea water all the time** – Subtidal coarse sediment, subtidal mixed sediments, subtidal sand, subtidal mud.

**Estuaries** - Intertidal mud, intertidal sand and muddy sand, intertidal mixed sediments, intertidal coarse sediment, intertidal rock, intertidal stony reef, intertidal biogenic reef: mussel beds, subtidal coarse sediment, subtidal mixed sediments, subtidal sand, subtidal mud, *Salicornia* and other annuals colonising mud and sand, Atlantic salt meadows (*Glauco-Puccinellietalia maritima*).

**Mudflats and sandflats not covered by seawater at low tide; Intertidal mudflats and sandflats** – Intertidal mud, intertidal sand and muddy sand, intertidal mixed sediments, intertidal seagrass beds, intertidal coarse sediment.

### **Coastal lagoons**

**Large shallow inlets and bays** – Intertidal mud, intertidal sand and muddy sand, intertidal mixed sediments, intertidal seagrass beds, intertidal coarse sediment, intertidal rock, intertidal stony reef, intertidal biogenic reef: mussel beds, intertidal biogenic reef: *Sabellaria* spp., subtidal stony reef, circalittoral rock, subtidal coarse sediment, subtidal mixed sediments, subtidal sand, subtidal mud, *Salicornia* and other annuals colonising mud and sand, Atlantic salt meadows (*Glauco-Puccinellietalia maritima*).

**Reefs** – Circalittoral rock, intertidal biogenic reef: mussel beds, intertidal biogenic reef: *Sabellaria* spp., intertidal rock, intertidal stony reef, subtidal stony reef.

### **Perennial vegetation of stony banks: Coastal shingle vegetation outside the reach of waves**

***Salicornia* and other annuals colonising mud and sand: Glasswort and other annuals colonising mud and sand; Pioneer saltmarsh**

**Atlantic salt meadows** (*Glauco-Puccinellietalia maritima*) (referred to as Saltmarsh)

### **Embryonic shifting dunes**

**Shifting dunes along the shoreline with *Ammophila arenaria* (“white dunes”); Shifting dunes with marram**

**Fixed dunes with herbaceous vegetation (“grey dunes”); Dune grassland**

**Atlantic decalcified fixed dunes (*Calluno-Ulicetea*); Coastal dune heathland**

**Dunes with *Salix repens* spp. *Argentea* (*Salicion arenariae*); dunes with creeping willow**

### **Humid dune slacks**

**Great crested newt (*Triturus cristatus*)**

**Supporting habitat:** Great crested newt (NON MARINE) – coastal sand dunes  
Natterjack Toad (NON MARINE)- coastal sand dunes

### **SPA and Ramsar**

Annual vegetation of drift lines, Atlantic salt meadows (*Glauco-puccinellietalia maritima*), coastal lagoons, freshwater and coastal grazing marsh, intertidal biogenic reef: mussel beds, intertidal coarse sediment, intertidal mud, intertidal rock, intertidal sand and muddy sand, intertidal seagrass beds, intertidal stony reef, *Salicornia* and other annuals colonising mud and sand, water column.

## Generic sub-feature(s):

Intertidal mud and sand, Intertidal mud, Seagrass, Saltmarsh spp., Brittlestar beds, Subtidal muddy sand, Intertidal boulder and cobble reef, Subtidal boulder and cobble reef, *Sabellaria* spp. reef, Intertidal boulder and cobble reef, Surface feeding birds, Estuarine birds, Intertidal mud and sand, Intertidal boulder and cobble reef, Saltmarsh spp., Coastal lagoons.

## High Level Conservation Objectives:

### **Morecambe Bay SAC**

With regard to the SAC and the natural habitats and/or species for which the site has been designated (the ‘Qualifying Features’ listed above), and subject to natural change;

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring;

- ☐ The extent and distribution of qualifying natural habitats and habitats of qualifying species
- ☐ The structure and function (including typical species) of qualifying natural habitats
- ☐ The structure and function of the habitats of qualifying species
- ☐ The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely
- ☐ The populations of qualifying species, and,
- ☐ The distribution of qualifying species within the site.

### **Morecambe Bay SPA**

With regard to the SPA and the individual species and/or assemblage of species for which the site has been classified and the Ramsar Site and the wetland habitats and/or species for which the site has been listed (the ‘Qualifying Features’ listed above), and subject to natural change;

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive and ensure that the site contributes to achieving the wise use of wetlands across the UK, by maintaining or restoring:

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

### **Duddon Estuary SPA**

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

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive and ensure that the site contributes to achieving the wise use of wetlands across the UK, by maintaining or restoring:

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

### **Lune Marine Conservation Zone (MCZ)**

The site is designated for smelt (*Osmerus eperlanus*) with a recover objective.

Updated conservation advice for Morecambe Bay and Duddon Estuary SPA.

Changes specific to this HRA:-

- Grey plover, dunlin, sanderling and turnstone have a restore target for population due to declines in population exceeding regional and national trends.

## **Fishing activities assessed:**

### **Gear type(s):**

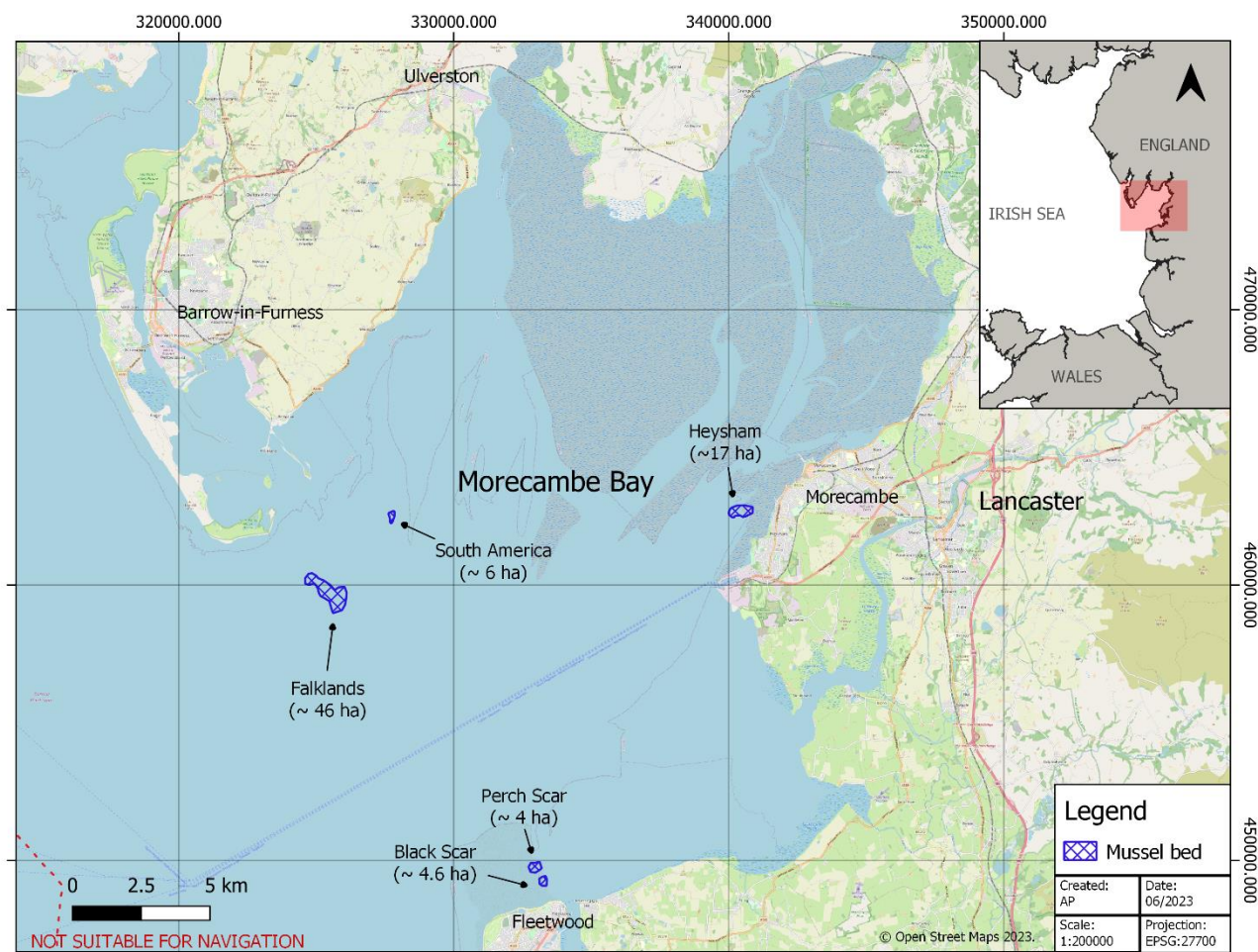
Hand-gathered – Undersize Mussel (*Mytilus edulis*)

Vessel dredge - Undersize Mussel (*Mytilus edulis*)

# 1. Introduction

## 1.1 Need for an HRA assessment

Each year, NWIFCA officers inspect the main seed mussel beds in the NWIFCA District for their suitability for fishing. The criteria a fishery needs to meet to be considered for opening is detailed in section 4.4. The fishing grounds typically assessed are South America, Falklands, Perch Scar, Black Scar and Heysham Flat (Figure 1).



**Figure 1.** Location and extent of the main commercial seed mussel beds in the NWIFCA District. Extend estimates based on 2022 data.

The fisheries considered here all fall within the Morecambe Bay and Duddon Estuary Special Protected Area (SPA) and the Morecambe Bay Special Area of Conservation (SAC). Any activity which takes place in the site which is not related to furthering the conservation objectives must undergo a habitats regulation assessment (HRA). As a competent authority under the provisions of the Habitats Regulations, the NWIFCA must undertake an Appropriate Assessment of the proposed fishery, in accordance with Regulation 61. Details of NWIFCA's inspections, along with advice from Natural England are used to inform the HRA. Natural England is a statutory consultee on the Appropriate Assessment stage of the Habitats Regulations Assessment process, and their advice is incorporated into this document.

### 2023 – Exceptional Circumstances

Typically, South America and Falklands mussel beds are inspected on tides that are below 1m at low water. Inspections take place at regular intervals from April through to August to track the initial settlement of mussel, its growth into seed, and any indication of scouring (where there is a risk that the seed will be washed away).



These inspections are made available to the Authority, inform the HRA, and typically the fishery opens around August. NWIFCA must strike a balance between ensuring the correct criteria are met for the fishery to be HRA compliant, while also working within the constraints of tides suitable for both surveying and fishing, and predicting the likelihood of stock being scoured.

This year, due to a phenomenon with the tides, there are no tides low enough to inspect these mussel beds until the beginning of July and August. Therefore, it will not be possible to get an early indication as to whether the beds will be viable for dredge fishing until such time. Typically, the fishery is opened around August, as the seed has grown, put down sufficient mud (section 4.4), is starting to become loose and is vulnerable to being scoured. Based on historic trends, it is likely that by the time of the next inspection, the resource may be in a fishable condition.

Due to the ephemeral nature of the beds, once an inspection is complete it is advisable (subject to the fishery meeting the required HRA criteria and looking liable to scour) that the fishery be opened on the next available tides to reduce the risk of the stock being 'lost' due to natural events (Section 4.6). The time between the next available inspection date, and the tides suitable for the fishery to be opened this year is short (<5 days).

Therefore, this year, a provisional HRA is being submitted prior to inspection of the beds to streamline the opening of the fishery, subject to it being HRA compliant. The HRA will detail specific criteria the beds must meet to be considered for opening. The HRA will also consider the 'worst case' scenario, of all beds being opened to fishing. The criteria will be based on parameters agreed in historical HRA's, and in line with NE. NE will assess whether to agree in principle to the HRA, on the proviso that once inspected, the results are made available and used to determine whether the condition of the beds are HRA compliant.

The scenario in which all proposed beds are opened to fishing is considered here, though the final decision will be based on the results of the inspections.

\*As this document is in draft – with the final document being produced post inspections. Areas in this document highlighted in yellow will be completed post inspection, and indicates where information is outstanding.

## **1.2 Proposal**

The NWIFCA proposes to authorise four undersize (less than 45mm) mussel hand-gathered and vessel dredge fishery within the protected site.

The proposed opened fisheries will be by permits issued under NWIFCA Restrictions on the Use of a Dredge 2017, and by authorisation issued under the flexible permit conditions of NWIFCA Byelaw 3, Cockle and Mussel Hand Fishing Permit (2019).

The NWIFCA proposes to authorise four undersize (less than 45mm) mussel hand-gathered and vessel dredge fisheries, these are:

- An authorised hand gathered seed mussel fishery on a section of Heysham Flat to open in August/September 2023.
- A permitted dredge seed mussel fishery on a section of South America (North Morecambe Bay) to open August / September 2023.
- A permitted dredge, seed mussel fishery on Perch Scar (Fleetwood, North Morecambe Bay) to open August/September 2023.
- A permitted dredge, seed mussel fishery on Falklands (North Morecambe Bay) to open August/September 2023.

All potential fisheries are provisionally considered in this HRA subject to agreed conditions being met. The conditions are detailed in section 4.

The proposed opened fisheries will be by permits issued under NWIFCA Restrictions on the Use of a Dredge 2017, and by authorisation issued under NWIFCA Byelaw 3, Permit to Fish Cockles and Mussels (para 6.) by derogating against the minimum landing size for mussel for the hand gathered fishery.

The purpose of this site-specific assessment document is to assess whether or not, in the view of NWIFCA the proposed fishing activity of hand-gathering and vessel dredging of undersize mussel at the specified beds in Morecambe Bay, is likely to have a significant effect on the designated features of the site. This assessment will determine whether the proposed activities will have an adverse effect on the integrity of this European Site.

## **2. Information about the EMS**

(See cover pages, where details of the designated features and sub-features are listed.)

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

The Morecambe Bay and Duddon Estuary European Site interest features of; boulder and cobble reef, *Sabellaria alveolata* reef and Seagrass beds are protected from all bottom towed gears, in addition Seagrass beds are protected from bait collecting or working a fishery by hand or using a hand operated implement through a prohibition under [NWIFCA Byelaw 6](#), introduced in May 2014.

## **4. Information about the fishing activities within the site**

### **4.1 Background**

It is important to note that mussel beds in Morecambe Bay are almost exclusively found on hard substrate – post-glacial moraine skears – and consequently respond quite differently to fishing pressures than in other fisheries such as the Wash in the UK, and the Waddensee in the Netherlands, where mussel beds are on soft substrates. There are two distinct mussel resources in Morecambe Bay that can be highly variable in abundance and distribution. These are size mussel (>45mm), and undersize (seed and part-grown) mussel.

A feature of Morecambe Bay is the irregular, but frequent, occurrence of large and extensive mussel spat settlements. These settlements are usually very dense with little or no embyssment to the underlying substrate and quickly build up large amounts of sediment and pseudo-faeces (mussel mud). Within a very short space of time (~4 to 6 months) these populations become unstable and vulnerable to erosion through weather and/or tide, or predation from vast numbers of starfish. They typically do not survive to winter. They are referred to as “ephemeral” beds (Dare, 1971 & 1976) and the Authority takes the line that although they are undersized they should be fished as early as possible as they would otherwise be washed out of the fishery and a valuable commercial resource lost. The mussel is fished, either by hand-raking or by specialised mussel dredgers, neither of which impact the cobble and boulder skears due to the deep soft mud layer on which the mussel sits. Removal of undersize has also been authorised over the years when huge swarms of common starfish (*Asterias rubens*) have been present on a bed, predating voraciously on mussel of varying sizes dependent on the size of the starfish and their ability to open the shells. The harvested mussel is re-deposited in other areas to grow on until of a commercially viable size. The number of mussel cultivation sites has grown in areas such as the Wash, Northern Irish and Irish loughs, and the Menai Strait, the latter of which is an MSC accredited sustainable fishery. Relaying in Morecambe Bay has been trialled unsuccessfully as

the mussel, even though relaid in more sheltered areas, is unable to persist due to the prevailing environmental conditions.

## **4.2 Mussel Hand-gathering**

Hand gathering of mussel has been a long-standing traditional fishery within Morecambe Bay and the Duddon Estuary. Methods have changed very little over the years, with a rake and net bag used to remove the mussel from the underlying muddy substrate. Hand gathers access the beds mainly by ATVs and occasionally tractors due to the soft sediment. Depending on the area being fished, fishing is often limited by the tides and can be severely restricted. There is little to no by-catch associated with this fishery as it is highly selective.

Hand gathering of seed mussel is by written authorisation to current NWIFCA Byelaw 3 permit holders only. As of the 1<sup>st</sup> of September 2022 this will be under the flexible permit conditions of the new NWIFCA Byelaw 3. Areas permitted for harvest are incorporated into the authorisation conditions, along with any other restrictions. Seed mussel is transported, usually by road-freight, to its relaying destination.

### **4.2.1 Regulation of Hand-gathering**

NWIFCA regulates mussel hand-gathering fisheries in its District through a suite of byelaws. Regulations relating specifically to hand gathering of mussels in Morecambe Bay are listed below. The full text of the regulations available on the NWIFCA website (<https://www.nw-ifca.gov.uk/byelaws/>).

NWIFCA Byelaw 3	Cockle and mussel hand fishing permit (2019) (in force as of Sep 1 <sup>st</sup> 2022)
NWSFC Byelaw 13a	Cockles and mussels – management of the fishery
NWSFC Byelaw 16	Shellfishery – temporary closure

NWIFCA Byelaw 3 Permit to Fish for Cockles and Mussels was introduced in 2012 and succeeded in creating vastly improved management of the fisheries creating a more professional and responsible group of fishers. Under these regulations, the number of permit holders has reduced significantly. There are currently a maximum of 150 NWIFCA Byelaw 3 permits, that will be issued for the 2023 – 2024 season under NWIFCA Byelaw 3. Without a permit within the NWIFCA district it is still permissible when mussel beds are open for 5kg per person per day of size mussel to be collected for human consumption.

In the NWIFCA District, all mussel beds are open to hand gathered size mussel fishing for Byelaw 3 permit holders. However, if it is deemed that activities may impact the protected features of the site, a HRA is conducted, and management implemented if/where required.

## **4.3 Mussel Dredging**

Dredging of undersize mussel for aquaculture has been a regular occurrence in Morecambe Bay since the 1960s. Dredging of mussel for aquaculture has developed significantly with technology concentrating on gear with low environmental impact. Seed mussel dredgers scoop up the top layer of loose mussel and mussel mud, bringing the catch through the water giving the mud a chance to flush through the netting, and depositing the catch in open holds on-board. There is little by-catch associated with this fishery, with starfish, shore crab, and the occasional flatfish found in the catch.

Mussel is typically transported by vessel to where it is going to be re-laid where it is flushed through the sides of the vessel and straight on to the bottom growing lays. In areas such as the Menai Strait where much of the Morecambe Bay mussel goes, operators work together to farm the mussel. Long-standing studies of what works in practice along with a wealth of research with Bangor University scientists has led to a method of

moving mussel around to gain best growth potential and minimise losses from crab and starfish predation. Much of this depends on the size of mussel when wild caught and the strength of its shell.

#### **4.3.1 Regulation of Dredge Fishery**

Dredging of undersize mussel has been previously been managed by the North West and North Wales Sea Fisheries Committee (NW&NWSFC) under a 30 year Fishery Order - the Morecambe Bay Mussel Fishery Order (MBMFO) 1978, whereby fishing could only be carried out by licensees of the Order. The SFC was the holder of the MBMFO and also the Menai Strait Several Order where it leased out areas for aquaculture. The MBMFO expired in 2009, and the administrative area for NWIFCA changed, removing North Wales and adding Cumbria to the old NW&NWSFC boundaries. NWIFCA managed the fishery from 2009 - 2017 by written authorisation.

In 2017 NWIFCA introduced a dredge byelaw that prohibits dredge fishing of all types across the District unless specifically permitted by the Authority, in which case fishers must apply and pay for a permit, with a fee structure based on vessel length. Areas permitted for dredging are incorporated into permit conditions, along with any other restrictions. Dredge permits fluctuate each year depending on the seed mussel resource and since the byelaw NWIFCA have issued a maximum of three permits in one year.

#### **4.4 NWIFCA Un-written Policy on Seed Mussel**

NWIFCA has been developing a Morecambe Bay mussel management plan over many years, unfortunately there are still a number of outstanding criteria to decide on regarding brood stock and bird food requirement. Once completed, this work will assist with the policy of managing the mussel fisheries.

Naturally there is some competition between sectors for mussel resources, and in the past there have been disagreements. NWIFCA set up a separate stakeholder forum to remove these discussions from committee proceedings, called the Bivalve Mollusc Working Group (BMWG). Established in 2015 it is made up of NWIFCA officers, stakeholder representatives from all sectors of the fisheries along with Natural England and nature conservation representatives.

In 2017 BMWG agreed a definition of ephemerality in relation to the mussel resources to assist NWIFCA in making decisions on when mussel could be harvested as seed. The agreed definition is:

*'Certain conditions need to occur for the NWIFCA to authorise fishing of seed mussel, namely that the stock has been assessed as in imminent likelihood of being lost to the fishery through natural causes, and subsequently that a high proportion of it will not grow through to reach size; and that conditions pertain to fishing being possible without risk of damage to the cobble and boulder substrate conservation features. These include:*

- *settlement in high abundance and density, and;*
- *fast growing and high deposits of pseudofaeces (mussel mud), and;*
- *the mussel mud becoming very soft and loose and at risk of being washed out, taking the mussel with it;*
- *or dense settlement being heavily predated on by thousands of starfish.*

*The fishery is highly variable depending on the vagaries of the stock, and the changes in the dynamic environment of the north west coast and have to be assessed on a year by year basis.*

In addition to the variables outlined above affecting the recruitment and longevity of mussel within the Bay, the fact that the natural environment is highly changeable with sandbanks and channels shifting tens of

metres overnight adds a further complexity to what can affect the stock on an annual if not seasonal basis. Considering the high unpredictability of stock and conditions, NWIFCA scientists assess each bed to ensure that authorisation / permitting of seed mussel removal only occurs when the mussel is in a vulnerable condition. This in itself can be challenging as some areas in some years can only be accessed by boats drying out over low water – such as Falklands.

#### **4.5 Biosecurity**

Morecambe Bay is currently shellfish disease free and the Authority considers it a priority to maintain this status. The non-native species Chinese Mitten Crab (*Eriocheir sinensis*), Wireweed (*Sargassum muticum*) and Leathery Sea-squirt (*Styela clava*) have previously been recorded within the area. In order to implement effective measures to prevent the introduction and / or spread of diseases or non-natives the Authority has developed and published a Biosecurity Plan, detailing controls and conditions that will be applied to all commercial shellfish activities. The Biosecurity Plan seeks to ensure that consignments and/or areas from which they come, are regularly and thoroughly checked for invasive non-native species (INNS). NWIFCA now has firm evidence of Chinese mitten crabs in Morecambe Bay. In September 2020 two adult Chinese mitten crab were caught and retained and were subsequently confirmed by NWIFCA. Gathers have been advised to inspect their catch for Chinese mitten crabs whilst fishing on mussel beds and a reporting system is in place in the NWIFCA biosecurity plan. Officers from the NWIFCA also completed quarterly monitoring and surveillance on Heysham Flat and Foulney mussel beds, producing report to assist other regulators between 2018 and 2020. Officers have produced informative posters for the general public in order to raise awareness of the risk of the Chinese mitten crab, and requirement to report sightings.

#### **4.6 Variability of Stock and Conditions**

Managing a resource such as mussel in Morecambe Bay is hugely problematic due to the highly dynamic environment in which it is found, the vagaries of mussel recruitment, changing weather patterns particularly associated with climate change, and variability of predator presence, particularly from common starfish. It is impossible to predict what will occur from one year to the next, and in times and places from one month to the next. NWIFCA holds decades of reports, stock assessments and photographic evidence on this resource.

Morecambe Bay is characterised by vast areas of sand underlain by glacial moraine. The channels shift, sometimes hundreds of metres overnight. The sand also moves around, sometimes covering over the glacial moraine, sometimes leaving it exposed. There are a number of examples where large areas have been covered in sand overnight.

Some areas of exposed moraine are relatively static due to their height on the shoreline and presumably shelter - Heysham Flat main skear, and Foulney Twist (main skear). The bottom ends of both of these areas have been sand covered in the past decade. Other areas are highly changeable and can change month on month, with areas that have been exposed one month, observed buried by a sand covering a month later.

Mussel needs a hard substrate on which to recruit, and when the moraine is exposed it provides ideal conditions. Where the brood stock for the dense aggregations seen in the Bay is situated has not established. There are older mussel stocks positioned on the upper reaches of Foulney and Foulney Ditch in most years and these may act as breeding stock. However, some larval dispersal modelling by Bangor University, although not specifically focussed on Morecambe Bay mussel, has provided evidence to the hypothesis that brood stock actually lies much further south even within the Mena Strait.

When considering the data from Dr Dare that 0 - 25% of stock might remain following natural scour, wash out and predation, a fact also observed by NWIFCA scientists, and also that dredge fishing is never 100% efficient and that a percentage of stock will remain post-fishing, it is natural to assume that some of this



remaining mussel may over-winter. Un-embryssed seed mussel has an ability to 'hunker down' into the sediment when space allows in order to avoid the elements, particularly the effects of wind. This is commonly observed on Morecambe Bay mussel beds and can occur in coarse ground as well as soft. This provides some protection against scour. A frequent occurrence in the following spring is the next cohort of dense spat settling on top of this remaining mussel and smothering it. As the new mussel grows (rapidly) and puts down high levels of mussel mud, the older mussel disappears under this accumulation and generally dies.

