North Western Inshore Fisheries and Conservation Authority

Cockle Fisheries Management Plan

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North Western IFCA

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Contents

Glossary

Acronym	Definition
Cefas	Centre for Environment, Fisheries and Aquaculture
Defra	Department for Environment, Food and Rural Affairs
EA	Environment Agency
EMS	European Marine Site
FMP	Fisheries Management Plan
FSA	Food Standards Agency
HRA	Habitats Regulations Assessment
MaCAA	Marine and Coastal Access Act 2009
MCRS	Minimum Conservation Reference Size
MMO	Marine Management Organisation
mNCEA	Marine Natural Capital and Ecosystem Assessment
MPA	Marine Protected Area
NE	Natural England
NRW	Natural Resources Wales
NWIFCA	North Western Inshore Fisheries and Conservation Authority
SAC	Special Area of Conservation
SPA	Special Protected Area
TAC	Total Allowable Catch
TSB	Technical, Science and Byelaw Sub-Committee

1. Executive Summary

Context

Common cockle (*Cerastoderma edule*) fisheries contribute to the cultural heritage and economic livelihoods of many coastal communities in the North West of England. In the North Western Inshore Fisheries and Conservation Authority (NWIFCA) district, they support 150 permit holders, along with associated buyers and other stakeholders, and represent one of the region's main commercial fishing opportunities.

Beyond their economic importance, cockles also serve as a key supporting feature within several Marine Protected Areas (MPAs) across the district, contributing to ecosystem health and biodiversity.

Given their ecological and socio-economic significance, improved and proactive management is essential to safeguard cockle populations for the sake of both the fisheries and the environment.

What is a Fisheries Management Plan, and Why Do We Need One?

A fisheries management plan (FMP) is an evidence-based action plan designed to support a fishery's, or group of fisheries', longer-term sustainable management. It sets out a clear vision, strategic goals, and the management measures required to achieve them, based on the best available science, and informed by stakeholder input.

Purpose of this FMP

This FMP outlines NWIFCA's strategic approach to the sustainable management of cockle fisheries across the district. It supports NWIFCA's statutory duties under the Marine and Coastal Access Act 2009 (MaCAA) and contributes to the delivery of national fisheries objectives under the UK Fisheries Act 2020.

The plan aims to deliver meaningful progress toward the long-term sustainable management of cockle fisheries in the North West and a structured framework to achieve this goal.

The plan is structured around the following key objectives:

- Review the status of the stocks, socio-economic importance, relevant legislation, and most recent scientific evidence base;
- Establish decision-making metrics for the opening and closing of cockle beds, and define appropriate management measures for active fisheries;
- Identify key management challenges and knowledge gaps affecting the fisheries; and
- Set out priority actions through measurable, time-bound objectives and a targeted research plan to strengthen future management.

Management Framework

This FMP introduces the following measures for management and decision making:

- Introduction of minimum stock biomass thresholds for opening across all fishing areas to ensure adequate spawning stock and prevent overharvesting.
- Establishment of Total Allowable Catch (TAC) limits for all commercial cockle fishing zones to manage extraction sustainably.
- Development of a clear decision-making pathway for fishery openings and closures, using flexible permit conditions under Byelaw 3.
- Inclusion of rationale for each measure, supported by scientific assessment and practical experience.

Conclusion

The plan brings together existing management measures, stock assessments, and landings data to inform a sustainable approach to cockle exploitation across the district cockle beds.

This plan is based on the best available evidence at the time of publication, and acknowledges that evidence gaps remain, which limit the ability to fully establish sustainable management measures. To address these gaps, the plan details research plan designed to guide future data collection and analysis. This will support ongoing improvements in the understanding and management of the fishery over time. This plan will be subject to annual review, and updated in response to emerging evidence and environmental change, to ensure management remains effective and adaptive.

Responsibility for implementing and delivering the objectives outlined in the plan lies with NWIFCA officers.

Part 1

2. FMP Purpose

2.1 Applicable Fisheries

Table 1: FMP details

Fishery	**NWIFCA cockle fishery**
Species covered	Common cockle (*Cerastoderma edule*)
Fishery location	The intertidal waters within the six nautical miles of the NWIFCA district.
Key fishing grounds	Solway Firth Morecambe Bay Ribble Estuary Leasowe (Wirral)
Fishing methods	Hand gathering (hand, rake, spade, craams, tamps or jumbos)
Term of the plan	Five years to completion (with annual review phases)
Date of next review	TBC, upon completion of the first FMP version

2.2 Purpose

The purpose of this FMP is:

- To provide an overview of the cockle fisheries in the NWIFCA district, including a description of the resource, stock status, socio-economics, relevant legislation, current management measures in place, and the scientific evidence base supporting this;
- To detail metrics for decision-making regarding the opening and closing of cockle beds, and to determine suitable management measures for open fisheries;
- To identify the fisheries' key management challenges and knowledge gaps; and
- To identify priority actions, in the form of objectives and a research plan, to address these knowledge gaps and progress effective management to achieve sustainable fisheries for the foreseeable future.

The FMP will set out both long-term and short-term objectives to strategically address these challenges, and wherever possible, these objectives will be measurable and verifiable. It is designed to be adaptive and will be reviewed every year to ensure that any changes in the status of cockle beds, or their environmental and conservation features have been fully considered. Over time, this FMP will evolve as NWIFCA's evidence base for the fisheries develops.

2.3 Aims and Objectives

NWIFCA's primary aim for the district's intertidal cockle fisheries is to facilitate a biologically sustainable intertidal cockle industry that balances resource use with ecological and environmental impacts while maximising socio-economic benefits and using sound scientific evidence to support management decisions.

This FMP sets out a framework of agreed measures, parameters, and constraints regarding the utilisation of cockle stocks. Where sufficient evidence is lacking, a precautionary approach will be adopted, supported by a targeted research plan to address priority knowledge gaps. The FMP is designed to be adaptive, enabling it to respond effectively to changing environmental, socio-economic, political and legislative conditions. It is designed as an iterative, feedback-driven process, allowing for continuous improvement as data gaps are filled and stakeholder input is incorporated. This approach requires a structured and methodical framework, with clearly defined steps and timelines. All proposed objectives will be measurable and time-bound to ensure accountability and progress tracking.

As all cockle beds within the district fall within a MPA of one form or another, NWIFCA is required to assess and mitigate the impact of cockle fishing activities on the protected features through the undertaking of a Habitats Regulations Assessment (HRA) for each fishery occurring within each individual MPA. Therefore, this FMP will also consider the criteria required to meet the obligations of the HRA process and develop agreed criteria to increase the confidence that fisheries are both within sustainable limits and not adversely impacting the wider environment.

Given the regular debate surrounding the opening and management of the district's cockle fisheries, this document also aims to detail the criteria that need to be met for management measures to be applied or not applied. In doing so, it seeks to streamline decision-making and enhance transparency for stakeholders regarding the rationale behind management decisions.

2.4 Methodology

This FMP has been developed by drawing from exemplar FMPs (Table 2) already implemented by other regulatory bodies across the UK, and using Defra's guidance framework on national FMP development set out in the Fisheries Act 2020.

Table 2: Exemplar FMPs used to guide the development of this document

Organisation	FMP	Document
Eastern IFCA	Wash Fishery Order 1992: Cockle Fishery Management Plan	https://www.eastern-ifca.gov.uk/wp-content/uploads/2021/03/2019_07_WFO_cockle_fishery_management_plan1.5_Final.pdf
Kent & Essex IFCA	Thames Estuary Cockle Fishery (no.2) Order 2024: Management Plan	https://kentandessex-ifca.gov.uk/website-content/20241209-tecfo-

		2024-management-plan-1733747705.pdf
Defra	National UK Cockle FMP	*Not yet published*

The FMP will also undergo consultation with Natural England (NE), members of NWIFCA's Technical, Science and Byelaw Sub-Committee (TSB), and industry representatives before a final document is agreed by NWIFCA members.

2.5 Long-Term Objectives

Table 3 below sets out NWIFCA's long-term fisheries management objectives[1].

Table 3: NWIFCA long-term cockle fisheries management objectives

Long-Term Objective	Detail	Plan
1. Develop a harvest control strategy	Develop a sustainable harvest control strategy that considers: a. a defined biologically sustainable limit, b. recruitment requirements, c. protected species prey requirements, d. spatial management, e. environmental variability; and f. socio-economic considerations.	This will be achieved through undertaking the research plan outlined in Section 10
2. Develop agreed parameters for fisheries assessment	Use the sustainable harvest control strategy to develop agreed criteria for fisheries assessment based on scientific evidence that enables streamlined decision-making (Section 9).	This will be achieved through undertaking the steps outlined in Section 9 and completing the research plan outlined in Section 10.

2.6 Short-Term Objectives

The following constitutes NWIFCA's short-term fisheries management objectives[2] and detail the main steps required to achieve the long-term overarching objectives of the FMP. These objectives have been developed to address the knowledge gaps identified in the relevant sections of this FMP.

[1] Long-term objectives have a timescale of more than five years.
[2] Short-term objectives of less than five years and are specific and measurable.

The key short-term objectives are detailed in Table 4 and fall under six main headings:

1. Improving and sustaining stakeholder relationships
2. Improving scientific evidence base
3. Streamlining NWIFCA's understanding and decision-making
4. Assessing the sustainability of the fisheries against accredited systems
5. Achieving site-specific conservation objectives
6. Securing the socio-economic viability of the fisheries.

Table 4: NWIFCA short-term cockle fisheries management objectives

Short-Term Objective	Detail	Completion Date
1. Improving and sustaining stakeholder relationships		
1.1 Establish a transparent information sharing process	Develop a process for sharing timely information with stakeholders and facilitating feedback.	2030
1.2 Develop a consultation and engagement protocol	Set out agreed commitments by NWIFCA to consult and engage with stakeholders on a regular basis with regards to the fishery and its management.	2030
1.3 Incorporate cultural value considerations into decision-making processes	Identify ways of incorporating social and cultural values of stakeholders into decision-making frameworks.	2030
1.4 Determine an appropriate open season for the fishery	Identify whether a July, August or September start to the fishery would be preferable to stakeholders (subject to being HRA and management compatible) and introduce this into the management process.	2029
2. Improving scientific evidence base		
2.1 Develop a five-year research plan	Develop a five-year research plan to address outstanding knowledge gaps (See Section 11).	2028
2.2 Develop a robust data gathering system	Develop a strong data gathering and analysis system for returns, fisheries activities, compliance, and stock assessments.	2028
3. Streamlining NWIFCA's understanding and decision-making		
3.1 Develop and agree a simple recommendation-forming framework	Develop a recommendation-forming framework that stakeholders understand, taking into account stock assessments and baseline metrics, and applying limits to increase the likelihood of sustainability.	2027

3.2 Develop and agree a clear set of management options	Develop a set of management options, that are easy for compliance and enforcement.	2027
4. Assessing the sustainability of the fisheries against accredited systems		
4.1 Assess the NWIFCA cockle fishery against international accreditation systems	Assess the NWIFCA cockle fishery against international accreditation systems or measures of sustainability (*e.g.* MSC accreditation)	2029
5. Achieving site-specific conservation objectives		
5.1 Establish ecological limits for the fishery	Improve our understanding of the impact of the fishery on designated features, and the requirement of shellfish resource for protected bird species.	2030
6. Securing the socio-economic viability of the fisheries		
6.1 Determine the viability of cockle beds in the Solway	Undertake a survey of the historical Solway cockle beds in the next two years.	2028

The initial version of this FMP was drafted in 2025. If its objectives are successfully met, future iterations may expand to consider additional factors such as the cost-effectiveness of management, support for local investment, and the fisheries' role in enhancing community and coastal wellbeing. These aspects are not addressed in the current version, which is primarily focused on establishing a foundation for sustainable management.

The plan provided in Section 3 sets out in detail the resources and actions required to achieve these objectives.

2.7 Not in Scope

This FMP outlines the decision-making framework for opening cockle fisheries, with a focus on stock status, sustainability, and effective management. It does not address additional considerations under the HRA process, such as bird disturbance or impacts on other designated site features. These factors are assessed separately in collaboration with NE and can vary annually based on bird populations, site conditions, and specific characteristics of the proposed fishery.

This plan refers specifically to hand-gathered cockle fishing, and does not consider the introduction, or management, of any other form *(e.g.* tractor wet-dredging, suction dredging, or boat-based fisheries).

3. Governance and Policy

This section details the relevant legislation for this FMP.

3.1 NWIFCA

NWIFCA was created under Section 153 of MaCAA which sets out the responsibilities it has for the sustainable management of sea fisheries resources within the district.

S.153 Management of inshore fisheries

(1) The authority for an IFC District must manage the exploitation of sea fisheries resources in that district.

(2) In performing its duty under subsection (1), the authority for an IFC district must –

a. See to ensure that the exploitation of sea fisheries resources is carried out in a sustainable way,

b. Seek to balance the social and economic benefits of exploiting the sea fisheries resources of the district with the need to protect the marine environment from, or promote its recovery from, the effects of such exploitation,

c. Take any other steps which in the authority's opinion are necessary or expedient for the purpose of making a contribution to the achievement of sustainable development, and

d. *See to balance the different needs of persons* engaged in the exploitation of sea fisheries resources in the district.

3.2 Fisheries Act 2020

The Fisheries Act 2020 provides a framework for fisheries management following the UK's exit from the EU and it no longer being part of the Common Fisheries Policy. The Act underpins the UK's management of fisheries with the UK Government now responsible for setting TACs in their waters. The Act requires the UK's fisheries policy authorities, Defra and the devolved administrations, to develop national FMPs to deliver the ambition of sustainable fisheries.

This FMP is regional and specific to NWIFCA's own cockle fisheries. However, it has been written in line with the Government's guidance for national FMPs, with the view that it may contribute towards the delivery of the eventual over-arching national FMP for cockles.

The Act sets out a series of objectives which have also been taken into consideration in the drafting of this FMP; these are laid out in Table 5.

Table 5: Overview of the Fisheries Act 2020 objectives

Objective	Detail
Sustainability	1. Fish and aquaculture activities are: a. Environmentally sustainable in the long-term, and b. Managed so as to achieve economic, social and employment benefits and contribute to the availability of food supplies. 2. The fishing capacity of fleets is such that fleets are economically viable but do not overexploit marine stocks
Precautionary	1. The precautionary approach to fisheries management is applied. 2. Exploitation of marine stocks restores and maintains populations of harvested species above biomass levels capable of producing maximum sustainable yield.
Ecosystem	1. Fish and aquaculture activities are managed using an ecosystem-based approach (an approach that ensures the collective pressure of human activities is kept within levels compatible with the achievement of good environmental status and does not compromise the capacity of marine ecosystems to respond to human-induced changes) so as to ensure that their negative impacts on marine ecosystems are minimised and, where possible, reversed. 2. Incidental catches of sensitive species are minimised and, where possible, eliminated.
Scientific Evidence	1. Scientific data relevant to the management of fish and aquaculture activities is collected. 2. Where appropriate, the fisheries policy authorities work together on the collection of, and share, such scientific data. 3. The management of fish and aquaculture activities is based on the best available scientific advice.
Bycatch	1. The catching of fish that are below minimum conservation reference size (MCRS), and other bycatch, is avoided or reduced. 2. Catches are recorded and accounted for. 3. Bycatch that is fish is landed, but only where this is appropriate and (in particular) does not create an incentive to catch fish that are below MCRS.
Equal Access	1. Access of UK fishing boats to any area within British fishery limits is not affected by: a. the location of the fishing boat's home port, or b. any other connection of the fishing boat, or any of its owners, to any place in the United Kingdom.

National Benefit	1. Fishing activities of UK fishing boats bring social or economic benefits to the UK.
Climate change	1. The adverse effect of fish and aquaculture activities on climate change is minimised. 2. Fish and aquaculture activities adapt to climate change.

3.3 UK Marine Policy Statement

MaCAA requires all public authorities taking authorisation or enforcement decisions that affect or might affect the UK marine area to do so in accordance with the Marine Policy Statement unless relevant considerations indicate otherwise.

3.4 The Conservation of Habitats and Species Regulations 2017

As the 'competent and relevant authority', NWIFCA has a statutory responsibility to ensure that the North West's cockle fisheries do not damage, disturb or have an adverse effect on the species or habitats protected by MPAs. All NWIFCA cockle beds fall within a designated MPA site boundary, and therefore, this legislation is relevant to the development of this FMP.

4. Description of the Fisheries

4.1 Overview

The NWIFCA district spans out to six nautical miles along the English coastline from the borders of Scotland in the Solway Firth to Wales in the Dee Estuary (Figure 1). There are extensive intertidal sandflats along its coastline that provide suitable habitat for the common cockle and have historically supported commercial scale fisheries.

The main cockle beds in the district are situated in the Solway Firth, Morecambe Bay, Ribble Estuary and on the north Wirral coastline at Leasowe (Figure 1). However, in the past 10 years, the predominant fisheries have taken place at Leasowe, in the Ribble Estuary and in Morecambe Bay. Table 6 details the cockle fisheries opened across the district's main beds in the past 13 years.

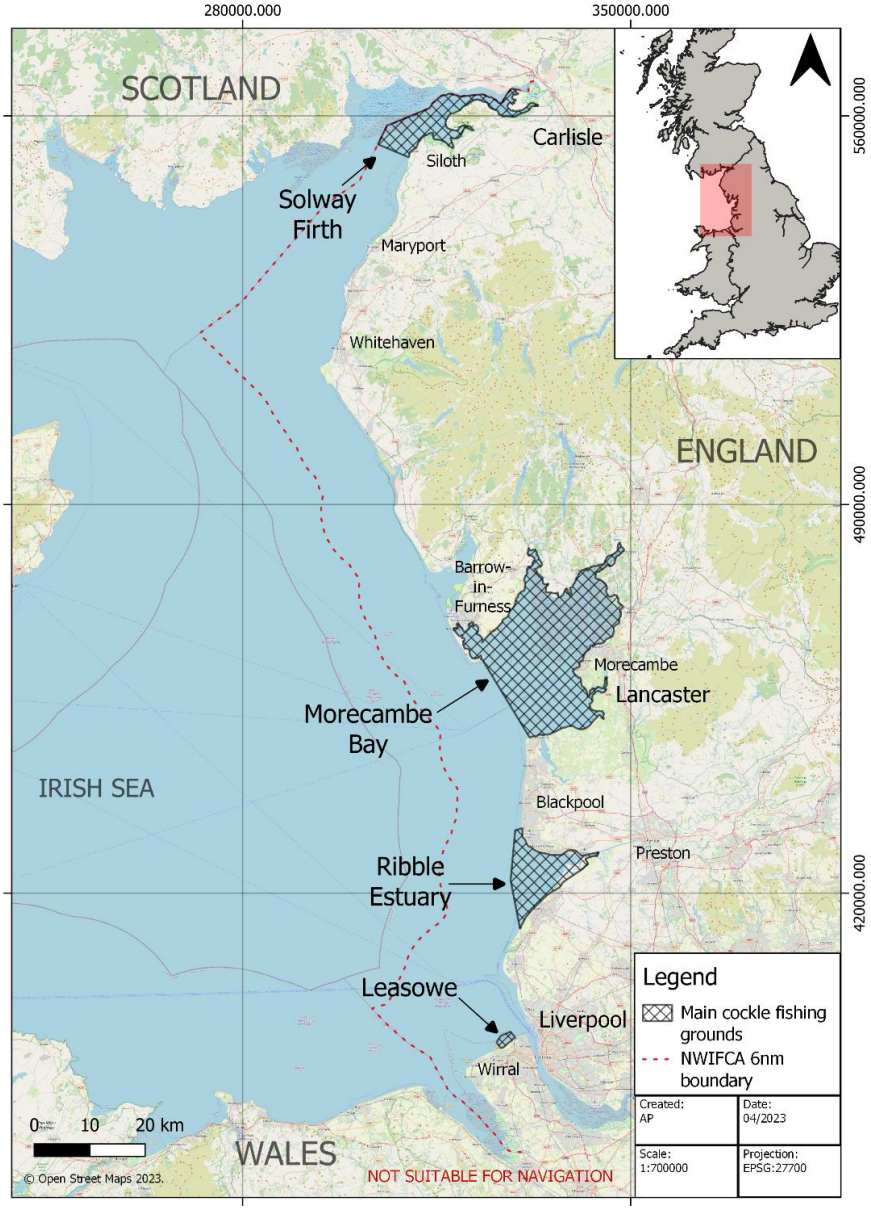


Figure 1: Location of the main cockle fishing grounds in the NWIFCA district

Table 6: Open cockle fisheries across the NWIFCA district in the past 13 years

	Cockle fishing season													
Area	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
Ribble Estuary	Open	x	x	x	x	x	Open	x	x	x	Open	Open	x	x
Leasowe	x	x	x	x	x	Open	x	Open	x	x	x	x	Open	x
Morecambe Bay	x	x	x	Open	Open	Open	Open	Open	Open	Open	x	x	Open	Open
Solway	x	x	x	x	x	x	x	x	x	x	x	x	x	x

*Open season typically spans from September 1st to May 1st the following year.

4.2 Fishing Method

Hand-gathering is the predominant method for fishing cockles in the NWIFCA district. Hand gathering of cockles has been a longstanding, traditional fishery across the district and is a low tech, highly specific fishing method that results in minimal bycatch. Fishers use a jumbo (Figure 2) to fluidise the sediment by rocking it side to side, and as they do so, the cockles rise to the surface where they are then raked into a net or bucket, riddled (to return the undersized cockle to the bed) and the retained sized cockle are placed into a 20-25kg cockle bag. Each bed is usually accessed by quadbikes or tractors due to the risk of getting stuck in soft sediment, and the often large distances from the shore.

Figure 2: Hand gathered cockle fishing method used in the NWIFCA district.

4.3 Stock Assessment Method

NWIFCA conducts stock assessments from May to August every year. Stock assessment data is available from 2017 onwards, from which point the survey methodology became standardised. All beds where stocks exist are assessed, including those not considered to be commercially viable. Non-commercially viable beds are considered for HRA purposes as they may be a potential food source for birds and serve as undisturbed (with relation to a cockle fishery) feeding areas.

The surveys assess:

- Stock biomass
- Stock density
- Size classes of cockles

For surveying, each cockle bed is split into a grid with sample points evenly spaced 250-500m apart. Sample locations are mapped on a GPS to ensure the same locations are surveyed each year. Officers access each sample location by quadbike, jumbo the sand to fluidise the sediment to cause cockles to rise to the surface and lay down a 0.5m^2 quadrat. They then pick and rake the cockles within the quadrat and collect them for analysis in the lab, where they are separated into size cohorts (0.1-<5mm, 5-<15mm, 15-<20mm, 20-<25mm, 25-<35mm, and ≥35mm), and the number in each cohort is recorded. A total of 200 cockles (100 undersized, 100 size, measured using a standard enforcement gauge) are taken from the combined samples of the whole bed, and are analysed for weight and length.

Sized cockle is classed as anything that cannot fit through a 20 x 20mm gauge. In practice, this typically translates into ≥25mm in length (*i.e.* undersized cockle being any less than 25mm in length) (Figure 3).

