

## Wash Cockle Fishery 2022 Update

28 June 2022

### Background

The intertidal cockle surveys conducted between March 17<sup>th</sup> and April 30<sup>th</sup> had identified the following stocks in the regulated fishery:

<b>Total Adult Stock</b> ( $\geq 14$ mm width)	8,226 tonnes
<b>Total Juvenile Stock</b> ( $< 14$ mm width)	5,485 tonnes
<b>Total Stock</b> (all sizes)	13,711 tonnes

This level of stock was the third lowest since 2000 and when combined in the bird food calculations with the 12,137 tonnes of mussel surveyed in Autumn 2021, were insufficient to reach the minimum threshold for the SSSI Conservation Objective target of 26,586 oystercatchers<sup>1</sup>. This alone was sufficient to prevent a fishery from opening, but officers also had serious concerns that with only low densities of adult cockles to target, the industry would predominantly target the juvenile stocks that had settled in 2021. Such behaviour would have serious detrimental impacts on the 2023 and 2024 fisheries.

At the Authority meeting on June 8<sup>th</sup>, officers advised the 2022 cockle fishery should remain closed. Following the meeting officers continued to explore further evidence, working in conjunction with a small group of industry members. This included a mussel bed that had not been surveyed in 2021 and several areas of cockle beds that fishermen highlighted had been left out of the surveys. They felt the inclusion of these beds could be critical in achieving the bird food threshold. Both the officers and fishermen also questioned:

- How the number of oystercatchers was calculated and whether the metrics were appropriate?
- Whether areas outside of the regulated fishery which are known to support feeding birds could be included in the calculations
- Whether Year-0 cockles could be included in the calculations. Previously they hadn't been included because at the time of the surveys they are considered too small for oystercatchers, but by the following winter they will have grown sufficiently to be part of the oystercatcher diet.

During a meeting held on 13<sup>th</sup> June, fishermen highlighted areas they would like to see additional surveys conducted. These included a previously un-surveyed mussel bed on the East Breast known locally as the Back of the Wall, and cockle surveys on the NW edge of the Gat sand, Hook Hill and the Bar sand. In addition to conducting these surveys, officers would also continue on-going discussions with Natural England and the developer of the Bird Food Model to answer the questions concerning the bird food model and bird numbers.

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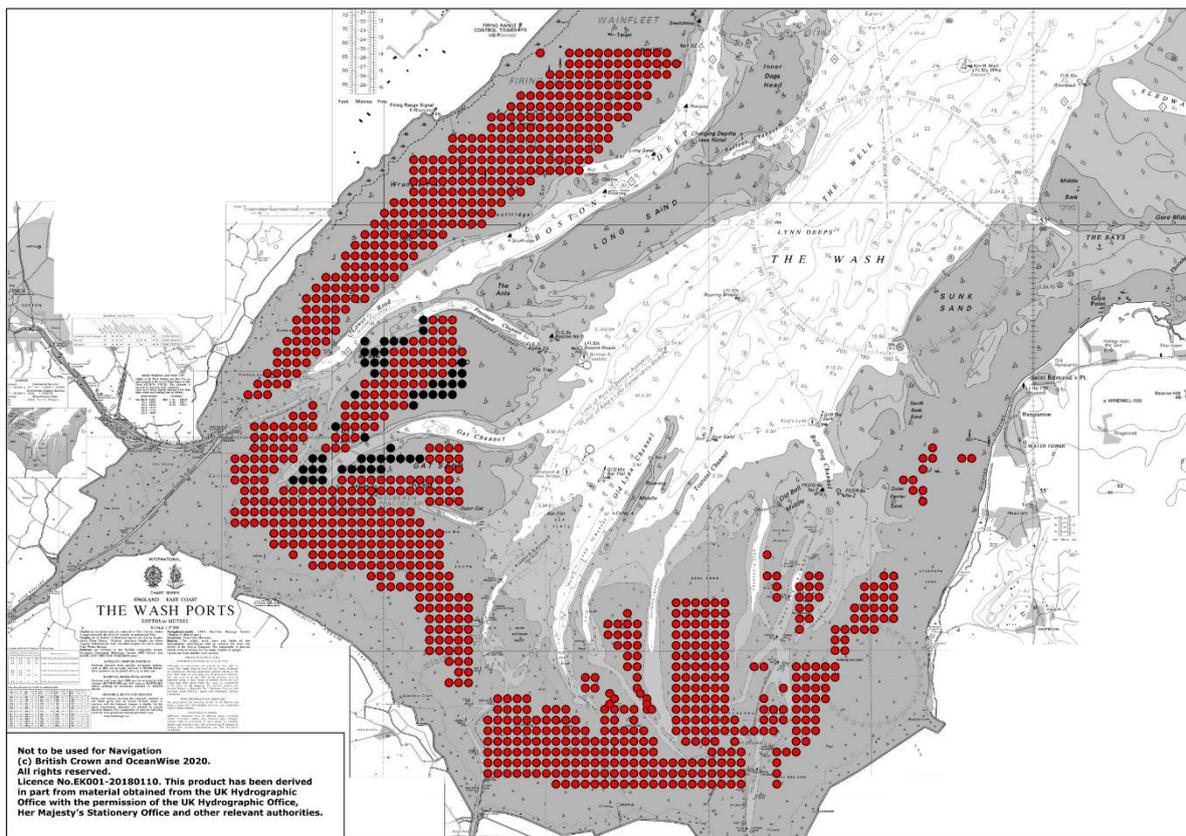
<sup>1</sup> Figure advised by Natural England to be the 5-year mean peak number of oystercatchers

## Mussel survey - Back of the Wall

This additional mussel survey was conducted on 15<sup>th</sup> June during which officers were accompanied by one fisherman. The bed was found to cover an area of 19.2 hectares and support 1,205 tonnes of mussels. Of these, 1,180 tonnes were  $\geq 25\text{mm}$  in length, the minimum size considered eaten by oystercatchers. The addition of these stocks increased the total biomass of mussel used in the bird food calculations from 12,137 tonnes to 13,317 tonnes.