#### **4.7 Current Status of Stock**

The current stock status of Heysham Flat, and Perch and Black Scar are detailed in the inspection reports in the Annexes to this HRA. An overview is given in this section on the current (most recent assessment) state of the beds but will be updated in line with the new inspection information before the final HRA submission. These sites have been inspected already this year as officers do not need to rely on very low tides to access these sites.

The status of South America and Falklands mussel beds will not be available until July or August. Therefore, the inspections of these sites will be added post the HRA agreement in principle.

##### **4.7.1 Heysham Flat mussel bed – UPDATED**

Heysham Flat has been inspected four times this year, as the nature of the beds can result in considerable changes over a short period. As of the most recent inspection on the 2<sup>nd</sup> of August, the extensive 2023 seed settlement that had been present across the bed from previous surveys was present across the majority of the skear which had grown on to 15-20mm with coverage at 70-80%.

The significant historic *Sabellaria alveolata* reef extending across the skear from close to Conger Rock to Dallam Dyke seen in the previous survey in May was no longer visible as it has been smothered by sed. The extent of the *Sabellaria alveolata* has been mapped from the previous survey on the 9th May 2023 (Figure 2).

The area shoreward from Conger Rock which had previously been proposed as a seed fishery due to the presence of dense mussel and the formation of mud, has now experienced significant scour. There are two small areas of mussel remaining. The full inspection report is provided in Annex 1.

**Recommendation:** This year, due to the loss of seed in the area from Conger Rock (previously proposed) revealing bare cobble substrate, and the presence of underlying *Sabellaria* reef structure beyond Conger Rock to Dallam Dyke, Heysham Flat is not proposed for seed mussel fishing.

##### **4.7.2 South America mussel bed**

The South America mussel bed was inspected on the 4<sup>th</sup> of August (For full report and corresponding figures please see Annex 1). The extent of the mussel across the area had increased significantly (Figure 2) with previous surveys identifying the area located between waypoints 2 to 17 where the bed was accessed over a large channel (the main bed). This time, mussel was present in the channel, and on the landward side on a new area of colonised bare cobble (near waypoints 11 and 12) (Figures, 21, 22, 23, 24 34 and 38). The seed present on the landward side of the channel was dense (Figure 23), largely smaller than that on the main bed, at 15 mm in size, and on a thin veneer of mud (Figures 21, 22, 23, 34, 35,36, and 37).

Across the majority of the main bed, mussel was patchy at approximately <50% density, with some areas of loose mussel (Figure 4) and many areas of exposed cobble (Figures 7, 16, 18, 25, 26, 28 30, and 32). Often mussel was only on a shallow layer of mud on top of the underlying substrate (Figures 6, 6, 11 17 and 26). There was evidence of scour across some of the central part of the bed (Figure 5). Much of the mussel had grown on to 25 to 30 mm (Figures 14, 29 and 37).

The southern part of the bed, became much thinner with a mud veneer over cobble (11, 12 and 13) and the density of mussel decreased.

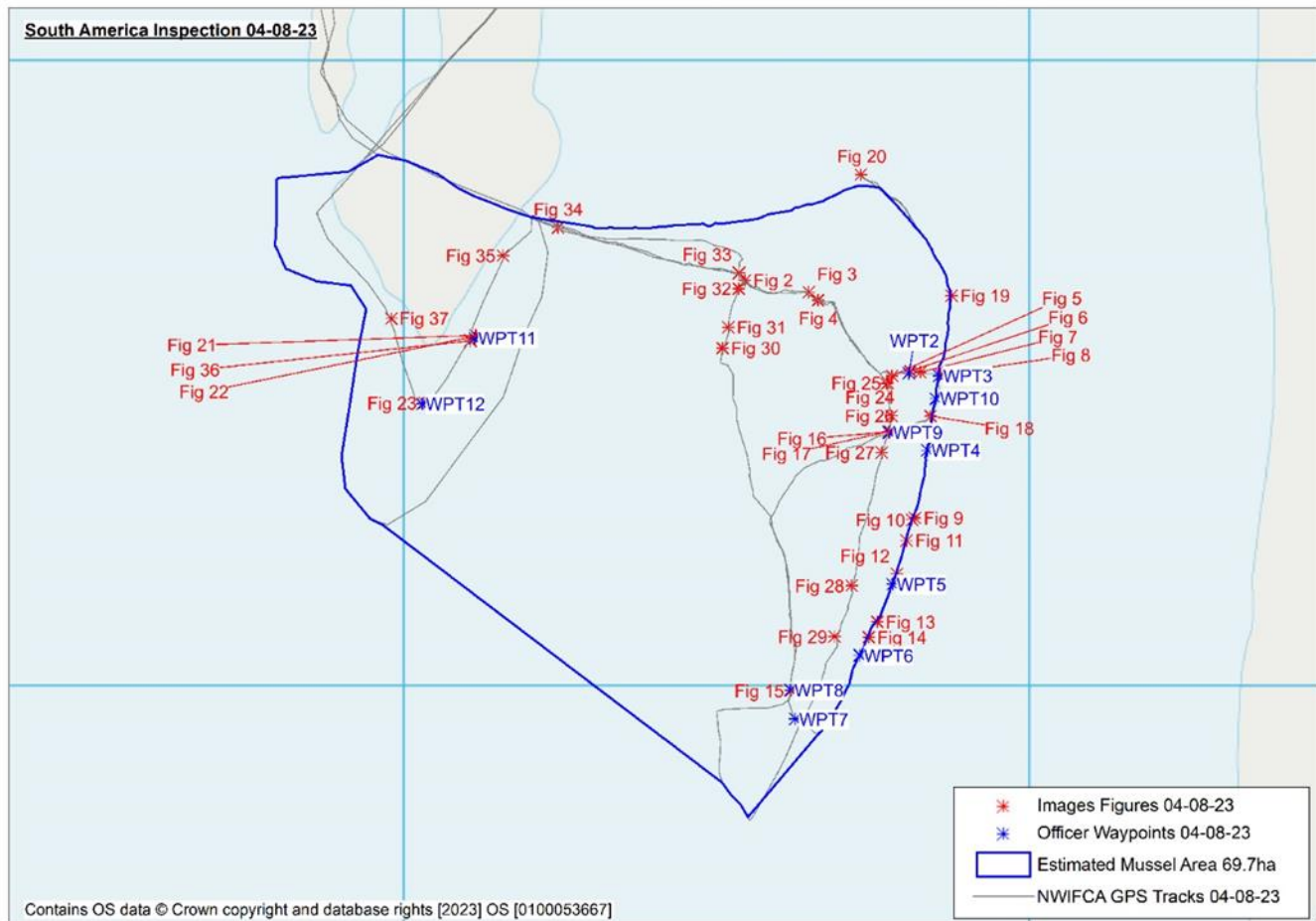


Figure 2. Map to show the approximate extent of South America mussel beds, and location of images taken.

**Recommendation: Due to the limited amount of mussel mud, patchy coverage and exposure of cobble substrate South America is not proposed for a seed fishery and will be re-inspected on the next available tides.**

#### 4.7.3 Fleetwood mussel beds

The mussel beds in Fleetwood consist of Rossall Scar, Necking Scar, Kings Scar, Perch Scar and Black Scar. Inspection reports are provided in Annex 1. Fleetwood has been inspected three times this year, Perch Scar and Black Scar are normally considered to be commercially viable for seed dredge fisheries as they typically wash off each year, receive dense spat falls, and lay down mussel mud.

This year, Black Scar has had a dense 2023 mussel settlement of approximately 80-90% coverage. The mussel was approximately 20 mm at the date of last inspection on the 3<sup>rd</sup> of August (full details of inspection report with associated figures is provided in Annex 1). At the time of inspection, the 2023 mussel settlement on Black Scar was still present and has grown on to approximately 20 mm in size with 80-90% coverage over the bed (Figure 2, 7 and 8). The mussel has put down significant mussel mud from previous surveys (Figure 3, 7, 10 and 11). This mussel mud covered the extent of the bed, and in the centre had formed 'hillocks' (Figure 7, 8 and 10). The mussel mud had grown deeper since the previous survey and in some areas was approximately a metre deep, with mussels above becoming loose. Coverage of mussel mud was thick across the main extent of the bed, however, near the lower edges, there was evidence of scour (Figure 10). Mussels thin out at the western edge of the bed (Figure 9)

There is a small area of size mussel along the channel edge (Figure 4 and 6). The approximate area of mussel is 4.1 hectares.

The 2023 mussel settlement on Perch Scar was also still present and has grown on to approximately 20 mm (Figure 13). Coverage of mussel over the bed is 70-80% (Figure 12, 17, 18 and 22), and similar to Black Scar the mussel mud was thick (Figure 21 and 26) (in places up to a metre thick) and had grown since the previous survey to form hillocks (Figure 14, 17, and 26) with channels cutting between where the mussel mud was coming loose (Figure 16). There was some evidence of scour near the channel edge of the bed (Figure 15). There was a strip of size mussel still present along the edge of the bed (Figure 19) with some of it becoming loose and forming mounds (Figure 20). There was no exposed cobble or bare substrate, and mussel mud covered the main extent. The approximate area of the mussel was 9.7 hectares and has started to put down mussel mud. The settlement was absent along the Eastern edge of the scar. There were small areas of size mussel along the channel edge. The approximate area of the mussel was 4.5 hectares.

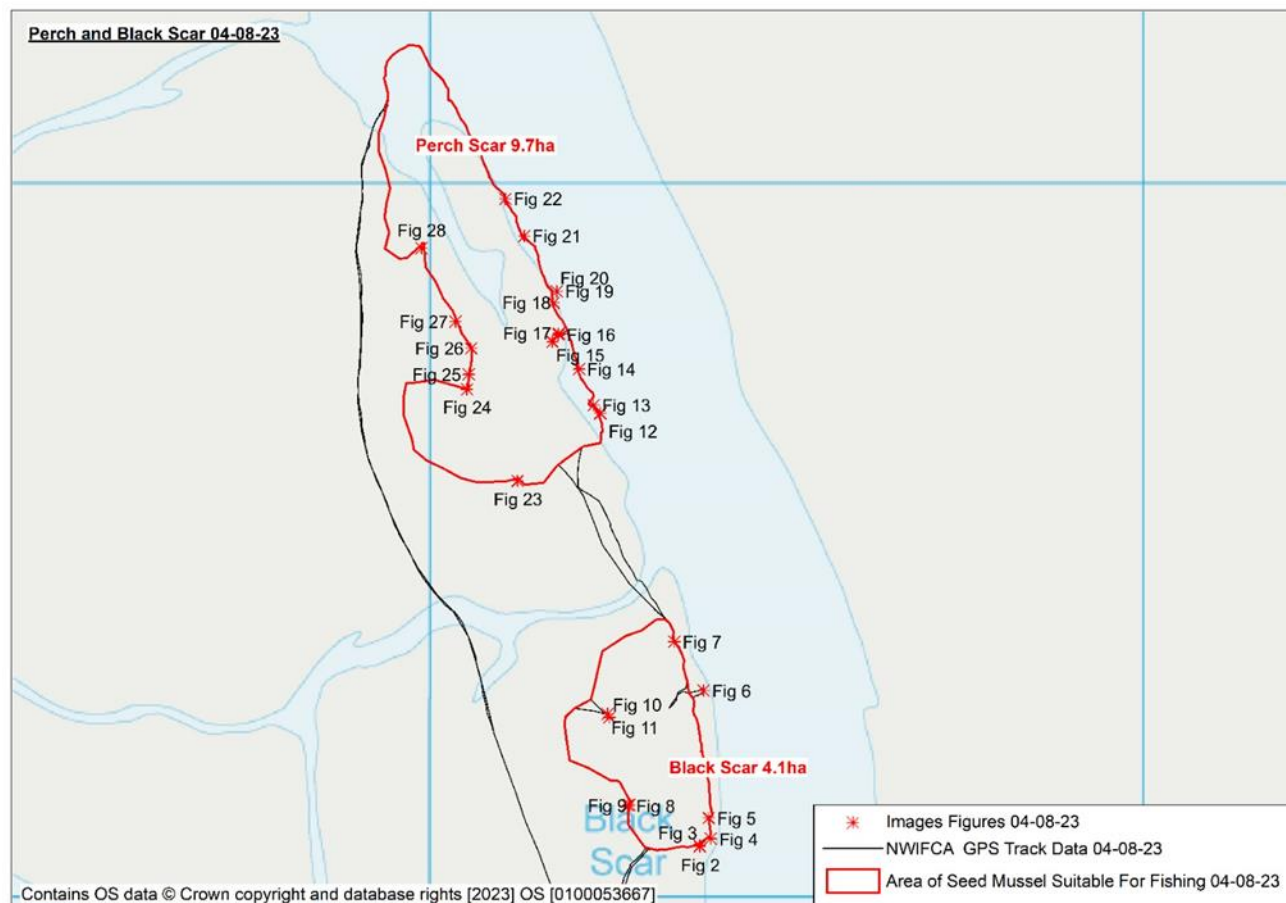


Figure 3. Map to show the approximate extent of South Perch and Black Scar beds, and location of images taken.

Given the high settlement cover over the bed, the deepening mussel mud and coverage over the extent of the cobble and boulder habitat beneath both Perch and Black Scar is recommended for seed dredging this year.

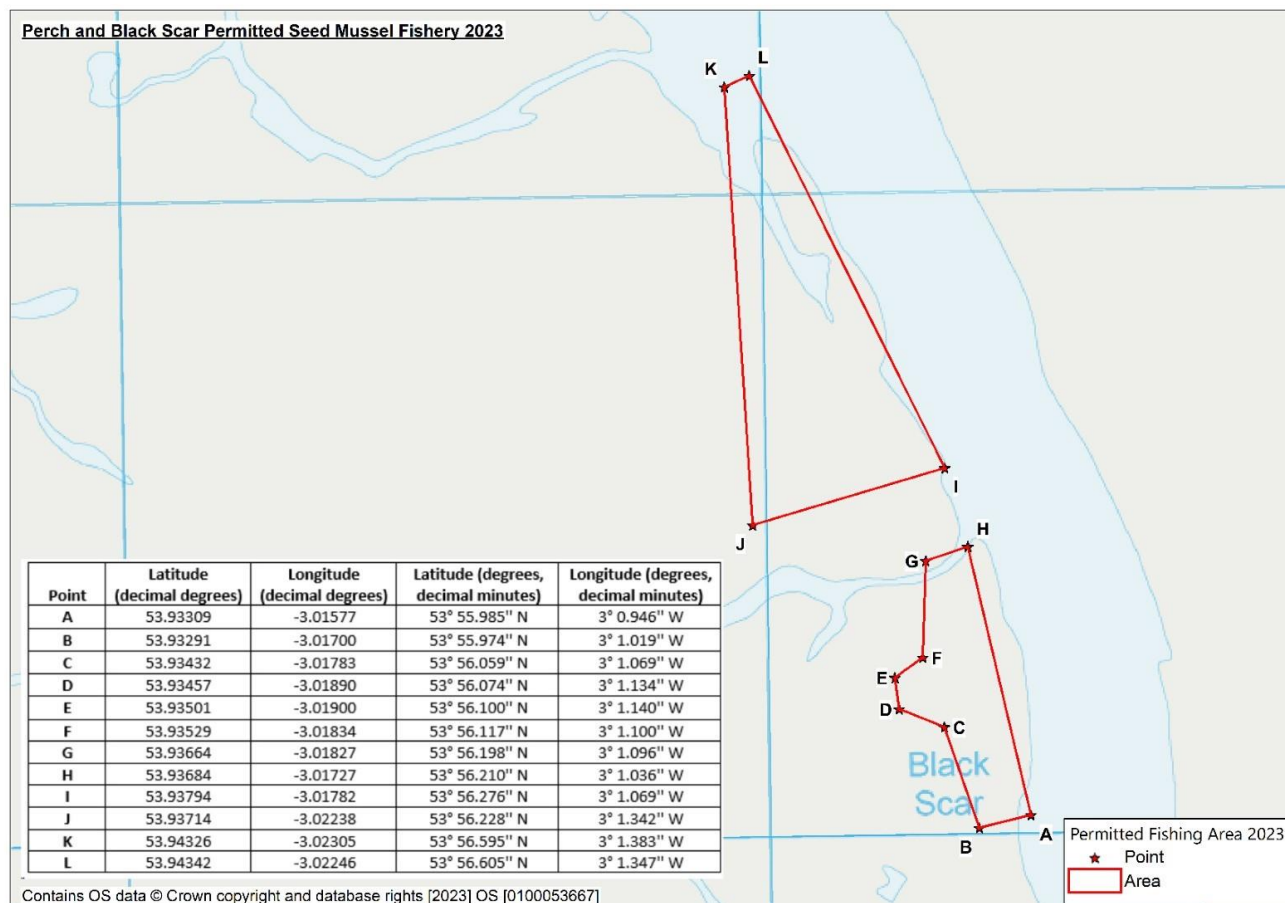


Figure 4. Map to show the approximate extent of the Perch and Black Scar Mussel beds, and the area proposed for seed dredging in 2023.

**Recommendation:** This year, due to the dense seed coverage, loose mussel, and mud covering the extent of the underlying substrate, **Perch Scar and Black Scar are proposed for a seed dredge mussel fishery** across the main area (excluding the size mussel along the channel edge) (Figure 4).

#### 4.7.4 Falklands mussel bed

Officers have been unable to access the Falklands mussel bed – therefore, it is not proposed open at this time.

### 4.8 Summary of proposed fisheries

Based on the information provided in the inspection reports, consideration of the key features of the beds (presence of mussel mud, bed extent, presence of *Sabellaria alveolata* etc.), and the condition of mussel settlements, the following fisheries (Table 1) are proposed for this year. The possible impact of these fisheries on the designated features of Morecambe Bay will be assessed further in this document. All other mussel beds will remain closed to seed fishing.

**Table 1.** Summary of proposed undersize fisheries to be opened in Morecambe Bay.

Mussel bed	Proposed fishery	Legislation	Open date
Perch Scar (Fleetwood)	Dredge seed fishery	Restrictions on the use of a dredge Byelaw 2017	August

Black Scar (Fleetwood)	Dredge seed fishery	Restriction on the use of a dredge Byelaw 2017	August
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## 4.9 Information on fishing activity

### 4.9.1 Hand gathered seed

There are currently ~150 Byelaw 3 permit holders able to fish for mussel and cockle in the district and could, in theory, target the beds for seed mussel. However, out of these permit holders, landings from the past two years show that ~20 fishers target mussel, and out of these, there are approximately 3 to 10 fishers that fish for seed mussel across the district by way of hand gathering when authorised to do so.

In the past 6 years, Heysham has been opened to hand gathered seed mussel since 2016. All previous HRA's are available here: <https://www.nw-ifca.gov.uk/marine-protected-areas/hra/>. Landings from the bed were 168 tonne in 2017, and 208 tonne in 2018, and the fishery was targeted for 1 to 2 months once opened. However, in the years from 2019 to 2022, no landings were made despite the fishery being opened. This is likely due to the presence of Chinese mitten crab.

### 4.9.2 Dredge seed fishery

The dredge fisheries have historically used a maximum of two boats. The activity takes between 1 to 4 tides once per year. Perch Scar was opened in 2019, 2020, 2021 and 2022 to dredge fishing. South America has historically been open to dredge fishing each year since 2016, apart from 2017 to 2019, and was opened to hand gathered seed fishers in 2018. The bed shows changes in extent and coverage each year and so does not always meet the requirements for the fishery to be HRA compliant. In addition, 2022 saw a poor seed settlement across a number of the beds. The Falklands was last opened to dredge fishing in 2016.



## 5. Test for Likely Significant Effect (LSE)

The Habitats Regulations Assessment (HRA) is a step-wise process and is first subject to a coarse test of whether a plan or project will cause a likely significant effect on an EMS<sup>1</sup>.

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

### 5.1 Table 1: Assessment of LSE

**Features:** All qualifying features and sub-features that do not interact with the fishing activity have been **screened out**. Features and sub-features identified to interact with the fishing activity have been included table 1 below.

**Pressures:** All pressures from the Advice on Operations table provided in the Morecambe and Duddon Estuary Conservation Advice package (<https://designatedsites.naturalengland.org.uk/SiteList.aspx?siteName=morecambe&countyCode=&responsiblePerson=&DesignationType=All>) have been screened out, other than the pressures in the following table, due to the nature of the fishing activity.

**Table 2.** Designated features, their sensitivity to fishing activity and the potential for likely significant effect.

Qualifying Feature	Sub-feature	Potential pressure(s) from hand gathered and/or dredge fishing (where relevant)	Sensitivity	Potential for Likely Significant Effect?	Justification and evidence
H1130. Estuaries  H1140. Mudflats and sandflats not covered by seawater at low tide; Intertidal mudflats and sandflats  H1160. Large shallow inlets and bays  SPA Supporting Habitats	Intertidal mud	Abrasion/disturbance of the substrate on the surface of the seabed	Sensitive	No	Activity does not occur within the vicinity of intertidal mud. Access to fishery will not be over the feature.
		Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion	Sensitive	No	
	Intertidal sand and muddy sand	Abrasion/disturbance of the substrate on the surface of the seabed	Sensitive	No	Hand-gathered access to fishery will be over feature but unlikely to have any impact in such a highly dynamic site, due to low levels of effort and number of tides available for fishing.
		Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion	Sensitive	No	Hand-gathered access to fishery will be over feature but unlikely to have any impact in such a highly dynamic site, due to low levels of effort and number of tides available for fishing.  Boat access over high water and no impact on intertidal sand and muddy sand features.
	intertidal/subtidal mixed sediments, intertidal coarse sediment	Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion	Sensitive	Yes	Potential for interaction with mixed and coarse sediments. Feature and pressure taken through to AA.

<sup>1</sup> Managing Natura 2000 sites: [http://ec.europa.eu/environment/nature/natura2000/management/guidance\\_en.htm](http://ec.europa.eu/environment/nature/natura2000/management/guidance_en.htm)

	Intertidal / subtidal stony reef	Abrasion/disturbance of the substrate on the surface of the seabed	Sensitive	Yes	Both hand-gathering and seed mussel dredge fishing remove the mussel from the surface of the seabed and there is potential for abrasion / disturbance / penetration of the substrate on and below the seabed. Feature and pressures taken through to AA.  The area is shellfish disease and INNS free. Industry are encouraged to use recognised procedures to ensure equipment is clean of INNS. Consignments are monitored closely through CEFAS shellfish hygiene inspections, and NWIFCA liaison with regulators in Ireland and North Wales to ensure risk of translocation is minimal  Feature and pressure taken through to AA.  There is little or no by-catch in this highly selective fishery.  Feature and pressure taken through to AA. The proposal is to remove mussel from the skear. Mussel beds are a characteristic and fluctuating community of the intertidal boulder and cobble skear interest sub-feature.
	Intertidal / subtidal biogenic reef: including mussel and Sabellaria communities	Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion	Sensitive	Yes	
		Genetic modification & translocation of indigenous species	Sensitive	No	
		Litter	Sensitive	Yes	
		Removal of non-target species	Sensitive	No	
		Removal of target species	Sensitive	Yes	
A026 <i>Egretta garzetta</i> ; Little egret	Supporting Habitats assessed above	Removal of target species (Mussels)	Some species sensitive, others screened out	Yes	Species sensitive to removal of mussels: - Common eider - Eurasian oystercatcher - Red knot - Herring gull - All other shore feeding SPA feature which occasionally feed on infaunal molluscs.
A038 <i>Cygnus Cygnus</i> ; Whooper swan					
A040 <i>Anser brachyrhynchus</i> ; Pink-footed goose					
A048 <i>Tadorna tadorna</i> ; Common shelduck		Removal of non-target species	Sensitive	No	Highly selective fishery. No by-catch or discards of non-target species.
A050 <i>Anas Penelope</i> ; Wigeon					
A054 <i>Anas acuta</i> ; Northern pintail		Visual disturbance	Sensitive	Yes	All species taken through to AA
A063 <i>Somateria mollissima</i> ; Common eider (Breeding)					
A067 <i>Bucephala clangula</i> ; Goldeneye					
A069 <i>Mergus serrator</i> ; Red-breasted merganser					
A130 <i>Haematopus ostralegus</i> ; Eurasian oystercatcher					
A137 <i>Charadrius hiaticula</i> ; Ringed plover					
A140 <i>Pluvialis apricaria</i> ; European golden plover					
A141 <i>Pluvialis squatarola</i> ; Grey plover					
A142 <i>Vanellus vanellus</i> ; Lapwing					
A143 <i>Calidris canutus</i> ; Red knot					
A144 <i>Calidris alba</i> ; Sanderling					
A149 <i>Calidris alpina alpina</i> ; Dunlin					
A151 <i>Calidris pugnax</i> ; Ruff					
A156 <i>Limosa limosa</i> ; Black-tailed godwit					
A157 <i>Limosa lapponica</i> ; Bar-tailed godwit					

A160 <i>Numenius arquata</i> ; Eurasian curlew A162 <i>Tringa totanus</i> ; Common redshank A169 <i>Arenaria interpres</i> ; Ruddy turnstone A176 <i>Larus melancephalus</i> ; Mediterranean gull <i>Phalacrocorax carbo</i> ; Cormorant <i>Podiceps cristatus</i> ; Great crested grebe A183 <i>Larus fuscus</i> ; Lesser black-backed gull (Breeding) A184 <i>Larus argentatus</i> ; Herring gull (Breeding)					
A191 <i>Sterna sandvicensis</i> ; Sandwich tern (Breeding)					
A193 <i>Sterna hirundo</i> ; Common tern (Breeding)					
A195 <i>Sterna albifrons</i> ; Little tern (Breeding)					
Seabird assemblage					
Waterbird assemblage					

Is the potential scale or magnitude of any effect likely to be significant? <sup>2</sup>	Alone  Yes  Comments :	OR In-combination <sup>3</sup>  Yes  Comments :  These activities also occur at the site: <ul style="list-style-type: none"> <li>• Beam Trawl (Shrimp)</li> <li>• Pots and Creels</li> <li>• Light otter trawl (Fish)</li> <li>• Drift and Fixed nets (including stake)</li> <li>• Hand working (size mussel)</li> <li>• Hand-working (cockles)</li> </ul>
Have NE been consulted on this LSE test? If yes, what was NE's advice?	No - NWIFCA consider AA required	

<sup>2</sup> Yes or uncertain: completion of AA required. If no: LSE required only.