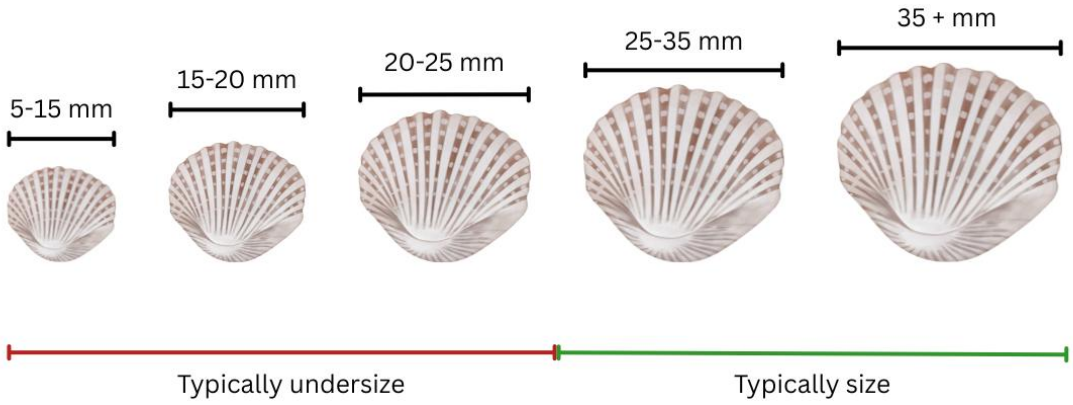


Figure 3: The size classes of cockles analysed during surveys.

From this data, officers can then determine the following:

- An estimate of sized cockle biomass
- An estimate of undersized cockle biomass
- The composition of the different size classes and their distribution across the bed
- The density of stock across the bed.

4.4 Main Fishing Grounds and Stock Assessments

4.4.1 Morecambe Bay

There are six main cockle beds situated in Morecambe Bay (Figure 4), four of which are historically commercial beds (Newbiggin, Leven Sands, Flookburgh, and Pilling), and two that have not been commercially viable in the past 10 years but still support cockle stocks and are surveyed annually along with the others (Warton Sands and Middleton).

Morecambe Bay has the largest expanse of intertidal sand and mudflats in the UK, at 31,000ha (310km^2), 7,790 ha (77.9km^2) of which supports cockle beds (25% of the total intertidal area).

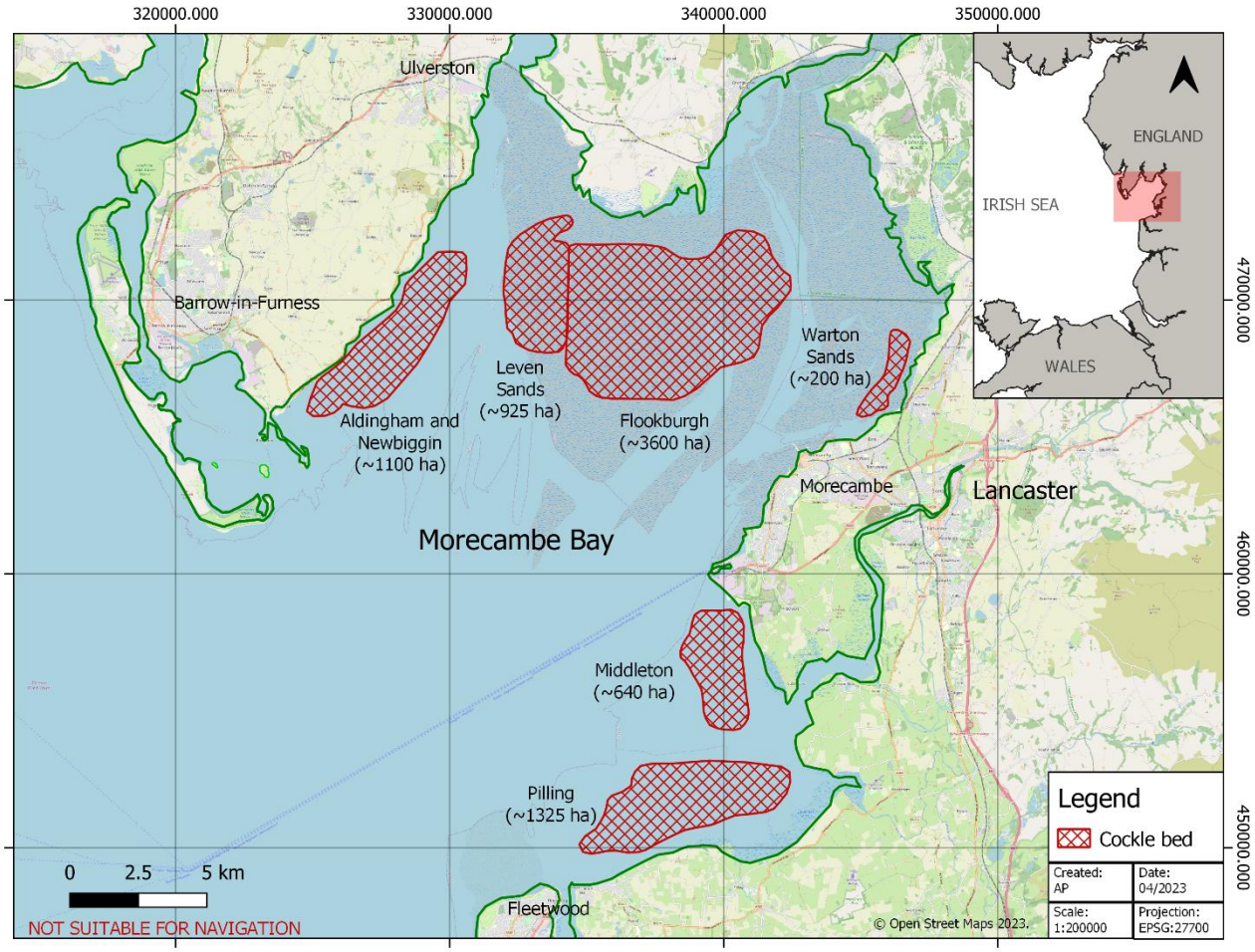


Figure 4: The location and extent of cockle beds in Morecambe Bay. The area of each bed is given in hectares and is an approximation based on the maximum size the bed has been in the past 10 years.

Each year, all beds in Morecambe Bay are stock assessed, including those not considered to be commercially viable. An overview of the Morecambe Bay cockle stock assessments from 2017 to present is provided in this section.

Table 7 shows the annual biomass of sized (approx. ≥25 mm) cockle and undersized (approx. <25 mm) cockle across the whole Bay from 2017 to 2025. It also shows the extent of each bed in hectares, and which beds were opened to permit holders that year.

Table 7: The yearly biomass of figures for sized, undersized and total biomass of cockles on Morecambe Bay cockle beds 2017-2025[3]

Year	All Surveyed Morecambe Bay Cockle Beds				Beds Opened
	Area (ha)	Sized Cockle (t)	Undersized Cockle (t)	Total Cockle (t)	
2017 (Jul)	5,177	6,847	4,097	10,944	Flookburgh Leven Pilling
2018 (Jul)	6,088	7,000	12,140	19,140	Flookburgh Leven Pilling Newbiggin
2019 (Jul)	6,705	4,635	12,900	17,535	Flookburgh Leven Pilling Newbiggin
2020 (Jul)	8,085	12,580	3,975	16,555	Flookburgh Leven Pilling Newbiggin
2021 (May)	7,089	6,450	955	7,415	*All beds recommended closed Pilling opened
2022 (Jul)	6,582	3,950	1,990	5,940	All beds closed
2023 (Jul)	7,730	3,035	12,975	16,010	All beds closed
2024 (Apr)	7,372	4,150	7,839	11,989	All beds closed
2024 (Jul)	7,222	7,309	5,586	12,895	Flookburgh Pilling
2025 (Apr)	6,568	6,001	2,015	8,016	Pilling
2025 (Jul)	7,700	8,243	3,057	11,300	Piling Flookburgh

[3] Figures represent the *maximum* cockle biomass.

					Newbiggin

Figure 5 shows the annual biomass of sized, undersized and total cockle for all the beds in Morecambe Bay from 2017 to 2025. Historical reports suggest the Bay typically goes through long cycles of high and low abundance which can be over a decade in duration. For example, there was a high abundance from 2003 to 2007 which dropped off in the following year, with low survivability and recruitment of stock until 2016 when the fishery was able to be re-opened consistently for the 2017/18 to 2020/21 fishing seasons. A decline was then seen again in 2021, with the fishery being either only partially open (Pilling 2021/22) or fully closed for two years (2022/23-2023/24). Officers recommended to keep all beds closed in 2021/22, but TSB voted to open Pilling.

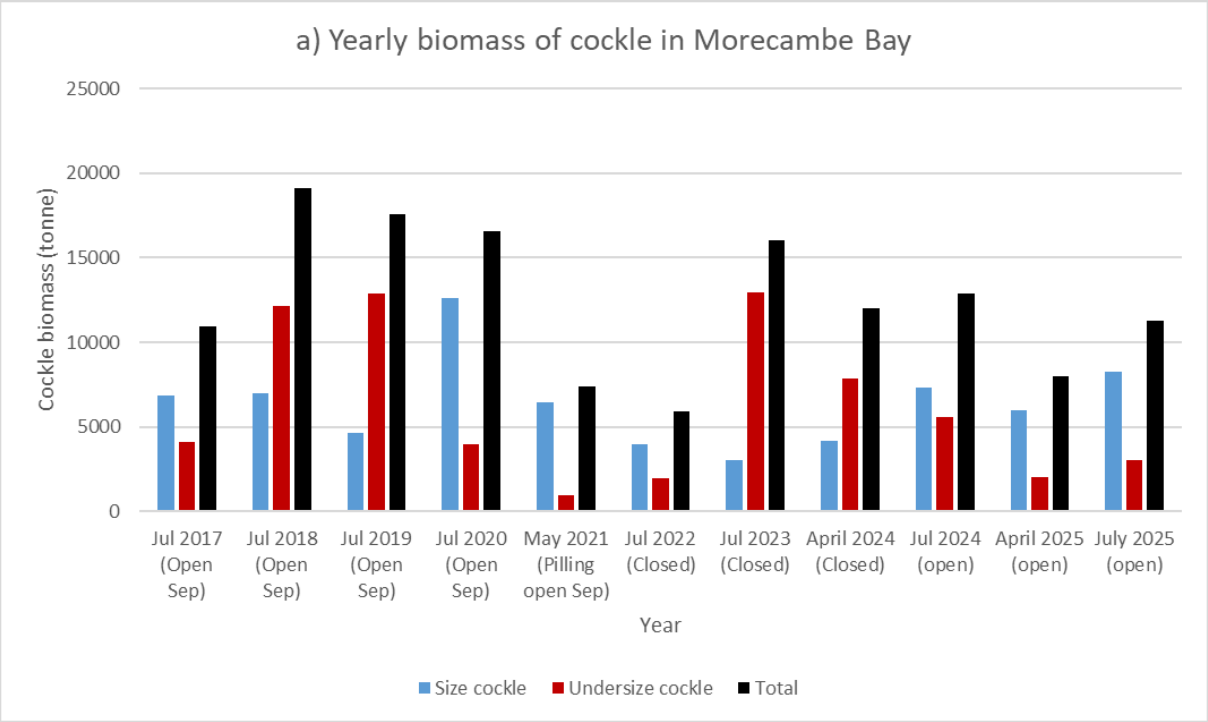


Figure 5: Annual Morecambe Bay cockle biomass calculations

Figure 6 demonstrates the cyclical nature of cockle stocks in Morecambe Bay. It also highlights the settlement of undersized cockle typically grows on to form the basis of the following two to three years of increase sized cockle population.

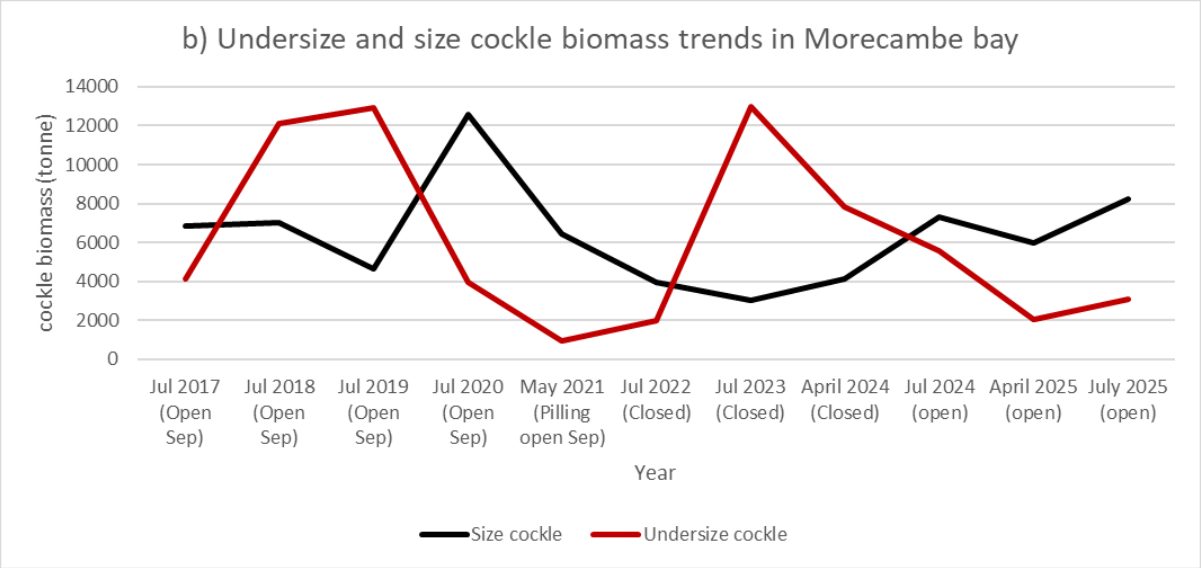


Figure 6: Biomass of sized and undersized cockle in Morecambe Bay from 2017-2025 (note the second additional surveys undertaken in April as of 2024)

Morecambe Bay is considered for opening based on the full site stock assessment (inclusive of all beds). However, officers also analyse individual beds to identify stock trends, density distribution and size composition, all factors that are important when determining management measures (see Section 2). The biomass trends of sized cockle for each bed are presented in Figure 7.

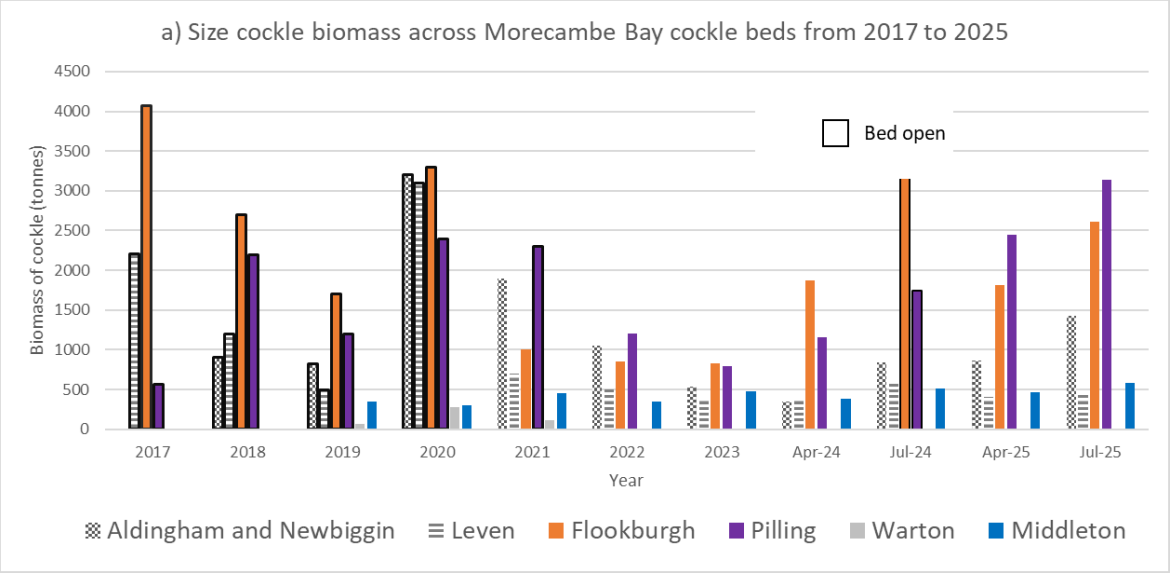


Figure 7: Trend in annual total sized cockle (+25mm) biomass for individual beds in Morecambe Bay since 2017. The bars outlined in black indicate beds which were opened that year.

Prior to 2025, there were no defined numbers for either the total biomass of cockle (per bed or across the Bay as a whole), or minimum density, below which the fishery is recommended

closed. The decisions were made based on historical officer knowledge of the trends in cockle stocks, and in consultation with NE with regards to bird food requirements.

Each year's stock assessment, including the distribution of cockle across each bed, density and size cohort biomass, is archived in science reports on NWIFCA's website here https://www.nw-ifca.gov.uk/meetings-archive/.

4.4.2 Ribble Estuary

There are four cockle beds in the Ribble Estuary (Figure 8). In the past 13 years, the Penfold cockle bed has supported commercial stock levels on three occasions, in the 2018/19, 2022/23 and 2023/2024 fishing seasons (Table 8). The Cockle fishery in the Ribble Estuary is predominantly sporadic in nature and beds do not typically sustain significant biomass of cockles.

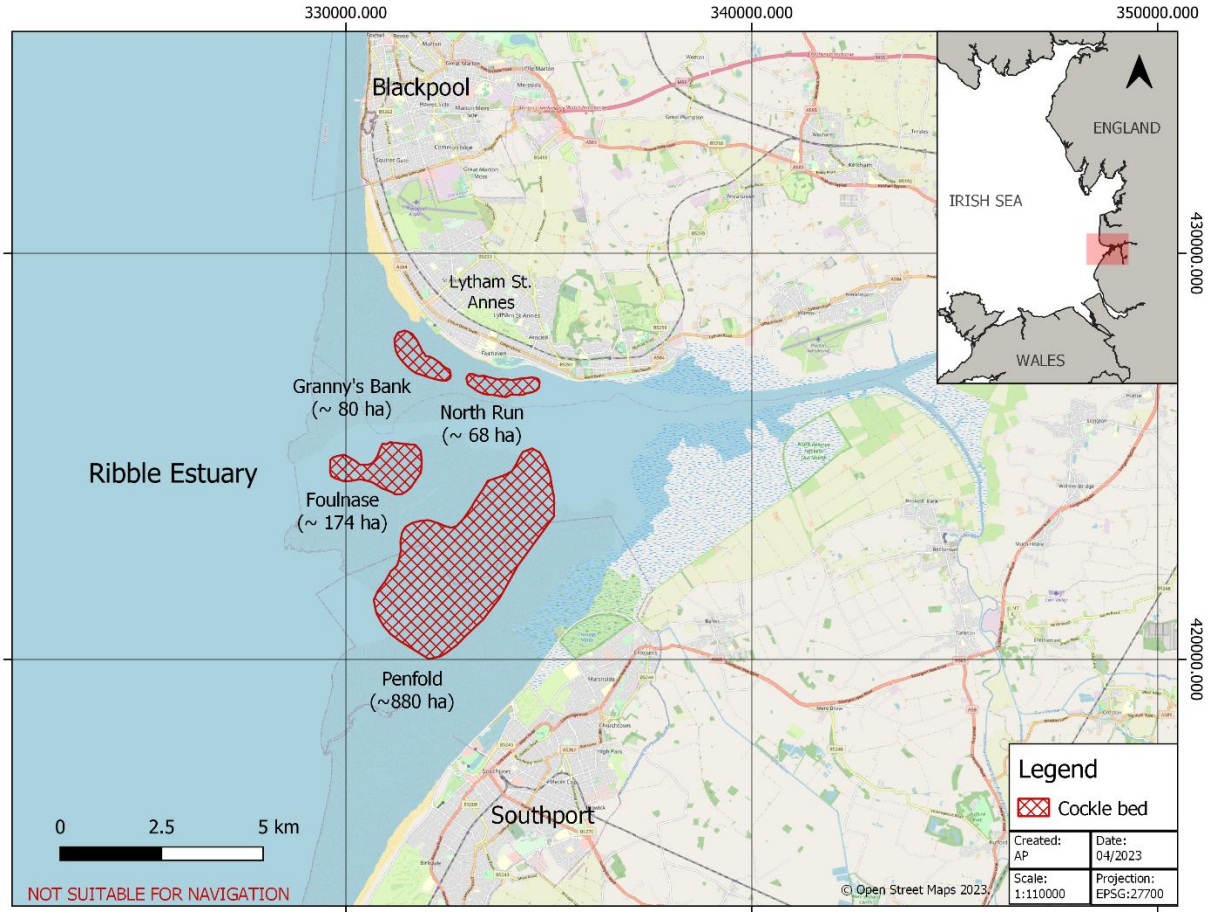


Figure 8: The location and extent of the cockle beds in the Ribble Estuary. The area of the bed is given in hectares and is an approximation based on the maximum size the bed has been in the past 13 years.

Table 8: The yearly biomass of figures for sized, undersized and total biomass of cockles in the Ribble Estuary 2017-2022[4]

Year	All Surveyed Ribble Estuary Cockle Beds				Beds Opened
	Area (ha)	Sized Cockle (t)	Undersized Cockle (t)	Total Cockle (t)	
2017	-	-	-	-	All beds closed
2018 (Jul)	38	*Not estimated due to limited access	*Not estimated due to limited access	*Not estimated due to limited access	Penfold
2019	-	-	-	-	All beds closed
2020	-	-	-	-	All beds closed
2021	-	-	-	-	All beds closed
2022 (Jul)	877	1,200	1,300	2,500	Penfold
2023 (Jul)	637	800	120	920	Penfold
2024 (Jul)	600	378	87	465	All beds closed
2025 (Jul)	355	113	24	137	All beds closed

The 2018/19 fishery at Penfold was a permitted undersized fishery due to the presence of high-density stock in a small area of the bed that had stunted in growth and was likely to die without reaching size. In 2023/2024, officers recommended the fishery close due to low stock levels, but was opened by TSB.

Granny's Bank and North Run are inspected each year but have not undergone full surveys in recent history due to very low stock levels. Foulnase cockle bed was last fished in 2012, and is inspected annually, but has not had enough stock to warrant assessment since.

The annual biomass estimates for cockles for all beds across the Ribble Estuary are presented in Table 8, with the sporadic nature of the stock reflected in the limited number of full surveys undertaken.

4.4.3 Leasowe

Leasowe cockle bed is located off the Wirral coast close to the Mersey Estuary (Figure 9). The bed is surveyed annually and consistently has cockle present. The bed is subject to a minimum biomass of sized cockle of 800t which must be retained on the bed for wading bird food resource, as per HRA stipulations from NE. Any sized cockle biomass in addition to the 800t can be made

[4] Figures represent the *maximum* cockle biomass.

available to the fishery. Therefore, the fishery is subject to a TAC restriction, derived from the estimated biomass minus the 800t. This minimum stock requirement was determined by NE and is intended to leave sufficient food resource for protected wading bird species of the Mersey Narrows and North Wirral Foreshore SPA. Prior to 2025, no other beds in the district have had a minimum stock requirement placed on them.