## Additional cockle surveys

On the 16<sup>th</sup>-17<sup>th</sup> June 51 additional cockle stations were surveyed on the Gat, Hook Hill and Roger/Toft/Bar sands outside of areas surveyed during the spring surveys (see figure 1). These were collected deploying a Day grab over high water periods from *RV Three Counties*.



**Figure 1 - Chart showing the coverage of the survey stations sampled during the spring cockle surveys (red) and stations surveyed in June (black)**

Of these 51 stations, 10 were found to support cockles. Of these, however, only one supported densities likely to be fishable. This was situated on the western edge of the Gat mussel bed, and supported Year-0 cockles with a density of  $930/\text{m}^2$ . These were found to have grown well and some had reached a size of  $14\text{mm}$  width. Despite their size, however, these cockles were less than a year old and won't have spawned yet. Although their density is slightly lower than the  $1,000$  cockles/ $\text{m}^2$  that would warrant

automatic protection under the Wash Hand worked Fishery Management Plan, cockles of this age should not be targeted by the fishery. Details of stocks found on each area can be seen in Table 1

**Table 1 – Biomass (tonnes) of cockles found in the additional survey areas samples on June 16-17<sup>th</sup> 2022**

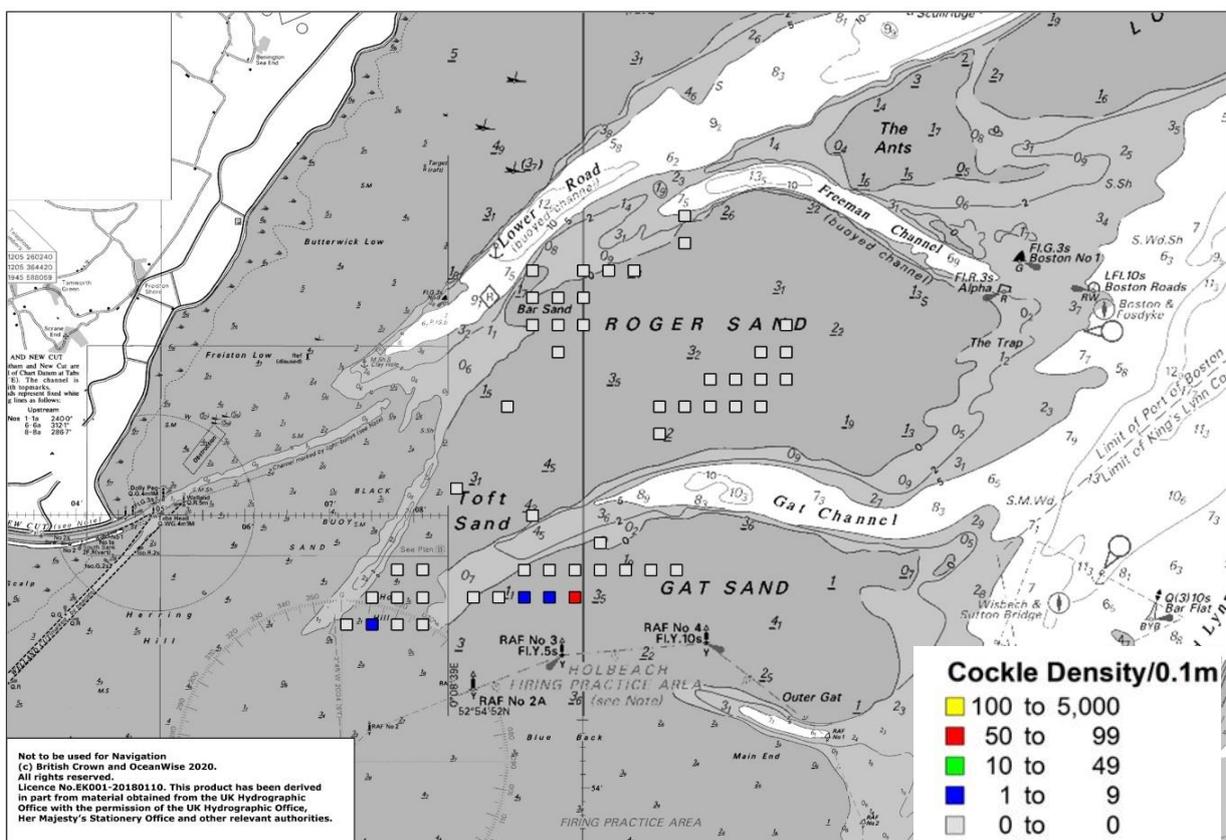
Bed	Weight (tonnes) Year-0	Weight (tonnes) Greater than 14 mm	Total Weight (tonnes)	Total Weight (tonnes) (ExcYear-0)
Gat	264	161	353	90
Hook Hill	2	40	42	40
Roger	0	76	76	76
<b>Total</b>	<b>265</b>	<b>277</b>	<b>471</b>	<b>206</b>