<sup>3</sup> If conclusion of LSE alone an in-combination assessment is not required.

## 6. Appropriate Assessment

### Potential risks to features

#### 6.1 Potential risks to SAC habitat features of Morecambe Bay and Duddon Estuary from undersize hand gathered mussel or dredge seed fishery.

##### Features at risk of interacting with fishing activity:

- Intertidal / subtidal mixed sediments, intertidal / subtidal coarse sediment
- Intertidal / subtidal stoney reef
- Intertidal / subtidal biogenic reef: including mussel and *Sabellaria alveolata* communities

##### 6.1.1 Pressures and Potential Impacts

The pressures that each Morecambe bay SAC feature and sub-feature are susceptible to are detailed in Natural England's 'Advice on Operations'. The key impacts that the relevant sub-features are vulnerable to are detailed below.

- i. Abrasion/disturbance of the substrate on the surface of the seabed
- ii. Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion.

i) and ii) assessed together - both hand-gathering and seed mussel dredge fishing remove the mussel from the surface of the seabed and there is potential for abrasion / disturbance / penetration of the substrate on and below the seabed from the use of rakes and dredges.

- iii. Litter

Past hand-gathered fisheries have had a poor reputation for large amounts of litter left deposited on the parking and access areas, and on the fishery. Items have included food and drink receptacles, net bags and sacks. Potential impacts could include entanglement of fish and birds in the bags and sacks, and swallowing / entanglement by / of birds and mammals (both marine and terrestrial) of other litter.

- iv. Removal of target species from biogenic mussel bed communities

Potential to affect the presence and spatial distribution of feature communities, the presence and abundance of typical species and the species composition of component communities.

As the provisional HRA was done prior to final inspection of these sites, the worst-case scenario will be considered here to ensure maximum extent of impact has been considered. However, post-survey, the scope of proposed activity is considerably lower than that considered in the early HRA. Information relating to the extent and location of the proposed fishery is detailed Section 4.

##### 6.1.2 Exposure

In this section, the level of potential pressure caused by hand or dredge fishing on each sub-feature is considered, and a recommendation as to whether the activity is likely or not affect the integrity of the designated feature.

##### 6.1.2.1 Abrasion and penetration

##### Pressure considered:

- i. Abrasion/disturbance of the substrate on the surface of the seabed
- ii. Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion

**Interaction with feature:**

- i. Intertidal / subtidal mixed sediments,
- ii. intertidal / subtidal coarse sediment; and
- iii. Intertidal / subtidal stoney reef

Hand-gathered seed Fishery: On Heysham, the mussel sits on a layer of soft substrate (mixture of mud, sand and sandy mud) which in places is over a metre thick. Hand-raking skims the mussel from its underlying sediment, with no contact with the cobble and boulder reef beneath.

Dredge Fishery: On South America, Falklands and Perch and Black Scar, the dredges used in the fishery have been developed over many years to impact the environment as little as possible by scooping the top layer (~10cm) of mussel and mud from the remaining layer and leaving the cobble substrate undisturbed. The presence of thick mud over the top of the protected feature minimises the potential interaction that fishing gear may have.

On all proposed fishing grounds (South America, Falklands, Perch and Black Scar), the extent of the proposed fishery will only take place where mud is deemed consistently thick over an area large enough for dredge fishing. Patches of bare grounds, exposed cobble and boulder, or thin mud are excluded from the proposed fishing areas to ensure the fishery has minimal interaction with the protected features.

There is a history of both of these fishery activities occurring on these areas with no known impact to the underlying features.

***The NWIFCA can conclude that due to the prevailing conditions of thick mud that abrasion and penetration on and below the surface of the seabed will have no risk of adverse effect on the integrity or conservation status of the designated features within the site.***

***\*Post-inspections detailed in Section 4 and the Annex 1 of this report – Fleetwood mussel beds are the only bed which reached this criteria as of the 3<sup>rd</sup> of August and as such are the only beds proposed for opening.***

**Interaction with feature:**

- iiii. Intertidal / subtidal biogenic reef: *Sabellaria alveolata* communities

**Heysham Flat:**

*Sabellaria alveolata*, is currently present on Heysham Flat in an area from Conger Rock to Dallam Dyke (figure 1). The extent of this *Sabellaria* has remained consistent since 2022 – in a band west of conger rock and extending seawards. The significant historic *Sabellaria alveolata* reef extending across the skear from close to Conger Rock to Dallam Dyke seen in the previous survey in May was no longer visible. The *Sabellaria* sp. has been completely smothered by seed mussel and mussel mud, with only a few small sections now visible. The extent of the *Sabellaria alveolata* has been mapped from the previous survey on the 9th May 2023 (Figure 2).

Previous advice from Natural England for Heysham Flat seed mussel fishery in 2016 highlights the importance of protecting the underlying 3D structure for potential future colonisation of *Sabellaria alveolata*. Therefore, we propose opening the area of bed closest to the foreshore from Conger rock (Figure 2 – red area) to remove the possibility of the fishing activity interacting with the designated feature.



\*Post-inspections detailed in Section 4 and the Annex 1 of this report - Heysham mussel bed has experienced significant scour and is not proposed for opening.

#### **South America:**

\* Post-inspection on the 4<sup>th</sup> of August (Annex 1), there was no *Sabellaria* on the main extent of the bed, and due to the limited mussel mud coverage and patchy extent of cobble and boulder exposure – South America is not proposed for opening.

#### **Perch Scar:**

There is no evidence of *Sabellaria alveolata* on Perch Scar, and therefore, there is no risk of this feature interacting with the proposed fishing activities at these sites.

#### **Black Scar**

There is no evidence of *Sabellaria alveolata* on Perch Scar, and therefore, there is no risk of this feature interacting with the proposed fishing activities at these sites.

#### **Falklands**

TBC

***The NWIFCA can conclude with the additional mitigation to remove the area of *Sabellaria alveolata* from the authorised fishery on Heysham, South America and Falklands, that abrasion and penetration on and below the surface of the seabed from a hand-gathered size mussel fishery (Heysham) and a seed dredge fishery (South America and Falklands), will have no risk of adverse effect on the integrity or conservation status of the designated features within the site.***

***\*Post-inspections detailed in Section 4 and the Annex 1 of this report – Fleetwood mussel beds are the only beds proposed for opening, and therefore, there is no risk to the features on Heysham, South America and Falklands from hand or dredge activities.***

***Due to the absence of *Sabellaria alveolata* Perch Scar and Black Scar, NWIFCA can conclude that the proposed fisheries at these sites will have no risk of adverse effect on the integrity or conservation status of the designated features within the site.***

#### **6.1.2.2 Litter**

##### **Pressure considered:**

##### **i. Litter**

Since 2016 there have been a number of cockle fisheries in Morecambe Bay (Newbiggin, Flookburgh, Leven Sands and Pilling Sands) and in most years there has been a fishery on Heysham Flat for seed mussel as well as on-going size mussel fisheries around Morecambe Bay. There have only been a few reports of litter being an issue at any of these fisheries, which are regularly inspected by fishery officers. Where issues have been raised officers work with gatherers, buyers and the local authority to resolve the issues. A Code of Practice for Intertidal Hand-gathering includes responsibility for littering. NWIFCA takes a swift response to any alerts to littering issues.

There is very little risk of littering from the vessel dredge fishery. Vessels are large and modern and have all facilities for dealing with litter aboard.

The NWIFCA is confident that littering will be minimal and controlled and monitoring will be in place to identify quickly if litter is a problem. ***Therefore, the NWIFCA can conclude that litter will have no risk of adverse effect on the integrity or conservation status of the designated features within the site.***

#### **6.1.2.3 Removal of target species**

##### **Pressure considered:**

- i. Removal of target species*

##### **Feature interaction:**

- i. Intertidal biogenic reef: including mussel and Sabellaria alveolata communities*

The fisheries are being proposed due to:

- 1) The presence of thick mud on the majority of the bed, and
- 2) Identification of large amounts of loose mussel.

Based on these conditions, and historical trends in stock wash off, it is highly likely that the 2023 year class of mussel and mud on which it sits will be removed by natural events.. Although attempts have been made over the years to identify *where* the mussel is washed to, it has never been found within the Bay and is believed to either wash into the wider Irish Sea or to die. Each year, there has been subsequent settlements, demonstrating the bed's ability to recolonise after natural scouring.

***NWIFCA is confident that the removal of target species will have no risk of adverse effect on the integrity or conservation status of the designated features within the site.***

## 6.2 Potential risks to SPA and Ramsar features of Morecambe Bay and Duddon Estuary from hand gathered mussel or dredge seed fishery.

Features at risk of interacting with fishing activity:

- SPA and Ramsar birds

### 6.2.1 Pressures and Potential Impacts

The pressures that each Morecambe bay SPA feature and sub-feature are susceptible to are detailed in Natural England's 'Advice on Operations'. The key impacts that the relevant sub-features are vulnerable to are detailed below.

- i) Removal of target species (mussels) for Common eider, Eurasian oystercatcher, Red knot, Herring gull, and those SPA features which occasionally feed on infaunal molluscs;

Mussels form part of an important prey resource for eiders, oystercatchers, knot and herring gull, as well as forming part of a wide variety of prey items for many of the designated species including grey plover, dunlin, sanderling and turnstone. If bird populations are to be maintained, or restored to healthy condition, sufficient shellfish to meet their demands must remain for them.

The impact of removal of essential prey resource by fishing activity varies at different times of the year. For example, prey resource requirements are far greater during autumn and at the beginning of winter than at other times of the year, as enough resource needs to be present for all the birds to feed through the cold months, when energy requirements are higher. Over-wintering waders require food to put on weight and get into best condition in the spring prior to migrations for the summer, or they will not survive long flight distances and suffer high mortalities. Equally, the breeding eider population of Morecambe Bay needs to get into prime condition prior to mating in order to reproduce successfully. This applies to both sexes but in particular to females who once on the nest do not feed again until ducklings have fledged, a period of up to three weeks. There have been concerns raised over the Bay's eider population, its sex ratio skew (3:1 males to females) and the lack of success in breeding.

Oystercatchers eat a range of sizes of mussels. Although the birds will eat alternative prey species when shellfish are scarce, these prey often are not as nutritious and do not enable birds to survive as well, and in such good body condition, as when shellfish are abundant (Atkinson et al 2003; Goss-Custard et al 2004).

Knot eat smaller bivalves with lower and upper size limits of around 5 and 12.5mm shell length respectively (Bell et al 2001).

Eiders generally feed on a mixed range of sizes of bivalves, although it is understood they will consume high quantities of small mussels when they are available.

Herring gulls fed on a range of sizes of bivalves with around 20mm thought to be the preferred size (Hilgerloh et al, 1997)

- ii) Visual disturbance - All SPA species within vicinity of fishery, on the saltmarsh access route and over the sandbanks.

Visual disturbance could impact on the condition of any of the listed bird species, by causing unnecessary energy expenditure if flushed and taking to flight. For birds feeding on the affected areas it could also reduce feeding times, and increase competition if birds are forced to concentrate into reduced feeding areas.

### 6.2.2 Exposure

In this section, the level of potential pressure caused by the proposed hand or dredge fishing on each feature is considered, and a recommendation as to whether the activity is likely or not to affect the integrity of the designated feature.

#### i) Removal of target species (mussels) for Common eider, Eurasian oystercatcher, Red knot, Herring gull;

The seed mussel on South America, Falklands, Heysham and Perch and Black Scar is highly vulnerable to natural wash out and therefore is highly unlikely to be available to the birds through autumn or winter whether fished or not. Every year natural processes remove the majority of seed, and a new spat settlement takes place the following year. The size of the mussel removed by the fishing activity is in the 20 - 30mm size range and therefore outside of the typical feeding size range for knot, but within the feeding range for eider, oystercatcher and herring gull.

There are approximately 6 recognised cockle beds in the bay, and over 9 recognised mussel beds. NWIFCA survey or inspect all the beds annually. These inspections serve to provide estimates on the coverage and biomass of mussel and cockle in the bay, all of which contributes as a food source to protected bird species.

Although no specific figures have been given for the bird food requirements for bivalve eating birds, using the summary of the cockle and mussel bed surveys provided (Annex 7) and the reasons listed below, NWIFCA is confident that the bird food requirements are met for the site due to the following reasons:

- Fishing is never 100% efficient and neither method will remove all of the mussel from the bed. In addition, on all proposed beds, fishing will be limited to the restricted areas, and those accessible to fishers
- On the proposed beds, the seed does not typically survive the winter and is already showing signs of scouring; therefore, it will likely not be available as a resource to birds either as size, or as seed.
- The duration and extent (effort) of the dredge vessels fishing, and Black Scar will be limited by suitable times. The fishery takes place over high water on smaller tides around the neap tide, and dredging will take place for 1-4 days maximum given the small size of the area and limited number of locations available. There will be a maximum of 2 boats targeting this fishery.
- Wader numbers are greatest during the winter months meaning feeding requirements are lower during the time of the fishery.
- There are significant size and seed mussel stocks greater than those on the areas proposed for opening are available on other mussel beds within the protected site (Annex 7).

***NWIFCA is confident that the removal of target species (undersize mussel) will have no risk of adverse effect on the SPA features, which utilise mussel as a prey source and therefore have no risk of adverse effect on integrity or conservation status of the site.***

#### ii) Visual disturbance - All SPA species within vicinity of the fishery, access route and over the sandbanks

Little egret have the potential to be disturbed when feeding. Little egret prefer to feed in shallow water 10cm to 20cm in depth (Kushlan & Hancock 2005). There is potential for the birds to be disturbed by hand-

gathering when tractors and quad bikes are travelling to and from the fishing areas and fishing. Little egret commonly feeds in solitary or in loose flocks (del Hoyo et al. 1992), and therefore any disturbance is likely to affect only a few individuals.

Displacement from temporary and short lived for the following reasons:-

- Seed dredgers require deeper water for vessels to operate, and therefore will not interact with the little egret on Perch Scar of South America.
- The gatherers will only travel once to and from the fishing area per tide
- Dredgers fish for between 1-4 days on suitable tides, typically only once within the determined time frame (which is often limited to >3months). Time and duration of disturbance is very limited.

Golden plover are only likely to feed in the intertidal areas when weather conditions are harsh and the ground is hard from frost on their normal inland feeding areas. Due to the fishing activity occurring mainly in August - September it is unlikely that golden plover will be found near the fishery.

Dunlin, black tailed godwit, bar tailed godwits, curlew and redshank mainly target mudflats as their feeding grounds. Lapwing use a variety of habitats (marine and terrestrial), and when present on the intertidal they tend to target mudflats. The fishing activity does not occur on or near to mudflats. Redshank are found on saltmarsh and are known to nest on saltmarsh but the fishing activity does not occur on or near saltmarsh. All access to the fishing grounds by hand-gatherers is by established access routes, and by vessels from open sea over high water; visual disturbance is unlikely.

Oystercatcher, ringed plover, grey plover, knot, sanderling and turnstone all feed on a variety of substrates in the intertidal area. Waders will move in and out with the tide feeding in and on the sediment, each wader will have a preferred prey source and size. Travel by hand-gatherers to and from the authorised area and fishing has the potential for disturbance. Visual disturbance to Oystercatcher, ringed plover, grey plover, knot, sanderling and turnstone will be minimal and any displacement temporary and short lived for the following reasons:

- the gatherers will only travel once to and from the fishing area per tide
- plentiful mussel stock present on other beds and some additional cockle stocks as alternative feeding (Annex 7) giving large areas of undisturbed feeding.
- there will be a limited number of hand-gatherers prosecuting the fishery with a maximum of 20 permit holders fishing over low water.
- At Perch and Black Scar the dredge vessels will fish over high water on smaller tides around the neap tide. ie. at times when the birds will be resting or feeding on inshore / inland sites.

Shelduck, pintail and wigeon spend a proportion of their time feeding on intertidal mud. The fishing activity does not occur on or near to mudflats meaning disturbance is unlikely. Red breasted merganser, cormorant and great crested grebe spend the majority of time on the water, so there will be minimal to no disturbance from an intertidal fishery accessed from the shore. Whooper swans and pink footed geese numbers are greatest during the winter, and as the fishery is in August to September and for a short period of time disturbance is likely to be minimal if any.

Eiders are known to feed on submerged mussels at shallow depths (2-3m) (Larsen & Guillemette 2000) and are regularly observed at or near to the Falklands beds, Foulney Island, Low Bottom, Morecambe and Fleetwood. Visual disturbance to Eiders by the fishing activity will be minimal and any displacement temporary and short lived for the following reasons:

Hand-gathering:



- no visual disturbance to feeding eiders from hand-gatherers as feeding on different tides to the fishing activity
- eiders loafing or resting on the exposed intertidal areas are mainly around Foulney and Walney Channel which is not part of the access route to Heysham. Those resting on the sands may be minimally disturbed as the quad bikes pass once on the way to the fishery and once on the way back over a low number of tides.

#### Dredge fishery:

- low number of boats with a large capacity meaning the fishery is often short lived – likely to be a max of 4 days.
- fishing lasts around 4-5 hours over high water at which point the boats are likely to move offshore until the next tide
- once the vessel has taken a load it has to steam back for a day or two to the operators lays
- fishing is not expected to take place over spring tides which further reduced the potential for visual disturbance.

Mediterranean gull, lesser black-backed gull, herring gull are present on both the intertidal and open water and therefore there is potential for visual disturbance from access and fishing to the authorised area. Visual disturbance to gulls will be minimal and any displacement temporary and short lived for the following reasons:

- Fishing can only take place in the upper part of the bed at Heysham Flat.
- The gatherers will only travel once to and from the fishing area per tide
- Plentiful mussel stock present on other beds and some additional cockle stocks as alternative feeding (Annex 7) giving large areas of undisturbed feeding.
- A large proportion of Heysham flat will remained closed to protect areas of *Sabellaria alveolata*, which is covered in mussel and available as an undisturbed area.
- There will be a limited number of hand-gatherers prosecuting the fishery with a maximum of 20 permit holders fishing over low water.
- The dredge vessels will fish over high water on smaller tides around the neap tide. ie. at times when the birds will be resting or feeding on inshore / inland sites.

Sandwich tern, common tern, and little tern rarely use the intertidal area at low water but will use the shallow areas covered by water. The tern species do nest in coastal areas but none of the known nest areas are access points for the fishery. The known nesting areas for terns in the European Site are Foulney and Hodbarrow. There is potential for fishing activity to disturb the terns while fishing in shallow water at low tide but terns have large foraging ranges and will not be displaced a large distance by the fishing activity. The main times of year when they are present are out with the time of these fisheries.

***The NWIFCA is confident that visual disturbance to the SPA features will have no risk of adverse effect on the integrity or conservation status of the site.***

## **7. Management and Mitigation to Ensure No Adverse Effect on the Integrity of the European Site:**

In order for the NWIFCA to be fully confident of no risk of adverse effect on the integrity or conservation status of the sites a precautionary approach is being taken, and the following management measures implemented:

- a) Rigorous enforcement of the conditions set out in the authorisation and permit conditions including sensitive areas outside of the fishery;

b) Monitored landings through:

- i. Regular IFCO reporting of numbers fishing and estimates of quantities removed;
  - ii. Landings returns from Byelaw 3 permit holders and Dredge permit holders (required under both byelaws);
- c) Monitoring and inspection to inspect catch and ensure that there are no litter issues;
- d) NWIFCA enforcement officers will use intelligence and contacts with fellow enforcement agencies to pursue any suspicions of non-permitted or illegal gathering activity;
- e) A NWIFCA officer will be present on the dredge vessel to ensure activities take place within the restricted areas and can enforce a closure at any point should the activity extend beyond the specified boundaries.

**Table 2: Summary of Impacts**

Feature/Sub feature(s)	Conservation Objective	Potential pressure <sup>4</sup> (such as abrasion, disturbance) exerted by gear type(s) <sup>5</sup>	Potential ecological impacts of pressure exerted by the activity/activities on the feature <sup>6</sup> (reference to conservation objectives)	Level of exposure <sup>7</sup> of feature to pressure	Mitigation measures <sup>8</sup>
Intertidal mixed sediments, intertidal coarse sediment  Intertidal biogenic reef: including mussel and Sabellaria alveolata communities	Maintain or restore the extent, distribution structure or function of the feature.	Abrasion/disturbance of the substrate on the surface of the seabed	Both hand-gathering and seed mussel dredge fishing remove the mussel from the surface of the seabed and there is potential for abrasion / disturbance / penetration of the substrate on and below the seabed from the use of rakes and dredges.	As in 6.1.2.1	None – no activity in areas where Sabellaria is present
		Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion			None – no activity in areas where Sabellaria is present
		Litter	Litter could pose potential threat to wildlife, especially birds through ingestion or entanglement	As in 6.1.2.2	None - current management measures sufficient with monitoring of the fishery
		Removal of target species	Potential to affect the:- - Presence and spatial distribution of the feature communities - Presence and abundance of typical species - The species composition of component communities	As in 6.1.2.3	None - current management measures sufficient with monitoring of the fishery
<i>Somateria mollissima</i> ; Common eider <i>Haematopus ostralegus</i> ; Eurasian oystercatcher <i>Calidris canutus</i> ; Red knot	Maintain or restore the population of each of the qualifying features, and, the distribution of the qualifying features within the site	Removal of target species (mussels)	Potential to affect the:- - Food availability - Condition and survival of SPA species - Abundance of SPA species	As in 6.2.2 (i)	None - current management measures sufficient with monitoring of the fishery

<sup>4</sup> Guidance and advice from NE.

<sup>5</sup> Group gear types where applicable and assess individually if more in depth assessment required.

<sup>6</sup> Document the sensitivity of the feature to that pressure (where available), including a site specific consideration of factors that will influence sensitivity.

<sup>7</sup> Evidence based e.g. activity evidenced and footprint quantified if possible, including current management measures that reduce/remove the feature's exposure to the activity.

<sup>8</sup> Detail how this reduces/removes the potential pressure/impact(s) on the feature e.g. spatial/temporal/effort restrictions that would be introduced.

<i>Larus argentatus</i> ; Herring gull					
<ul style="list-style-type: none"> <li>Common eider</li> <li>Eurasian oystercatcher</li> <li>Red knot</li> <li>Little egret</li> <li>Whooper swan</li> <li>Pink-footed goose</li> <li>Common shelduck</li> <li>Wigeon</li> <li>Northern pintail</li> <li>Common eider</li> <li>Goldeneye</li> <li>Red-breasted Merganser</li> <li>Eurasian oystercatcher</li> <li>Ringed plover</li> <li>European golden plover</li> <li>Grey plover</li> <li>Lapwing</li> <li>Red knot</li> <li>Sanderling</li> <li>Dunlin</li> <li>Ruff</li> <li>Black-tailed godwit</li> <li>Bar-tailed godwit</li> <li>Eurasian curlew</li> <li>Common redshank</li> <li>Ruddy turnstone</li> <li>Mediterranean gull</li> <li>Cormorant</li> <li>Great crested grebe</li> <li>Seabird assemblage</li> <li>Waterbird assemblage</li> <li>Lesser black-backed gull</li> <li>Herring gull</li> <li>Sandwich tern</li> <li>Common tern</li> <li>Little tern</li> </ul>	Maintain or restore the population of each of the qualifying features, and, the distribution of the qualifying features within the site	Visual disturbance	Potential to affect the:- <ul style="list-style-type: none"> <li>- Condition and survival of SPA species</li> <li>- Abundance of SPA species</li> <li>- Extent and distribution of supporting habitat available whilst a fishing activity is occurring</li> </ul>	As in 6.2.2(ii)	None - current management measures sufficient with monitoring of the fishery

## 7. Conclusion

The authorisation, permit, management and mitigation measures incorporated into this fishery, the use of an effective enforcement team of NWIFCA Officers with multi-agency support, the highly dynamic environment in which the fishery lies, and the recorded history of the resources in this area, allows the NWIFCA to conclude that:

- A permitted dredge, seed mussel fishery at Perch and Black Scar (Fleetwood) in August/September 2023;

will not have an adverse effect on the integrity of the designated features of Morecambe bay, Ramsar, SAC and SPA.

## 8. In-combination assessment

### 8.1 Other ongoing and Authorised Fisheries to be Included in the In-combination assessment:

- Tractor shrimp fishery – it is possible that some operators could go shrimp fishing in close proximity with the mussel fishery.
- 
- Size mussel fisheries – there is an active hand-gathered size mussel fishery in Foulney.