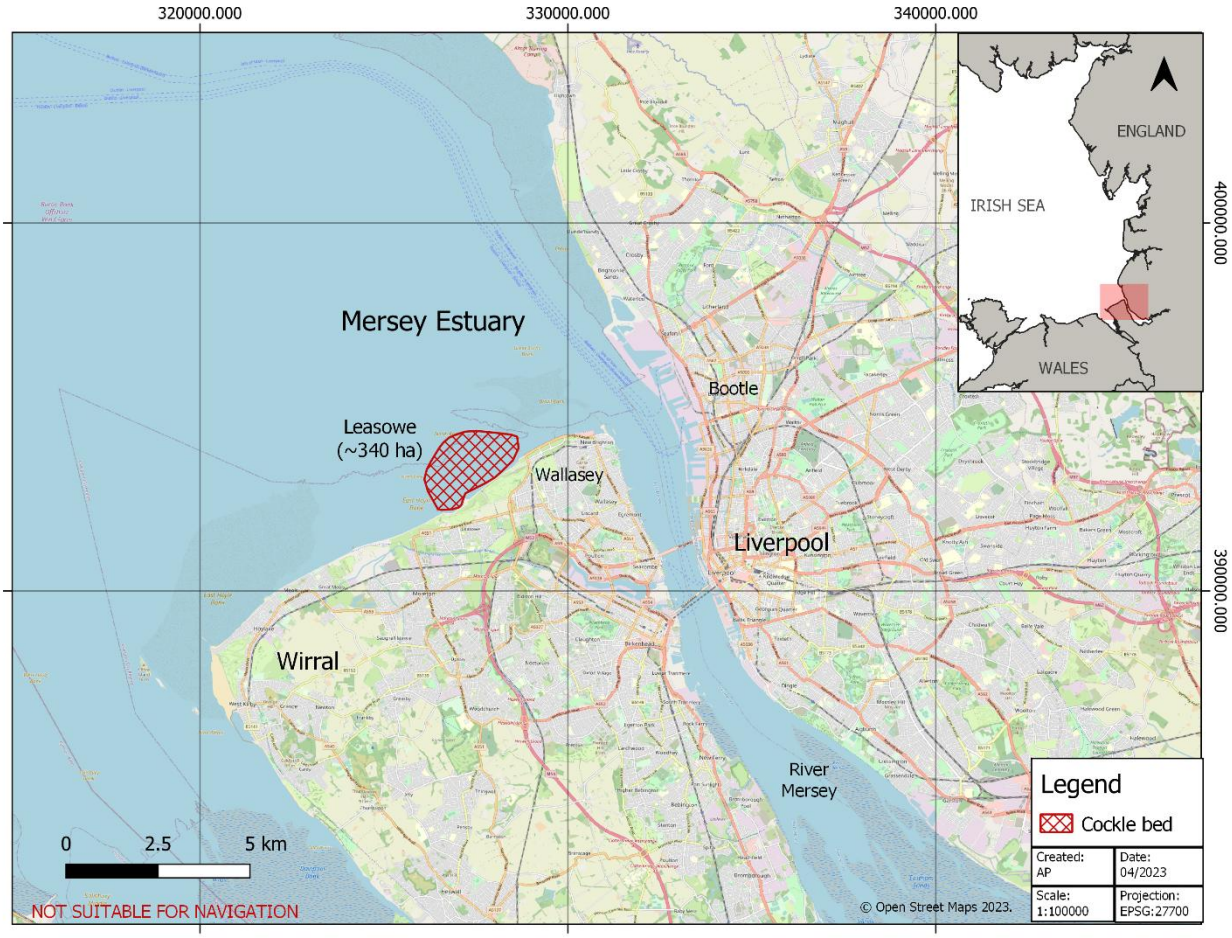


Figure 9: The location and extent of the Leasowe cockle on the Wirral. The area of the bed is given in hectares and is an approximation based on the maximum size the bed has been in the past eight years.

Table 9 shows the annual biomass of sized and undersized cockle at Leasowe from 2017 to 2025. It also shows the extent of the bed in hectares, and which years the bed was opened to permit holders when sized stock exceeded 800t. Unlike other beds in the district, cockle is known to grow quickly after settlement on Leasowe, typically reaching size at just over a year old. This is often the reason for survey timings in November and for a later opening date (Table 9). In comparison, cockle on other beds in the district typically reach size over two years of age. Figure 10 shows the annual biomass estimates in graphical form, and Figure 11 shows the trends in sized and undersized cockle from 2017 to 2025.

Table 9: The yearly biomass of figures for sized, undersized and total biomass of cockles on the Leasowe cockle bed 2017-2025[5]

Year	Leasowe Cockle Bed				Bed Opened
	Area (ha)	Sized Cockle (t)	Undersized Cockle (t)	Total Cockle (t)	
2017	212	3,524	293	3,816	Open
2018	238	700	10	710	Closed
2019 (Nov)	220	1,200	500	1,700	Open
2020 (Jul)	200	607	20	627	Closed
2021 (Jul)	206	367	17	384	Closed
2022 (Jul)	225	120	100	220	Closed
2023 (Jul)	235	171	604	775	Closed
2024 (Jul)	213	799	751	1,550	Closed
2024 (Nov)	256	1,370	350	1,720	Open
2025 (Jul)	163	705	8	713	Closed

[5] Figures represent *maximum* cockle biomass.

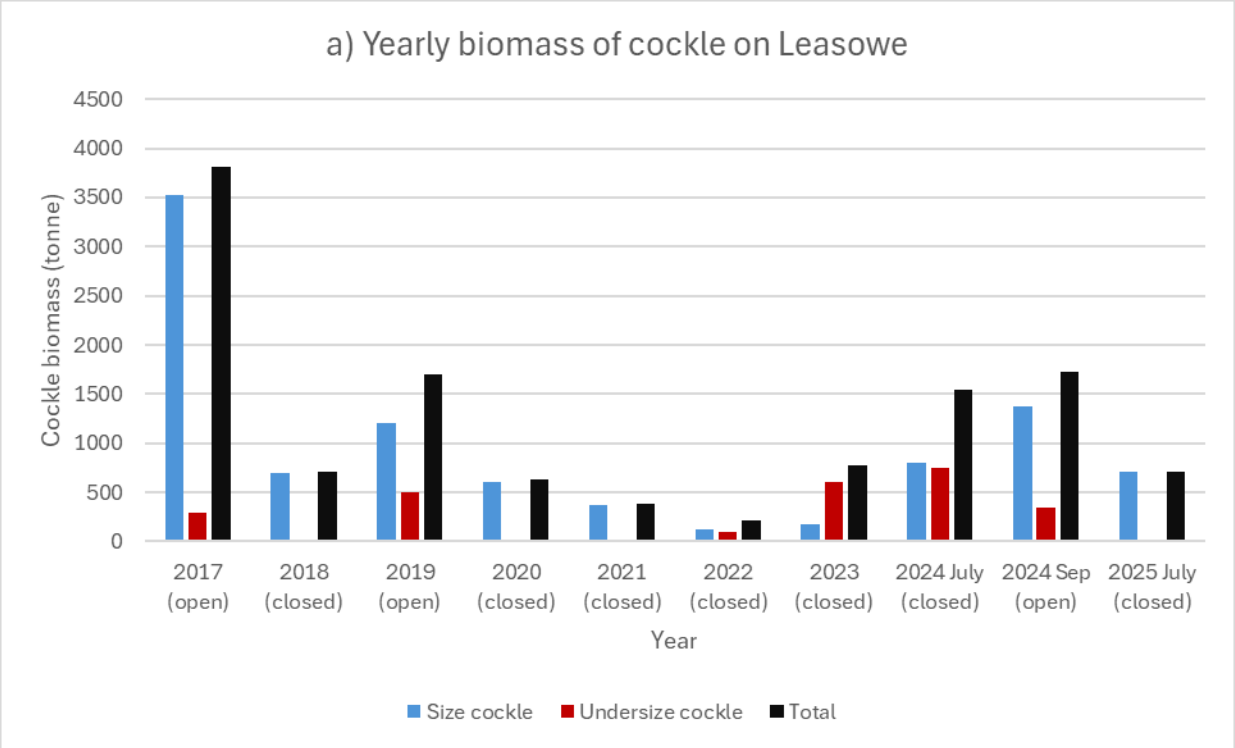


Figure 10: Annual biomass of cockle on Leasowe 2017-2025

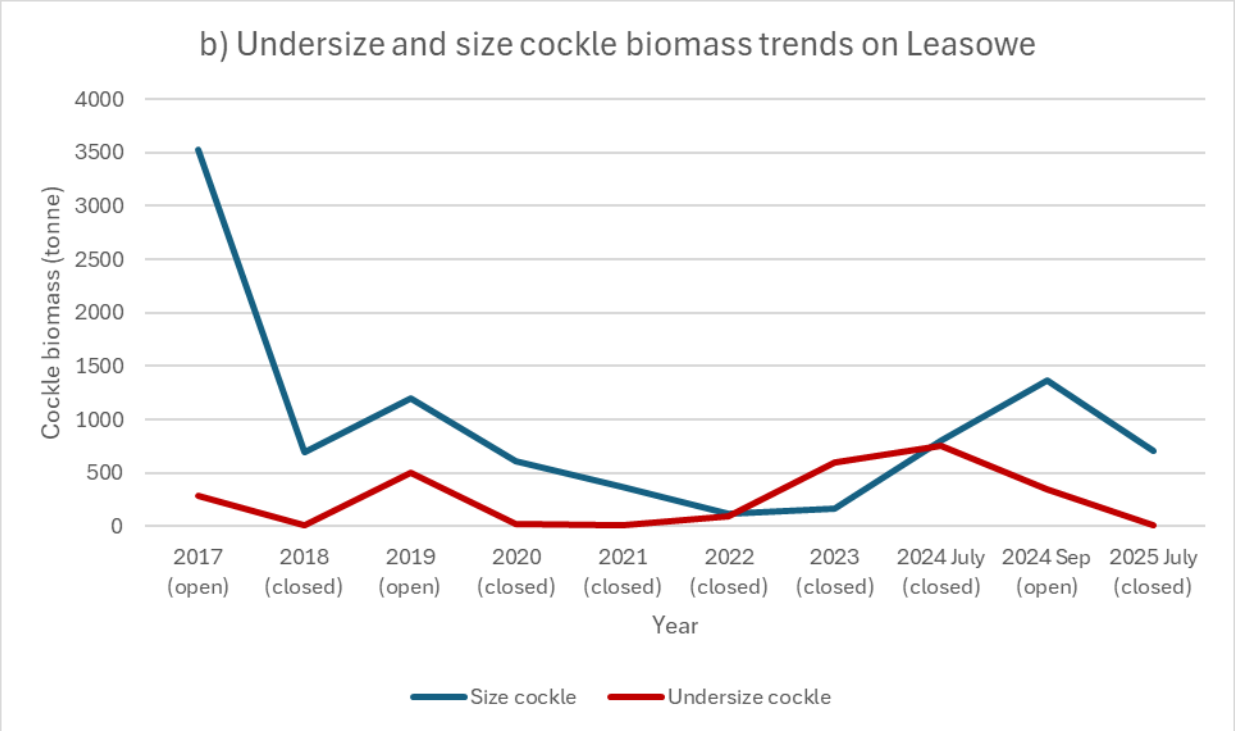


Figure 11: Annual trend in sized and undersized cockle on Leasowe 2017-2025

A review of the 2017-2025 stock assessments indicates that the biomass of undersized cockle typically supports the biomass of the following year's sized stock.

The data does not currently show a clear link between the biomass of sized stock and successful recruitment of the following year's spat settlements on any of the beds.

4.4.4 Solway Firth

There are three main cockle beds situated in the Solway Firth: Beckfoot, Middle Bank, and Cardurnock Flat (Figure 12). Historically, there has been a commercial dredge fishery in the region as much of the area is accessible by boat only. The last cockle fishery undertaken in the NWIFCA portion of the Solway was prior to the formation of NWIFCA. Cockle beds on the Scottish side, were last open for a limited fishery in 2011, and have since been closed due to low stock levels and concerns over sustainability (Solway Firth Partnership, 2025).

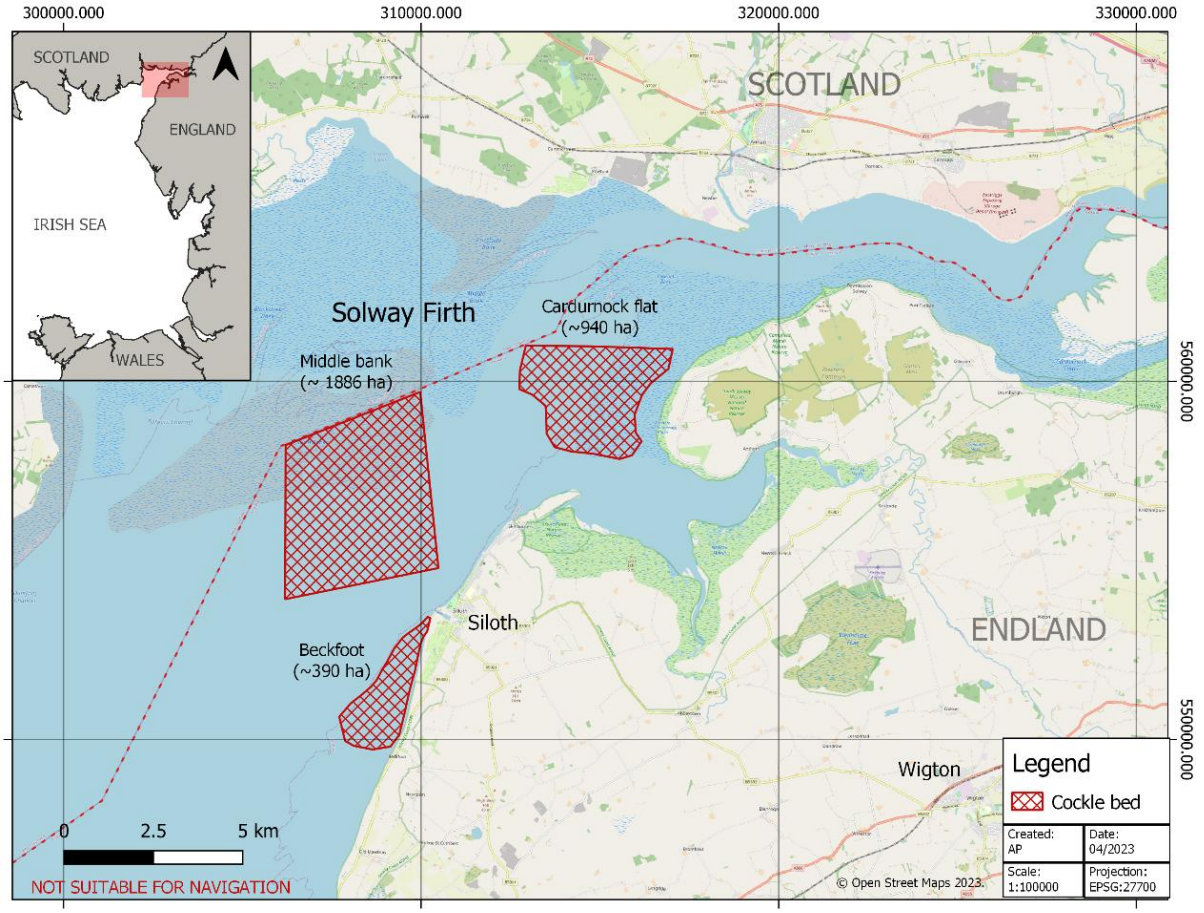


Figure 12: The location and extent of the cockle beds in the Solway. The area of the bed is given in hectares and is an approximation based on the maximum size the bed has been in the past 13 years.

No surveys have been undertaken in the region in at least the past 13 years, and, therefore, no fishery opened. Work is being undertaken in the Scottish portion of the Solway Firth to re-survey the cockle beds there and determine if they can support a cockle fishery. Further research is required in the NWIFCA district portion of the Solway Firth to ascertain whether a cockle fishery could be supported on the English side. Further information on proposals for this work is provided

in Section 10. The current byelaw does not facilitate the removal of cockle via boat-based fishing methods; this is covered under NWIFCA's Restriction on the Use of Dredge Byelaw 2017.

4.4.5 Dee Estuary

The Dee Estuary straddles the England-Wales border; there are nine distinct cockle beds in the Estuary that lie across both the Welsh and English side (Figure 13). In 2008, The Dee Estuary Cockle Fishery Order 2008 was established under the Sea Fisheries (Shellfish) Act 1967. Management under the Order is shared in terms of grantees: Natural Resources Wales (NRW) is the grantee for the Welsh part of the fishery; the Environment Agency (EA) is the grantee for the English side. The Order gives powers to regulate cockle fishing in the Estuary including granting licences, developing licence conditions, setting TACs, and closing and opening beds. NRW is currently the lead authority in day-to-day management of the entire fishery, including enforcement and management decisions, despite many the beds falling on the English side of the Estuary. However, the Order is set to expire on 30th June 2028, and in 2024, NWIFCA voted to pursue a new joint Regulating Order with NRW, to ensure consistent management across both sides of the estuary.

*Survey data and proposed management of this site will be incorporated into this plan in due course.

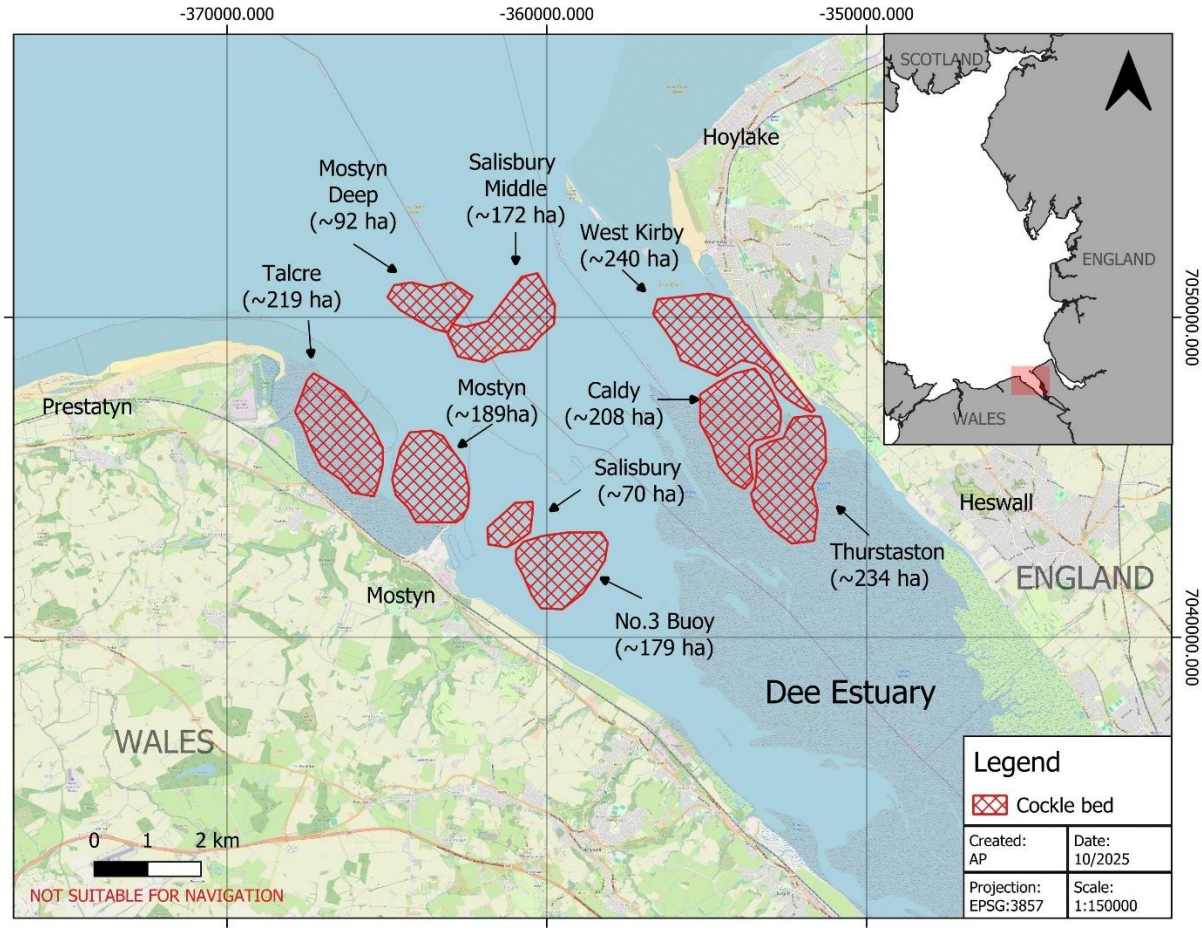


Figure 13: The location and extent of the cockle beds in the Dee Estuary. The area of the bed is given in hectares and is an approximation based on the 2025 survey sample points.

4.5 Annual Fisheries Landings

Fishers with a permit to fish cockles in the district are required to provide monthly catch returns to NWIFCA. On a national scale, landings from hand-gathered cockles go largely unreported from statistics, as the requirement to provide landings applies only to vessels.

NWIFCA have collected returns data from all authorised cockle fisheries from 2017 to 2025. Returns are recorded for each individual bed. Figures 14 to 16 show the sized cockle biomass removed from Morecambe Bay, the Ribble Estuary and Leasowe respectively, against the available biomass of sized cockle that year. Sized cockle biomass is used instead of total biomass, as sized cockle is what is available to fishers.

It is important to note that the landings data presented here is likely to be inaccurate. Evidence from the 2024/25 Leasowe cockle fishery highlighted significant discrepancies between the landings data provided by fishers and those provided in movement documents. Landings data is presented here as an estimate, and to highlight the need for further work to address these concerns.

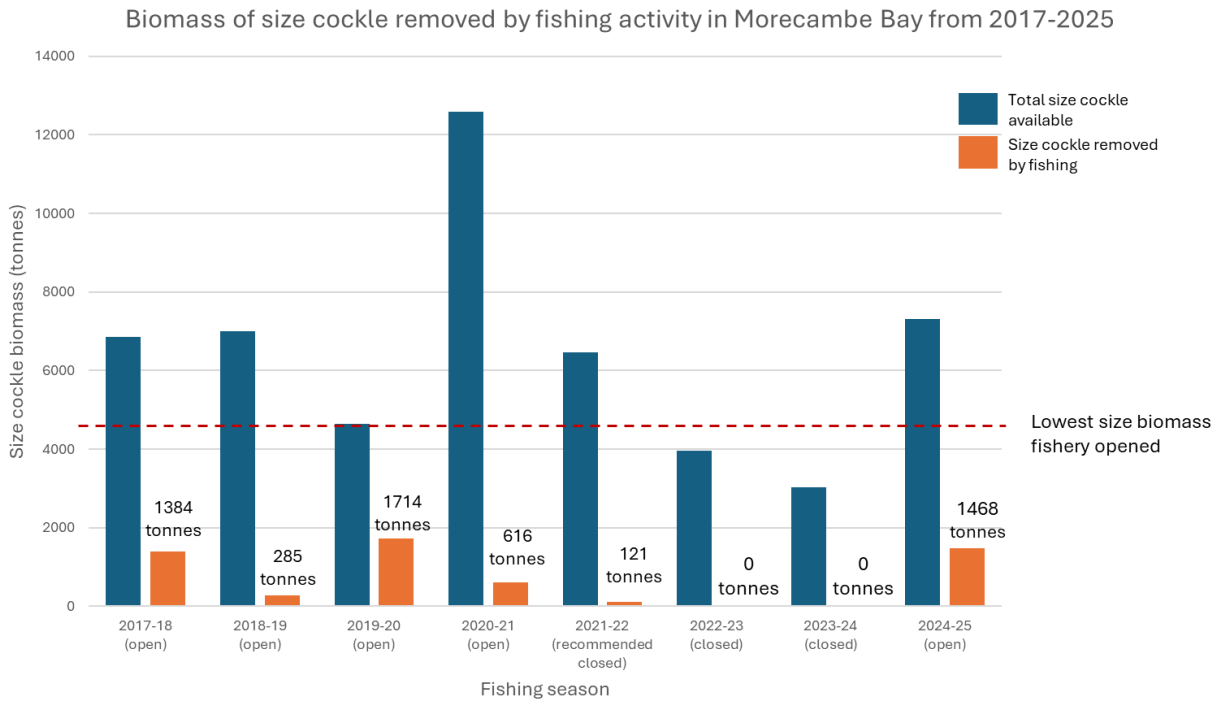


Figure 14; The annual biomass of sized cockle in Morecambe Bay (blue), and the estimated biomass of sized cockle removed via the fishery (orange).