The inclusion of these stations meant the stocks within the whole area surveyed this year had increased to:

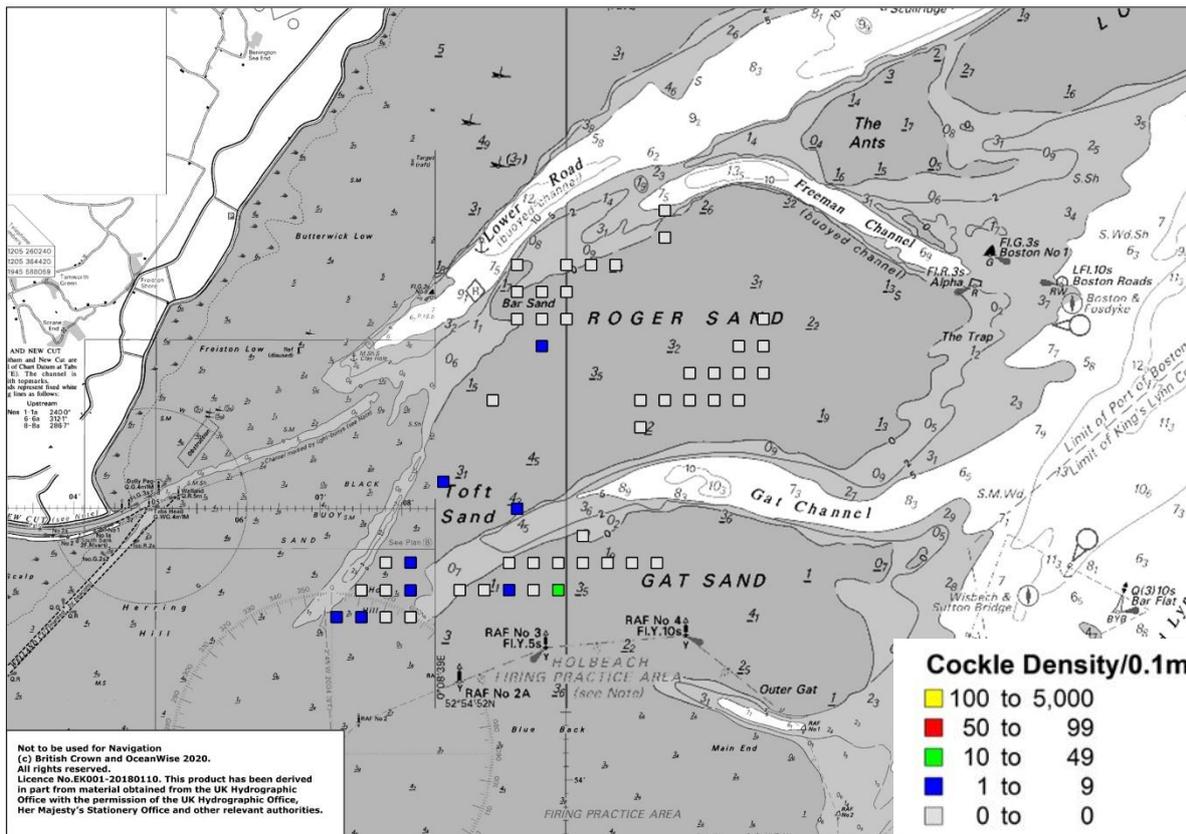
**Total Adult Stock** (≥14mm width) 8,498 tonnes  
**Total Juvenile Stock** (<14mm width) 5,680 tonnes  
**Total Stock** (all sizes) 14,178 tonnes

Based on these figures the maximum TAC for the fishery would be 2,833 tonnes. This quantity could be taken without dropping the total cockle stock below the minimum required threshold of 11,000 tonnes.