#### 8.1.2 In-Combination Assessment

Low water intertidal fisheries:

The shrimp fishery has undergone an HRA which concluded no adverse effect on the integrity of the European Site. Most of the shrimp fishing occurs between spring and autumn with autumn being the key time. Most of the shrimp tractor fishers in Morecambe Bay are also NWIFCA Byelaw 3 permit holders. Most of them prosecute a range of fisheries and it is most likely that they will fish size mussels at Foulney which will result in reduced shrimp fishing.

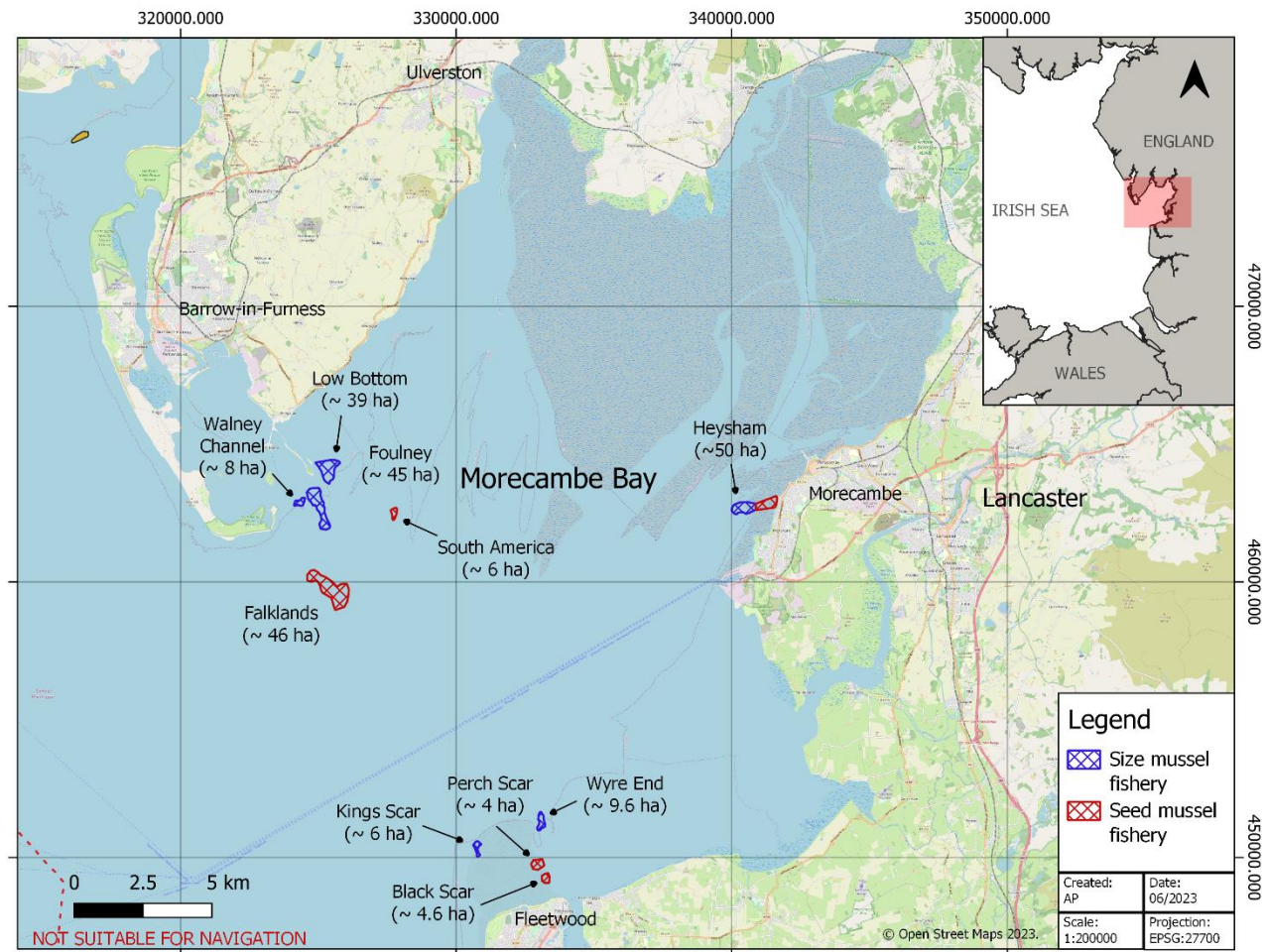
The size mussel fishery is open throughout the District all year round for Byelaw 3 permit holders. Each fishery is rigorously monitored and enforced by warranted IFCOs. In reality each fishery is only prosecuted by low numbers and modest amounts of mussel removed. For example in the months of January 1<sup>st</sup> to May 15<sup>th</sup> 2023 landings reports for the north Morecambe Bay mussel beds, which include Low Bottom, Foulney Ditch, Walney Channel, Foulney and Foulney Island, came to 224 tonnes. Biomass estimates of size mussel made from Dutch Wand survey data in March came to a combined total of 5295 tonnes of size mussel on the surveyed beds in North Morecambe Bay, and 3578 tonnes of undersize (table 3) illustrating it is a low level fishery. These same gatherers will prosecute the undersize mussel if they chose and therefore in relative terms of resource removed and disturbance risk there is no effect.

Table 3. biomass of size and undersize mussel in North Morecambe and the volume removed in the first half of 2023.

Area	Biomass (tonne)		
	Size (≥45mm)	Undersize (≤	Size removed (2023)
Foulney	3702	2365	224
Walney Channel	510	138	

Low Bottom	1083	1075	
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The location and extent of these beds is provided in Figure xx.



Considering cockle, size mussel and shrimp fisheries in the Bay in combination with intertidal hand-gathering of seed mussel the NWIFCA can conclude no adverse effect on the integrity of the European Site providing the management measures of the authorised mussel fishery are implemented and enforced.

High water dredge fishery:

The area of the fishery is small in size a prosecute by a low number of vessels. The resource is often lost to natural causes if not fished. Dredging occurs over different tides to hand-gathering and tractor shrimping.

Considering cockle, size mussel and shrimp fisheries in the Bay in combination with dredge fishery of seed mussel the NWIFCA can conclude no adverse effect on the integrity of the European Site providing the management measures of the authorised mussel fishery are implemented and enforced.

## 9. Summary of consultation with Natural England

Natural England were involved in discussions around the management of the fishery when discussed at TSB.

## **10. Integrity test**

The NWIFCA concludes no adverse effect on the integrity of the European Site providing the management and mitigation measures of the undersize mussel fisheries 2022 are implemented and upheld.

## Annex

### Heysham Flat Inspection

#### **Heysham Flat Mussel Inspection 02-08-23**

Officers present: MC, GG  
Tides LW 06:56 1.2m (Liverpool tides)

Officers inspected the mussel on Heysham Flat to assess if mussel was present and if seed mussel had grown on. Access to the outer skears was not possible across Dallam Dyke due to depth of water and timings.

The significant historic *Sabellaria alveolata* reef extending across the skear from close to Conger Rock (Big stone) to Dallam Dyke was visible in places across the skear, particularly on the Southern edge. The majority of the *Sabellaria* sp. is still smothered by seed mussel and mussel mud, with only a few small sections now visible on the main skear. Officer notes have been mapped in Figure 1.

The extensive seed settlement across the majority of the skear has grown on in size, with the majority 15-25mm. The seed coverage over the entire skear was predominantly 70-80%, with areas over 90%. The seed is putting down mussel mud and most is solid, however some patches are loose.

In the area from Conger Rock to shore, there was significant scour with much less mussel coverage, and only two dense mussel bands remaining at approximately 10m wide across the skear.

The outer skears appeared dark in colouration suggesting mussel still present.

Numerous bird species were present feeding in the area including oystercatchers and gulls.

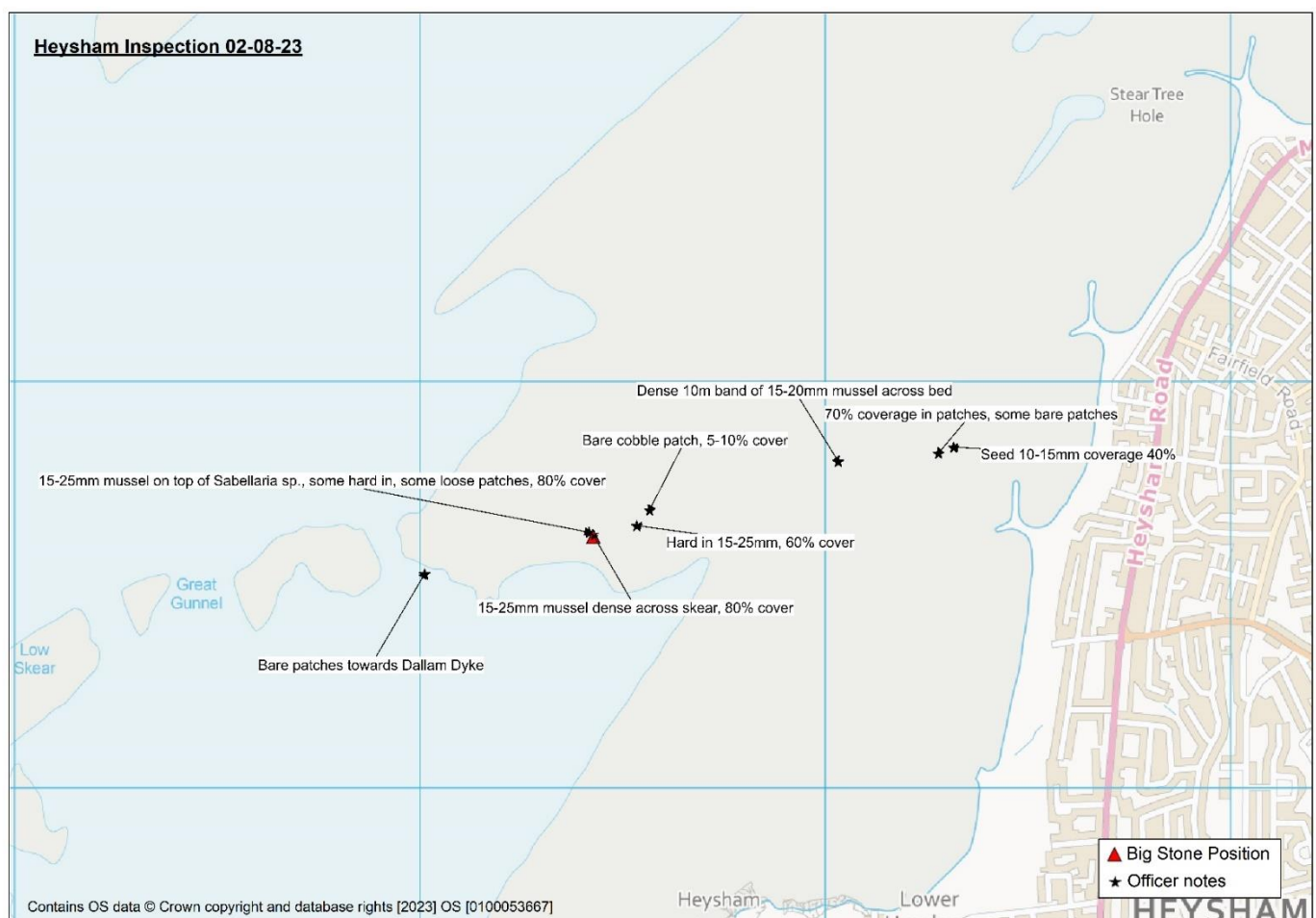


Figure 1. Map showing officer notes on Heysham Flat survey 02-08-23.





Figure 2. Band of mussel across Heysham skear 02-08-23.



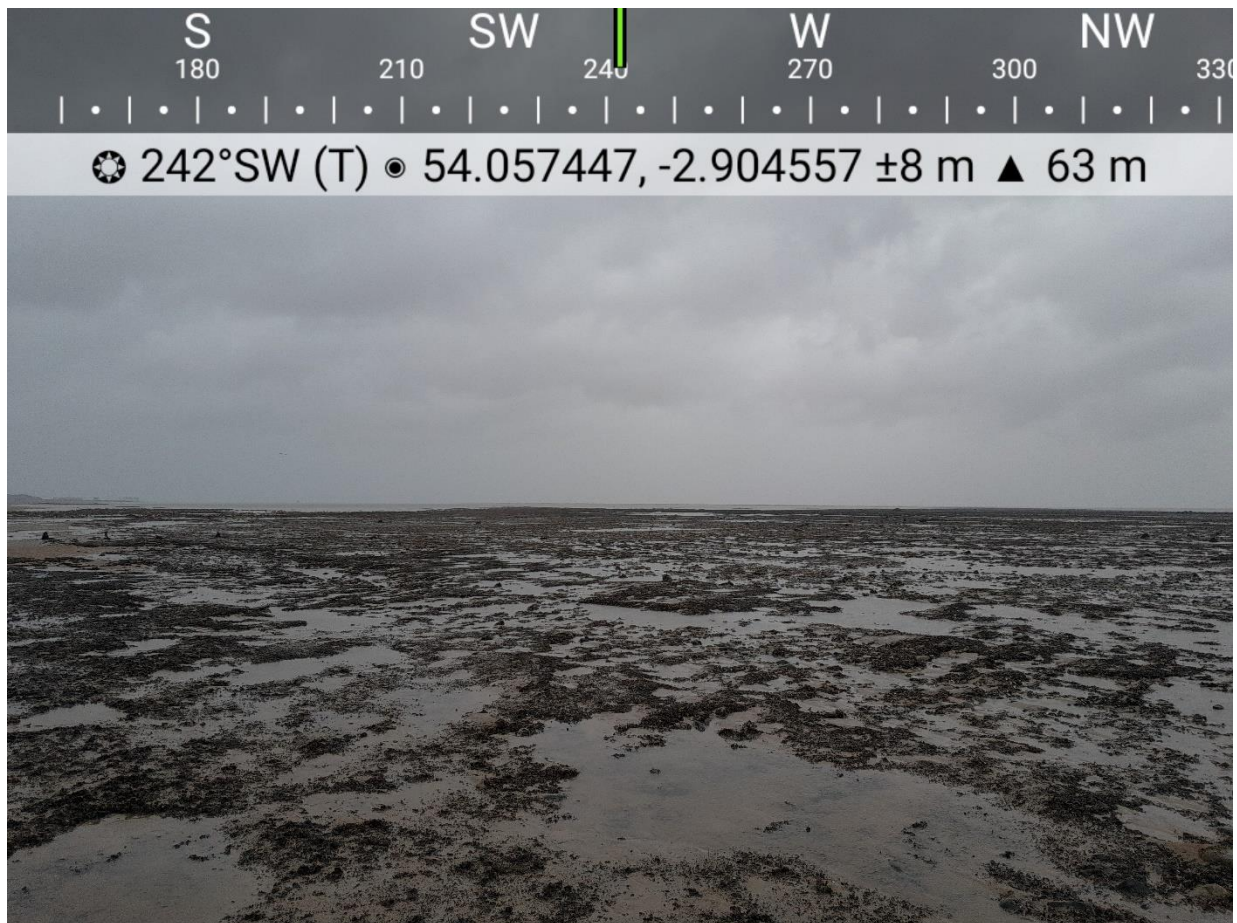


Figure 3. Evidence of scouring on Heysham Flat 02-08-23.

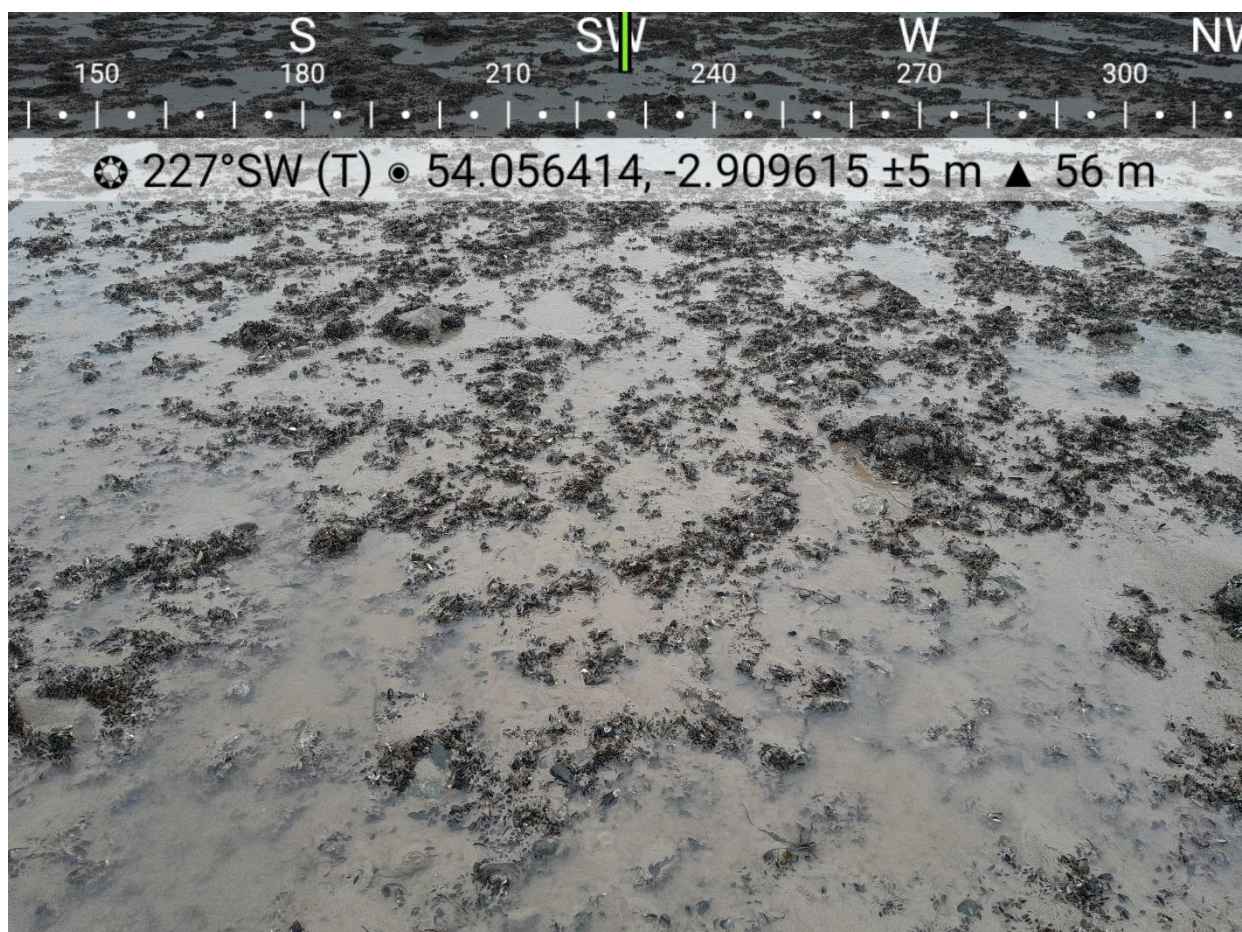




Figure 4. Evidence of scouring on Heysham Flat 02-08-23

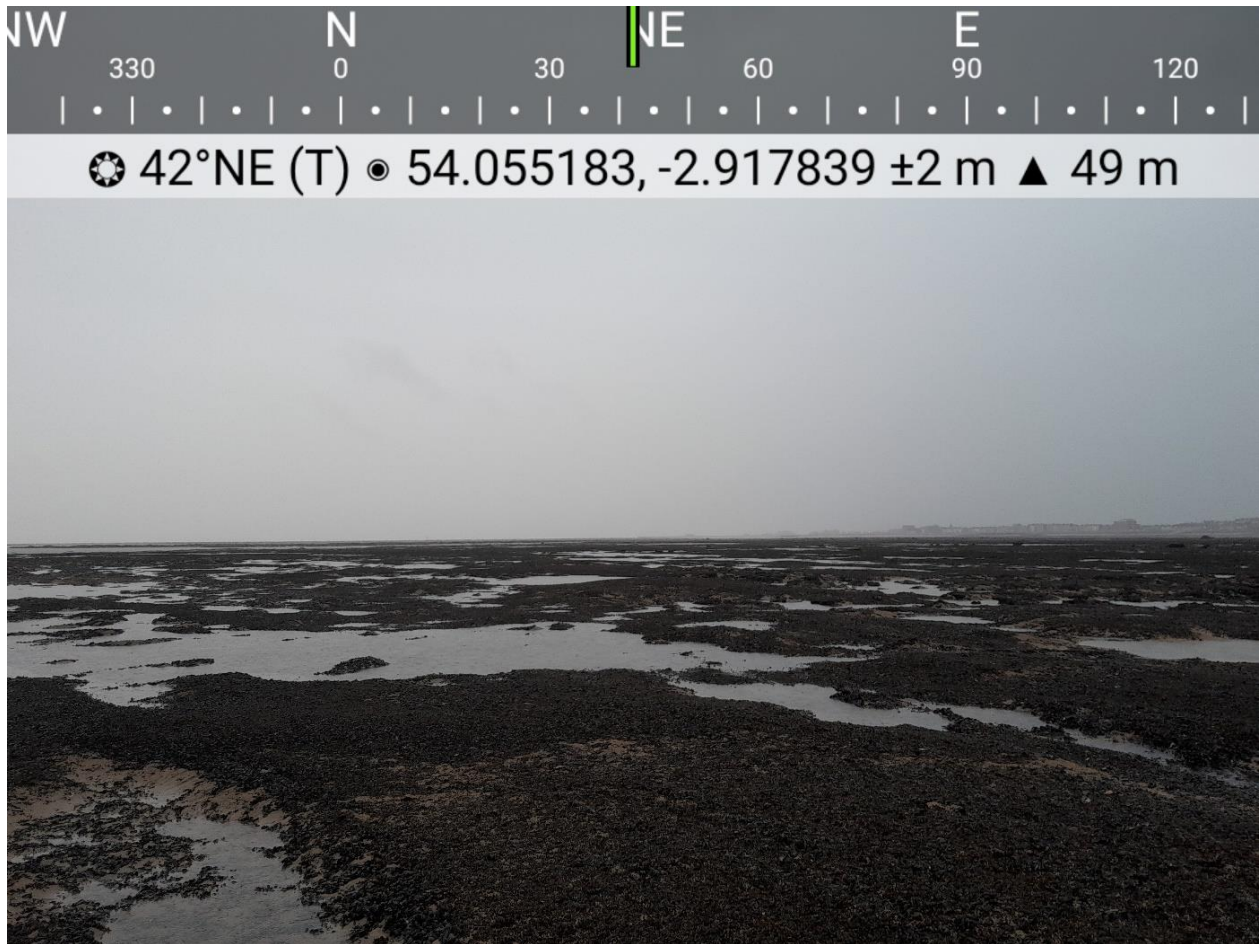


Figure 5. Mussel on Heysham skear 02-08-23.



Figure 6. Evidence of scour close to Dallam Dyke 02-08-23.

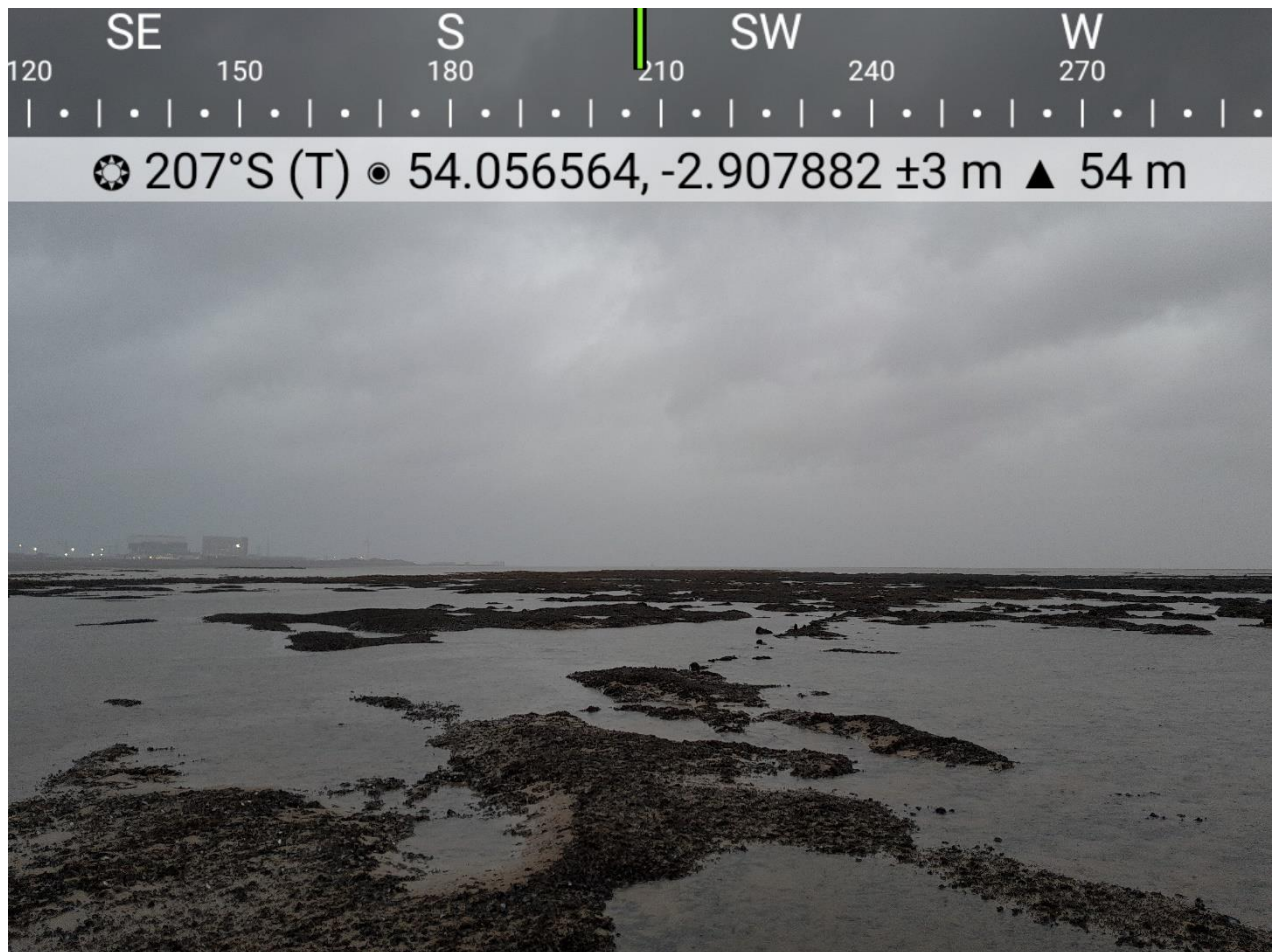


Figure 7. Scoured mussel on Heysham Flat 02-08-23.