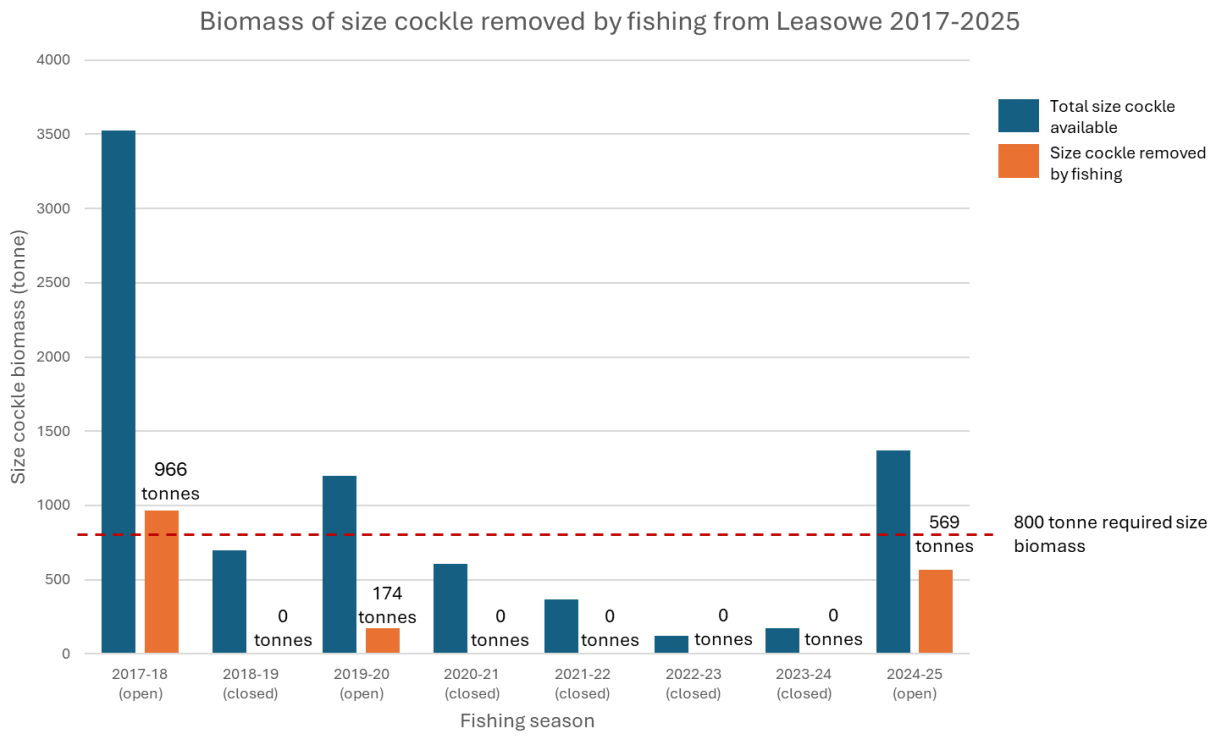


Figure 15: The annual biomass of sized cockle on Leasowe (blue), and the estimated biomass of sized cockle removed via the fishery (orange).

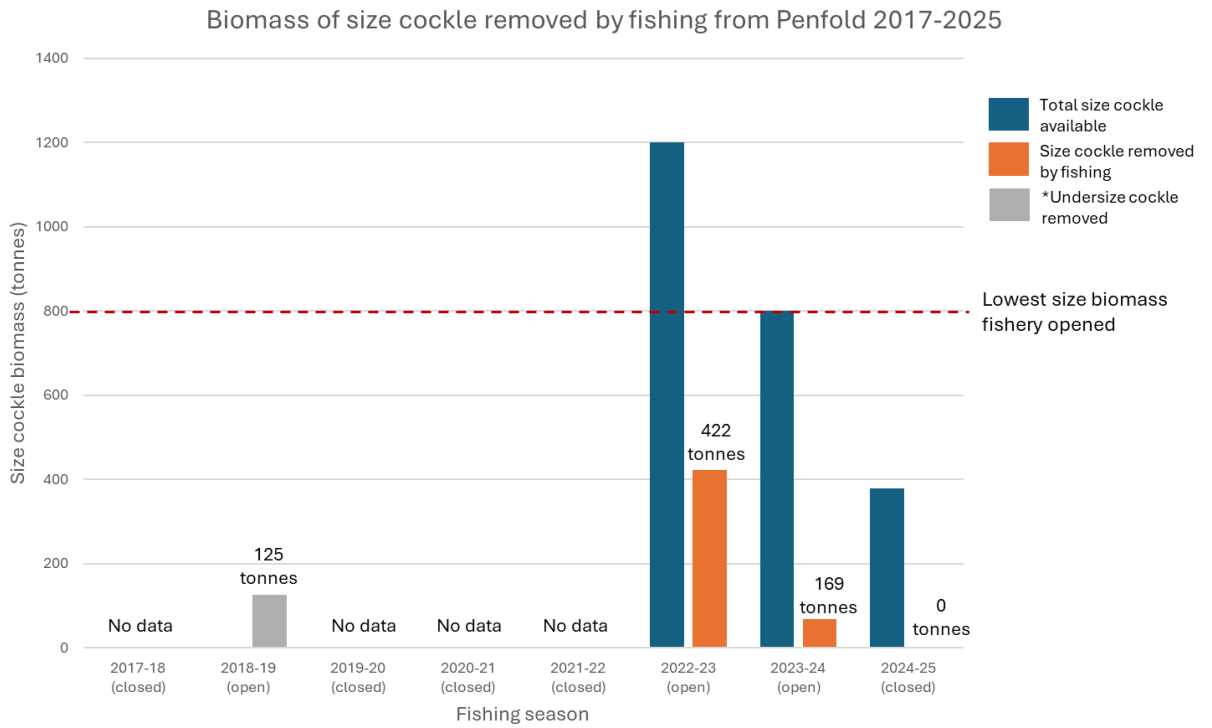


Figure 16: The annual biomass of sized cockle on Penfold (blue), and the estimated biomass of sized cockle removed via the fishery (orange).

Using the current information available on landings, fishing activity typically removes 5-40% of the total sized cockle biomass available across the sites. However, specific beds such as Flookburgh, Pilling and Leasowe typically have 4-45% of their total sized biomass removed, and in some years close to 100% of sized cockle biomass. This is caveated by the fact these percentages are based on July biomass estimates, and cockles will have continued to grow until late August.

The Pilling and Flookburgh cockle beds in Morecambe Bay have been the most consistently open since 2017, as they typically support significant biomass of cockle (see Figure 7 above for comparison). It is therefore worth noting the landings of cockle from the individual beds which constitute the site as a whole (Figures 17 and 18).

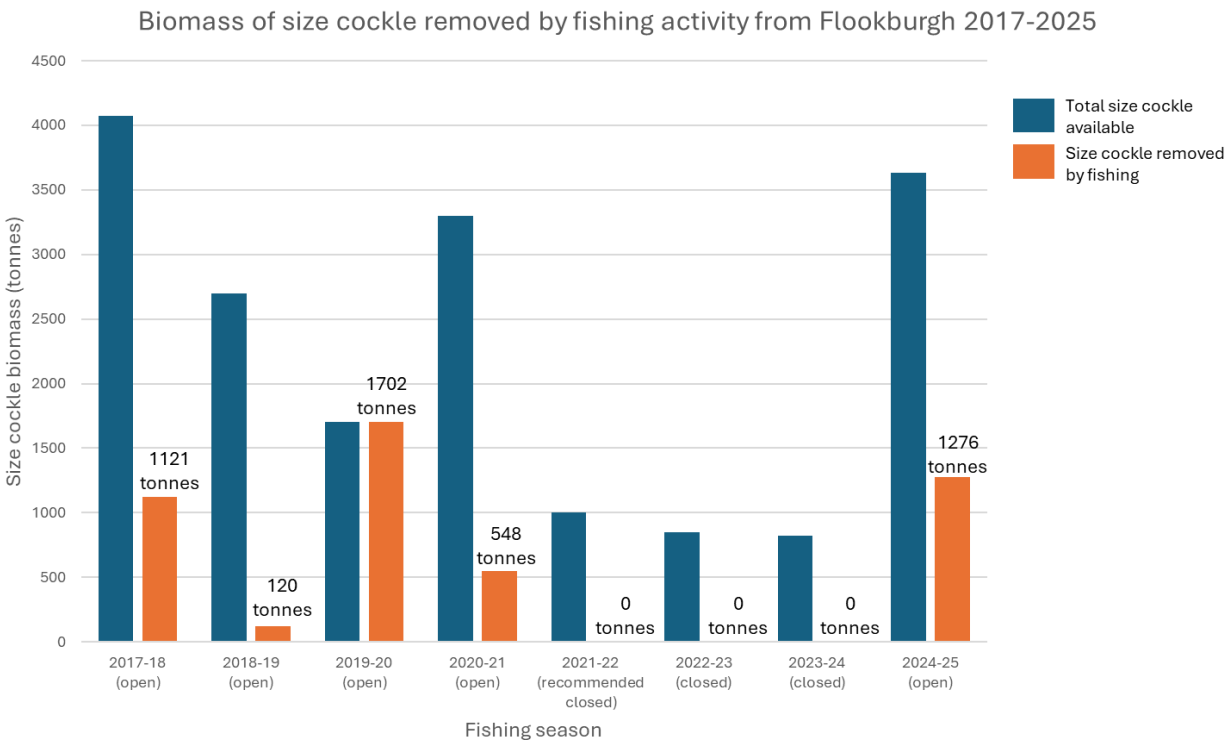


Figure 16: The annual biomass of sized cockle on Flookburgh cockle bed (blue), and the estimated biomass of sized cockle removed via the fishery (orange).

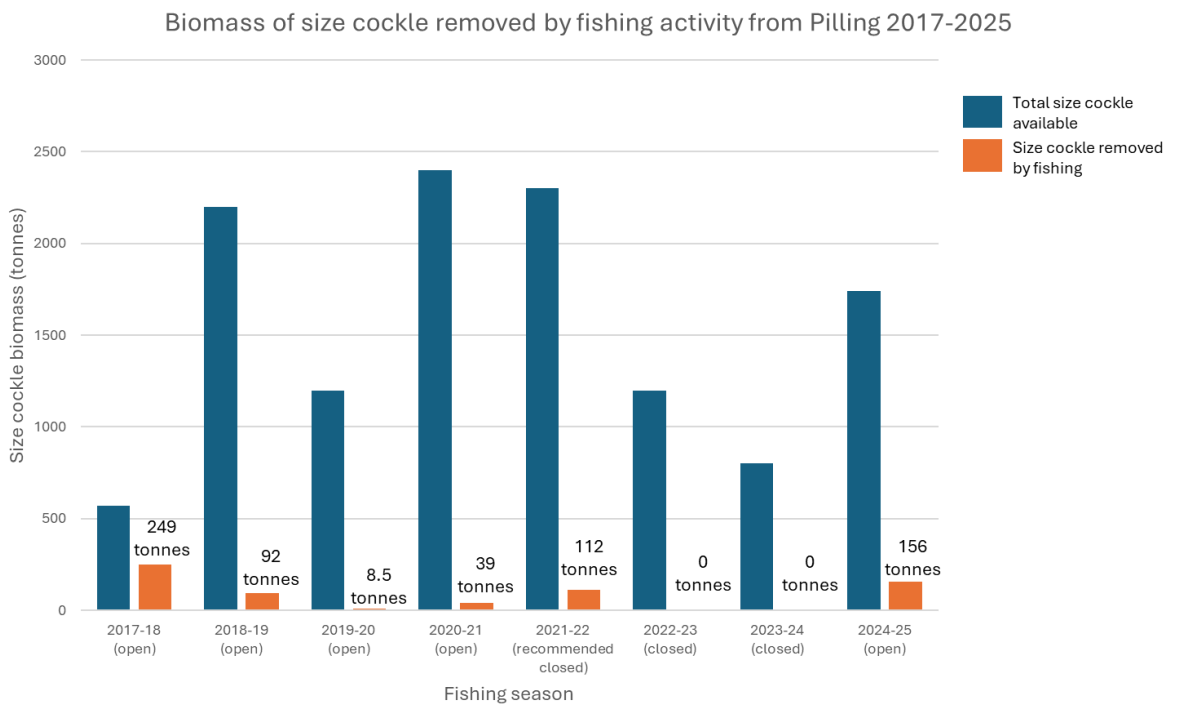


Figure 17: The annual biomass of sized cockle on Pilling cockle bed (blue), and the estimated biomass of sized cockle removed via the fishery (orange).

From the current data, the variation in landings between different years does not seem to be related to the biomass of cockle available. This may be due to two reasons:

1. The density of cockle affects the total quantity removed more than the total biomass available (*e.g.* fishers can more easily catch cockles that are densely spaced, than those that are spread across a wider area, even if in total there is more available)
2. NWIFCA fishers' landings data has a degree of inaccuracy.

Reviewing stock trends alongside the landings data of the same period shows:

- Quantities removed do not show a clear pattern with available sized biomass (*e.g.* a large biomass of sized cockle available does not always translate into a large volume being removed by fishers)
- Fishers typically remove 5-40% of the total sized cockle biomass available across the sites
- Flookburgh, Pilling and Leasowe cockle beds typically support a greater biomass of sized stock than any other cockle bed in the district
- Flookburgh, Pilling and Leasowe cockle beds typically have 4-45% of their total sized biomass removed. In 2019, landings indicate almost 100% of Flookburgh's estimate sized cockle biomass was removed. This is likely due to the biomass of cockle increasing over the two months between the survey calculations in July, and the fishery opening September 1st.

4.6 Daily Removal Rates and Trends

Fishing intensity is potentially dependent on the density and location of stock. Fishing patterns and how they influence fishing intensity requires further research and will be addressed in the research plan in Section 11.

Table 10 shows landings data from NWIFCA and demonstrates that permit holders typically fish 100-500kg of cockle each per day. On good years, when high biomass of dense cockles is present, individuals can fish upwards of 2t.

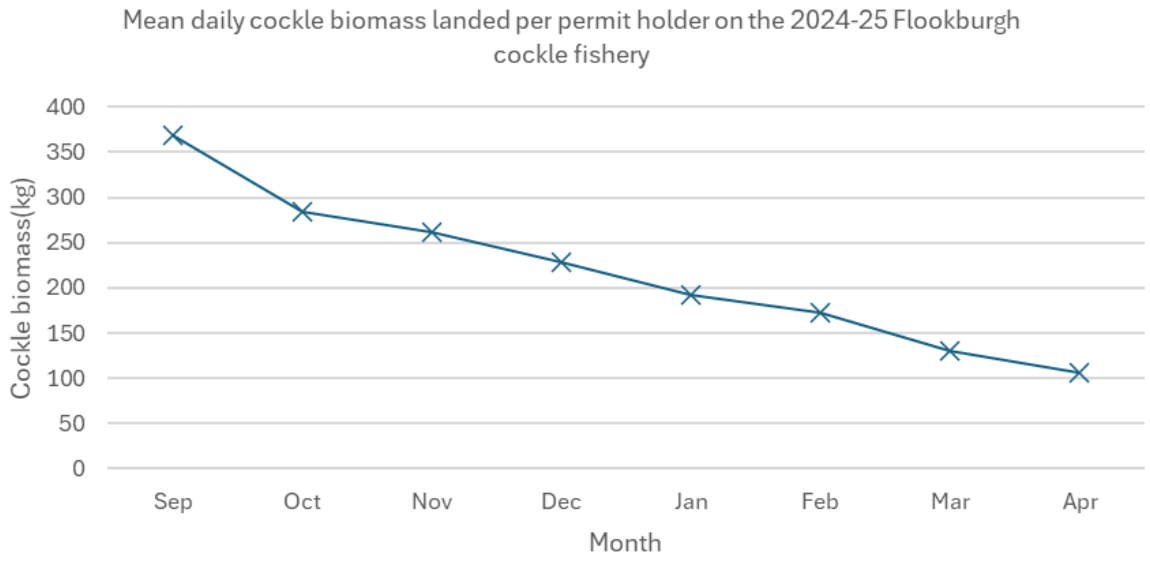
Table 10: Average and maximum daily removal weights of cockle from each of the open beds

Fishing season	Bed	Average removal of cockle per day per permit holder (kg)	Maximum daily removal by a single permit holder (kg)
2017/18	Morecambe Bay: Flookburgh	280	1,150
	Morecambe Bay Pilling	200	880
	Leasowe	535	2,490
2018/19	Morecambe Bay: Flookburgh	120	1,800
	Morecambe Bay Pilling	170	550
	Morecambe Bay Newbiggin	80	600
	Penfold	415	1,900
2019/20	Morecambe Bay: Flookburgh	350	2,235
	Morecambe Bay: Pilling	305	690
	Morecambe Bay: Newbiggin	170	615
	Leasowe	210	1,200
2020/21	Morecambe Bay: Flookburgh	160	1,050
	Morecambe Bay: Newbiggin	115	295
	Morecambe Bay: Leven	150	260
	Morecambe Bay: Pilling	185	400
2021/22	Morecambe Bay: Pilling	112	550
2022/23	Penfold	245	1,800
2023/24	Penfold	95	1,000

2024/25	Morecambe Bay: Flookburgh	305	3,347
	Morecambe Bay: Pilling	355	1,040
	Morecambe Bay: Leven	402	570
	Leasowe	410	1,595

The highest cockle landings typically occur during the first two months of an open fishery. After this period, both the number of participating permit holders and the average daily landings tend to decline (Figure 18).

Figure 18: The mean daily biomass of cockle removed per permit holder on the 2024-25 Flookburgh cockle fishery.



Section 4: Outstanding knowledge gaps / areas for action

1. Determine what stocks are available in the Solway Firth
2. Investigate what factors influence the variation in fishery landings, including daily removal rates, and total amount removed (e.g. density, total biomass, market conditions, etc.)
3. Determine how we can improve the accuracy of NWIFCA's cockle returns data?

Answering these questions would allow us to:

a. Determine whether there is a viable cockle fishery in the Solway
b. Better predict how much stock may be removed under certain conditions
c. Improve the accuracy of returns
d. Develop an adaptive TAC

5. Current Management

This section provides an overview of the current management in place, the annual timeline for fisheries management, and NWIFCA's decision-making framework.

5.1 National Legislation

The management of the common cockle fisheries is not subject to any national legislation and is therefore exclusively undertaken by NWIFCA within its district. The Food Standards Agency (FSA) are responsible for the classification of cockle harvesting areas under their legislation.

5.2 Byelaw 3 – Permit to Fish for Cockle and Mussel

The fisheries are managed under the legislative framework of NWIFCA's Byelaw 3 – Permit to Fish for Cockles and Mussels (https://www.nw-ifca.gov.uk/app/uploads/NWIFCA-Byelaw-3-Permit-to-Fish-for-Cockles-and-Mussels.pdf). Table 11 details the current management measures applied to the district's fisheries under Byelaw 3.

Table 11: Key Byelaw 3 management measures

Measure	Description	Purpose
Permit required	All fishers required to have a permit	Monitoring
Limited permit numbers	Max 150 permits issued per year	Effort limitation
Gear type	Hand, rake, spade, craams, tamps or jumbos only	Selectivity
Closed season	All cockle beds closed May to August	Protection of juveniles
MCRS	Cockle must pass through a gauge that has a square opening of 20mm across each side	Protection of juveniles
Flexible permit conditions	Conditions which can vary dependent on information submitted by permit holders, NWIFCA scientific surveys, advice from Cefas, NE or other such bodies. • Dates, times or tides when fishing is permitted; • Specified areas where fishing is permitted/bed closure(s); • Specified closure period(s); • Total catch limits within a specified area(s); • Specified equipment or fishing methods allowed; • Specified minimum landing size; and	Effort limitation Protection of designated species Sustainability

	• Specified access routes.	

5.3 History of the District's Cockle Fishery Management

Table 12 provides a timeline of the management of fishing in the NWIFCA district over the past two decades until present.

Table 12: History of the North West cockle fisheries management

Year	Detail
Pre-2003	No limitations on the fishery.
2003	A permit scheme is introduced by the North West and North Wales Sea Fisheries Committee (NWNWSFC). There was no cap on permit numbers or limitations placed on the fishery. Over 1,000 permits were issued.
2007	NWNWSFC introduce Byelaw 5. A permit was still required but was limited to those who had previously held a permit. There was no cap on permit numbers.
2011	IFCAs created and replace Sea Fisheries Committees.
2012	NWIFCA introduce Byelaw 3. Permits were still required and no cap was stipulated. However, only 10 additional permits were allowed per year. A permit fee was introduced.
2022	Byelaw 3 updated again, this time introducing flexible permit conditions which allows for adaptive management and the application of management measures such as access, closure periods, tide times, locations *etc*. During the intervening period, permit holder numbers had significantly dropped due to limited cockle stocks. A total cap of 150 permit holders was introduced.

The current management stipulates that all those intending to fish for cockles in the NWIFCA district must have a permit under Byelaw 3. It is no longer possible to fish for cockles for recreational purposes on any of the commercial beds in the district.

When the 150 cap on permit holders was introduced in 2022, the number of Byelaw 3 permit holders was 126. However, today the maximum number of permit holders has been reached, and there is a long waiting list for permits. There is no restriction on who can request a permit, or requirements for being given one. There is currently limited ability within the Byelaw to facilitate changing the process by which permits are issued.

5.4 NWIFCA Decision-Making Process

Each year officers undertake stock assessment surveys between June and July for all cockle beds in the district. Officers review the results, and with consideration to the criteria set out in the HRA, develop recommendations for the fishery to bring to the TSB for members' and stakeholders' consideration.

The TSB is made up of councillors from NWIFCA's funding local authorities, statutory representatives from the MMO, NE, EA, and stakeholders with practice-based knowledge appointed by the MMO that represent different interested parties, such as commercial and recreational fishers or the marine environment. TSB is a sub-committee of NWIFCA's full member committee and has delegated responsibility via NWIFCA's Constitution for reviewing the evidence and recommendations made by officers and voting on the proposed management of the district's fisheries, including its cockle fishery. TSB can vote against officer recommendations and propose alternatives. Stakeholders including members of the industry can also attend the public quarterly meeting and comment on the proposals.

Once the management measures have been agreed by the TSB, officers prepare flexible permit conditions and preparations for the opened fisheries begin.