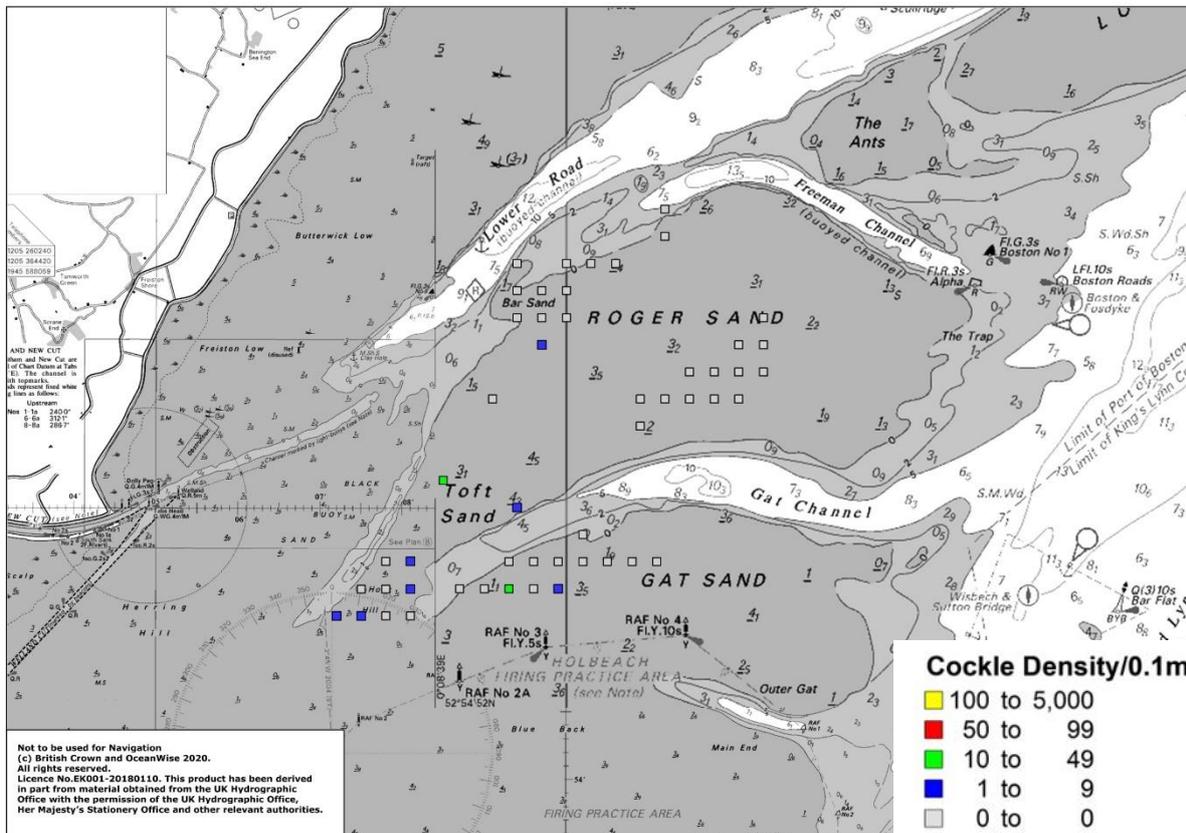
Figures 2-4 show the distribution of Year-0 cockles, cockles ≥14mm width and total biomass of cockles (excluding Year 0's) at the additional sample stations.



**Figure 2 – Distribution of Year-0 cockles at additional stations**



**Figure 3 – Distribution of cockles  $\geq 14$ mm width at additional stations**



## Figure 4 –Total biomass of cockles at additional sites (excluding Year 0's)

In addition to samples grabbed over high water, an assessment of stocks on the Tofts was conducted over low water on 16<sup>th</sup> June. The track walked can be seen in figure 5. This identified a patch of Year-0 cockles south-west of the Tofts mussel bed that supported densities exceeding 3,000 cockles/m<sup>2</sup> (yellow square). Apart from this patch, which extended to the stations coloured red in the chart, only low densities of cockles were found between the Tofts mussel bed and the Ridge, an area that frequently supports high densities of cockles.

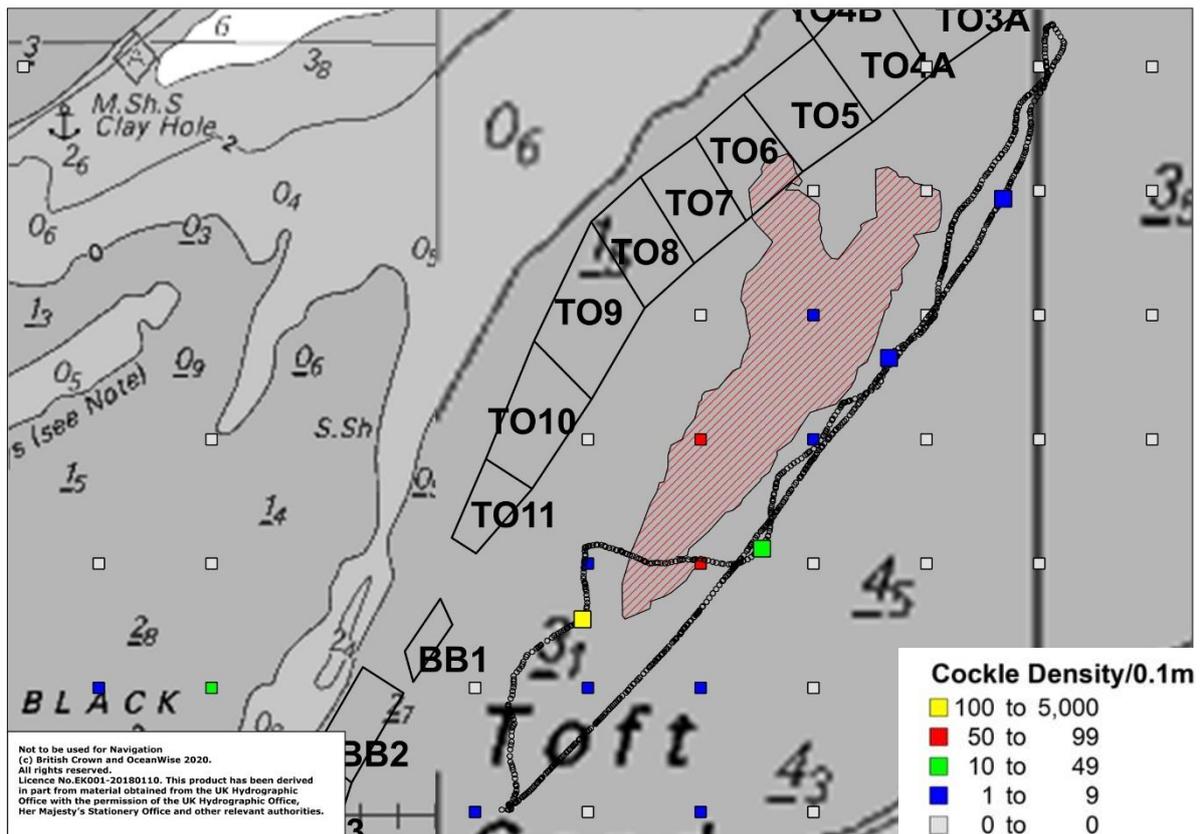


Figure 5 – Chart showing track of foot assessment on Tofts and juvenile cockles

## Bird Food Model discussions

Officers have held discussions with Natural England and the scientist who developed the bird food model for The Wash. During these discussions, it was determined:

1. **Appropriateness of 40kg AFDM figure** – The particular model used was developed specifically for the Wash utilising Wash-specific data. The original model had calculated oystercatcher food requirements as 40kg Ash Free Dry Mass (AFDM). The 2021 review of the Bird Food Model confirmed that 40kg AFDM is still an appropriate figure to use as the over-winter requirement for oystercatchers.
2. **Inclusion of Year-0 cockles in bird food availability calculations** – On the basis that year-0 cockles are likely to grow into target size for oystercatchers

by the end of the summer, it is appropriate to include Year-0 cockles in the calculations of available over-wintering food for oystercatchers.

3. **2019-20 Oystercatcher numbers** – The RSPB have identified an error in the BTO's WeBS bird count data from one area in August 2019 that resulted in the 5 year mean peak increasing significantly in 2021 to 26,586. Having removed the error, the 5 year mean peak has dropped below the 24,000 minimum threshold level again. As such, the minimum threshold of 24,000 birds should be used in the calculations rather than the 26,586 which was originally advised.
4. **Accounting for seasonality in relation to bird food requirements** – In future, it might be more appropriate to base the bird food requirements on a figure derived from the [5-year rolling mean of the] average over-winter (September to March) count of oystercatchers, rather than on the [5-year rolling mean of the] peak count for any month of the year, which is currently used. This would more accurately represent the birds being supported by the cockles and mussels.
5. **Inclusion of private fishery stocks in calculations** – Currently we cannot include stocks on Le Strange estate or on the WFO lays into food availability calculations, because we do not have guarantees that the stocks will remain available to birds over the coming winter. NE consider it is possible we could consider Le Strange stocks in future, so long as we can assure Le Strange that their private fishery will not be jeopardised by the public fishery.
6. **Exclusion of birds on private fishery areas in calculations** – We could only exclude birds on private fishery areas if site fidelity of oystercatchers is confirmed. The recent radio tracking work showed a high degree of site fidelity, but was only based on 10 oystercatchers and cannot be interpolated for the entire Wash. It is possible that the comprehensive dataset of counts across different sectors of The Wash (dating back to 1970) could be analysed to understand the relative importance (usage by oystercatchers) of the Le Strange fishery area and the wider Wash and derive a proportion of birds that could be discounted from the wider Wash bird food availability calculations.

Of the above points, 1-3 will be applied immediately for the management of the 2022 cockle fishery. 4-6 will require further consideration and data analysis to determine whether they could be applied, so will not be applied to the 2022 fishery.

### **Revised Bird Food Model Calculations**

The additional cockle and mussel stocks identified in the recent surveys and the revised advice from Natural England regarding the oystercatcher numbers and the inclusion of Year-0 cockles in the food requirement calculations have resulted in the following changes to the bird food calculations (original advice in black, changes in blue).

- Bird food AFDM requirement = 26,586 oystercatchers x 40kg = 1,063 tonnes AFDM
- Bird food AFDM requirement = 24,000 oystercatchers x 40kg = 960 tonnes AFDM

- Mussel AFDM contribution = 12,137 tonnes x 0.058 = 704 tonnes AFDM
- Mussel AFDM contribution = 13,317 tonnes x 0.058 = 772 tonnes AFDM
- Cockle AFDM contribution = 10,027 tonnes x 0.030 = 301 tonnes AFDM
- Cockle AFDM contribution = 14,178 tonnes x 0.030 = 425 tonnes AFDM
- Total shellfish AFDM = 704 tonnes + 301 tonnes = 1,005 tonnes AFDM
  - ⇒ A deficit of 58 tonnes AFDM (equivalent to 1,933 tonnes of cockle deficit)
- Total shellfish AFDM = 772 tonnes + 425 tonnes = 1,197 tonnes AFDM
  - ⇒ 237 tonnes AFDM excess (equivalent to 7,900 tonnes of cockle excess)