### **South America Mussel Inspection (Quad) 04-08-23**

LW: 08:36 0.5m (Liverpool tides)

An inspection of South America was completed to assess the condition of the mussel on the bed. An inspection had been completed previously on the 20<sup>th</sup> of April, and since then, officers had been unable to access the beds due to the limited spring tides this year.

Although tide and conditions were good, access remains limited to a short period over low water due to the depth and size of the channel needing to be crossed. However, officers did manage to access a significant portion of the bed and obtain evidence of the condition and extent of the mussel present.

Figure 1 shows officer tracks (grey), the estimated area of mussel (blue) and the geolocations of the photographic evidence provided below.

The extent of mussel across the area has increased significantly. Previous surveys have identified the area located between waypoints 2 to 17 where the bed was accessed over a large channel (the main bed). This time, mussel was present in the channel, and on the landward side on a new area of colonised bare cobble (near waypoints 11 and 12) (Figures, 21, 22, 23, 24 34 and 38). The seed present on the landward side of the channel was dense (Figure 23), largely smaller than that on the main bed, at 15 mm in size, and on a thin veneer of mud (Figures 21, 22, 23, 34, 35,36, and 37).

Crossing over the channel, mussel in the channel was present in patches and on thick mud (Figure 31 and 33) though it was difficult to determine the full extent and coverage due to the water. From the water to the channel edge of the main bed, there was a small area of thick mussel mud and mussel, interspersed with patches of cobble (Figure 32 and 30).



Across the majority of the main bed, mussel was patchy at approximately <50% density, with some areas of loose mussel (Figure 4) and many areas of exposed cobble (Figures 7, 16, 18, 25, 26, 28 30, and 32). Often mussel was only on a shallow layer of mud on top of the underlying substrate (Figures 6, 6, 11 17 and 26). There was evidence of scour across some of the central part of the bed (Figure 5). Much of the mussel had grown on to 25 to 30 mm (Figures 14, 29 and 37).

The southern part of the bed, became much thinner with a mud veneer over cobble (11, 12 and 13) and the density of mussel decreased.

The area of *Sabellaria* identified from previous surveys has been overgrown by mussel. The extent of *Sabellaria* is not within the boundaries shown in Figure 1.

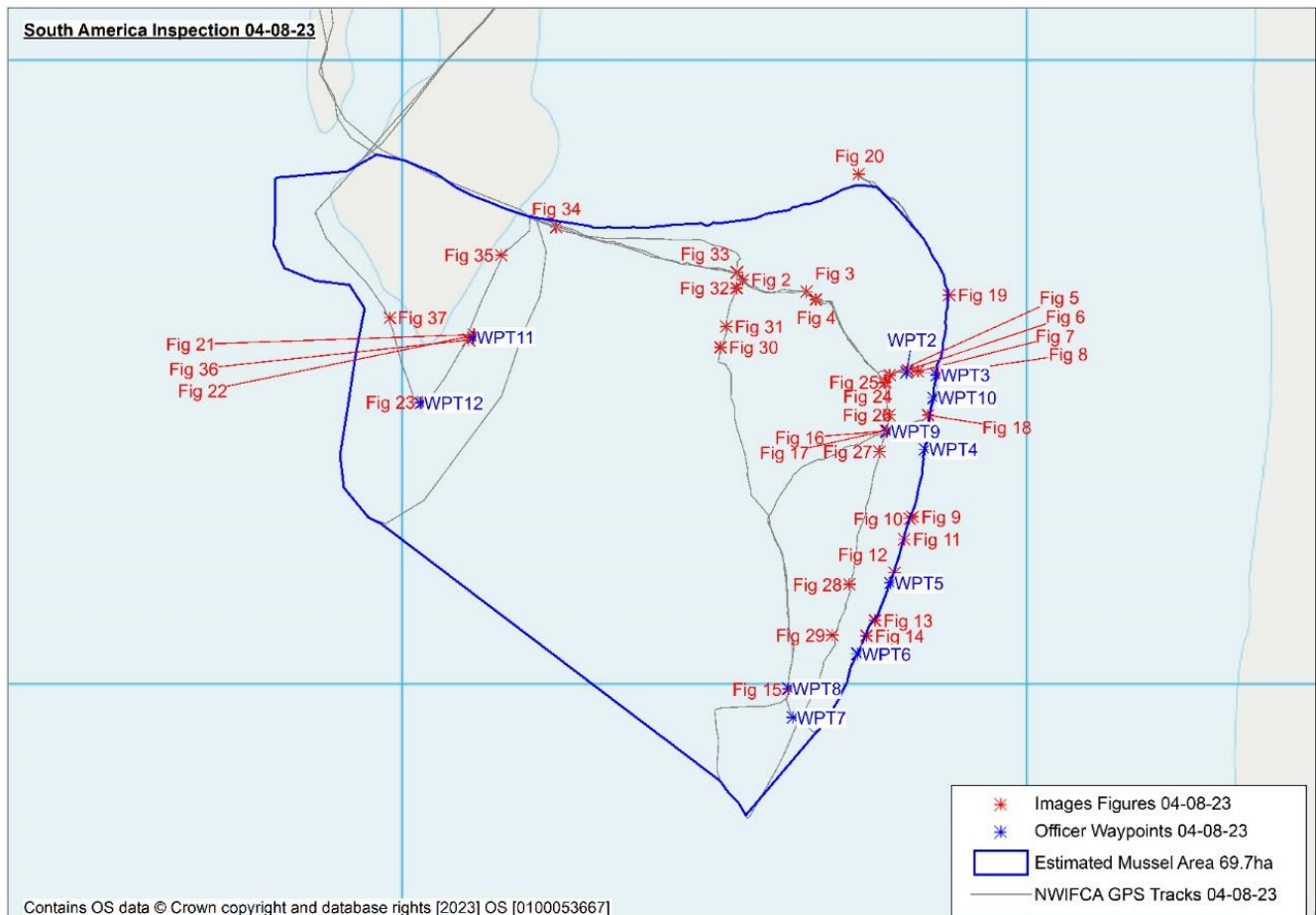


Figure 1. The location and extent of the South America mussel bed in Morecambe bay, and the geolocations of survey photos.



Figure 2. 25-30 mm mussel seed on South America 04-08-2023



Figure 3. Mussel mud on the edge of the bed near the channel on South America 04-08-2023



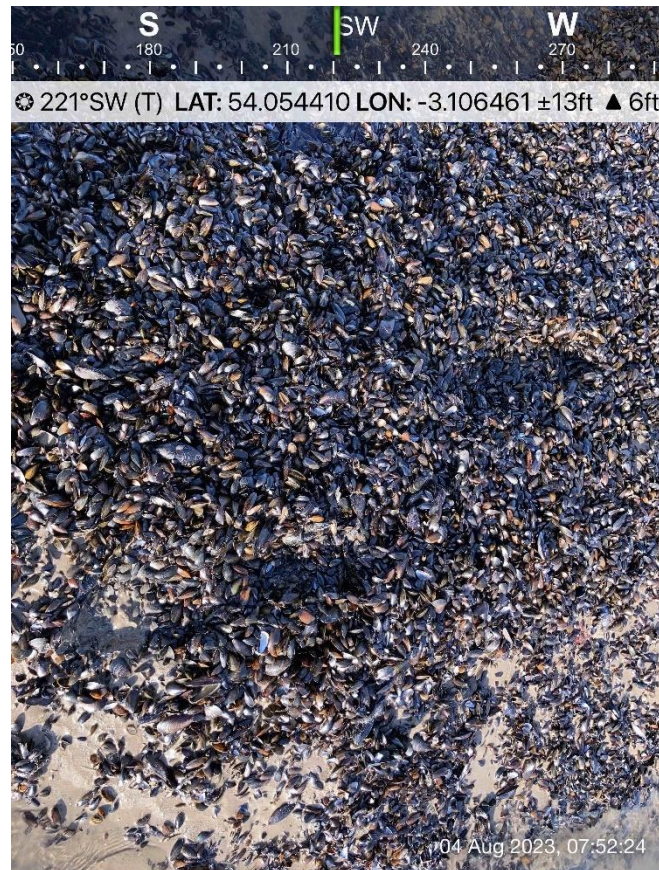


Figure 4. An area of loose mussel on South America 04-08-2023



Figure 5. evidence of Scouring on South America 04-08-2023





Figure 6. This mud over cobble on South America 04-08-2023

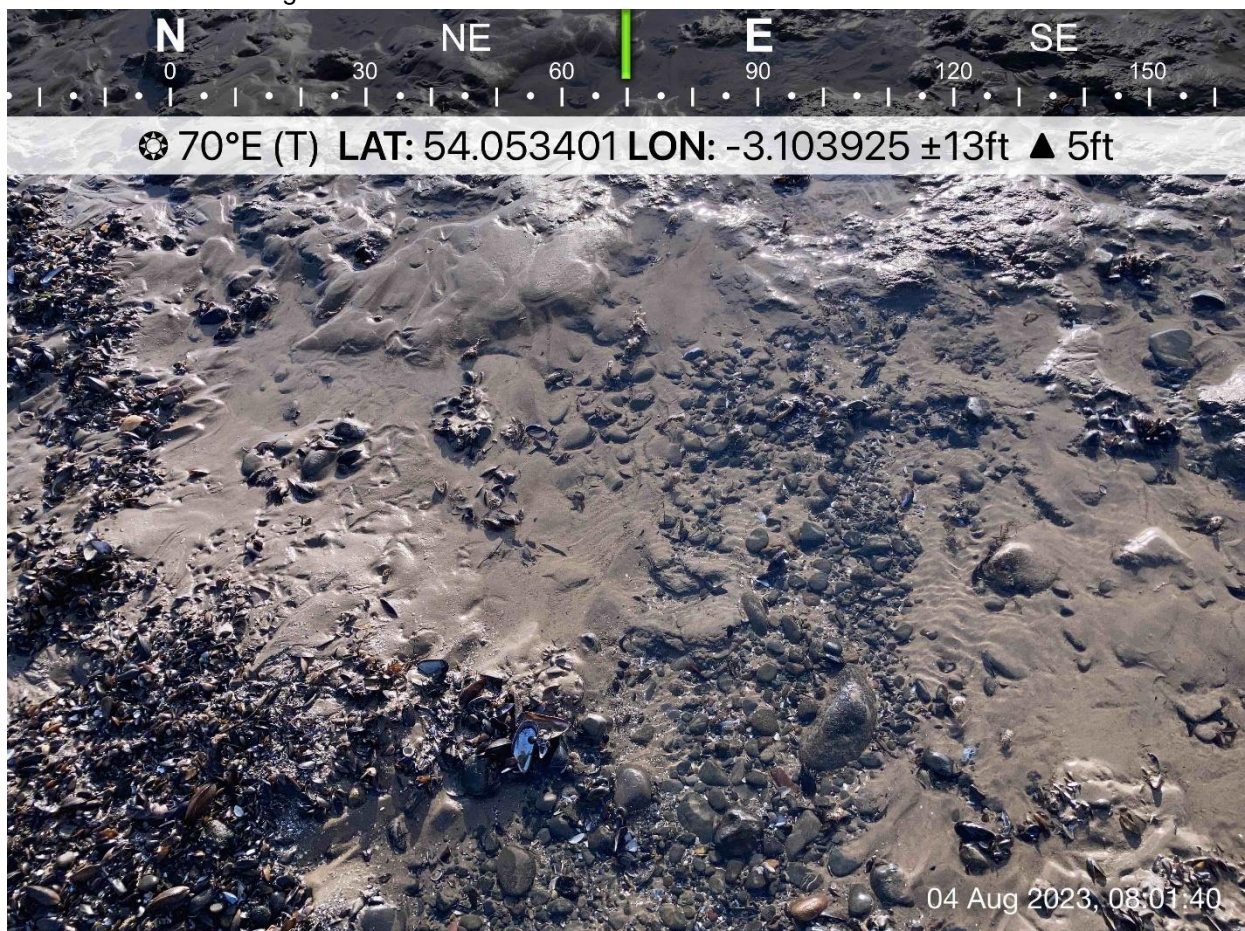


Figure 7. Exposed cobble beneath thin mud South America 04-08-2023





Figure 8. Mussel mud forming on the seaward edge of the bed 04-08-2023



Figure 9. Mussel mud forming 04-08-2023



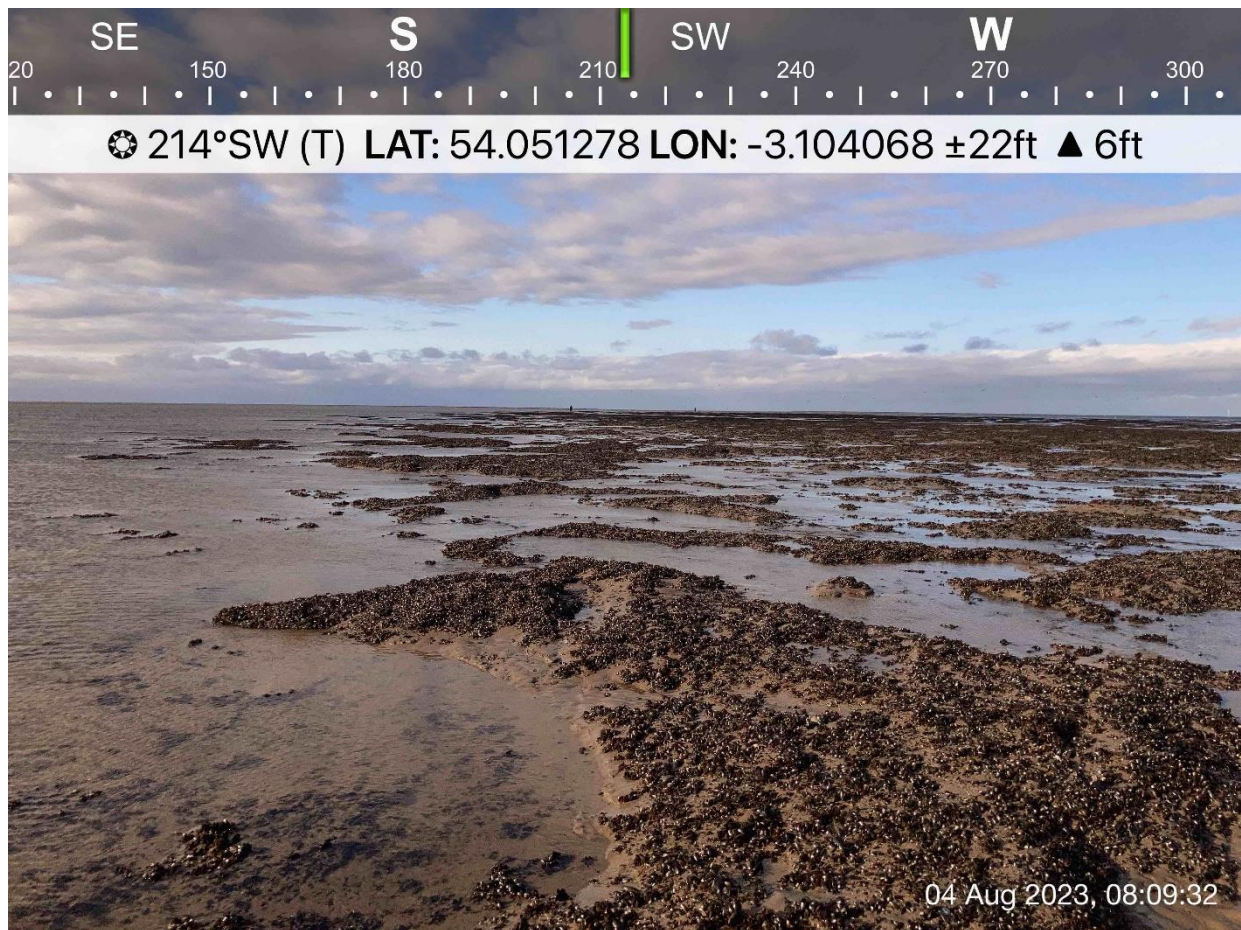


Figure 10. Shallow mud forming on the seaward edge of South America 04-08-2023.



Figure 11. Thin mud and mussel coverage on South America 04-08-2023.





Figure 12. Thin mud and mussel coverage on South America 04-08-2023.



Figure 13. Thin mud and mussel coverage on South America 04-08-2023



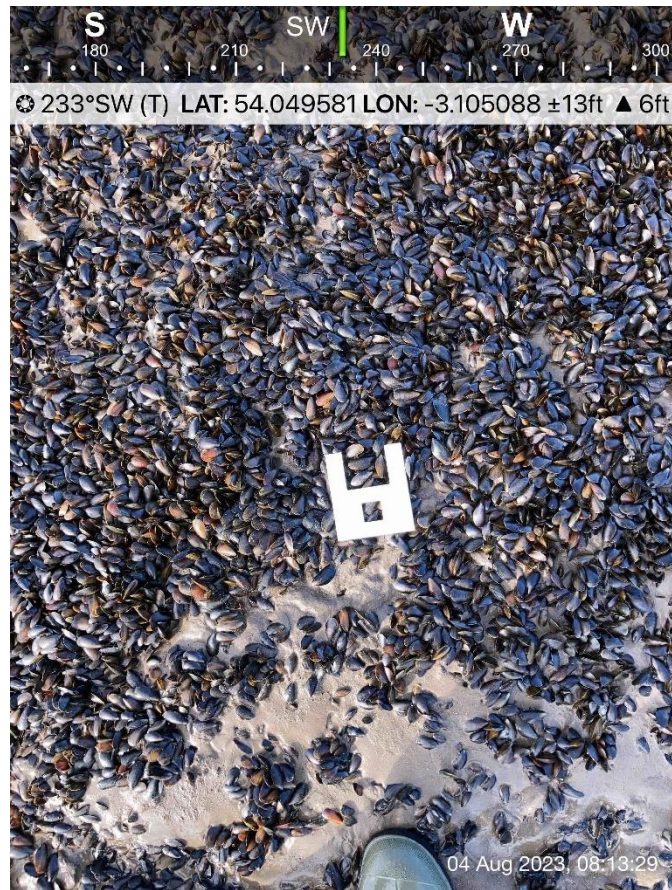


Figure 14. 25-30 mm mussel seed on South America 04-08-2023



Figure 15. Mussel in the channel South America 04-08-2023



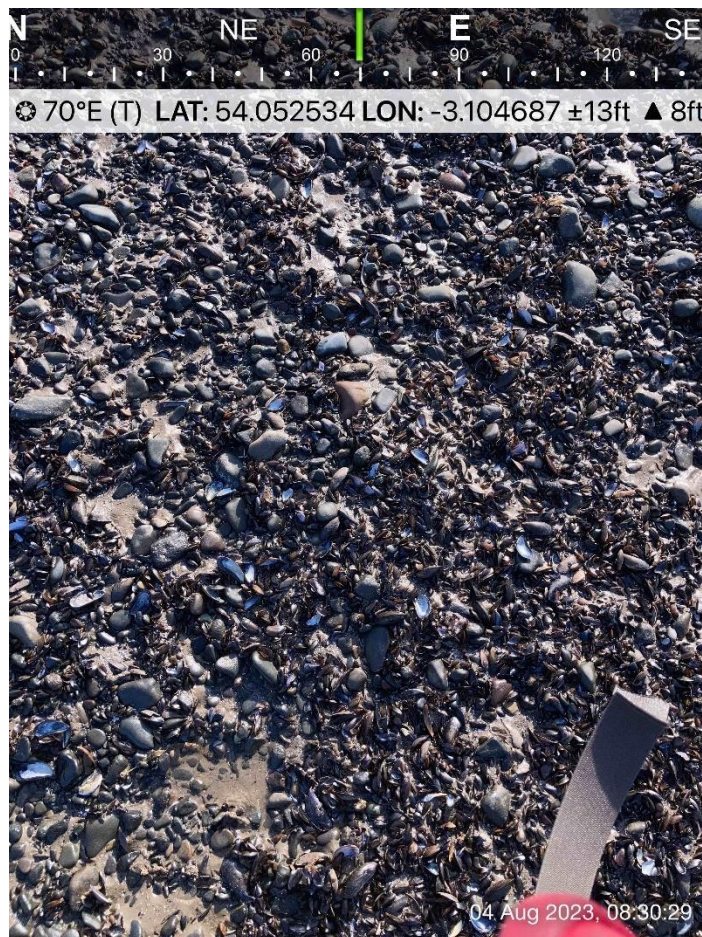


Figure 16. Exposed cobble substrate on South America 04-08-2023



Figure 17. Thin mud and mussel coverage on South America 04-08-2023



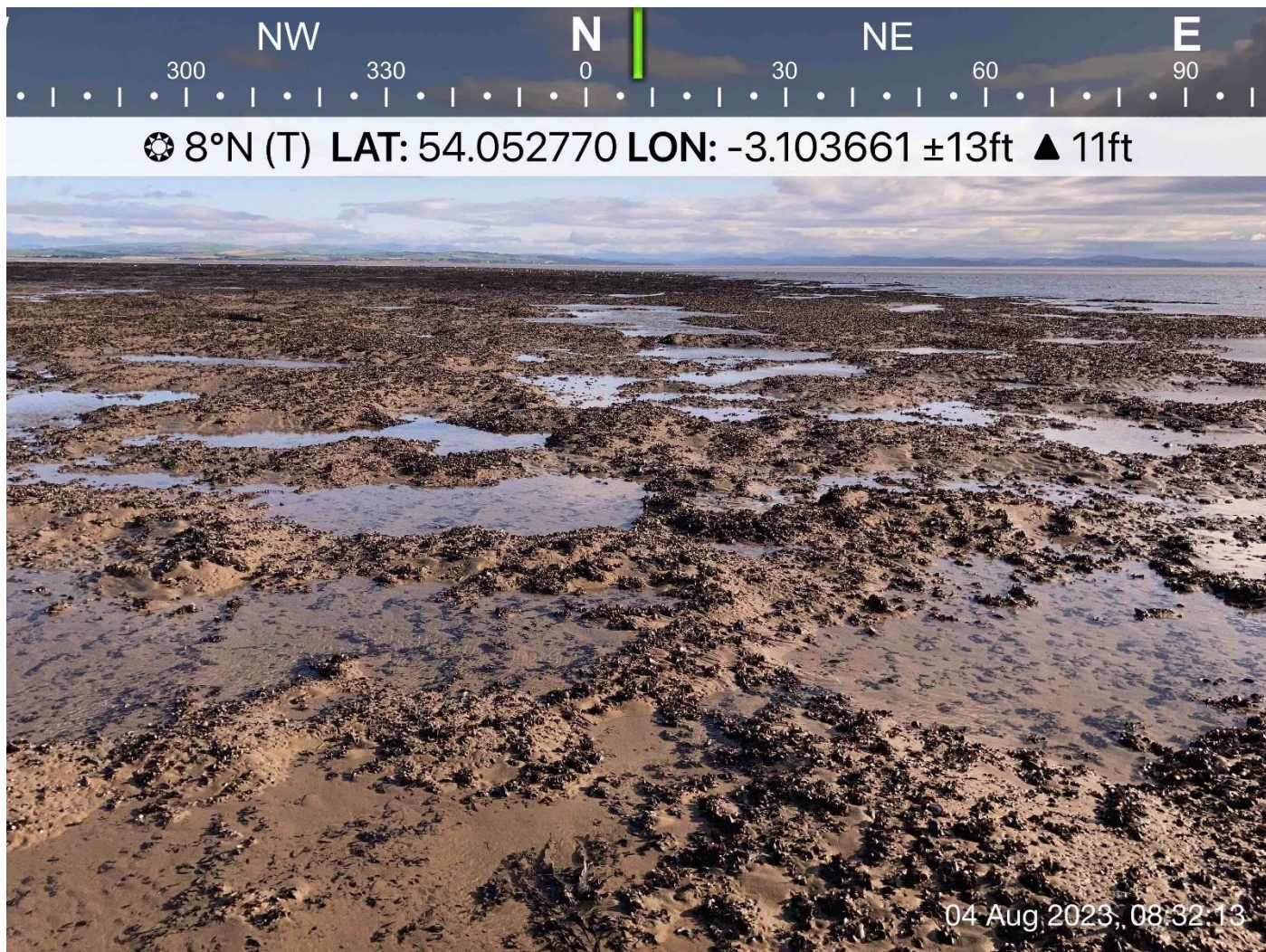


Figure 18. Thin mud and mussel coverage on South America 04-08-2023



Figure 19. Exposed cobble and mud on South America 04-08-2023



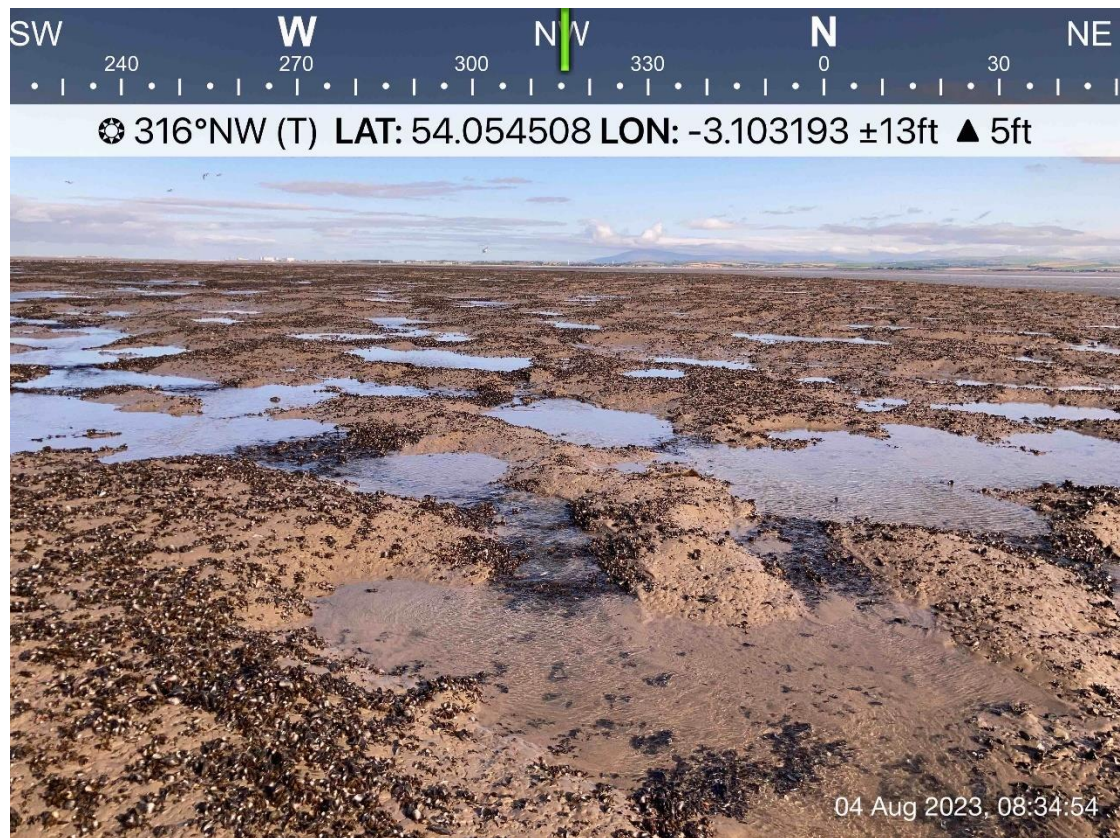


Figure 20. This mussel on mud in central South America 04-08-2023



Figure 21. Loose mussel patches on shallow mud on the new area landward of the South America channel 04-08-2023