All cockle beds within district fall within a European Marine Site (EMS) (*i.e.* a Special Area of Conservation [SAC] or a Special Protection Area [SPA]) and are classed as a supporting feature of the designated bird species (see Section 7). Therefore, any proposed fishery requires an HRA before it can be opened. Running in conjunction with the process outlined above, NWIFCA officers complete an HRA for the fishery and submit it to NE. The purpose of the HRA is for NWIFCA to demonstrate that, with the proposed management measures, we are confident that the fishery will not impact the protected features of the site.

Figure 19 provides an overview of the process of decision-making in relation to the NWIFCA cockle fisheries.

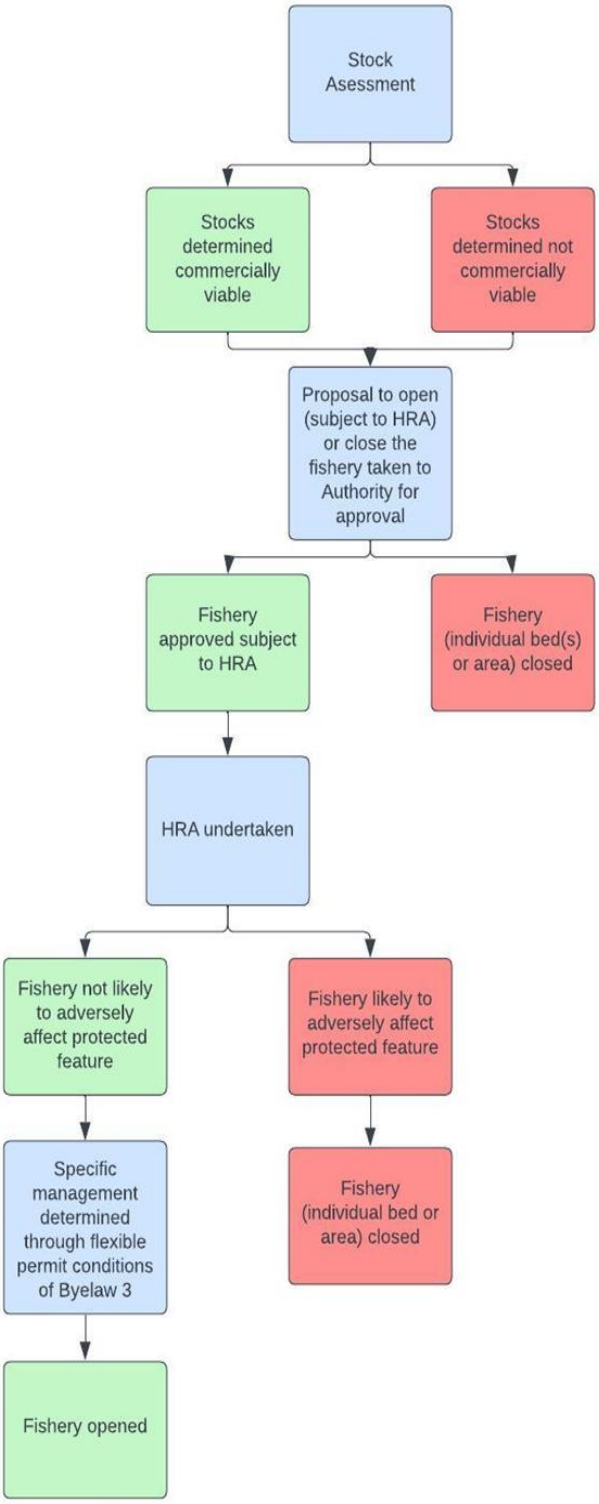


Figure 19: Overview of the decision-making process in relation to the NWIFCA cockle fisheries

Fisheries can be proposed open later in the year subject to survey timing, or other constraints.

5.5 Limitations of the Current Process

The current decision-making process has several limitations that reduce NWIFCA's flexibility and increase the risk of decisions being made with insufficient information.

1. Time constraints

The process is constrained by tight timelines. Surveys must be conducted as late as practicable to allow cockles the maximum time to grow and give a more accurate assessment of biomass as close to any prospective opening date as possible. However, as laid out in NWIFCA's Constitution, officers are required to submit reports at least ten days before any NWIFCA meeting to give members sufficient time to review recommendations. Additionally, NE has a statutory 28-day period to respond to an HRA. The fisheries are typically opened on 1st September, as set out in Byelaw 3.

2. Only formally considers stock assessment evidence base

The current process takes into consideration the scientific evidence base, but there is no agreed framework for the inclusion of social or economic parameters. Considerations of the scientific evidence base are informal and unstructured.

3. No formally agreed parameters for decision-making

As of 2025, no formal parameters have been established in agreement with NWIFCA members and officers to guide decisions on opening a fishery or implementing associated management measures.

Currently, officers rely on internal guidelines informed by historical knowledge and data from 2017 to 2025. Prior to 2025, NWIFCA only had minimum stock requirements for opening or closing the Leasowe cockle fishery. This fishery is subject to a minimum stock biomass of 800t, and a TAC is applied to any surplus sized stock above 800t. No other beds have been subject to TACs (apart from Penfold in 2023), nor have minimum stock biomass limits been determined. Establishing agreed-upon parameters, such as minimum stock biomass, composition, density, and a clear framework for determining appropriate management actions, would help streamline TSB's decision-making and enhance transparency for stakeholders. These issues are addressed in Section 2.

5.6 Other UK Cockle FMPs

A review of other national UK cockle FMPs was undertaken to inform the development of this FMP.

Other major UK cockle fisheries include:

- The Thames Estuary fishery managed by Kent and Essex IFCA under a Regulatory Order.
- The Wash fishery managed by Eastern IFCA under a Regulatory Order.

- The Dee Estuary fishery managed by NRW under a Regulatory Order.
- The Three Rivers and Burry Inlet (South Wales) cockle fisheries in Wales managed by the Welsh Government under a national statutory instrument.
- The Solent mixed shellfishery (Manila clam and cockle) managed by Southern IFCA under the Poole Harbour Dredge Permit Byelaw

The management measures applied by each fisheries authority in their plans are detailed in Table 13.

Table 13: Management measures in different UK cockle fisheries

Management measure	**Fishery**					
	Thames	**The Wash**	**Dee**	**South Wales**	**Solent**	**NWIFCA**
MCRS	✓	✓	✓	x	✓	✓
Gear specification	✓	✓	✓	✓	✓	✓
TAC	✓	✓	✓	✓	x	x
Daily catch limit (per-person quota)	✓	x	✓	✓	x	x
Closed season	✓	✓	✓	✓	✓	✓
Spatial restrictions	✓	✓	✓	✓	✓	✓
Limitations on days and tides	✓	✓	✓	✓	✓	✓
Limited permit numbers	✓	✓	✓	x	✓	✓

The main outstanding measure between NWIFCA and other management authorities is the application of a TAC for its fishery. For many of the fisheries detailed here, TACs are derived from bird food requirements calculated using the bird food model where a minimum stock biomass is stipulated as needing to be reserved for protected species. In the absence of this value, it has been difficult for NWIFCA to apply a formal TAC. To date, recommendations are based on biomass trends and historical recommendation rationale.

Section 5: Outstanding knowledge gaps / areas for action

1. Investigate if a TAC should be applied to the NWIFCA cockle fisheries and what it should be
2. Explore how socio-economic factors could be incorporated into the decision-making process
3. Propose and agree decision-making parameters with stakeholders and the Authority to improve transparency and streamlining of decision-making.

Answering these questions would allow us to:

a. Apply an appropriate TAC to the fishery to better ensure sustainability
b. Better incorporate the perspectives of stakeholders and fulfil the IFCA mission statement
c. Improve transparency to stakeholders
d. Stream-line decision-making and improve agreement with recommendations.

6. Cockle Biology

This section details the biology of the common cockle, the natural factors which influence its abundance, and the implications of its biology for fisheries management.

Information in this section is predominantly informed by a review study undertaken by Bangor University researchers Malham *et al.*, 2012.

Table 14: Summary of key life history traits of the common cockle

Species	Common cockle
Taxonomy	Bivalve mollusc
Maximum size	38mm
Life Span	Five to eight years. However, dense beds generally persist for only one to five years (Dare *et al*. 2004) and only one to four years in Morecambe Bay (pers. comms NWIFCA)
Habitat	Top 5-10cm of surface sediments. Found on clean sand, muddy sand, mud or muddy gravel, from the middle to lower intertidal and sometimes subtidal. Often abundant in estuaries and sheltered bays
Environmental position	Infaunal (beneath the seabed)
Food source	Phytoplankton, zooplankton and organic particulate matter
Size at reproductive maturity	15-20mm shell height (Seed and Brown, 1977)
Age at reproductive maturity	18 months (Seed and Brown, 1977)
Method of spawning	Broadcast
Fecundity	Up to 1.7 million eggs for a large female (Honkoop & van der Meer, 1998)
Larval phase	30 days (Dare *et al*. 2004)
Age at entry into the fishery	Approximately two years
Spawning season	May to July
Growth rate	Variable (see Section 6.3)
Supporting species (*i.e.* predators of cockle)	Variety of bird and marine species. In Morecambe Bay these are namely: • oystercatcher *(Haematopus ostralegus*) • knot (*Calidris canutus*) • scaup (*Aythya marila*)

	• common scoter (*Melanitta nigra*)

6.1 Habitat

Common cockle is a bivalve mollusc typically found in intertidal flats and shallow subtidal areas of estuaries, coastal lagoons and sheltered bays of the UK (Kater, Geurts van Kessel, & Baars, 2006). They inhabit the top 5-10cm of the seabed, preferring predominantly sandy and mud sediments. The main cockle beds in the NWIFCA district are detailed in Section 4.

6.2 Breeding and Spawning

Cockles are gonochoric, meaning an individual is either male or female. They spawn by releasing eggs and sperm into the water column through a process called broadcast spawning. The eggs are then fertilised externally while in the water column. Temperature change is the cue for the males and females to synchronise the release of their gametes (Honkoop & Van der Meer, 1998). Spawning generally occurs between March and August in the UK (www.marlin.ac.uk) when water temperatures reach 13-14°C.

In preparation for spawning, the sexually mature cockles direct their energy into body growth in spring and early summer. This corresponds with a higher 'meat content' desirable for the fishing industry. Following the spawning period, cockles are said to be in a 'spent' condition, which refers to the loss of body mass due to spawning. They last in this condition from around August until the next spring growing season (Seed & Brown, 1977).

Once fertilised, eggs develop into larvae and become part of the zooplankton, their dispersal dictated by tide and wind currents. This free-living planktonic phase lasts approximately 30 days before metamorphosis and settlement onto the seabed as post-larvae (around 280 µm) (Dare, Walker, & Bannister, 2004)

Peak spatfall in the UK occurs May to September (www.marlin.ac.uk). Once cockles have settled post-larval phase, they remain briefly in their habitat before initiating a second dispersal. At 0.5-3.5mm in size, they re-suspend themselves in the water column and secrete long, fine byssal threads to help them drift to a new location (Armonies, 1992). Cockle spat disperse gradually up shore within an estuary over short distances and time scales. In the Wadden Sea, they are known to move mainly in June and July, some as late as September, and show migratory rhythms, moving mainly at night and during spring tides (Armonies, 1992).

There is currently limited information on the optimum density of cockle for spawning success.

6.3 Growth and Sexual Maturity

Cockles are suspension feeding bivalve molluscs, meaning they consume small particulate matter from the water column. The particulate matter can be living (plankton) or non-living (plant debris). They grow rapidly in their first two years, after which growth rates decline (Seed & Brown, 1977). Growth rates also vary with the season, geographical location, tidal height, temperatures, food availability, population density and interspecific competitions (see Table 15).

Table 15: Natural factors affecting stock abundance, recruitment and growth

Life Stage	Natural Factor	Evidence
Spawning and Recruitment	Temperature	In the Wadden Sea, winter sea temperature has been shown to affect fecundity. Individual cockles produce more but smaller eggs after warm winters (Honkoop & Van der Meer, 1998). In The Wash an examination of historical data suggests that above average winter temperatures resulted in increased spatfall, possibly due to increased reproductive output. However, spatfall is also enhanced after exceptionally cold winters that have killed most of the adult cockles, likely due to reduced predation and competition for space and food between spat and adult cockles (Dare, Walker, & Bannister, 2004).
	Season	Greater cockle recruitment can be related to the time in the year when spawning takes place. When temperatures reach 14°C in May, early recruitment is stimulated, and recruit density is high (500–1000 ind/m^2). The resulting cohort has longer to feed and settle, leading to a relatively long lifespan (>1 year) with high associated secondary production. Conversely, when temperatures reach 14°C later in the year (June), recruit density can be lower (0–500 ind/m^2), and the cohort has a shorter lifespan (<4 months) with a consequent low secondary production (Magalhaes, Freitas, & de Montaudouin, 2016).
	Adult cockle biomass	Adult spawner biomass was not positively correlated with recruitment, and the spawner biomass at the time of recruitment did not negatively affect recruitment. Natural factors driving cockle recruitment success are highly site-dependent, temperatures at the site being only one component.
Larval dispersal and settlement	Wind and hydrodynamics	Larval dispersal is influenced by wind and the flushing rate of a system. For example, onshore winds in June are likely to improve retention of cockle larvae within a bay or estuary (Young, Bigg, Grant, Walker, & Brown, 1998). However, it is also possible for some beds to be seeded from areas several kilometres away. On the East coast of the UK, it has been suggested that cockle larvae from the Humber Estuary may reach The Wash, a distance of 40km (Dare, Walker, & Bannister, 2004). The extent to which the Morecambe Bay, Ribble and Leasowe cockle stocks are self-recruiting, or dependent upon external sources of larvae, is unknown. This is an important knowledge gap as differences in larval transport between years could produce as much as a 40-

		fold difference in the number of successful larvae settlements (Young, Bigg, Grant, Walker, & Brown, 1998).
	Tidal Height and food availability.	Tidal elevation governs the amount of time a cockle is submersed. The longer the cockles are submerged, the greater the feeding time and, therefore, quicker the growth. Additionally, food availability will be impacted by time of year, daylight and temperature, which will affect phytoplankton / algae production (the main food source for cockle).
	Population density	Adult cockle feed on cockle larvae which can impact the success rate of settlement and survival.
Survival and growth	Sediment dynamics	Storms can destroy entire cockle beds, sweeping them into channels, or piling them into runnels and ridges where they become smothered. Cockles have limited ability to actively move post their larval dispersal phases. Their passive movement is dictated by the dynamics of the sediment layer where they inhabit. Morecambe Bay is highly dynamic and changes in the position of sandbanks and subtidal channels regularly (Mason, Scott, & Dance, 2010) can occur over relatively short periods. There is some research on sediment dynamics in Morecambe Bay (including sediment transport modelling by (Aldridge, 1997) and remote sensing by (Mason *et al*., 2010), though, there is seemingly little research on the relationship between cockles and sediment dynamics.
	Rainfall (salinity)	Cockles can survive between 10 and 35psu (salinity) (Ysebaert & Herman, 2002). However, heavy rainfall and subsequent river discharge can reduce the ambient salinity of intertidal areas to as low as 5psu. Once a certain threshold is reached, there is a sharp decline in cockle survival. High mortality of cockles occurred in northern Spain after a winter with more than double the long-term average of rainfall and there was no fishery the following year (Parada & Molares, 2008). Larger spat and adult cockle have been observed to survive heavy rainfall by digging themselves into the sediment, whereas smaller spat (<2 mm) were more likely to die (Kristensen, et al., 2012). Runoff from land during periods of high rainfall can introduce terrestrial pollutants into estuarine and intertidal environments which can not only affect the health of the cockles but also negatively impact the shellfish hygiene classification of a cockle bed.

	Predation mortality	Cockles are predated on by a variety of species, including birds, crustaceans, and fish (Norris, 1999). In some instances, mass mortality events have occurred due to predation events (Bury Inlet 1960, Morlaix France 1993)
	Disease	In the Burry Inlet and Wash cockle fisheries, occurrences of parasitised (*Marteilia*) and viral infected cockle caused significantly greater cockle mortality. In addition, they were shown to infect each other with transmissible cancer. This has led to a high prevalence of early mortality in these cockle stocks, and difficulties in reaching size.
	Pollution	Exposure to pollutants such as those found in fuels, polycyclic aromatic hydrocarbons, polychlorinated biphenyls and hormone compounds found in the environment can delay maturation, reduce fecundity and prevent successful growth and recruitment (Malham, Hutchinson, & Longshaw, 2012).
	Temperature and weather	Cockle growth is strongly influenced by season and temperature. Often temperature influences food availability in the form of plankton.
	Density	Competition from other cockles for resources can reduce growth rates.

Yearly growth demonstrates seasonal patterns, with most of the active growth happening each year between May and August. Increased temperature and phytoplankton availability in the summer months provides greater feeding opportunities and therefore facilitate faster growth, in comparison to the winter, where growth can be negligible. These seasonal changes in growth result in external growth rings on the cockle shells which can be used to age cockles. Reduced food and severe weather mean mortality is highest in the winter and spring.

Cockles in the UK reach sexual maturity in their second year, spawning in the second summer at approximately 18 months old and at 15-20mm in length.

6.4 Food Web and Interspecies Interactions

Cockles play a vital ecological role as a food source for a wide range of predators, including birds, crustaceans, and fish (Norris, 1999).

Predation on cockles varies by predator species, season, and shore height. In the summer, smaller cockles (<15 mm in length) are preyed upon by shore crab (*Carcinus maenas*) (Sanchez-Salazar, Griffiths, & Seed, 1987). On the upper shore during winter months, oystercatcher targets larger cockles (>15 mm) when they are abundant but will shift to consuming smaller individuals (<15 mm) when larger ones are scarce (O'Connor & Brown, 1977). Although larger, older cockles can be more difficult to open, they offer the greatest energetic return, and are therefore, preferred

(Norris, 1999). This predation pattern can result in lower shore areas containing a mix of spat and larger individuals, while upper shore areas may be dominated by fewer, smaller cockles.

Cockles are also consumed by shrimp and flatfish. Brown shrimp (*Crangon crangon*) feed on very small cockles, typically under 2mm. Juvenile cockles, particularly those 5–10mm in length, are a key food source for flatfish such as flounder (*Platichthys flesus*) and plaice (*Pleuronectes platessa*) (Malham, Hutchinson, & Longshaw, 2012).

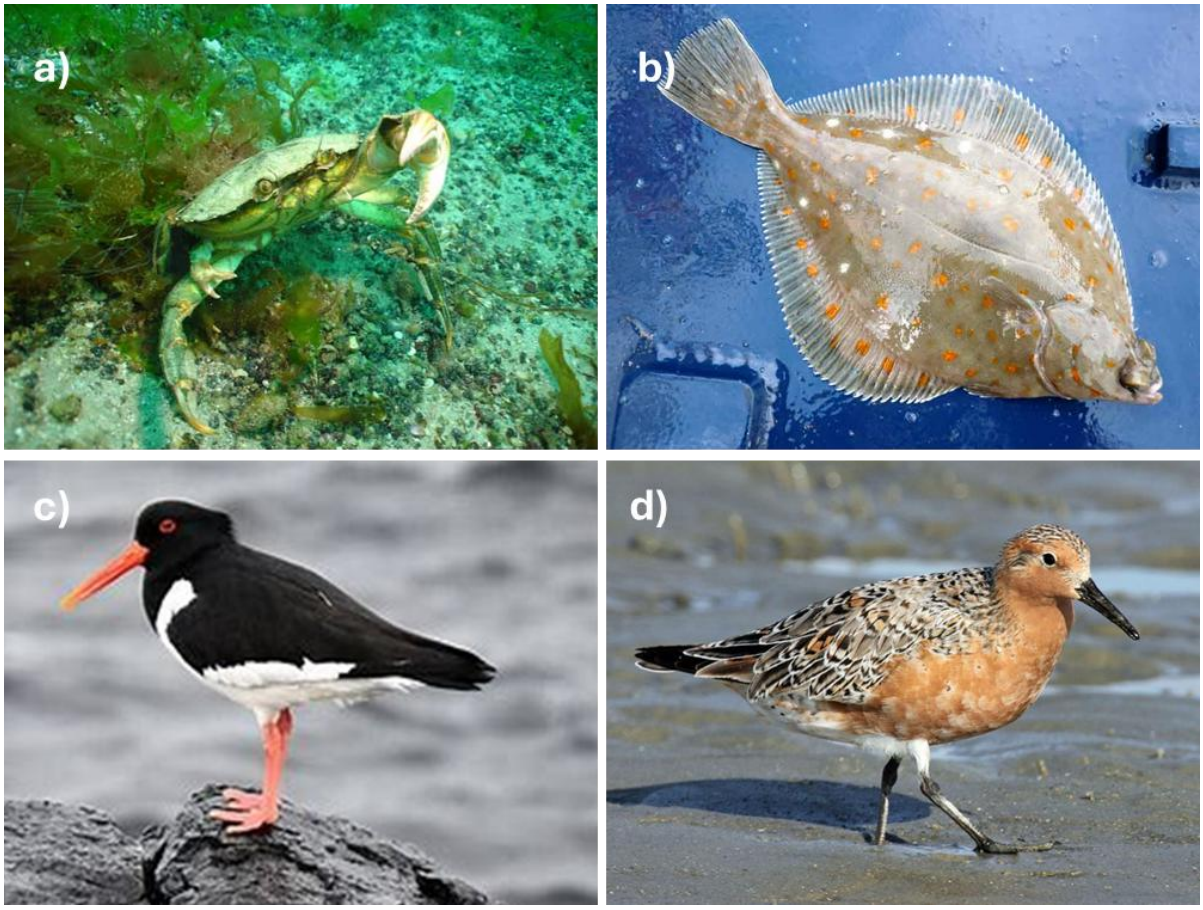


Figure 20: Predators of the common cockle; a) green shore crab, b) plaice, c) oystercatcher, and d) knot.

In addition to external predators, adult cockles engage in larviphagy – the consumption of cockle larvae. This behaviour can reduce larval settlement by up to 40%, limiting recruitment within cockle beds (Andre & Rosenberg, 1991).

Birds are among the most significant predators of cockles, with oystercatcher and knot being the main two. However, other avian predators include sanderling (*Calidris alba*), grey plover (*Pluvialis squatarola*), redshank (*Tringa totanus*), common eider (*Somateria mollissima*), common gull (*Larus canus*), and long-tailed duck (*Clangula hyemalis*) (Malham, Hutchinson, & Longshaw, 2012). An individual bird can consume up to 300 cockles per day.

6.5 Natural Factors Affecting Stock Abundance, Recruitment and Growth

The abundance of an exploited cockle population depends on the balance between inputs (reproduction / recruitment and growth) and outputs (mortality and fishery removals). Most studies indicate that the factors driving successful cockle recruitment, growth and survival are highly site-dependent and influenced by a variety of factors.

6.6 Implications for Fisheries Management

There are a significant number of natural and anthropogenic factors influencing the abundance and successful reproduction of cockle stocks in the district. Many of these are outside the scope of influence of NWIFCA and this FMP. However, the information serves to highlight several important factors:

- There is still limited research into the life-history and specific environmental factors which influence cockle stocks in the North West. Much of the research to date is on cockle stocks outside of the district, making it difficult to determine the cause of regionally observed stock fluctuations. Knowing this information would better assist NWIFCA in predicting potential stock levels and adapting management in response.
- There is very little research on the impact of hand-gathered cockle fishing activities on the recruitment and sustainability of cockle fisheries. For example, how such activities impact cockle settlement, survival, infaunal diversity, and productivity. Research predominantly focusses on the impact of mechanical removal.
- Natural factors, such as temperature, season, and local conditions, appear to affect cockle biomass and recruitment success more significantly than the biomass of adult cockle available. This seems to be corroborated by data from NWIFCA stock assessments, where years with significant biomass of sized cockle (2017 Leasowe, 2018 and 2020 Morecambe Bay), did not translate into successful stock replenishment of the following year's juvenile stock. This information is key to setting suitable TACs or determining when and how to apply effort limitation measures.