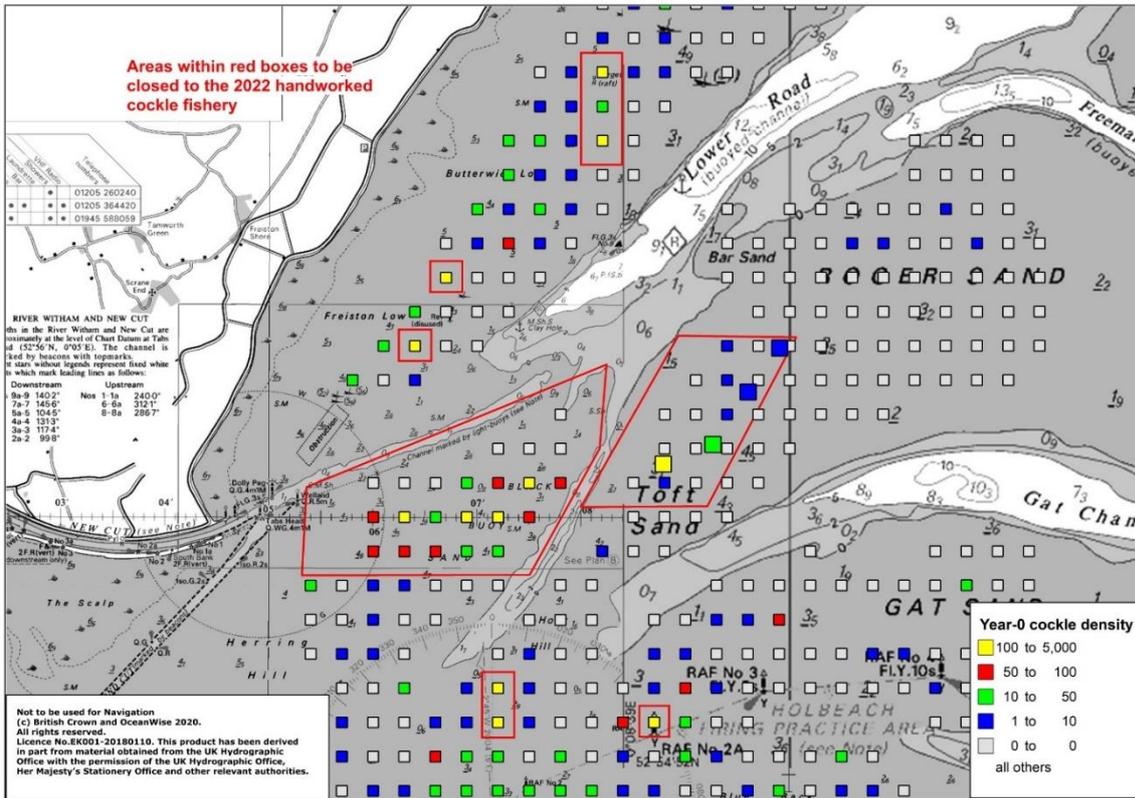
The revised figures indicate that with an excess of 237 tonnes AFDM, the current shellfish stocks are safely within margins that could support a cockle fishery with a TAC of 2,833 tonnes without impacting on the bird's food requirements. It should be noted that there would also be sufficient shellfish above the minimum AFDM threshold to also support the 900 tonnes mussel fishery that had been proposed earlier in the year but deferred pending further evidence.

### **Risks to sustainability associated with opening a 2022 cockle fishery**

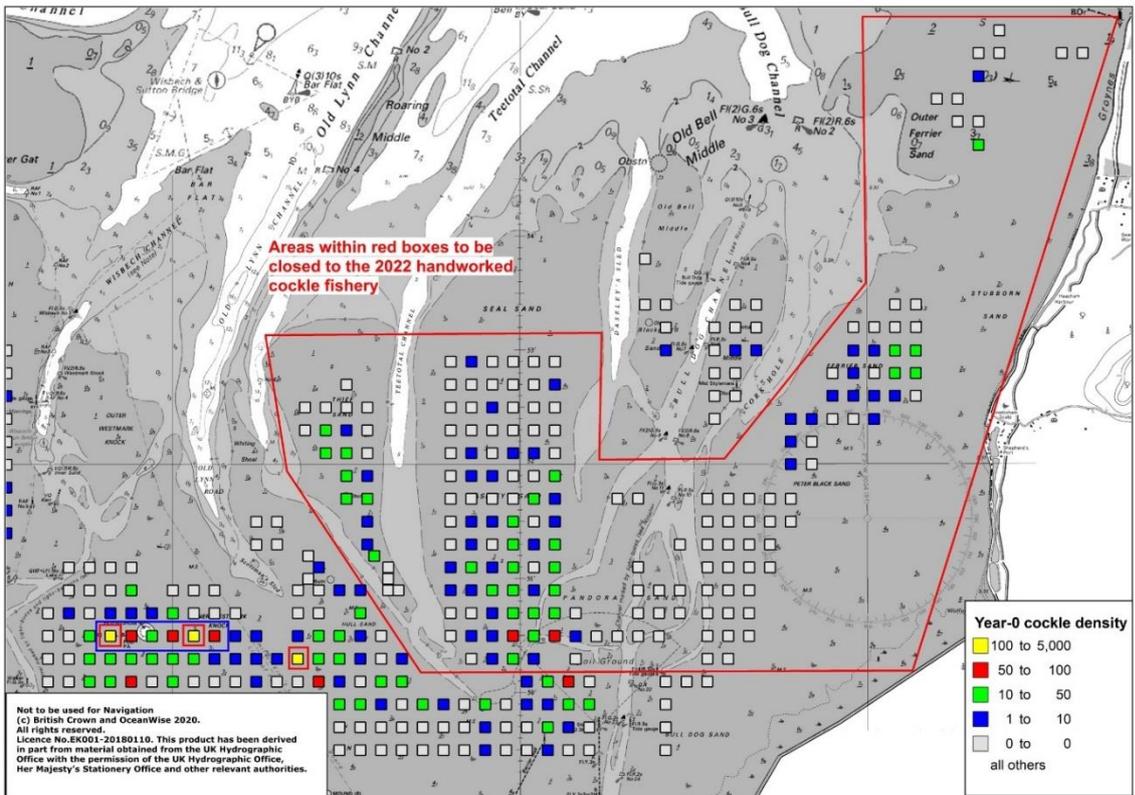
While the conditions for the bird food model have now been met, there nevertheless remains the issue posed by the low densities of older cockles on the beds. The additional surveys did not identify any significant fishable densities of cockles other than 2021 year-class (Year-0) stocks. Unless small patches of older cockles have remained unidentified between survey stations, the survey data suggests that a fishery in 2022 would be quickly reliant on targeting that cohort of juvenile cockles. This cohort have not spawned yet and will not reach their peak biomass until 2023. Removal of any of this year-class will reduce the success of future fisheries. Officers highlighted this risk to representatives of the fishing industry and Authority members at a meeting held on June 22<sup>nd</sup> to discuss the fishery. When asked, none of the fishermen present at that meeting voiced an opinion that the fishery should remain closed, although all agreed that measures were required to minimise the number of small cockles that would be landed. Officers, therefore, worked with the industry representatives at the meeting to identify management measures that would help to mitigate the risks that opening the 2022 fishery would have on future fisheries.