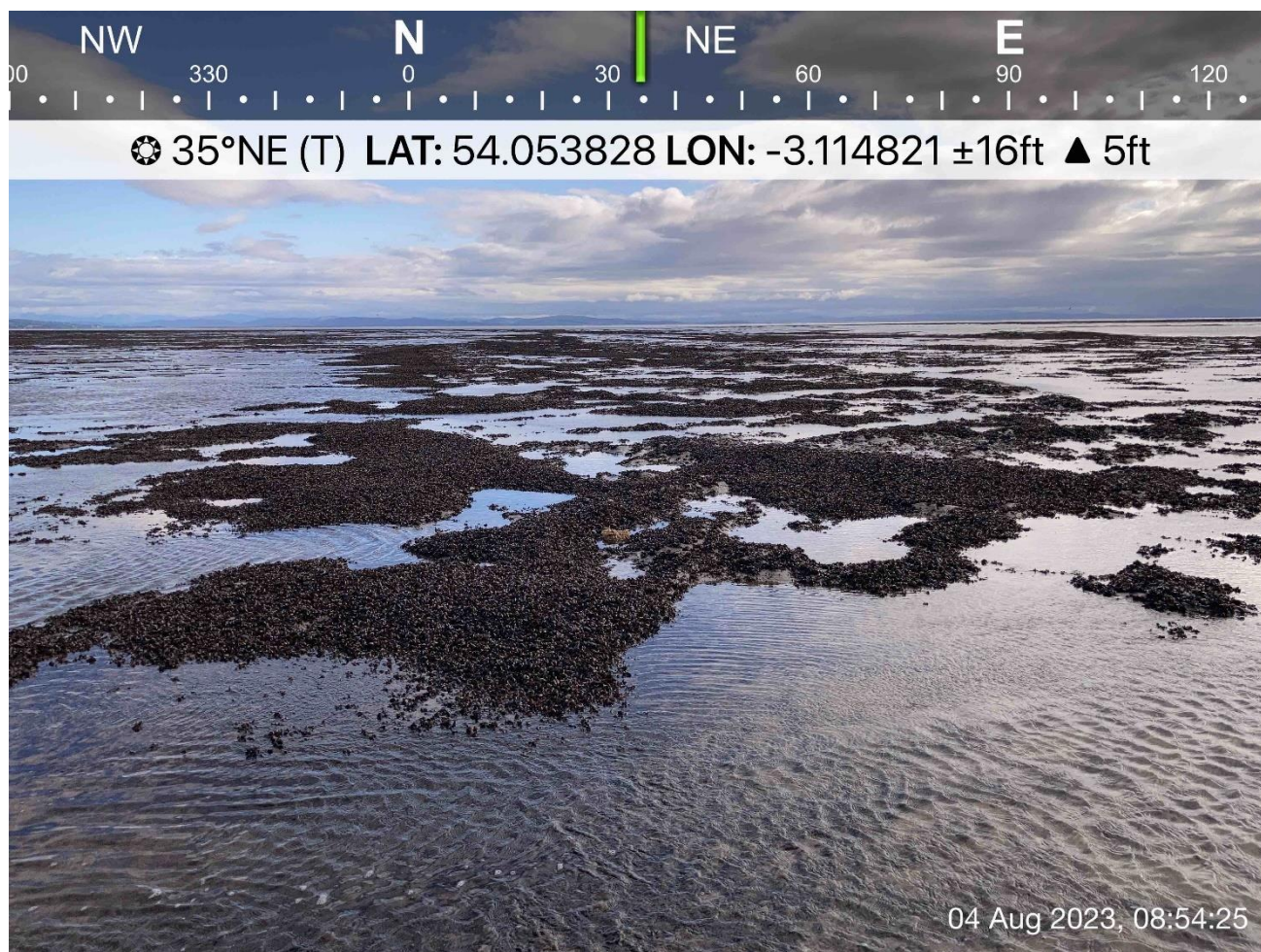


Figure 22. patch of dense mussel on shallow mud on the new area landward of the South America channel 04-08-2023





Figure 23. patch of dense mussel on shallow mud on the new area landward of the South America channel 04-08-2023





Figure 24. Area of thin mud and dense seed on the new area, landward of the South America channel 04-08-2023

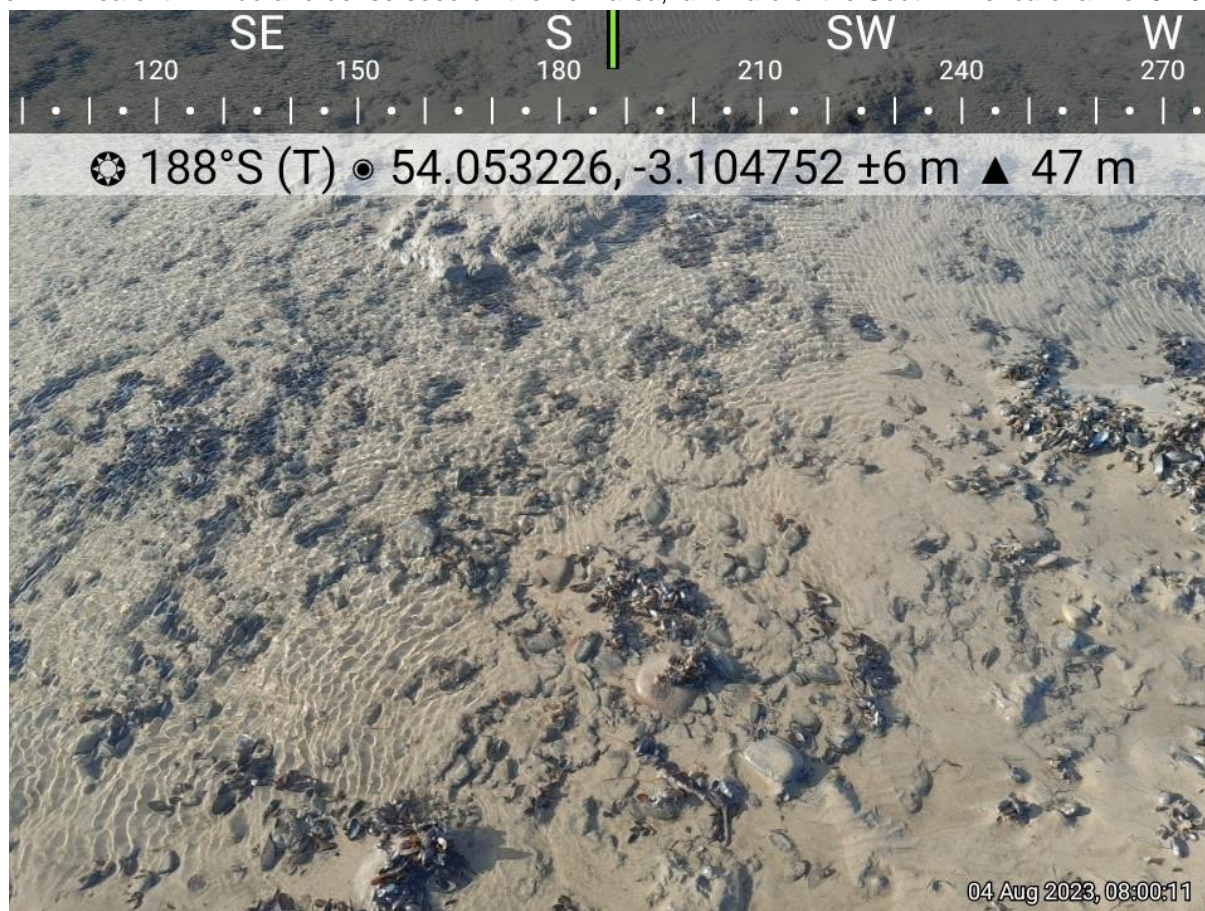


Figure 25. Exposed cobble substrate on South America 04-08-2023

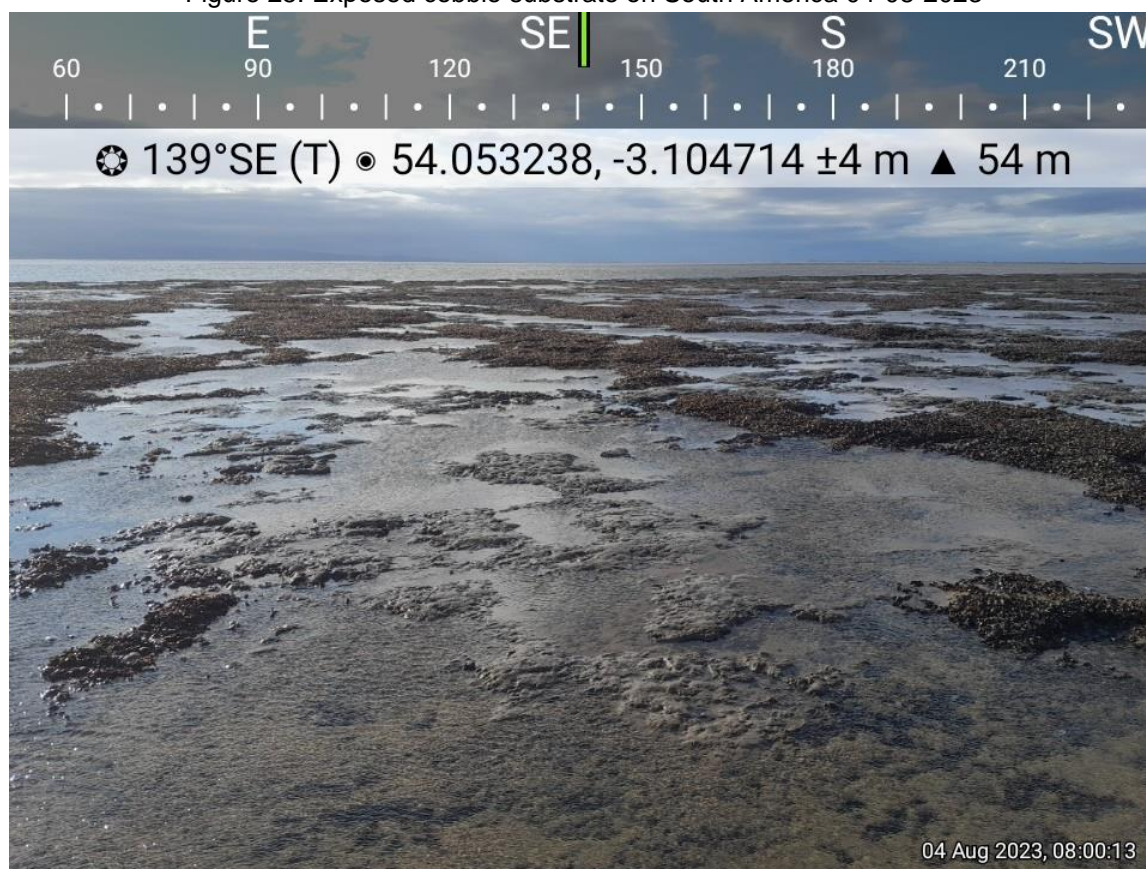


Figure 26. Mussel on thin mud South America 04-08-2023



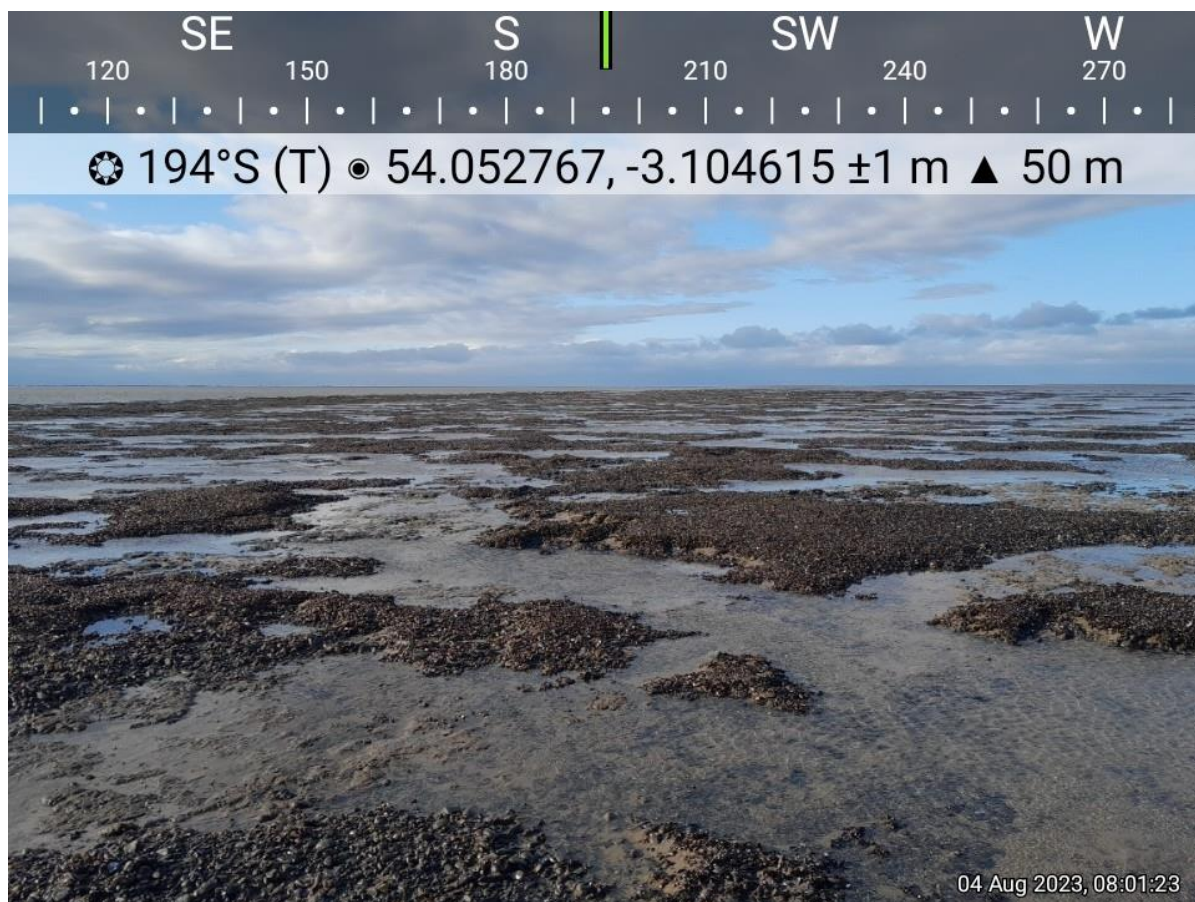


Figure 27. Mussel mud forming on South America with evidence of scour 04-08-2023



Figure 28. Bare cobble and underlying substrate South America 04-08-2023



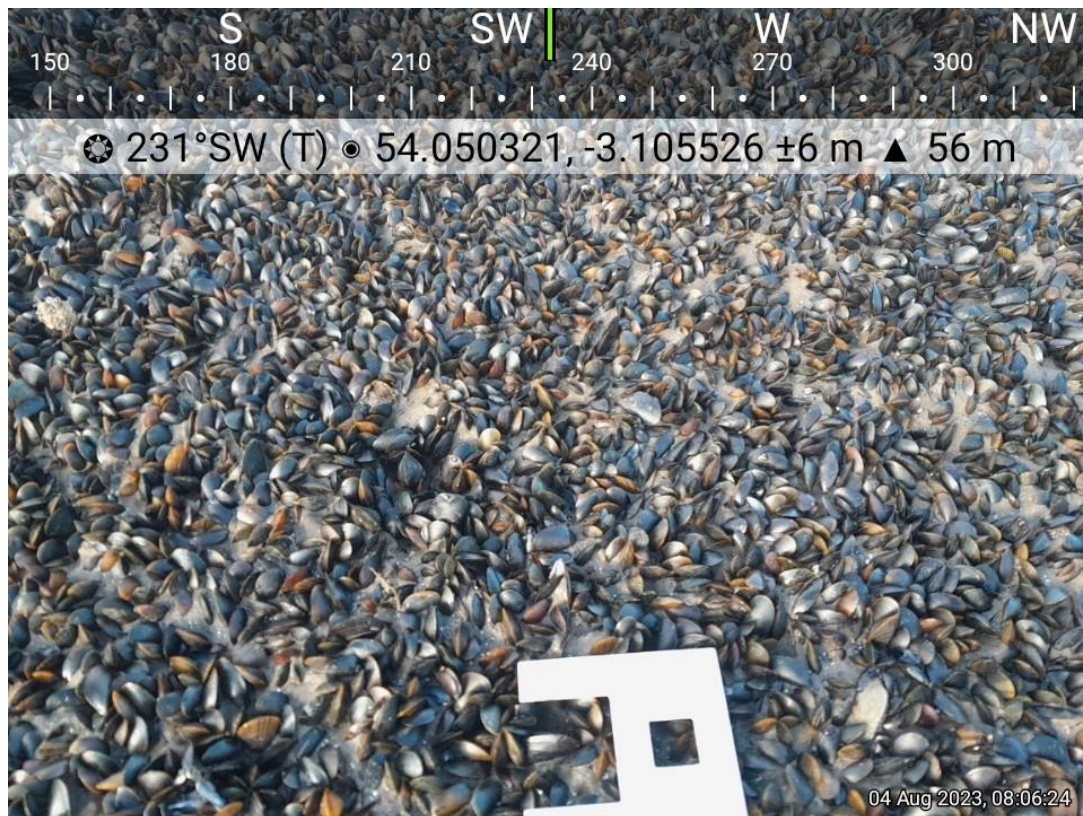


Figure 29. 25-30 mm mussel seed on South America 04-08-2023

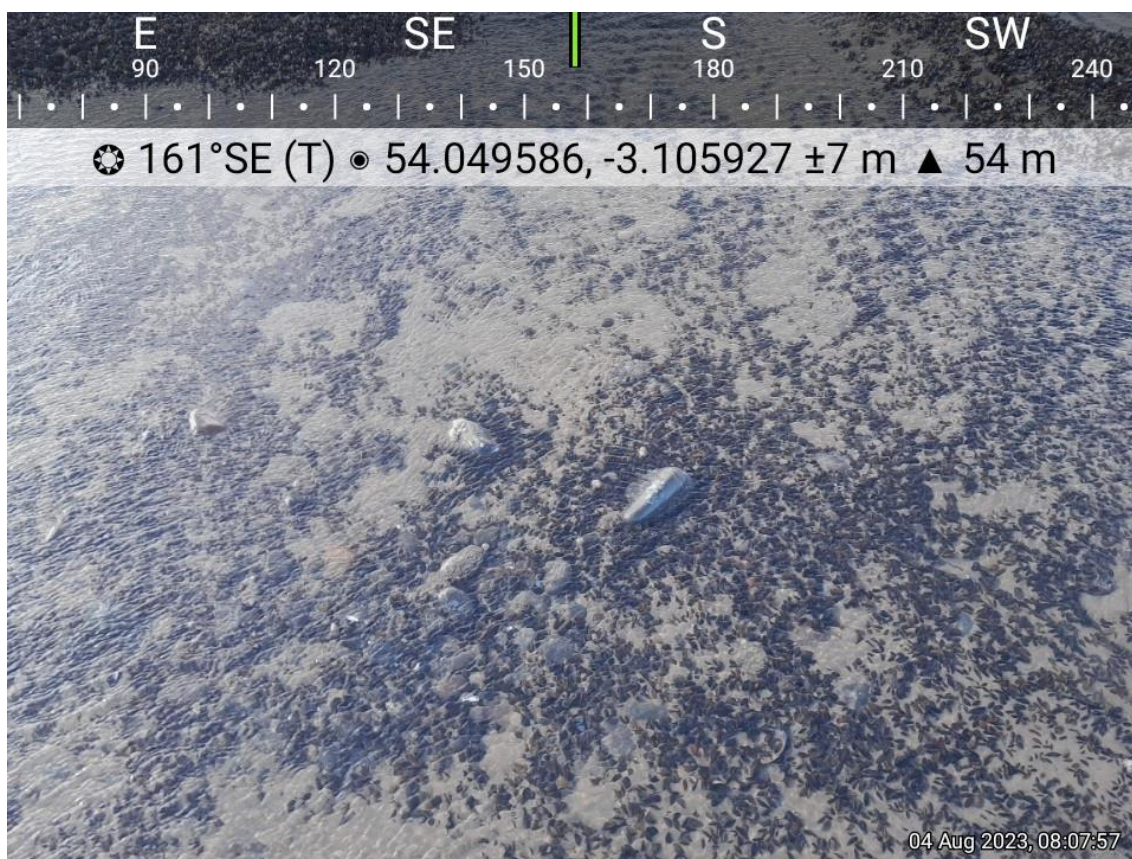


Figure 30. Mussel on thin mud with exposed cobble on South America 04-08-2023



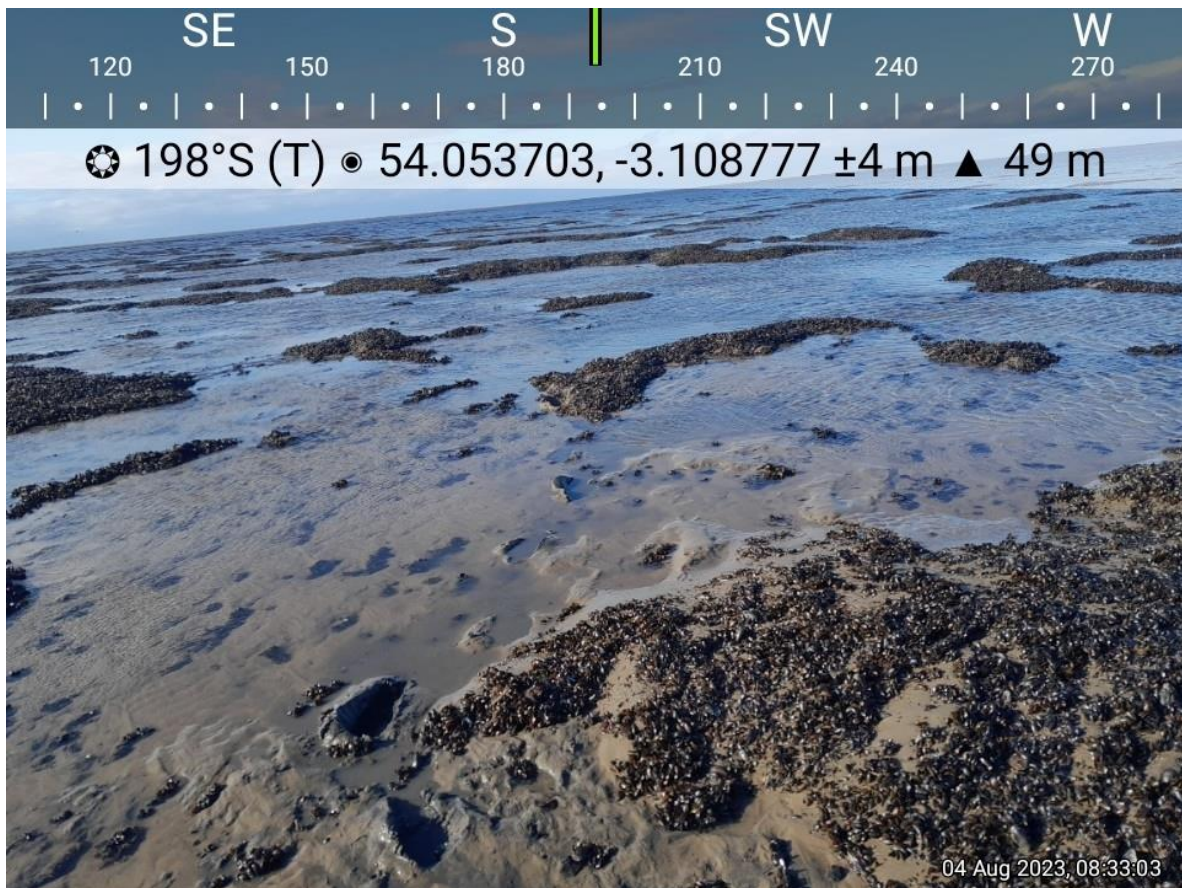


Figure 31. Mussel mud with loose mussel near the channel edge on South America 04-08-2023