Table 16 details the principles of sustainable fisheries management (FAO 1995) and the knowledge gaps preventing NWIFCA from effective management.

Table 16: A summary of key outstanding knowledge gaps impacting fisheries management in the North West.

Principle	Possible Management	Outstanding Questions	Implications
1. Protect sufficient adult stock to repopulate the fishery	Apply a TAC	How much adult stock should be protected at each site to effectively replenish the fishery?	Difficult to determine a suitable TAC
		Do cockles re-seed from within the site, or are there	Spawning densities are important for maintaining good

		external populations that support replenishment?	recruitment into the following years cohort. Difficult to determine a suitable TAC without knowing the minimum adult biomass required.
2. Remove a safe proportion of the additional recruits each year to maintain safe biological limits	Apply a TAC Open select beds Apply daily quota	Why do cockle populations in the district fluctuate so significantly over the course of several years?	Difficult to determine suitable effort limitation measures as the cause is not known.
		Do different beds require different management considerations? Are some more critical than others for replenishment? Why?	Difficult to determine management measures (*e.g.* which beds to prioritise for opening)
		Is current fishing activity impacting stock recruitment or sustainability of the fishery?	Difficult to determine suitable effort limitation measures
3. Retain a minimum stock level to support wider ecosystem functions	Apply a minimum biomass threshold for opening a fishery	What shellfish biomass is required by the protected bird species that rely on them?	Difficult to determine a minimum threshold level
		How much of this resource is apportioned to sized or undersized stock of cockle? Or do birds rely on another species?	Difficult to determine a suitable TAC
4. Adapt management to new and emerging pressures	Alter any of the above	How are other environmental factors affecting yearly stock recruitment success (*e.g.* weather, sea temperature, climate change)? How significantly do these play a role?	Difficult to build a framework of adaptive management that isn't just reactive.

This information is key to determining successful management measures. The approach to addressing these knowledge gaps is detailed in Section 11 and incorporated into the overarching short-term objectives of this FMP.

Section 6: Outstanding knowledge gaps / areas for action

1. Undertake research into the life-history and recruitment dynamics of cockles in the North west
2. Undertake research into the impact of hand-gathered cockle fishing activites on cockle stocks in the North west

Answering these questions would allow us to:

a. Better understand the specific factors influencing the cyclical nature of cockle stock abundances
b. Better determine an appropriate TAC and management measures
c. Better understand the impact of hand-gathered fishing activities and adjust management accordingly

7. MPAs and Fisheries Interactions

This section provides information on the protected area considerations that NWIFCA must make when managing the cockle fishery within its district.

7.1 MPAs

All NWIFCA cockle beds fall within a designated MPA (Figures 21 and 22). As such, any cockle fishery must undergo an HRA prior to approval to ensure the activities do not adversely affect the integrity of the protected features.

It is, therefore, relevant that fisheries management decisions be undertaken from both the context of ensuring sustainable stocks and protecting the designated features of the protected areas they take place within.

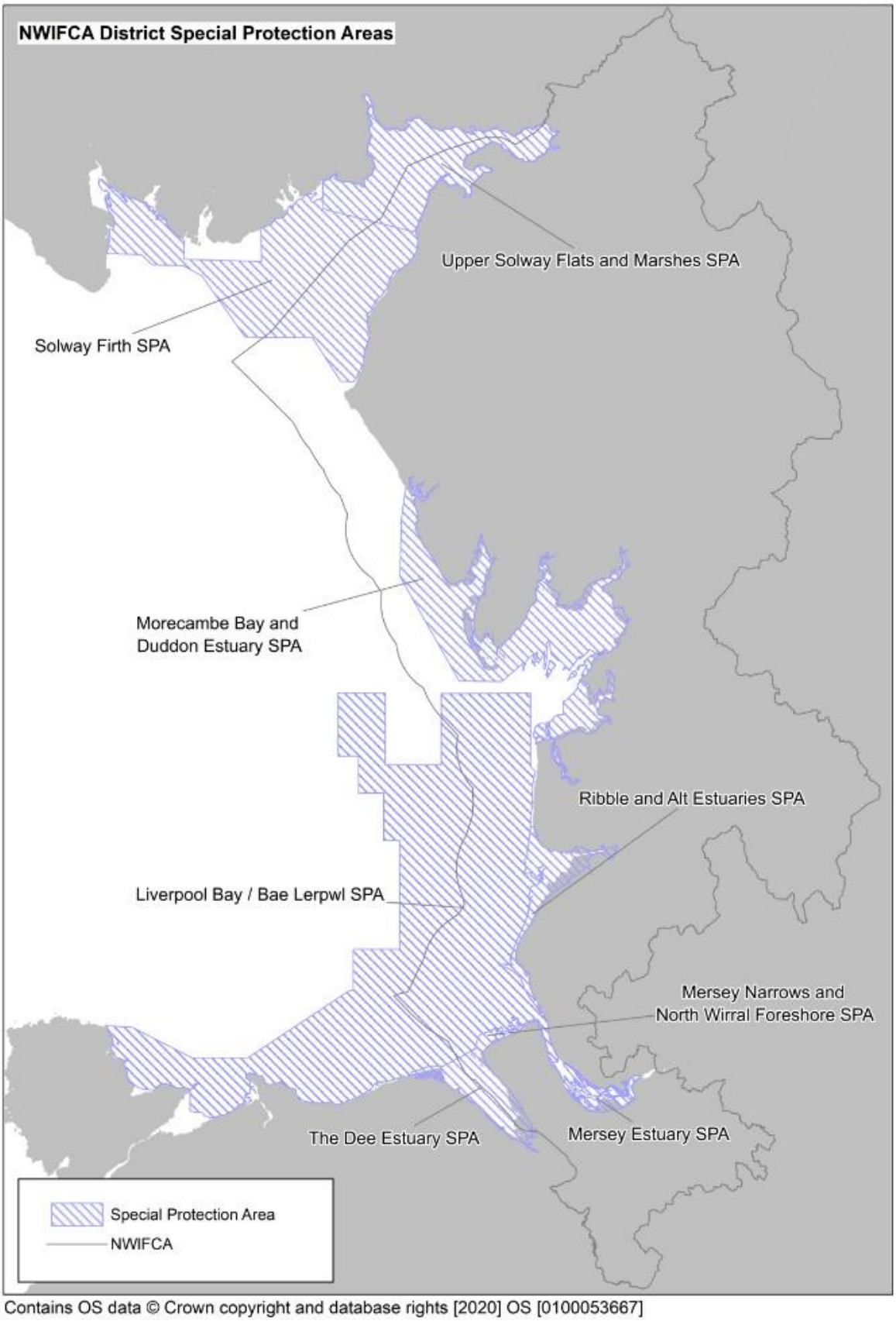


Figure 21: The location of designated SPAs in the NWIFCA district

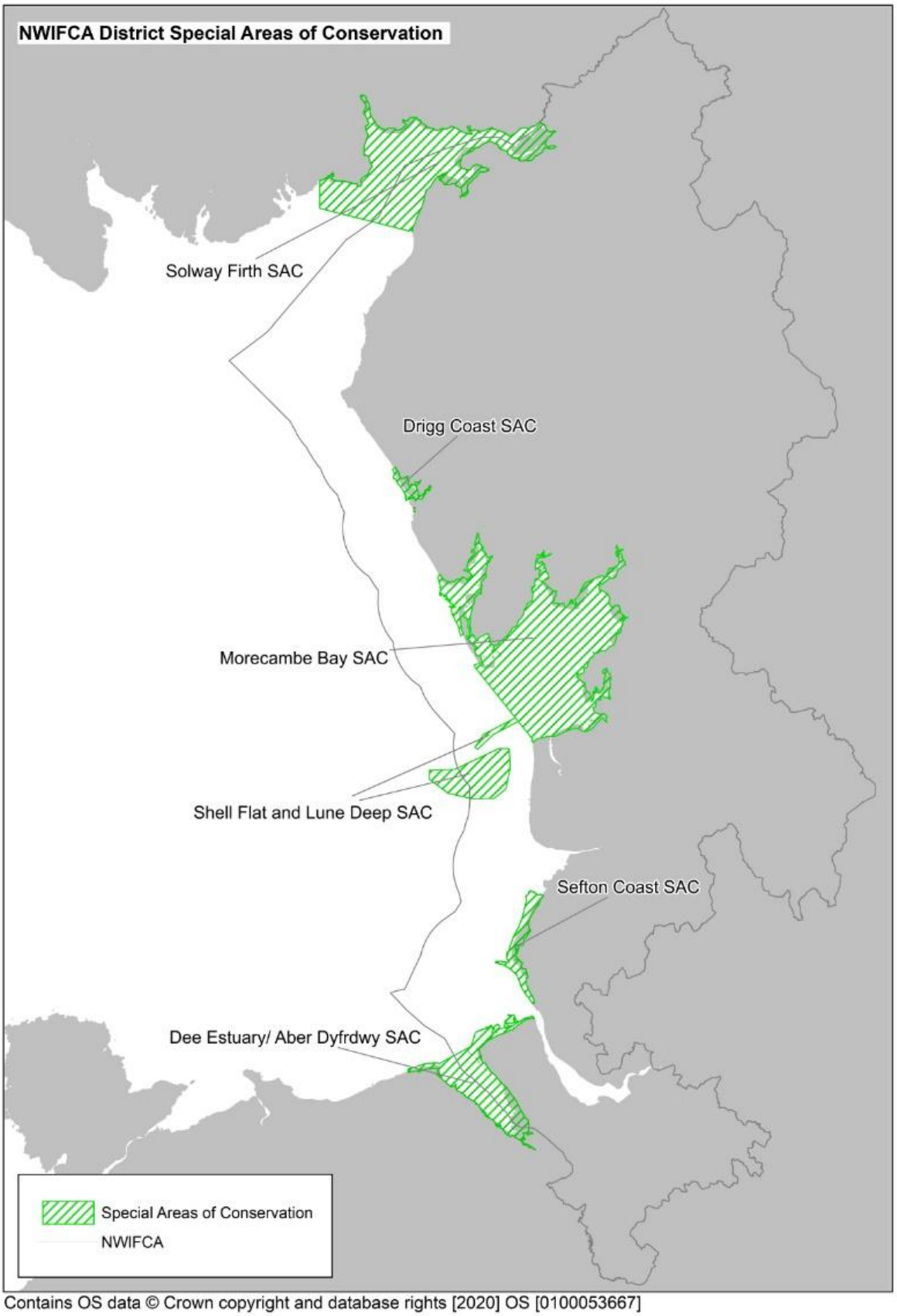


Figure 22: The location of designated SACs in the NWIFCA district

Table 17: Relevant MPAs for each commercial cockle bed

Cockle Fishery / Bed	Relevant MPA designation
Morecambe Bay (Flookburgh, Leven, Middleton, Newbiggin, Pilling and Warton)	1) Morecambe Bay SAC
	2) Morecambe Bay and Duddon Estuary SPA
	3) Morecambe Bay Ramsar Site
	4) Duddon Estuary Ramsar Site
Ribble Estuary (Penfold, Granny's Bank, Northrun and Foulnase)	1) Ribble and Alt Estuaries SPA
	2) Ribble and Alt Estuaries Ramsar Site
	3) Sefton Coast SAC
	4) Ribble Estuary MCZ
	5) Liverpool Bay SPA *adjoining site
Leasowe	1) Mersey Narrows and North Wirral Foreshore SPA and Ramsar Site
	2) Dee Estuary SPA
	3) Dee Estuary SAC
	4) Dee Estuary Ramsar Site
Solway	1) Solway Firth MCZ
	2) Solway Firth SPA
	3) Solway Firth SAC

The full list of protected features within these sites is extensive and can be found here https://designatedsites.naturalengland.org.uk/ . For the purposes of this FMP, the key features for consideration regarding the cockle fishery and its management are detailed in Table 18.

7.2 Relevant Considerations

Table 18: The designated features of relevance to the cockle fisheries and the management measures that may be applied to limit impact.

Feature	Interaction with fishery	Concern	Management measure current or proposed
Birds **(roosting, overwintering, breeding)**	Removal of food resource	Cockle forms an important part of the shellfish resource for birds such as oystercatcher and knot, and to a lesser extent other species such as sanderling, grey plover, redshank, and the common gull. Oystercatcher in particular target larger cockle (>15mm) which can also fall within the target range of fishers (~25mm+). Bird numbers are monitored by NE and are under stress from multiple factors.	Effort limitation in the form of a TAC (proposed) or limited days (current)
	Disturbance from access and activity on the beds	Increased energy expenditure when disturbed can lower the likelihood of survival	Effort limitation in the form of tides and days Specify access routes
Saltmarsh	Access	Many of the access routes to the fisheries traverse saltmarsh beds.	Specify access routes

In addition, NWIFCA have a Cold Weather Protocol which details the extreme conditions at which a fishery will be closed during wintertime to prevent impacting protected bird species. The Cold Weather Protocol can be accessed here https://www.nw-ifca.gov.uk/app/uploads/NORTH-WEST-IFCA-INTERTIDAL-FISHERY-COLD-WEATHER-PROTOCOL-WEBSITE-VERSION-updated-Jan-2025.pdf

Section 7: Outstanding knowledge gaps / areas for action

1. Determine what is the optimum food requirement for protected bird species in each MPA in agreement with Natural England
2. Investigate the impacts of bird disturbance from the fishery and determine optimum management measures

Answering these questions would allow us to:

a. Better determine an appropriate TAC and management measures
b. Improve confidence in the conclusions of the HRA
c. Streamline decision-making

8. Stakeholder Engagement and Socio-Economic Considerations

This section provides a brief overview of the stakeholders involved in the fishery. It also covers recent information on the factors influencing their perspective on the fisheries and input into management.

8.1 Stakeholders

The main stakeholders involved in the fishery include government agencies, local communities, fishing industry members (hand-gatherers and buyers), environmental NGOs, landowners and other interest groups. A description of the involvement of these groups in the fisheries' decision-making is detailed in Section 5.

Table 19: Relevant stakeholders and their input to the fisheries' management

Stakeholder	Bed	Example	Interest/expertise
Local councils or government agencies	Leasowe	Mersey Port Health Authority Wirral Council	Matters of public safety and interest Providing permits to access the foreshore Access points Ancillary work locations Environmental Health
	Ribble Estuary	Sefton Council Mersey Port Health Authority West Lancashire County Council	
	Morecambe Bay	Wyre Council Lancaster City Council Westmorland and Furness Council	
	Solway Firth	Cumberland Council	
Public/local communities and land owners	District wide	Boughton Estates Wild fowlers Holker Estates Local farmers	Access points Ancillary work locations
Environmental NGOs	District wide	RSPB Wildlife Trust	Matters of conservation importance

Industry (including fishers, buyers, and processors)	District wide	Byelaw 3 permit holders Local and regional buyers	Best practice fishing methods Stock levels and Factors affecting fishing dynamics (*e.g.* removal rates, locations, market demands etc)

8.1.1 Fishers and industry members

There are currently 150 fishers who hold a permit to fish for cockle and mussel in the NWIFCA district under Byelaw 3. The only criteria currently in place for obtaining a permit is the right to work in the UK. They also must register with the local council as a 'Food Business Operator' and apply for movement documents when they sell the cockles to allow for traceability.

Fisher stakeholders can be broadly categorised based on where they live (Scotland, Morecambe Bay, Fylde Coast, Wales and the EU), and whether they have permits to fish other UK cockle beds (*e.g.* the Dee, Three Rivers *etc*). Many of these factors influence their preferred management approaches year to year, and for the specific areas they intend to target.

8.2 Concerns and Pressures

Some of the main challenges currently facing industry are:

1. **Changes in legislation because of EU exit**
   Changes to legislation have limited the ability to export live cockle to EU markets. Typically, wintertime exports of Class A live cockles are a good source of income for fishers following the summer cooked market season.

2. **Water quality and classification concerns**
   More frequent pollution events have increased occurrences of lower shellfish classifications in recent years. Some fishers have altered their approach and invested in purification facilities.

3. **Increased regulations and restrictions**
   Over the past two decades, the introduction of MPAs in many of the main fishing grounds, and introduction of the Byelaw 3 permit scheme, have brought with them restrictions on the fishery not previously seen. Concerns over declining bird species, disturbance and removal of prey resource has led to restrictions on the cockle fishing effort in some areas.

4. **Disparity of approaches and changing demographics of permit holders**
   There are roughly two approaches to fishing undertaken by stakeholders, with some preferring low level, consistent fishing throughout the season as they are predominantly full-time fishers, whilst others hold alternative employment, and prefer to have periods of intense fishing before returning to other work. The cohort is currently increasing in

average age, with limited ability for young fishers to enter the fishery under the current scheme.

5. **Climate change**
   The increases in extreme weather events make it less predictable as to reliability of cockle stocks. This can cause displacement into other fisheries, or removal from fisheries entirely.

8.3 Stakeholder Engagement

NWIFCA will seek the engagement of stakeholders into the decision-making process wherever appropriate and feasible to do so. Section 9.9 details NWIFCA's commitment to stakeholder engagement in the annual fisheries management decision-making process.

8.3.1 Recent engagement with industry (2024/25)

In 2024, NWIFCA carried out a stakeholder consultation to assess support for changing the current open season. This followed requests from industry to review the timing of the season in light of shifting market conditions resulting from the UK's exit from the EU.

As a result of this engagement, it was agreed to trial an earlier opening date, subject to sufficient stock levels. The first year of the trial took place in 2025–26, with the Pilling fishery opening on 1st July 2025.

Following the closure of all opened cockle fisheries in February 2026, NWIFCA will consult with industry again to determine whether to adopt a permanent shift to a 1st July opening or return to the traditional 1st September start date.

8.3.1 Future engagement

The research plan outlines a strategy for continued stakeholder engagement on broader cockle fisheries management and the future development of Byelaw 3 regulations.

Key knowledge gaps that currently affect management decisions—and require stakeholder input to address—include:

1. Exploring alternative management approaches that could support longer-term, sustainable access for local fishers (*e.g.* considering the viability of opening beds with lower stock levels).
2. Understanding how to account for external factors that influence fishing pressure, such as market dynamics (*e.g.* cockle prices, availability of alternative stocks), and how these should be reflected in management decisions.

Section 8: Outstanding knowledge gaps / areas for action

1. Complete the trial early open season and determine its viability with stakeholders.
2. Identify a way to capture, and incorporate, social values of stakeholders into the fishery decision-making process
3. Set out a clear process for stakeholder engagement throughout the decision-making process to ensure timely sharing of information and transparency (e.g. a stakeholder engagement protocol)
4. Establish a way to capture specialist knowledge of the fishery from stakeholders and develop joint working projects.

Undertaking this work would allow us to:

a. Alter management to suit the needs of industry
b. Improve understanding and engagement with the recommendation and decision-making process
c. Improve our overall understanding of the factors influencing stakeholder perspectives
d. Improve knowledge sharing

Part 2

9. Developing a Recommendation for Management

When determining a recommendation to open or close a fishery, NWIFCA officers consult a range of criteria. All criteria must be considered from the viewpoint of maintaining designated species' conservation objectives and stock sustainability.

The following section details the key criteria considered at each stage of determining a recommendation. Stage 1 involves determining whether a fishery should be recommended open or closed. Stage 2 involves determining what management should be in place *if* a fishery is recommended open.

9.1 Stage 1: Determining Whether a Fishery Should Open

9.1.1 Key Criteria

Table 20: Key criteria for consideration when deciding whether to open a cockle fishery

Criteria	Sub-Criteria	Details / Importance
1. Total Stock Biomass **(whole protected sites and individual beds)**	Total sized biomass	Determines total biomass available to: • Fishers • Birds (*e.g.* oystercatcher) • Recruitment stock for repopulation
	Total undersized biomass	Forms the basis of the following year's sizeable stock and fishable biomass Part of the food resource for bivalve eating birds Key consideration: How close the stock is to reaching size (*e.g.* it may reach size by the opening date)
2. Stock Spatial Distributions and Size Composition (individual beds)	Size composition	Mixed size stock can cause: • disturbance to undersized stock during fishing • increased risk of removal of undersized stock Thresholds needed for acceptable percentage of sized vs undersized
	Spatial distributions	The composition of sized:undersized stock on a bed may be low, but if stock is spatially separated, the risk of disturbing undersized stock is reduced. Conversely, sized:undersized composition may be high for the bed as a whole, but if the stock is mixed together in the same locations, disturbance

		to undersized and risk of its removal will be increased.
3. Stock Density (whole protected sites and individual beds)	Density of size	Consideration of areas where density matches bivalve feeding bird preferences
	Density of undersized	Consideration of areas where density matches knot feeding preferences, or following year stock

The aim of this section is to formalise these decision-making parameters and provide baseline thresholds.

9.1.2 Decision-Making Process

Figure 23 lays out the process for determining whether a fishery should be recommended open based on three key criteria: total cockle stock biomass, sized cockle biomass, and the distribution and composition of stock.

The criteria are presented in priority order; failure to meet the requirements of the preceding criteria means the fishery will be recommended closed. Only when all the criteria are met in this instance will the fishery be considered for opening.