### **Risk mitigation – Spatial closures to protect juvenile stocks**

One of the policies in the Wash Hand worked Cockle Fishery Management Plan is to protect patches of Year-0 juvenile cockles with spatial closures if their densities exceed 1,000/m<sup>2</sup>. As a minimum, such areas would be closed for the 2022 cockle fishery. These proposed closures were shown to and agreed with the industry members at the meeting on June 22<sup>nd</sup>. In addition to the required closures, industry members also proposed some further extensive closures which they agreed to at the meeting. The combined suite of closures can be seen in figures 6 and 7.



**Figure 6 – Indicative spatial closures to protect juvenile cockles – South-west Wash.**



**Figure 7 – Indicative spatial closures to protect juvenile cockles – South-east Wash (not intended to include the Le Strange Estate).**

Table 2 – Table showing the biomass of Year-0 and total stocks protected by the proposed closures.

Bed	Yr-0 total	Yr-0 closed	% Yr-0 closed	Total Biomass	Total biomass closed	% total biomass closed
Black Buoy	400	400	100	1005	1005	100
Blackguard	0		0	0		0
Breast	568	220	39	2317	468	20
Butterwick	228	146	64	545	208	38
Butterwick EXT	155	77	50	367	169	46
Daseleys	204	204	100	522	522	100
Friskney	42		0	518		0
Friskney EXT	17		0	151		0
Gat	323		0	1002		0
Herring Hill	25		0	226		0
Holbeach	606		0	1828		0
Hook Hill	2		0	42		0
IWMK	349	123	35	1518	226	15
Maretail	460	217	47	1486	237	16
Outer Ferrier	4	4	100	50	50	100
Pandora	0	0	0	25	25	100
Peter Black	0	0	0	28	21	75
Roger	20	6	30	842	483	57
South Ferrier	46	46	100	192	192	100
Stylemans	4		0	26		0
Thief	291	291	100	457	457	100
Whiting Shoal	15		0	47		0
Wrangle	176		0	954		0
Wrangle EXT	9		0	33		0
<b>Grand Total</b>	<b>3946</b>	<b>1735</b>	<b>44</b>	<b>14182</b>	<b>4065</b>	<b>29</b>

The figures in table 2 show that 4,065 tonnes (29%) of the total cockle biomass on the regulated beds are estimated to be present within the proposed closed areas. Although the closures incorporate the densest patches of Year-0 cockles that were identified in the surveys, only 44% of this cohort's biomass is protected by them. With over half of the Year-0 biomass situated outside of the closed areas, and potentially able to be harvested, the fishery could have a significant impact on the 2023 fishery. Such areas that are significantly thinned out this year are unlikely to support major fisheries next year.

The clustering of the closures do, however, ensure a protective effect over some large areas that include 100% of the juveniles stocks on the Black Buoy, Daseley;s, Thief and Ferrier sands; 58% on Butterwick (including Butterwick Extension) and 47% on the Mare Tail. Although not apparent from these figures, another area of juveniles identified during a foot survey on the Roger Sand (Figure 5) are also protected.

Because the placement of spatial closures is only as effective as the 400-yard resolution of the survey sampling regime, small closures around what is often just a single sampling station frequently do not align well with the stocks on the ground. Previously this has led to over-protection in some areas, where potentially older cockles have inadvertently been excluded from the fishery, while in other areas, juvenile stocks have extended outside of the protective areas and have been fished. These larger closures that incorporate whole sands will be more effective at protecting the juvenile cockles within them, hopefully resulting in better survival.

### **Risk mitigation – Technical measures**

While the proposed closures incorporate the densest patches of Year-0 juvenile cockles, 56% of their biomass are situated in areas that will be open to the fishery. Where these are co-located with larger cockles, or have grown well themselves, there will be a strong temptation for fishermen to harvest them, particularly as in recent years their financial value has been equivalent to or higher than larger cockles.

In most fisheries, juvenile stocks are protected with a Minimum Landing Size (MLS). For a number of reasons, a MLS for cockles in the Wash fishery would be ineffective and difficult to administer. Without a MLS, however, juvenile cockles in The Wash have no legislative protection. During the meeting with industry representatives, officers stressed the importance of protecting the juvenile cockles and fishermen made some suggestions to reduce the quantity landed.

#### Using nets and rakes rather than shovels

When cockle stocks are dense enough to be prop-washed into ridges, the cockles are often shovelled directly into bags. With no riddling, this method is indiscriminate, leading to juvenile cockles and shell being landed. If the mesh on a net is of a sufficient size, and/or has a square-mesh panel in the bottom, it can be used to sort the catch in situ, returning the small cockles back to the ground they were taken from. This approach can be more effective for juvenile survival than riddling the catch close to the boat, where piles of juveniles build up beneath the riddle and might not be scattered.