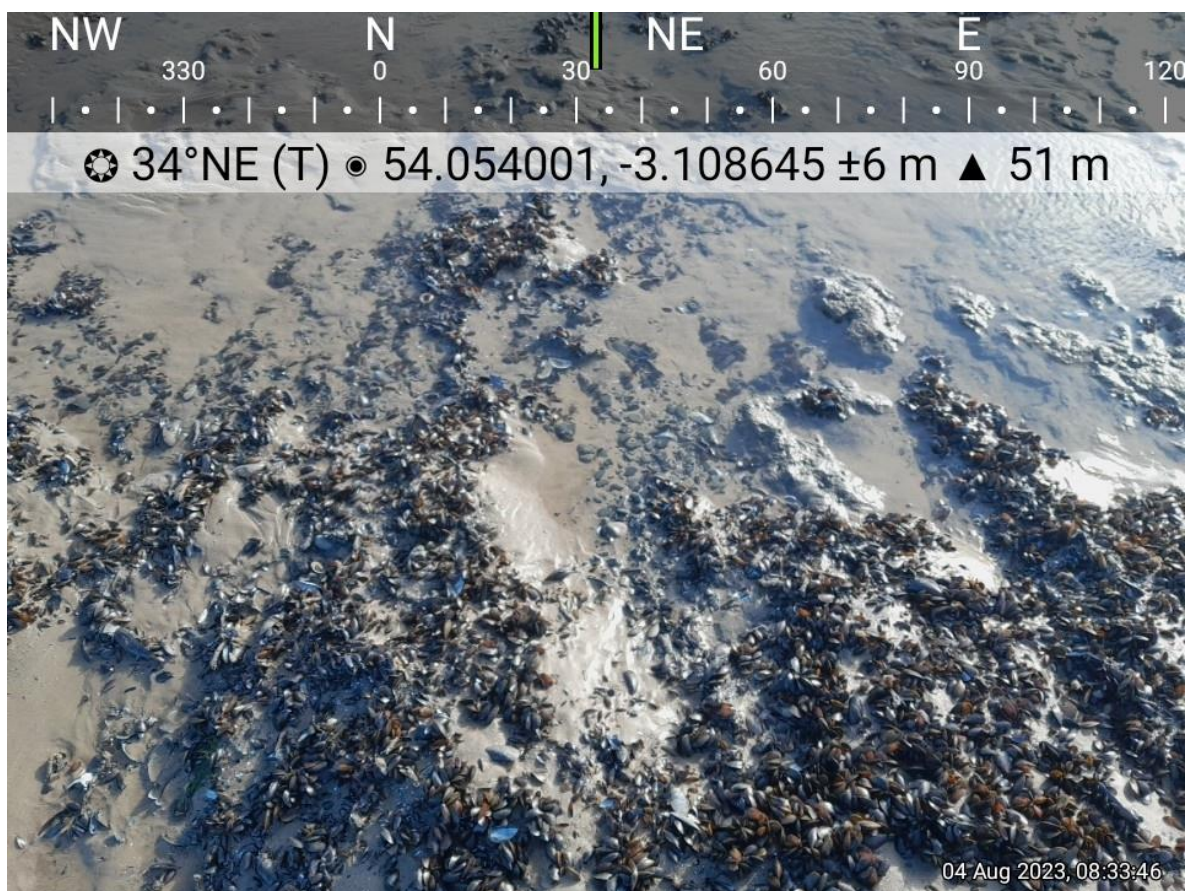


Figure 32. Mussel on thin mud with exposed cobble on South America 04-08-2023







Figure 34. Loose mussel on mud on the opposite side of the channel to South America 04-08-2023

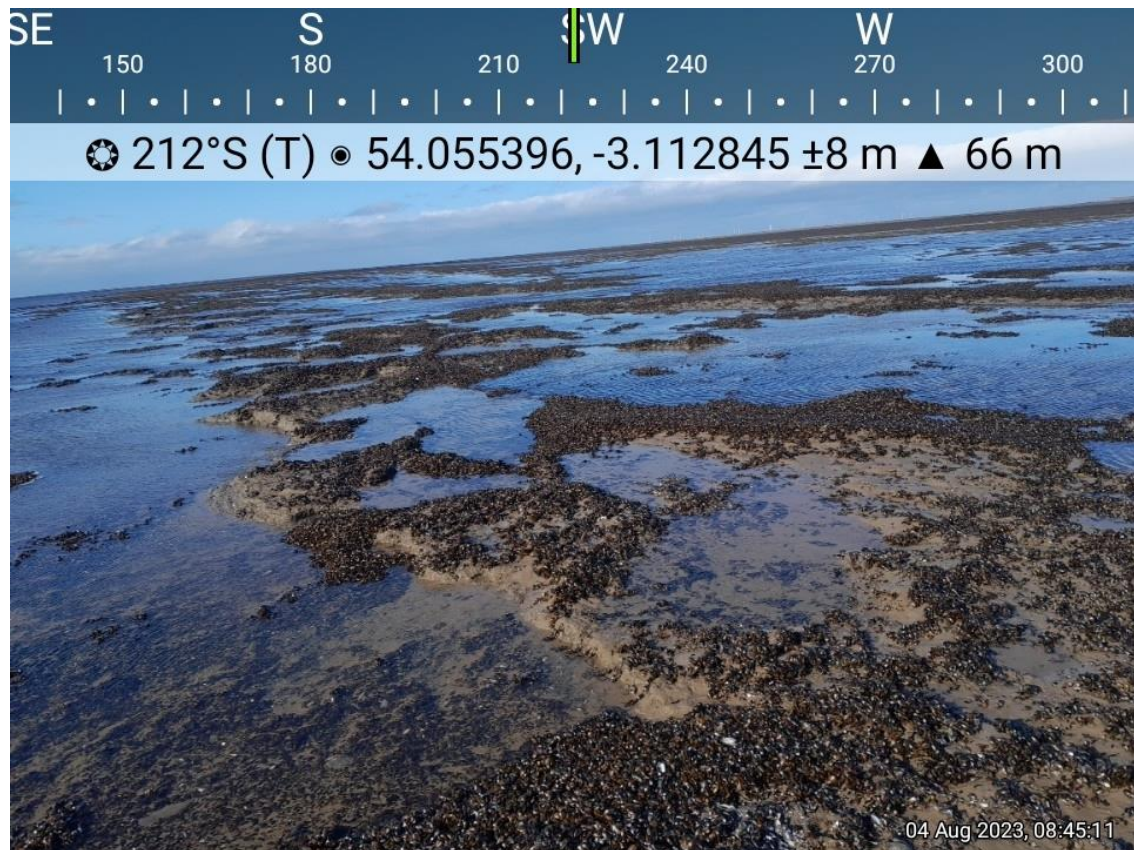


Figure 35. Mussel on thin mud on the new area on the seaward side of the South America Channel 04-08-2023

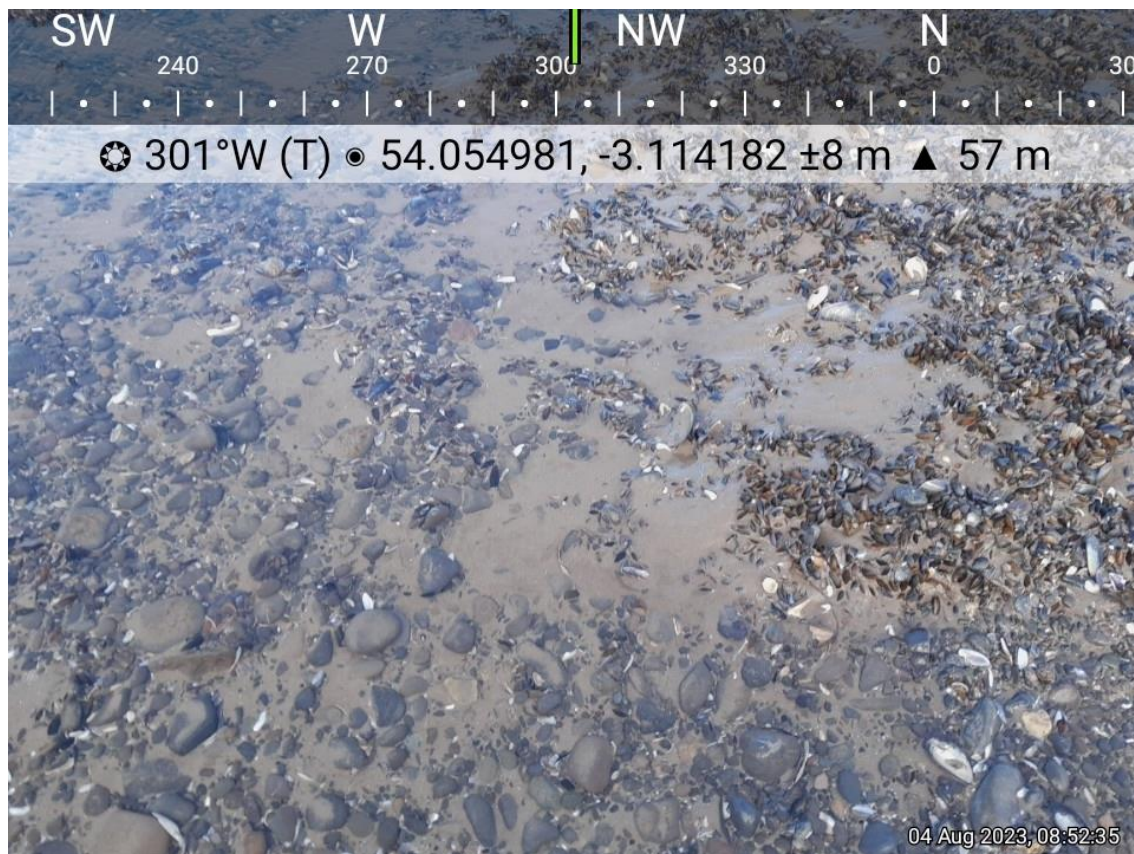


Figure 36. Exposed cobble substrate and thin patches of seed mussel 04-08-2023



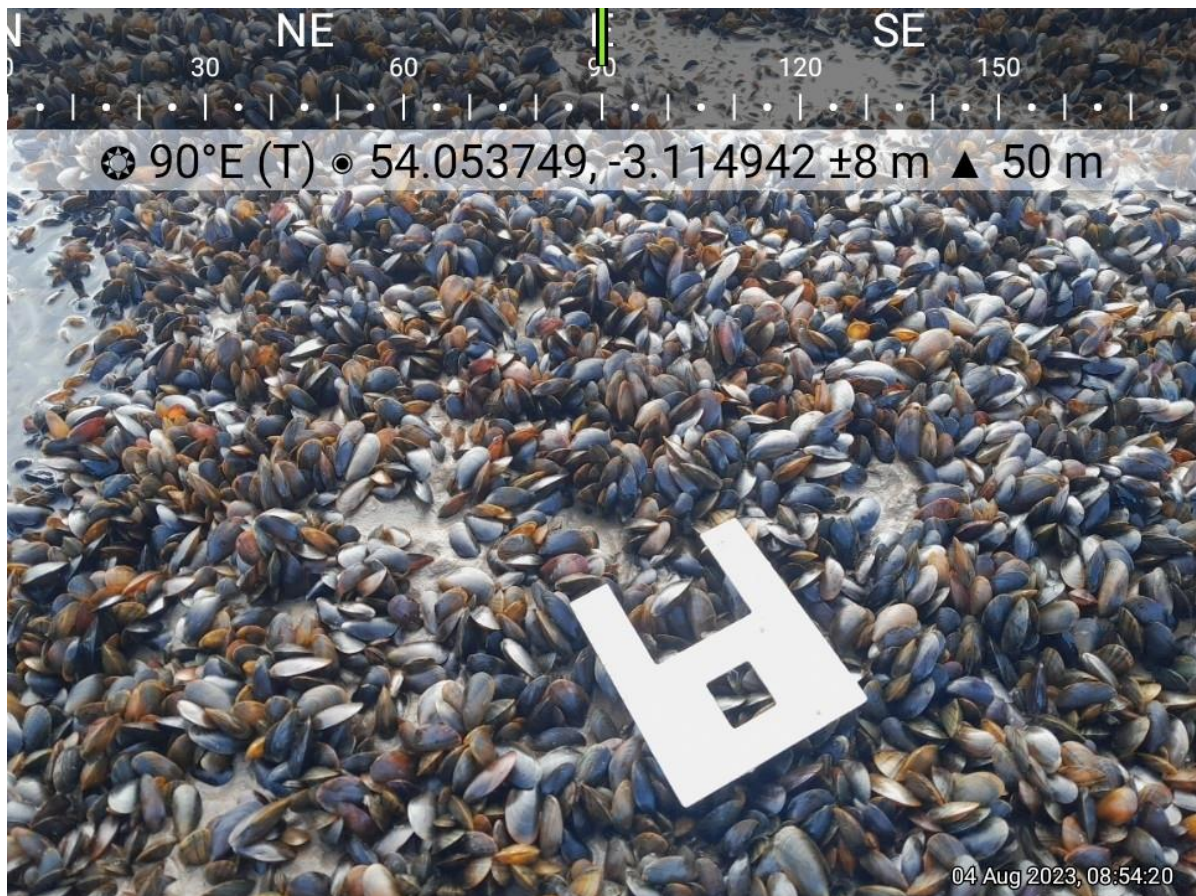


Figure 37. 20 mm seed mussel 04-08-2023

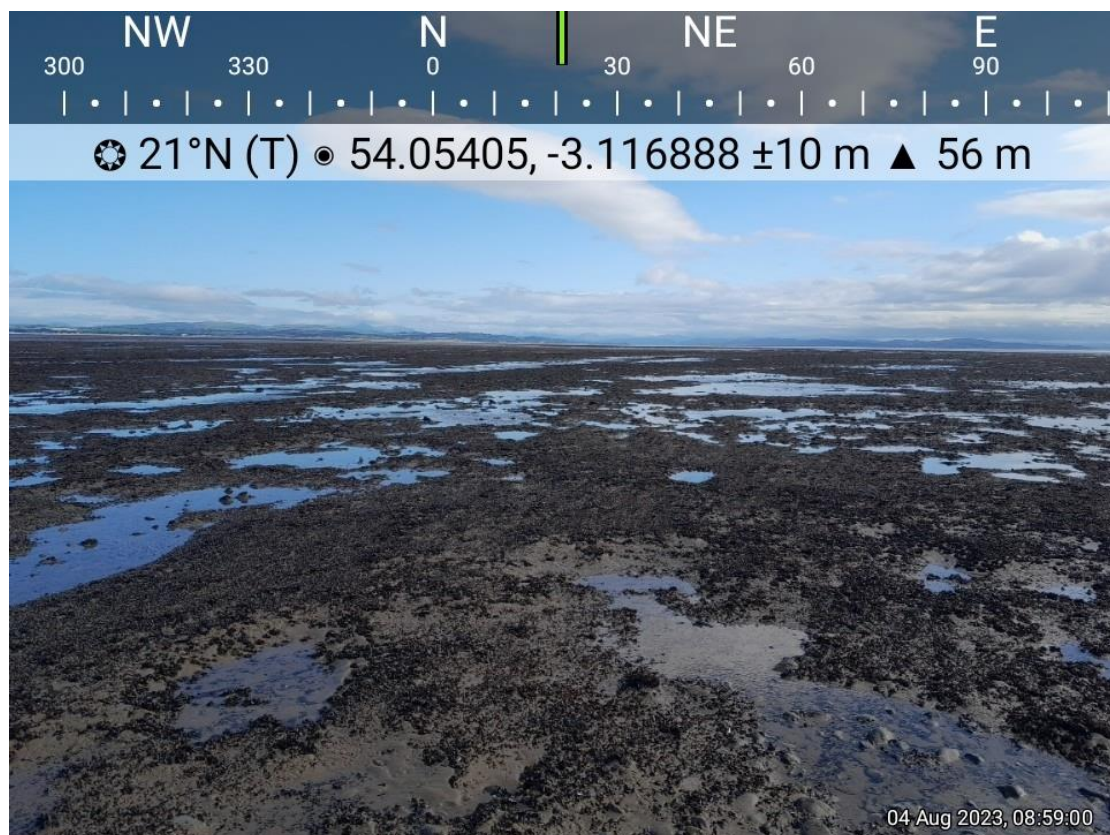


Figure 38. New settlement of seed mussel over cobble 04-08-2023

## **Fleetwood Mussel Inspection 03-08-2023**

Officers: AP, JH

LW: 07:50 0.8m (Liverpool Tides)

The Fleetwood mussel beds of Perch and Black Scar were surveyed as these are the historically commercial beds Figure 1.

### **Black Scar**

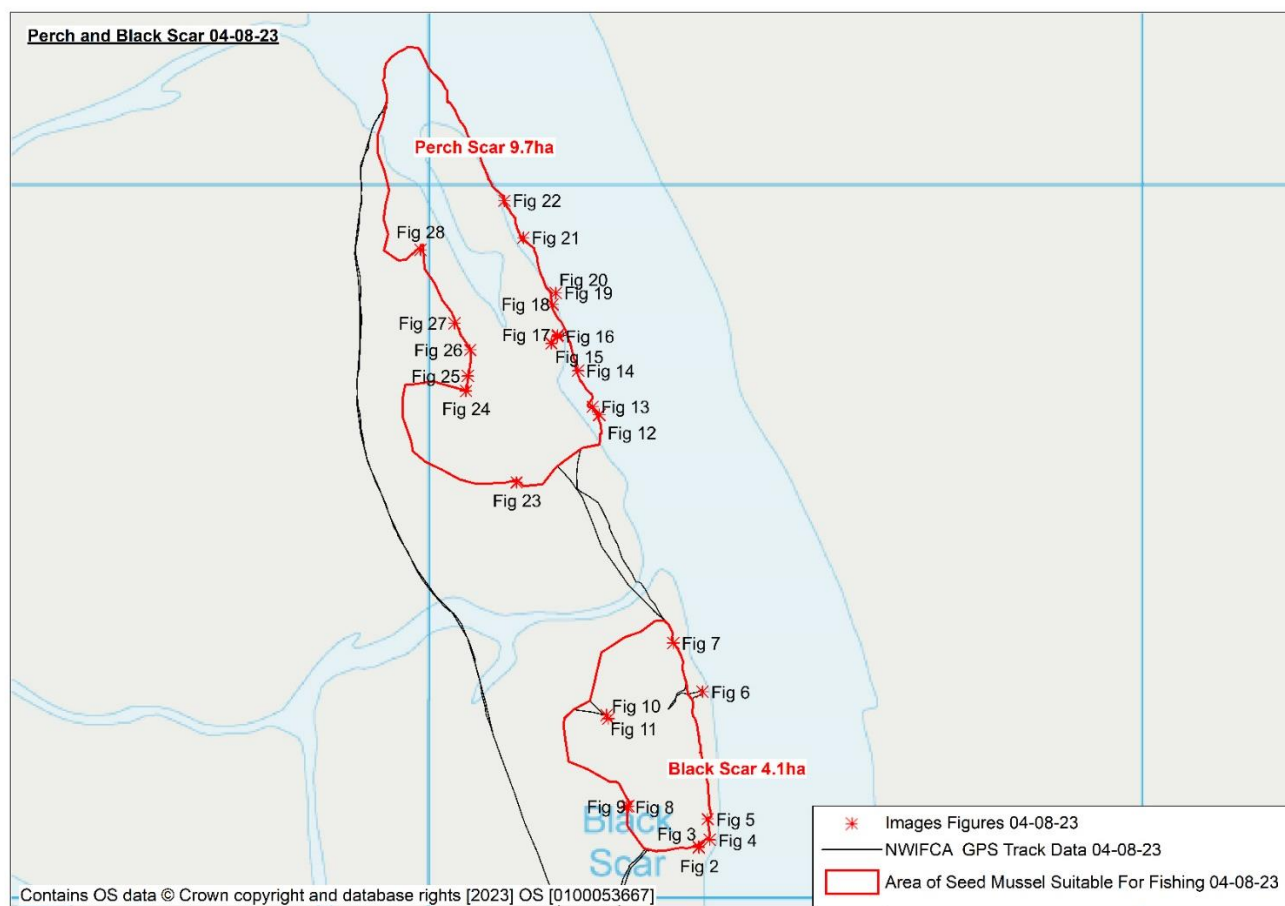
The 2023 mussel settlement on Black Scar is still present and has grown on to approximately 20 mm in size (Figure 5), with 80-90% coverage over the bed (Figure 2, 7 and 8). The mussel has put down significant mussel mud from previous surveys (Figure 3, 7, 10 and 11). This mussel mud covered the extent of the bed, and in the centre had formed 'hillocks' (Figure 7, 8 and 10). The mussel mud had grown deeper since the previous survey and in some areas was approximately a metre deep, with mussels above becoming loose. Officers were unable to access the centre of the bed due to the depth of mussel mud. Coverage of mussel mud was thick across the main extent of the bed, however, near the lower edges, there was evidence of scour (Figure 10). Mussels thin out at the western edge of the bed (Figure 9)

There is a small area of size mussel along the channel edge (Figure 4 and 6). The approximate area of mussel is 4.1 hectares.

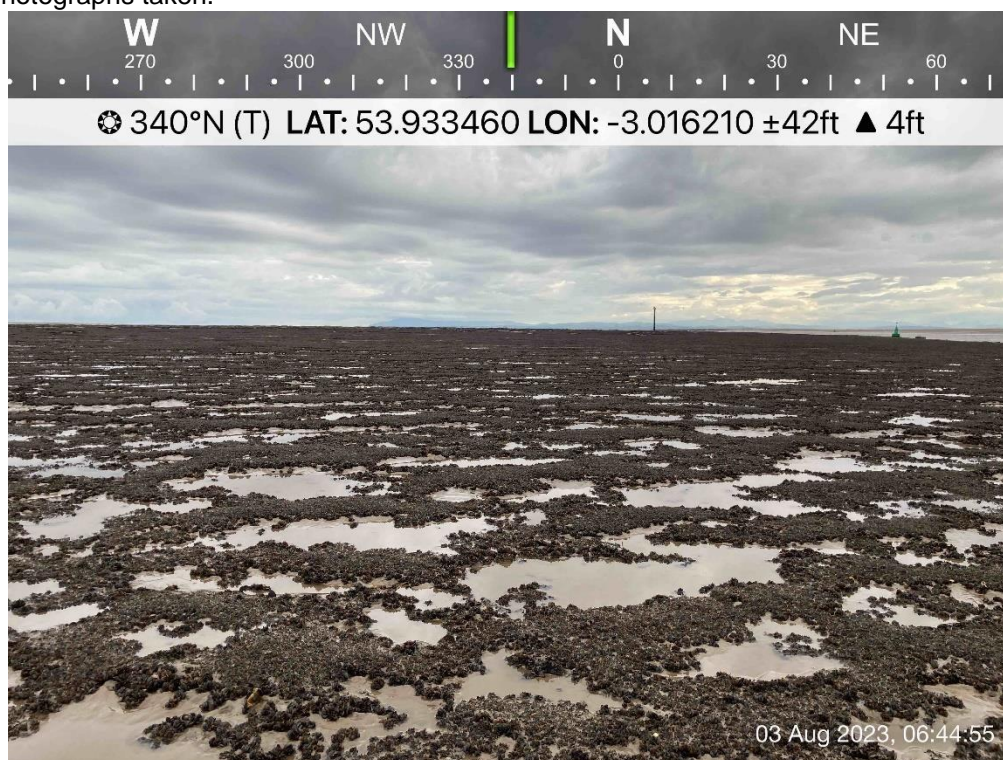
### **Perch Scar**

The 2023 mussel settlement on Perch Scar is still present and has grown on to approximately 20 mm (Figure 13). Coverage of mussel over the bed is 70-80% (Figure 12, 17, 18 and 22), and similar to Black Scar the mussel mud was thick (Figure 21 and 26) (in places up to a metre thick) and had grown since the previous survey to form hillocks (Figure 14, 17, and 26) with channels cutting between where the mussel mud was coming loose (Figure 16). There was some evidence of scour near the channel edge of the bed (Figure 15). There was a strip of size mussel still present along the edge of the bed (Figure 19) with some of it becoming loose and forming mounds (Figure 20). There was no exposed cobble or bare substrate, and mussel mud covered the main extent. The approximate area of the mussel was 9.7 hectares.