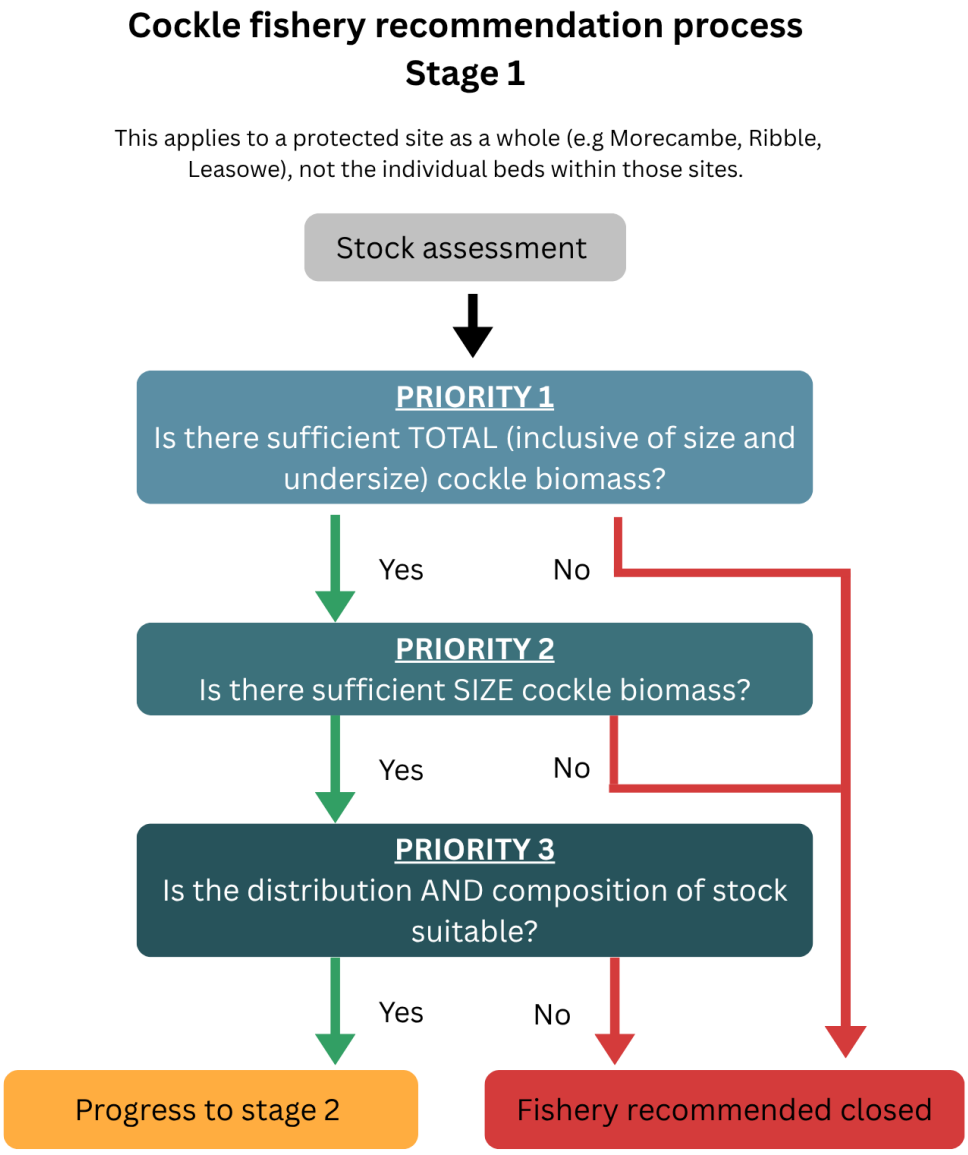


Figure 23: Process of determining an open fishery recommendation

9.2 Recommendation Parameters

Table 21 details the biomass of cockle required for a fishery to open, broken down by total cockle biomass, sized biomass, and minimum TAC.

Table 21: Minimum cockle biomass thresholds required for a fishery to open for each of the district's main commercial cockle beds.

Threshold	Morecambe Bay	Leasowe	Ribble Estuary[6]	Solway Firth[7]
1. Minimum total biomass needed to be left on the bed (t)	10,000	800	1,500	TBC
2. Minimum biomass of sized cockle to be left on the bed (t)	4,000	800	900	TBC
3. Minimum TAC (t)	400	300	300	TBC
4. Minimum buffer (% of TAC)	10%	10%	10%	TBC
5. Minimum biomass of sized cockle required for a fishery to open (t)	4,400	1,300	1,200	TBC

9.3 Rationale for Parameters

The minimum thresholds have been calculated by looking at:

- past biomass trends from 2017-2025 stock assessments
- landings data from 2017-2025, including total landings and fishers' daily removal rates
- other national fishery TACs
- rationale in support of previous officer fisheries recommendations.

9.3.1 Rationale for Threshold 1

The total biomass of cockle is a critical factor in ensuring adequate food availability for birds, supporting recruitment, and sustaining stock levels for the following year. As such, establishing a minimum biomass threshold is essential.

Threshold 1, the minimum total biomass to be retained on an individual bed, effectively sets a limit below which stocks should not be depleted. The method of calculation for this is as follows:

1. Review the minimum total biomass a fishery has previously been recommended open
2. Subtract the maximum biomass removed by fishing in any given year
3. Review similar UK fishery baseline metrics

[6] Penfold only.
[7] There is currently insufficient data on the Solway Firth cockle fishery to inform a minimum biomass threshold.

4. Back-model the proposed threshold to see how this baseline would have affected previous recommendations had it been applied.

Morecambe Bay

The lowest total biomass the fishery has previously been opened on since 2017 is 10,944t (~11,000t). The maximum quantity of cockle removed in a single fishing season was in 2019/2020 when 1,714t was removed from the fishery. This would have left 9,230t of stock; providing for the precautionary principle, this has been brought up to 10,000t.

The Wash cockle fishery, which covers a similar geographic extent, has a comparable minimum threshold of 11,000t of stock (Eastern IFCA 2019).

If 10,000t had been the minimum biomass placed on the fishery in previous years, then all other fisheries would have previously been opened (apart from Pilling 2021/22). 10,000t, therefore, seems reasonable as a minimum stock threshold given this rationale.

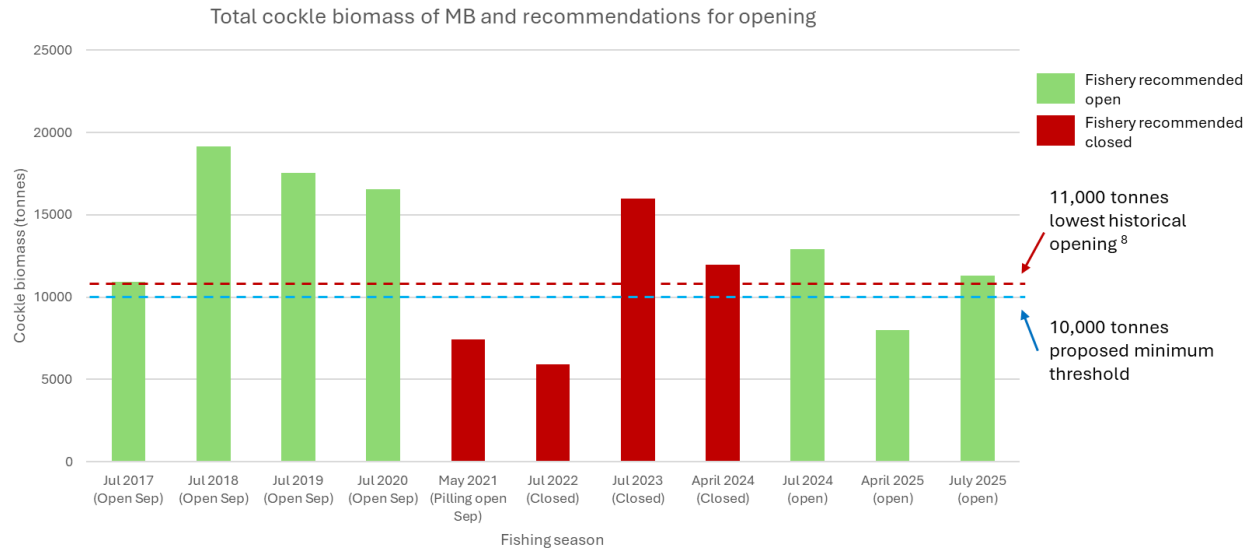


*Figure 24: The total biomass of cockle (t) on Morecambe Bay since 2017. The green bars show years the fishery was recommended open, and the red bars were years the fishery was recommended closed. The blue dotted line shows the lowest biomass a fishery was recommended open, the blue dotted line shows the proposed minimum stock threshold (*e.g. *no fishery should deplete the stock below this level).*

Leasowe

Leasowe has a pre-agreed minimum stock biomass of 800t of sized cockle required to be left on the bed as bird food resource (NWIFCA HRA 2019).

Ribble Estuary (Penfold)

All Ribble Estuary cockle beds suffer from significantly limited data given the minimal number of fisheries there in the past decade. The TACs proposed here cover only Penfold. There are additional beds in the site (see Figure 8) which may in the future support commercial stocks.

Should this situation arise, minimum thresholds will need to be developed for these beds at that time, if feasible.

The lowest biomass a fishery at Penfold has previously been recommended open on is 2,500t, with 422t of biomass removed, leaving 2,078t.

Given the limited data, the minimum biomass to be retained on the bed is proposed at 1,500t.

9.3.2 Rationale for Threshold 2

Threshold 2, the minimum biomass of *sized* cockle to be retained on the bed, considers the need for recruitment and bird food resource. There is scientific research to show recruitment is more dependent on environmental factors than adult cockle biomass. However, in the absence of data on recruitment success and minimum bird food requirements for the district's fisheries (except for Leasowe), the minimum biomass required will initially be based upon historical stock assessment trends. The method of calculation is as follows:

1. Review the minimum sized biomass a fishery has previously been recommended open
2. Review the rationale at the time in support of this
3. Calculate the maximum biomass of sized cockle removed by fishing effort
4. Back-model the proposed threshold to see how this baseline would have affected previous recommendations had it been applied.

<u>Morecambe Bay</u>

For Morecambe Bay, Figure 25 demonstrates the lowest biomass of size a fishery was previously recommended open was 4,635t of sized cockle. This was due to large quantities of undersized available to grow on to the following year. In comparison, 2021/22 was recommended closed due to concerns regarding the recruitment stocks for following years. To strike a balance between these two scenarios, a minimum threshold of 4,000t provides a precautionary baseline stock level.

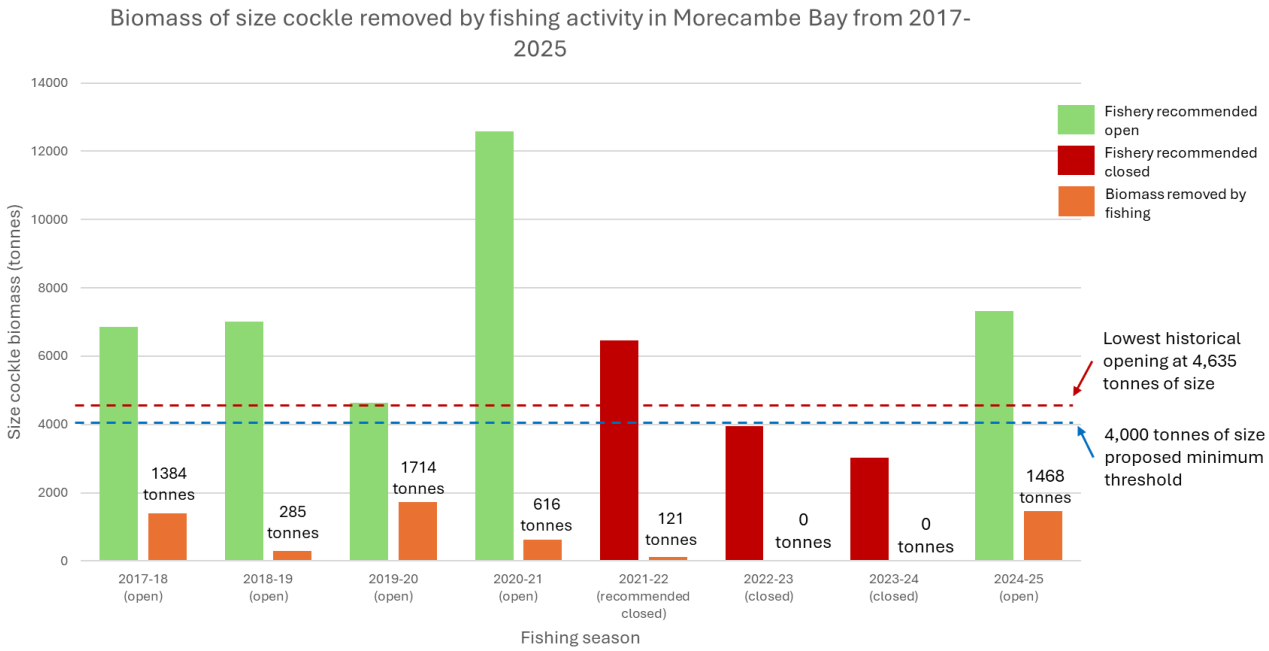


*Figure 25: The total cockle biomass (t) on Morecambe Bay since 2017 (green on recommended open years, and red on recommended closed years) and the quantity removed via the fishery (orange). The red bars show years the fishery was recommended closed. The red dotted line shows the lowest biomass of sized cockle a fishery was recommended open, the blue dotted line shows the proposed minimum sized stock threshold (*e.g. *no fishery should deplete the stock below this level).*

Leasowe

Leasowe has a pre-agreed minimum stock biomass of 800t of sized cockle required to be left on the bed as bird food resource (NWIFCA HRA 2019).

Ribble Estuary (Penfold)

Limited information from previous fisheries, provides only three years' worth of data on stock.

The lowest biomass of sized cockle a fishery has previously been recommended closed was 800t due to concerns over stock recruitment and significantly low levels of undersized. Therefore, a minimum sized biomass of 900t will be applied to the Penfold cockle bed.

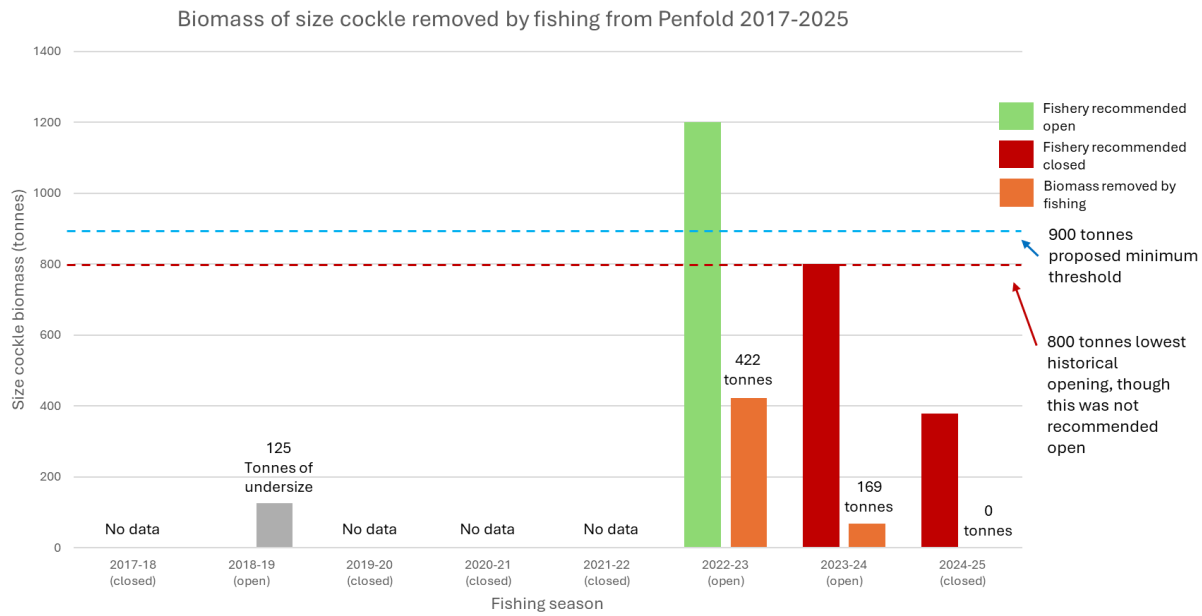


Figure 26: The total cockle biomass (t) on Penfold since 2017 (green on recommended open years, and red on recommended closed years) and the quantity removed via the fishery (orange). The red dotted line shows the lowest biomass of sized cockle a fishery was not recommended open, the blue dotted line shows the proposed minimum sized stock threshold (e.g. no fishery should deplete the stock below this level.

9.3.3 Rationale for Threshold 3

Stock assessments may identify biomass above the minimum threshold, however, if it only exceeds it by a small amount, it may still not be practical to open the fishery. A TAC needs to be both practical to enforce, and reasonable for fishers to obtain. Low TACs will be vulnerable to being exceeded if we do not consider the number of permit holders and rate of removal.

The method for establishing a minimum TAC will be:

1. Assess the historic minimum total biomass removed by fishers to give a baseline
2. Consider the number of permit holders
3. Consider average and maximum removal quantities per person

In this instance, the minimum TAC is calculated as the maximum possible weight of cockle that could be removed from a bed in one tide. Rate of removal is affected by the quantity and distribution of stock, and number of permit holders accessing the fishery.

A review of the historical returns was used to identify the maximum quantity removed by an individual permit holder at each fishery (Table 22). This was multiplied by the number of permit holders to give a minimum TAC for the following fisheries.

Table 22: Minimum TAC for each cockle bed

Fishery	Minimum TAC (t)
Morecambe Bay	400

Penfold	300
Leasowe	300

The biomass of total cockle required to open a fishery is, therefore, the minimum biomass that must be left on the bed, plus the minimum TAC.

Similarly, the biomass of sized cockle required for a bed to open is the minimum biomass of sized cockle that must be left on the bed, plus the minimum TAC.

9.3.4 Rationale for Threshold 4

A buffer on the TAC is necessary to ensure minimum biomass thresholds are not breached. Currently, permit holders are required to submit monthly returns, meaning TAC monitoring is not in real time and could be exceeded before officers are able to intervene.

To mitigate this risk, officers will collect daily estimates of landings and movement documents. However, there remains a concern that the TAC could still be exceeded before it is detected. The buffer provides an added safeguard against this possibility.

The proposed minimum buffer of 10% of the total TAC is based on maximum observed rates of cockle removal and daily returns data. This figure may be adjusted depending on the number of active fishers and actual removal rates.

9.3.5 Rationale for Threshold 5

The minimum biomass of size cockle required for a fishery to open is calculated from combining the minimum TAC, buffer, and the minimum biomass.

9.3.6 Additional considerations regarding composition of stock

The composition and spatial distribution of sized and undersized cockle on a bed are critical factors to consider, particularly when sized and undersized are intermixed closely on the bed, where the following challenges are presented:

- **Disturbance of Juvenile Stock**

  During fishing, juvenile (undersized) cockle may be unintentionally disturbed. Although these are usually riddled and returned to the sediment, the effectiveness of reburial is uncertain. Success likely depends on how fishers return them—for example, whether they are evenly spread or deposited in concentrated piles.

- **Risk of Undersized Removal**

  The risk of undersized cockle being removed from the fishery increases in mixed beds. This issue was observed at the 2024/25 Pilling fishery, where, despite riddling efforts, the industry was unable to comply with enforcement tolerance limits, ultimately leading to the fishery's closure.

Stock Ratio Considerations

The Authority will consider closing dense areas where the sized:undersized ratio is low, and the risk of undersized stock being removed or disturbed due to fishing activity is increased. Such closed areas within an open bed could be considered where it is practical to delineate and manage them, and where there is obvious spatial delineation as demonstrated in survey results.

9.5 Revision of Parameters

Each year officers will review the parameters from available data and amend the minimum thresholds and / or TACs based on the following:

1. Information on bird food resource requirements
2. Evidence regarding stock recruitment biomass requirements
3. Evidence regarding fisheries harvesting rates
4. Any additional, relevant information

Historical rationale for previous fisheries has been used to guide the proposed parameters. However, this does not mean that the assumptions made at the time were correct, and it is important to annually review the evidence base in support of these limits.

9.6 Exceptions

The application of the minimum thresholds criteria will be reviewed in exceptional circumstances such as the following:

Table 23: Exceptional circumstances and their implications for management

Exceptional circumstance	Description
"Choking"	Choking refers to situations where cockles are present in high-density, localised areas, but fail to grow and are at risk of being washed out before reaching harvestable size. In such cases, managers may consider opening areas containing potentially undersized cockle, as was done at Penfold in 2018–19. Further research is needed to better understand the underlying causes of choking and to identify the most effective management responses.
Large size cockle (30mm+) among small cockle	There have been instances, such as in Morecambe Bay 2018 fishing season, where large, older cockle (30mm+) was present among smaller cockle. This lead to the proposal of a craam-only fishery to selectively target large cockle with minimal impact on smaller ones. Enforcement concerns and lack of compliance during this fishery would need to be considered

Cross-boundary stock	The opening of a bed would allow for fishers to access cross-boundary stock, without harming the overall conservation measures (*e.g.* Leven was opened in 2024/25 as a portion of sized cockle stock bridged the boundary between the Leven and Flookburgh cockle beds. Much of the rest of the bed was small and therefore, unlikely to be targeted. In this instance to minimise non-compliance, officers recommended Leven jointly opened with Flookburgh).

9.7 Consideration of Alternative Measures and Limitations

Over the years, NWIFCA has discussed various approaches to the management of the fishery, including opening all beds regardless of stock level, stipulating per-person quotas, and apportioning stock by the rule of thirds. Detail regarding these measures and why they are not being considered at this time are provided in Table 24.

Table 24. Details of alternative management measures and rationale against them

Alternative management measure	Detail	Rationale for not apply this measure
Opening all beds regardless of stock level	The assumption with this approach is that low biomass beds tend to 'self-regulate' as fisher levels decline with diminished returns. In addition, there is the perception that when more beds are opened the effort is spread.	Fishers tend to target areas where the effort-to-return ratio is highest, and therefore effort typically is concentrated in these areas, regardless of other open beds. Effort I,s also influenced by external factors such as cockle price and other available fisheries, which fluctuate year to year – therefore making it unpredictable. All beds fall within protected sites, and therefore, must provide a minimum sustainable stock level for bird resource requirements and future year recruitment.
Individual per-person quotas	Individual permit holders could be given a daily limitation on landings, the intention being to provide a fair allocation of stock and manage effort.	Per-person quotas requires daily returns and officer monitoring which is not currently feasible through Byelaw
Rule of thirds	The rule of thirds is a commonly used approach that allocates one-third of the total *adult* cockle stock to the fishery, while leaving the remaining two-thirds to	Relying on the rule of thirds alone does not guarantee that adult stock levels will remain above sustainable thresholds. As such, a minimum spawning stock biomass remains

	support spawning and account for natural mortality.	essential to ensure the long-term health of the fishery. The minimum biomass thresholds set for each fishery (see Table 21) take into account the proportion of stock needed for both reproduction and natural mortality, ensuring that sufficient spawning biomass is maintained for stock replenishment. Back-calculations applying the rule of thirds to historical fisheries data show that, in most years, allocating one-third of the adult stock to fishing would have resulted in biomass levels falling below the 5,000-tonne threshold. This indicates that such an approach, in isolation, would not have maintained stock sustainability. Given that hand-gathering fisheries typically exert lower effort and generate lower landings than larger-scale operations, the use of a minimum biomass threshold offers a more flexible and proportionate management tool. It allows hand-gatherers to harvest surplus stock without compromising sustainability—something that strict application of the rule of thirds may not permit.

9.8 Stage 2: Determining Appropriate Management

Once a fishery is determined suitable for opening following the parameters detailed above, appropriate management measures must be applied.

The following section details:

- the steps for determining the management measures to be applied to a fishery,
- the rationale behind the use of each option
- the evidence that officers will present in order to support these decisions.

Note: not all the applicable circumstances listed in each box need to be met in order for the management measure to be applied; steps follow in priority order.