**Figure 1.** Location and extent of the Perch and Black Scar seed mussel beds with figure numbers included to show the location of photographs taken.



**Figure 2.** Dense seed settlement on Black Scar 03-08-2023.

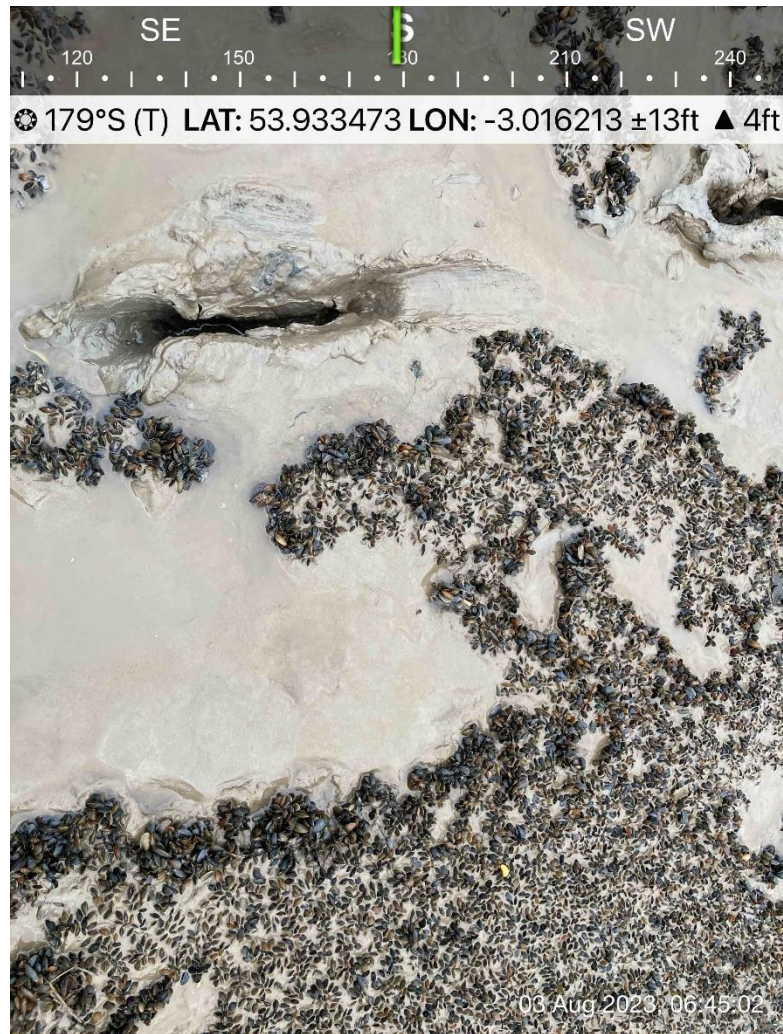


Figure 3. dense mussel on thick mud on Black Scar 03-08-2023.



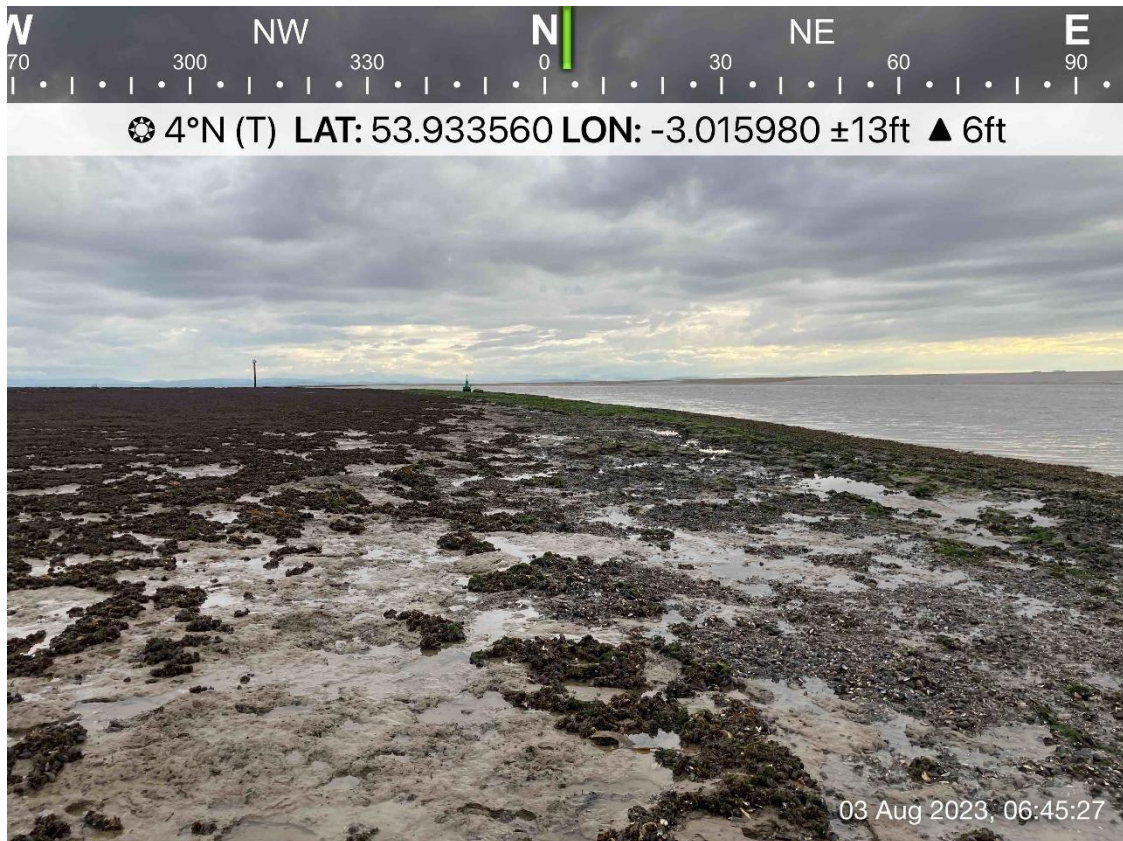


Figure 4. Strip of old, size mussel along Black Scar channel edge 03-08-2023

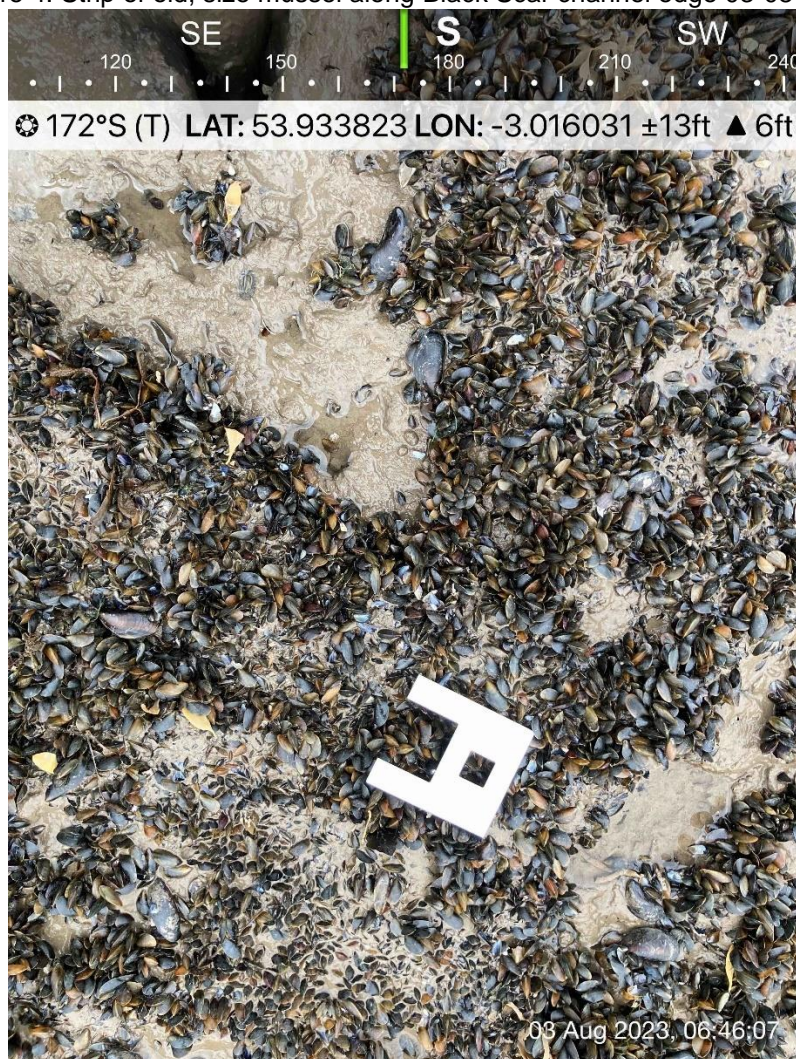


Figure 5. Loose, dense mussel on thick mud 03-08-2023







Figure 6. Large, old mussel present on the channel edge strip of Black Scar 03-08-2023



Figure 7. Dense mussel on deep mud on Black Scar seaward end 03-08-2023.





Figure 8 dense mussel on mud on Black Scar 03-08-2023.



Figure 9. Edge of the bed – Black Scar 03-08-2023.



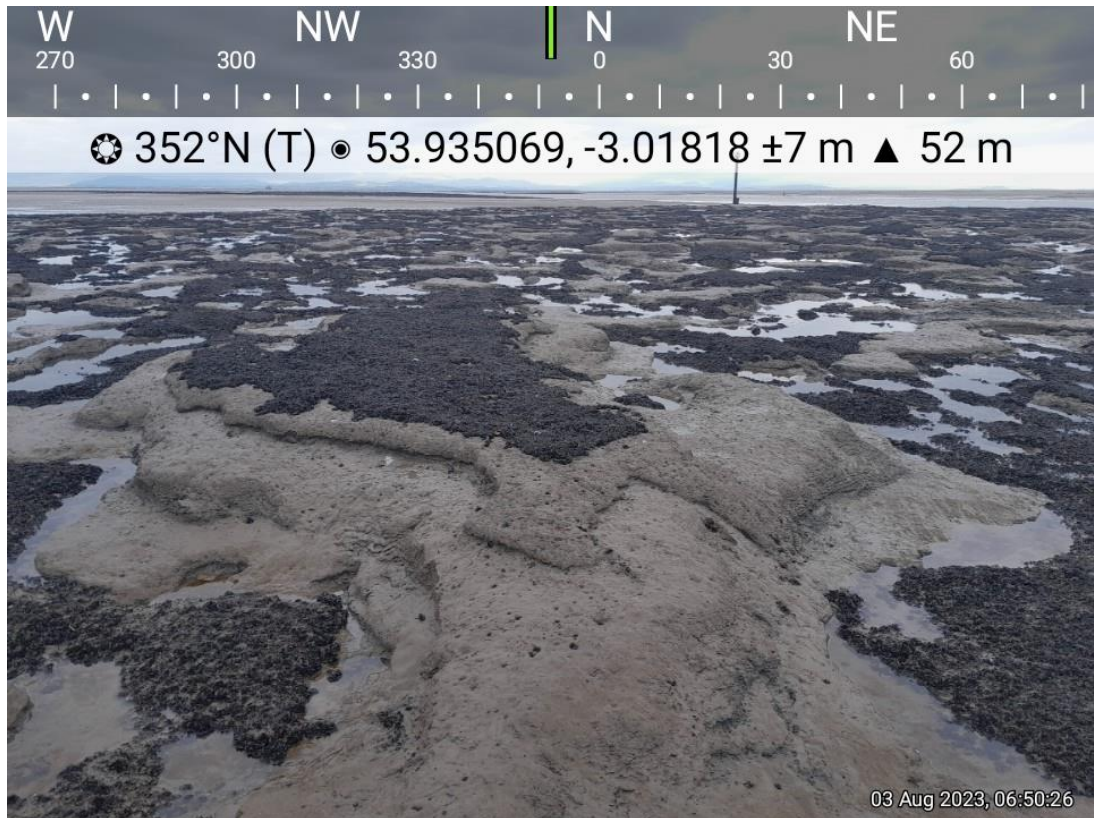


Figure 10. Deep mud and scour on Black Scar 03-08-2023.



Figure 11. Deep mussel mud on Black Scar 03-08-2023.





Figure 12. Dense coverage and 'fluffed' mussel on Perch Scar 03-08-2023.

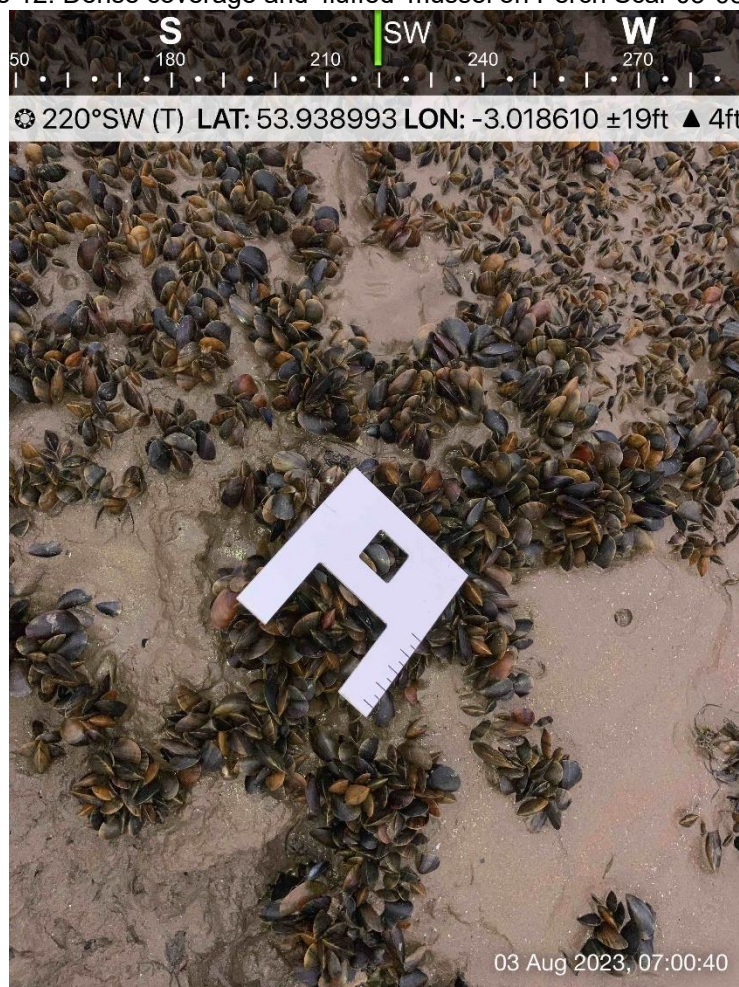


Figure 13. Mussel at 20 mm on Perch Scar 03-08-2023.







Figure 14. Dense mussel on hillocks of mussel mud on Perch Scar 03-08-2023.



Figure 15. Evidence of scour on Perch Scar 03-08-2023.









Figure 18. Dense settlement on Perch Scar 03-08-2023.

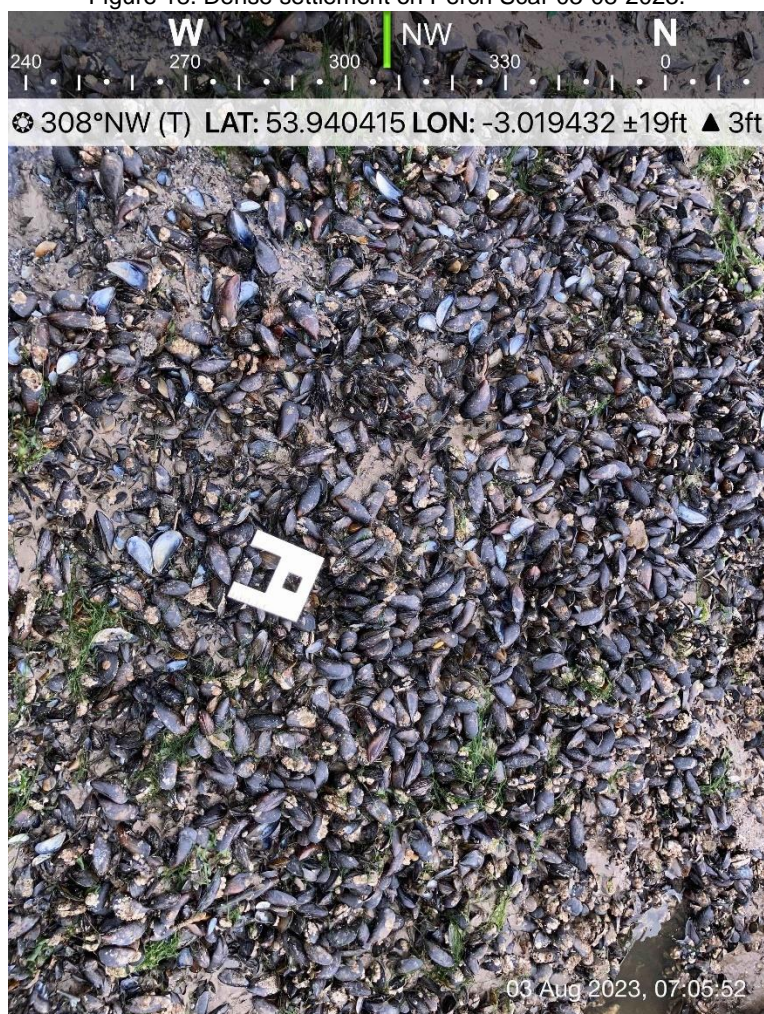


Figure 19. Size mussel on the edge of Perch Scar 03-08-2023





Figure 20. Size mussel on the edge of Perch Scar 03-08-2023



Figure 21. Deep mud and evidence of scouring on the end of Perch Scar 03-08-2023





Figure 22. Dense mussel on Perch Scar 03-08-2023

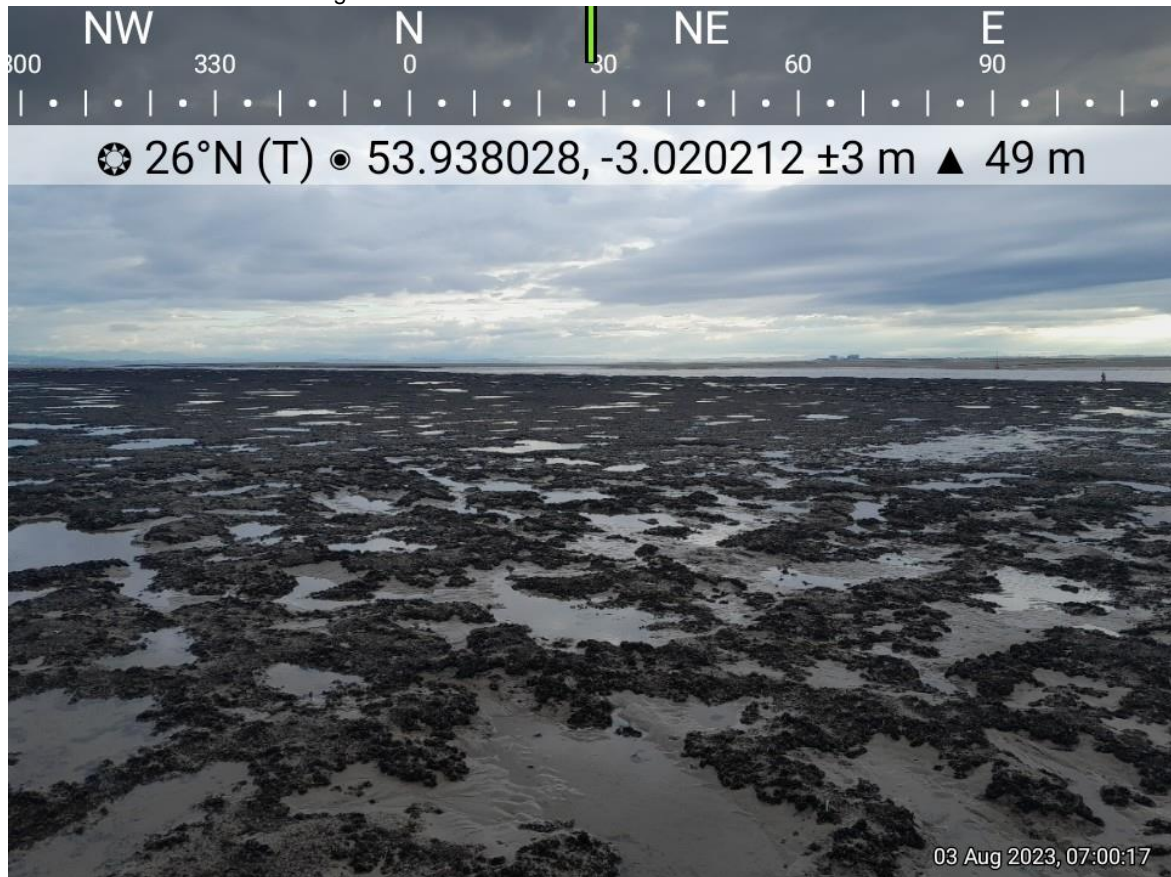


Figure 23. Landward end of Perch Scar 03-08-2023





Figure 24. far edge of Perch Scar 03-08-2023

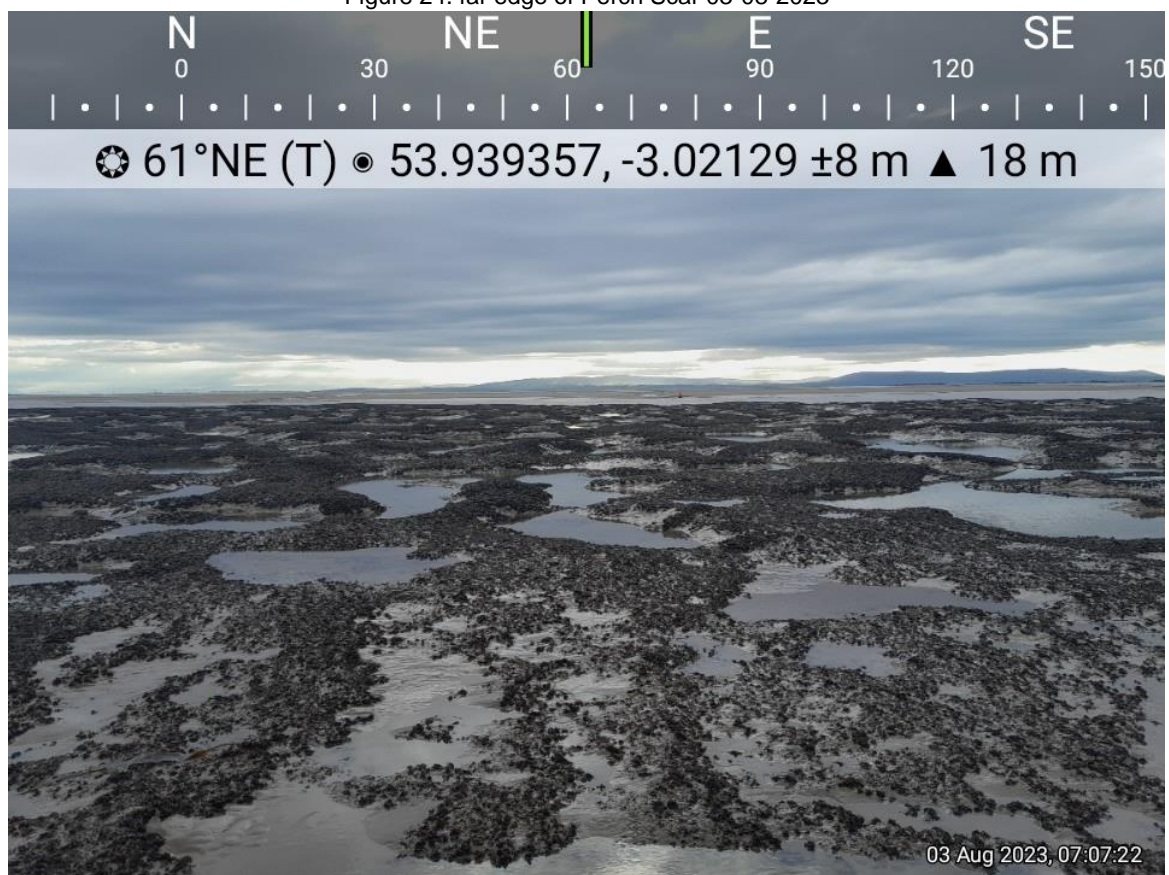


Figure 25. Thick mussel mud and dense mussel on Perch Scar 03-08-2023





Figure 26. Deep mussel mud on Perch Scar 03-08-2023



Figure 27. Hillocks of mussel mud and evidence of scour on Perch Scar 03-08-2023



Figure 28. Hillocks of mussel mud and evidence of scour on Perch Scar 03-08-2023