STEP 1: Identify the area, or bed, where fishing will be permitted
Relevant Byelaw 3 flexible permit condition: specified areas where fishing is permitted/bed closure(s);
Applicable circumstances: Fishing will be permitted on beds/areas where:

• The biomass of size cockle is above acceptable limits (for Morecambe Bay this will apply to the individual beds). • The Authority will consider closing dense areas where the sized:undersized ratio is low, and the risk of undersized stock being removed or disturbed due to fishing activity is increased. Such closed areas within an open bed could be considered where it is practical to delineate and manage them, and where there is obvious spatial delineation as demonstrated in survey results. • When requested in consultation with industry • TAC can be split among beds (applicable to Morecambe Bay).
Rationale behind the application: • Limit the disturbance to juvenile stocks, therefore increasing the likelihood of their survival and growth to size – contributing to the following year's fishery. • Reduces the risk of juvenile stock being removed from the bed by fishing activities and therefore surviving and contributing to the following year's fishery. • Reduces non-compliance rates
Officers will provide the following information in support of the management measure: • The distribution of sized and undersized stock across the surveyed beds • The ratio of sized to undersized across the bed for survey data • Recommendations for the specific closed / open areas, noting the rationale from both an enforcement and conservation perspective (*e.g.* evidence of non-compliance from previous fisheries, evidence that protected juvenile stock has survived and contributed to the following year's fishery *etc.*)

STEP 2: Determine appropriate effort limitations
Relevant Byelaw 3 flexible permit condition: dates, times or tides when fishing is permitted
Applicable circumstances: • We may implement a limitation on the tides and / or days • When requested in consultation with industry
Rationale behind the application: • Limiting the days in the week and number of tides elongates the fishery and minimises instances of boom and bust • Reduces pressure on the site for access and bird disturbance • Provides greater time for officers to monitor TAC effectively, in the absence of daily return requirements
Officers will provide the following information in support of the management measure: • Results of a stock assessment detailing the distribution and biomass of cockle • the rationale from both an enforcement and conservation perspective (*e.g.* evidence of enforcement concerns from previous fisheries, evidence from previous examples of the proposed management measure)

STEP 3: Determine any additional constraints
Relevant Byelaw 3 flexible permit conditions: • Specified equipment or fishing methods allowed, • Specified access routes and means. • Specified minimum landing size
Applicable circumstances: • Access routes will be specified as standard and only changed in agreement with NE after HRA approval • In previous exceptional circumstances, a craam-only fishery has been permitted due to the mix of size classes on the cockle bed. This form of fishing method may be considered if similar future conditions arise, and it is deemed practical to enforce • In previous exceptional circumstances, a reduced MCRS was applied due to 'choking' cockle
Rationale behind the application: • Specifying access routes controls for the impact of fishing activity on protected site features • The ability to alter an MCRS or change the fishing method with which cockles are obtained, allowing for a more adaptive approach to manage for rare or unforeseen circumstances
Officers will provide the following information in support of the management measure: • Results of a stock assessment detailing the distribution and size composition of cockle in the relevant areas • Recommendations for the specific management noting the rationale from both an enforcement and conservation perspective (*e.g.* evidence of enforcement concerns from previous fisheries, evidence from previous examples of the proposed management measure)

9.9 Stakeholder Engagement

Once officers have progressed through the decision-making process detailed above, they will present the results of the surveys, their recommendations, and the rationale and evidence in support of these decisions to industry stakeholders via our website prior to the next TSB meeting. A consultation with stakeholders regarding the recommendations will be initiated, at the latest, a week before the TSB. A text message and email alert will be sent to inform the wider stakeholder group of the consultation.

Industry will be able to make further representations at the meeting and raise points of interest in accordance with our Constitution.

A timeline of the opening and decision procedure is provided in the Gantt Chart below. Blue indicates the process for a July opening fishery (should it be changed to this), and orange the process for a September opening fishery.

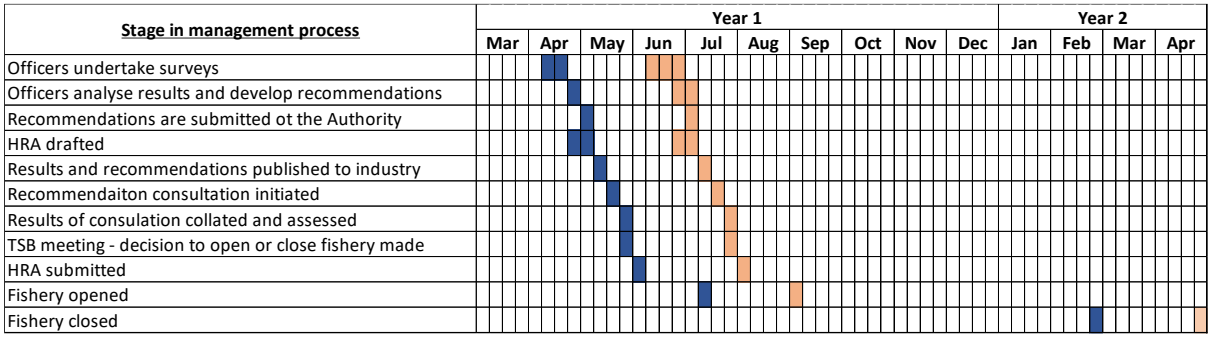


Figure 28: Decision-making process timeline

9.10 Factors Not Considered

The following details the factors that will not be included for consideration when developing a recommendation:

1. Cockle must reach size by the time of opening, and not later beyond the opening of the fishery
2. The assumption that potential weather could affect the stocks will not be considered regarding the opening of a fishery

Part 3

10. Research Plan

Following on from the management and knowledge review detailed in the sections above, there is a clear need to address NWIFCA's outstanding knowledge gaps to determine the viability of proposed new management measures. This section summaries the knowledge gaps that currently limit the effective management of the district's cockle fisheries and the proposed actions for addressing these (Table 25). Developing our understanding in these areas will help us to develop management that works to achieve our strategic objectives and build a sound scientific evidence base to strengthen our HRA conclusions.

Table 25: NWIFCA intertidal cockle fishery five-year research plan

Objective	Approach	Knowledge Gaps Addressed	Management Impact	Year
ECOLOGICAL RESEARCH				
Understand life-history and reseeding dynamics of cockles in the district	PhD on Cockle Dispersal External Partnership with Bangor University	- Reseeding sources - Key reseeding areas in the district - Required stock for sustainability - Possible reasons for stock fluctuations	Informs TAC setting	2025
Identify what shellfish resources are required for protected bird species, and how much are apportioned to cockles.	Incorporation of Bird Food Model External Partnership with NE and Bournemouth University through the mNCEA project	- Biomass needed to support protected bird species - Minimum stock retention requirements	Informs TAC for Morecambe Bay, ensuring bird conservation objectives are met	2025
Develop understanding of the impact hand-gathered	Internal research project alongside industry	- How specific activities impact cockle stocks	Potential to specify methods, or to adapt	2027

fishing has on recruitment and survivability of cockle stocks	Establish trial research work with industry and a stakeholder working group	- How fishing activities such as method of jumboing and riddling impact the survivability of juvenile cockles - Most sustainable cockle fishing methods - Merit of alternative management measures (*e.g.* thinning, riddling requirements *etc.*) - Required densities for successful spawning	management options to specific conditions Improves specialist knowledge sharing from fishers with officers Improves confidence in management options and HRA conclusions. Improves stakeholder input	
Improve understanding of the impact the fisheries have on bird disturbance	Joint research project with NE or academic partner	- How the fisheries impact birds - Severity of disturbance - Are the conclusions we make in our HRA assessments correct? - Are there alternative management options more suitable for the fishery?	Informs management options and HRA conclusions.	2028
MANAGEMENT RESEARCH				
Determine whether an early open season should be made permanent	Consultation with stakeholders and officer review Undertake a trial review period and consultation with stakeholders to determine the permanency of such a change and	- Would a change in cockle open season be more suitable for both a fisher and conservation perspective? - Can we take a more adaptive approach?	Supports stakeholder considerations	2027

	consequences for Byelaw 3			
Analyse fisheries trends and dynamics against stock data to determine effective management	Review of landings data	- How do changes in biomass, densities, composition and distribution influence both the rate of removal and total quantity removed during fishing? - Identify if this can be used to model total stock removal and duration of a fishery - Determine removal rates over time and trends in fisher attendance - Determine how different management measures will influence the rate of removal - Determine suitable management for the fishery - Explore adaptive management throughout the duration of a fishery in response to the conditions and effort exerted	Improves evidence-based decision making on management measures	2027
Determine potential fishery viability in Solway	Undertake grab sample surveys	- Is there stock available in the Solway Firth to support a potential cockle fishery?	Support further fisheries Determine fisheries management for Solway	2026
Review cockle survey locations and sample points and methodology	Internal review of methodology annually	- Ensure surveys cover the main extent of the cockle beds	Accurate survey data	Annually
Investigate and improve the current returns system	Internal review	- How can returns data accuracy be improved?	Accurate returns data	2027

Research long-term trends in cockle stocks, analyse the size composition of consistent beds, and explore alternative management options	Internal analysis of data	- Why are some beds maintained at a consistently low level? - What would happen if lower stock level beds were opened and subjected to fishing pressure? - Do they offer the potential for additional fishery resources without impacting conservation objectives? -should we introduce per-bed minimum thresholds?	Improves evidence-based decision making on management measures Improves stakeholder relationships	2028
Determine thresholds for size to undersize ratios	Internal analysis of data	-How can we best protect juvenile cockle stocks -Should there be a threshold limit introduced regarding the ratio of size to undersize, and is this dependent on density?	Improves evidence-based decision making on management measures	2028
Determine the sustainability of stock management against internationally accredited systems	Review the current management against the Marine Stewardship Council standards	- Is our current management sufficient? - What needs to be improved? - What further knowledge gaps require addressing?	Improves sustainability and national recognition for NWIFCA cockle fisheries	2029
STAKEHOLDER ENGAGEMENT AND RELATIONSHIPS RESEARCH				
Incorporate stakeholder values into management	Integration of Oral Histories project undertaken by NE	- Key values of stakeholders - Effective methods to capture stakeholder views	Supports socio-economic considerations in management	2025
Improve stakeholder relationships	Initiate regular stakeholder engagement satisfaction surveys and fishery review consultations	-Identify the overall satisfaction of fishers with management, and areas for improvement or further research	Improves stakeholder engagement and relationships	2028

Set out a clear and transparent process for decision-making to streamline the process	Develop and agree parameters within the Cockle FMP with NWIFCA members Develop a stakeholder engagement protocol	-How can we streamline our current process, and how can we improve stakeholder perspectives in our decision-making process	Improves decision-making timelines Improves confidence in recommendation approval Improves stakeholder engagement	2026

11. Monitoring and Review

This section details the methods NWIFCA will use to assess the effectiveness of the FMP and progress against the objectives proposed.

11.1 Key Performance Indicators

The following KPIs will be evaluated every year by officers to monitor the ongoing progress in achieving the FMP's objectives, and overall improvement in fisheries management. Progress against these KPIs will be presented at quarterly TSB meetings.

Table 26: KPIs and method of measuring progress.

KPI	Detail	Next Review Date	Report method
Stakeholder satisfaction	Once every two-years NWIFCA will undertake a survey of industry members	2026	Consultation Report to Authority 2026
	Increase in stakeholder engagement	2026	Review of engagement statistics in end of year report
Achievement of objectives	Reviewed annually against given targets	Annual review at TSB	TSB report and Annual report
Sustainability of the fishery	Review against international standards	2027	TSB report
	Annual review of cockle stocks and consistency of fishery openings	Annual review at TSB	TSB report
	Improved landings data	Annually	Survey and Inspection report
	Increased productivity and returns from the fishery.	Long-term (five years) 2030	TSB report
Knowledge improvement	Continual revision and update of the FMP in light of new evidence	Annually	Cockle FMP available on website
	Establishment of academic partnerships	Annually	TSB report and Annual Report

Improved decision-making timeframes and process	Increase in approved recommendations	2027	Authority report

Annex 1

Cockle Bed Management Criteria Crib Sheets

The following details the agreed criteria and management options for each commercial cockle bed within the district. These have been developed (and will be agreed) from the criteria in Section 2 of this FMP.

Wirral

Leasowe		
Consideration	**Management action**	**Rationale**
MCRS	25mm total shell length (or 20mm square gauge)	As per the rest of the district
Minimum sized biomass for fishery to open (t)	1,100	Based on the minimum amount to meet the bird food requirement, and allow for an enforceable TAC to be applied
Bird food requirement (t)	800	Based on previous HRAs and NE advice
Minimum TAC (t)	300	Based on minimum amount enforceable for 150 permit holders for one day
Latest survey timings to which these considerations apply	September – early October	Leasowe has quick growth and can reach size in under 2 years (evidence in previous stock assessments). Stock surveyed in July may reach size by September, OR re-survey in September may demonstrate sufficient size for later opening.
Access route	North Wirral Coastal Park car park – Slipway 7	Minimal interference with public, MPA features and is close to the fishery
Permitted vehicles	Quadbikes 4x4s Tractors (>2t and 60 hp)	Consideration must be given alongside council regulations and public concerns and damage/disturbance to protected features.
Ancillary works location	North Wirral Coastal Park carpark – associated road and fields	Minimal interference with public, MPA features and is close to the fishery
Open tides	Monday-Friday One tide per day Daylight tides	Public area and council restrictions
Special additional considerations	Public use, timings of summer holidays and tourist use.	The area is commonly used for tourist activity, and access permits for the beach will not be issued by the council until September.

Ribble Estuary

Penfold		
Consideration	**Management action**	**Rationale**
MCRS	25mm total shell length (or 20mm square gauge)	As per the rest of the district
Minimum sized biomass for fishery to open (t)	1200	Based on historical decision making – subject to revision and change.
Bird food requirement (t)	TBC	This requires further research
Minimum TAC (t)	300	See section 9
Latest survey timings to which these considerations apply	July	Surveys timing allows for growth, and management preparation pre-fishery.
Access route	Haul Lane	Fishers are only allowed to transit Haul Lane onto the bed and no ancillary works or parking are permitted due to concerns over the saltmarsh features. Haul Lane is a public right of way.
Permitted vehicles	Quadbikes 4x4s Tractors (>2t and 60 hp)	Consideration must be given alongside council regulations and public concerns and damage/disturbance to protected features.
Ancillary works location	TBC	Haul Lane must not be used for ancillary works due to concerns over saltmarsh features. Locations for ancillary works are still under review and dependent on council/local land owner permissions.
Open tides	Monday-Sunday One tide per day Daylight tides	Currently no other restrictions on open tides from local authorities
Special additional considerations	Haul lane is not to be used for ancillary works.	The access route is owned by RSPB.

Morecambe Bay

Flookburgh		
Consideration	**Management action**	**Rationale**
MCRS	25mm total shell length (or 20mm square gauge)	As per the rest of the district
Minimum total biomass for bed to open (t)	10,400 across Morecambe Bay	Based on historical decision making – this includes the minimum amount of stock that must be left in the Bay plus the minimum TAC and buffer.
Bird food requirement (t)	TBC	TBC
Minimum TAC (% of total)	TBC	This is a minimum and could be subject to change based on number of permit holders and stock dynamics
Latest survey timings to which these considerations apply	July	Surveys timing allows for growth, and management preparation pre-fishery.
Access route	West Plain track	Fishers are only allowed to transit West Plain track onto the bed and not allowed ancillary works or parking due to concerns over the saltmarsh features. West Plain track is a public right of way.
Permitted vehicles	Quadbikes 4x4s Tractors (>2t and 60 hp)	Consideration must be given alongside council regulations and public concerns and damage/disturbance to protected features.
Ancillary works location	Flookburgh Airfield and fields along Moor Lane	West Plain track must not be used for ancillary works due to concerns over saltmarsh features.
Open tides	Monday-Sunday One tide per day	Currently no other restrictions on open tides from local authorities
Special additional considerations	Opening depends on the biomass and composition of cockle in Morecambe Bay as a whole	Biomass of cockle across Morecambe Bay as a whole must be considered when determining if a bed can be opened or not – even if the individual bed surpasses the minimum amount of size previously opened on.

Pilling		
Consideration	**Management action**	**Rationale**
MCRS	25mm total shell length (or 20mm square gauge)	As per the rest of the district
Minimum total biomass for bed to open (t)	10,400 across Morecambe Bay	Based on historical decision making – this includes the minimum amount of stock that must be left in the Bay plus the minimum TAC and buffer.
Minimum TAC (% of total)	TBC	This is a minimum and could be subject to change based on number of permit holders and stock dynamics
Latest survey timings to which these considerations apply	July	Surveys timing allows for growth, and management preparation pre-fishery
Access route	Pilling Embankment Slipway	No ancillary works are permitted on the sands or marsh beyond the slipway
Permitted vehicles	Quadbikes 4x4s Tractors (>2t and 60 hp)	Consideration must be given alongside council regulations and public concerns and damage/disturbance to protected features.
Ancillary works location	Flook Hall Lane	Located adjacent to access route
Open tides	Monday-Sunday One tide per day	Currently no other restrictions on open tides from local authorities
Special additional considerations	Opening depends on the biomass and composition of cockle in Morecambe Bay as a whole	Biomass of cockle across Morecambe Bay must be considered when determining if a bed can be opened or not – even if the individual bed surpasses the minimum amount of size previously opened on.

Newbiggin		
Consideration	**Management action**	**Rationale**
MCRS	25mm total shell length (or 20mm square gauge)	As per the rest of the district
Minimum total biomass for bed to open (t)	10,400 across Morecambe Bay	Based on historical decision making – this includes the minimum amount of stock that must be left in the Bay plus the minimum TAC and buffer.
Minimum TAC (% of total)	TBC	This is a minimum and could be subject to change based on number of permit holders and stock dynamics
Latest survey timings to which these considerations apply	July	Surveys timing allows for growth, and management preparation pre-fishery
Access route	Numerous access points along coastal road	No ancillary works are permitted on the sands beyond the slipways
Permitted vehicles	Quadbikes 4x4s Tractors (>2t and 60 hp)	Consideration must be given alongside council regulations and public concerns and damage/disturbance to protected features.
Ancillary works location	Carparks along coastal road	No ancillary works are permitted on the sands beyond the slipways
Open tides	Monday-Sunday One tide per day	Currently no other restrictions on open tides from local authorities
Special additional considerations	Opening depends on the biomass and composition of cockle in Morecambe Bay as a whole	Biomass of cockle across Morecambe Bay must be considered when determining if a bed can be opened or not – even if the individual bed surpasses the minimum amount of size previously opened on.

Leven		
Consideration	**Management action**	**Rationale**
MCRS	25mm total shell length (or 20mm square gauge)	As per the rest of the district
Minimum total biomass for bed to open (t)	10,400 across Morecambe Bay	Based on historical decision making – this includes the minimum amount of stock that must be left in the Bay plus the minimum TAC and buffer.
Minimum TAC (% of total)	TBC	This is a minimum and could be subject to change based on number of permit holders and stock dynamics
Latest survey timings to which these considerations apply	July	Surveys timing allows for growth, and management preparation pre-fishery
Access route	West Plain track	Fishers are only allowed to transit West Plain track onto the bed and not allowed ancillary works or parking due to concerns over the saltmarsh features. West Plain track is a public right of way.
Permitted vehicles	Quadbikes 4 x 4s Tractors (>2t and 60 hp)	Consideration must be given alongside council regulations and public concerns and damage/disturbance to protected features.
Ancillary works location	Flookburgh Airfield and fields along Moor Lane	West Plain track must not be used for ancillary works due to concerns over saltmarsh features.
Open tides	Monday-Sunday One tide per day	Currently no other restrictions on open tides from local authorities
Special additional considerations	Opening depends on the biomass and composition of cockle in Morecambe Bay as a whole	Biomass of cockle across Morecambe Bay must be considered when determining if a bed can be opened or not – even if the individual bed surpasses the minimum amount of size previously opened on.

Middleton		
Consideration	**Management action**	**Rationale**
MCRS	25mm total shell length (or 20mm square gauge)	As per the rest of the district
Minimum total biomass for bed to open (t)	10,400 across Morecambe Bay	Based on historical decision making – this includes the minimum amount of stock that must be left in the Bay plus the minimum TAC and buffer.
Minimum TAC (% of total)	TBC	This is a minimum and could be subject to change based on number of permit holders and stock dynamics
Latest survey timings to which these considerations apply	July	Surveys timing allows for growth, and management preparation pre-fishery
Access route	Carr Lane	Typically accessed by public
Permitted vehicles	Quadbikes 4x4s Tractors (>2t and 60 hp)	Consideration must be given alongside council regulations and public concerns and damage/disturbance to protected features.
Ancillary works location	TBC	TBC
Open tides	Monday-Sunday One tide per day	Currently no other restrictions on open tides from local authorities
Special additional considerations	Opening depends on the biomass and composition of cockle in Morecambe Bay as a whole The bed is currently unclassified	Biomass of cockle across Morecambe Bay must be considered when determining if a bed can be opened or not – even if the individual bed surpasses the minimum amount of size previously opened on.

References

Aldridge, J. (1997). Hydrodynamic model predictions of tidal asymmetry and observed sediment transport paths in Morecambe Bay. *Eastuarin, Coastal and Shelf Science*, 39-56.

Andre, C., & Rosenberg, R. (1991). Adult-larval ineractions in the suspension-feeding bivalves Cerastoderma edule and Mya arenaria. *Marine Ecology Progress Series*, 227-234.

Armonies, W. (1992). Migratory rhythms of drifting juvenile molluscs in tidal waters of the Wadden Sea. *Marine Ecology Press Series*, 197-206.

Dare, P., Walker, P., & Bannister, R. (2004). Historical and current status of cockle and mussel stocks in the Was. *Cefas internal report*.

Honkoop, P., & Van der Meer, J. (1998). Experimentally induced effects of water temperature and immersion time on reproductive output of bivalves in the Wadden Sea. *Jounral of Experiemental Marine Biology and Ecology*, 227-246.

Kater, B. J., Geurts van Kessel, A. M., & Baars, J. (2006). Distribution of cockles Cerastoderma edule in the Eastern Scheldt. *Marine Ecological Progress*, 221-227.

Kristensen, E., Penha-Lopes, G., Delefosse, M., Valdemarsen, T., Quintana, C., & Banta, G. (2012). What is bioturbation? The need for a precise definition for fauan in aquatic sciences. *Marine Ecology Progress Series*, 285-302.

Magalhaes, L., Freitas, R., & de Montaudouin, X. (2016). Cockle population dynamics: recruitment predicts adult biomass, not the inverse. *Marine Biology*.

Malham, S. K., Hutchinson, T. H., & Longshaw, M. (2012). A review of the biology of European cockles (Cerastoderma spp.). *Journal of the Marine Biological Association of the United Kingdom*.

Mason, D., Scott, T., & Dance, S. (2010). Remote sensing of intertidal morphological change in Morecambe Bay U.K between 1991 and 2007. *Estuarine, Coastal and Shelf Science*, 487-496.

Norris, K. (1999). A trade-off between enerft intake and exposure to parasites in oystercatchers feeding on bivalve molluscs. *Proceedings of the Royal Society Biological Sciences*, 1703-1709.

O'Connor, R., & Brown, R. (1977). Prey depletion and foraging strategy in the oystercatcher Haematopus ostralegus. *Oecologia*, 72-92.

Parada, J., & Molares, J. (2008). Natural mortality of the cockle Cerastoderma edule from the Ria Arousa (NW Spain) intertidal zone. *Revista de biologia marine y oceanografia*.

Sanchez-Salazar, M., Griffiths, C., & Seed, R. (1987). The effect of size and temperature on the predation of cockles Cerastoderma edule by the shore crab Carcinus maenas. *Journal of Experimental Marine Biology*, 181-193.

Seed, R., & Brown, R. (1977). A comparison of the reproductive cycles of Modiolus modiolus, Cerastoderma edule, and Mytilus edulis in Strangford Lough, Northern Ireland. *Oecologia*, 173-188.

Young, E., Bigg, G., Grant, A., Walker, P., & Brown, J. (1998). A modelling study of environmental influences on bivalve settlemtn in The Wash, England. *Marine Ecology Progress Series*, 197-214.

Ysebaert, T., & Herman, P. (2002). Spatial and temporal variation in benthic macrofauna and relationships with environmental variables in an estuarine, intertidal soft-sediment environment. *Marine Ecology Progress Series*.