#### Closing further sands

Fishermen suggested that if during the course of the fishery large numbers of juveniles were landed from specific sands, those sands should be closed. In theory this proposal makes sense, but in practice could be unfair on fishermen who were using nets to land large cockles from a sand where others were using shovels and landing juveniles.

#### Closing the fishery if processors detect high proportions of juvenile cockles being landed

Two of the three processors who operate in The Wash were present at the meeting. Both said they were unhappy at the quantity of small cockles that have been landed in the past few years, but unless all three processors refused to take them, they couldn't do anything alone. There was a suggestion that if officers detected high quantities of the juvenile cockles being landed into any of the processing plants, the fishery should be closed.

## **Fishery sustainability vs stock sustainability**

Fisheries sustainability and stock sustainability are closely linked and usually considered as one. However, they are not quite the same for at certain stock densities a fishery might not be financially viable, while the stocks themselves are still sustainable. There is evidence to suggest this is the case with the hand worked cockle fishery, where historic stock data shows cockle stocks have frequently recovered very quickly from very low stocks following good settlements. To be viable, the hand worked cockle fishery requires relatively dense stocks in order to achieve quotas. These minimum densities are certainly higher than the cockle stock itself requires to remain sustainable. As such, there is very little risk of a hand worked cockle fishery reducing cockle stocks to levels it cannot recover from. From a purely stock perspective, therefore, there is little long-term risk of the fishery causing a collapse of the stocks.

Sustainability of the fishery, itself, is another matter, however. High natural mortalities coupled with a recent tendency for the fishery to target younger cockles, creates a situation in which cockle densities might not be sufficient to support a viable fishery. While stock sustainability can never be dismissed, most of the management measures associated with the Wash cockle fishery over the years have been aimed at keeping the fishery, itself, sustainable. The decision on whether or not to open a cockle fishery this year is, therefore, not a concern about the stocks per se, but balancing the current needs of the fishermen with the future viability of their industry.

## **2022 cockle fishery risk assessment**

IFCA duties under MaCCA are to *ensure healthy seas, sustainable fisheries and a viable industry*<sup>2</sup>, in effect, protecting the environment and both future and existing fisheries. By conducting a Habitats Regulations Assessment and implementing mitigation needed to avoid adverse effect on site integrity, ensuring there is sufficient shellfish for overwintering oystercatchers and following the policies described in the Wash Hand worked Cockle Fishery Management Plan, the Authority are delivering their responsibility to the environment. Fisheries management measures tend to focus on protecting the sustainability of future fisheries from being over-fished by current fisheries. The cockle stocks identified in the 2022 surveys suggest the 2022 cockle fishery would be heavily reliant on harvesting 2021 year-class juvenile cockles to the detriment of the 2023 fishery. Officers judge that to best protect the sustainability of the 2023 (and future) fisheries, the cockle fishery should not be opened this year. However, the IFCA vision requires we also have a responsibility to existing fisheries. Several fishermen have expressed concerns that, already faced with financial hardships, the failure to open a cockle fishery year could put them out of business or cause them to permanently lose their crew. Although opening a cockle fishery this year is likely to impact next year's fishery, there is a need to balance current and future needs.

Therefore, a risk assessment has been undertaken to consider the risks of each scenario. The Risk Assessment (Appendix 1) assesses the immediate risks that not

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<sup>2</sup> From the IFCA Vision statement

opening a fishery would have against the longer-term risks on sustainability that opening the fishery would have.

In summary, the Risk Assessment highlights risks in both scenarios, i.e. where a cockle fishery is not opened and where a fishery is opened.

The key risks associated with not opening a fishery are the risk to businesses in the context of the current cost of living crisis and other financial pressures (including the loss of skilled crew and skippers as a result) and the displacement of activity into other fisheries with potential for impacts on sustainability and viability of the industry who rely on them.

The key risk associated with opening a fishery is that the adult cockle stock is not of sufficient density to support a hand-worked fishery which will lead to the removal of smaller, pre-spawning cockles which are present at higher densities. Whilst this is not considered likely to risk the stock per se (i.e. the stock will recover from this) it is very likely to reduce the amount of cockle available next year and the year after as typically, these smaller cockles would not be fished this year. Therefore opening a fishery poses a risk to industry viability over the longer term.

## Appendix 1 – Risk Assessment

The following risk assessment evaluates the risk associated with two scenarios; that where a fishery is not opened and that where a fishery is opened. To determine risk the likelihood (L) of an occurrence happening is considered with the severity of the consequence (C) should it occur and risk scores are generated using the standard matrix (below). The same assessment is then undertaken when mitigation is applied (e.g. management measures) to determine remaining risk.

Likelihood	Rating
Almost certain	5
Likely	4
Possible	3
Unlikely	2
Rare	1

Consequence	Rating
Extreme	5
Major	4
Moderate	3
Minor	2
Insignificant	1

		Consequence				
		Extreme (5)	Major (4)	Moderate (3)	Minor (2)	Insignificant (1)
Likelihood	Almost certain (5)	25	20	15	10	5
	Likely (4)	20	16	12	8	4
	Possible (3)	15	12	9	6	3
	Unlikely (2)	10	8	6	4	2
	Rare (1)	5	4	3	2	1

Implications	Risk before mitigation			Mitigation	Risk after mitigation		
	L	C	RR		L	C	RR
<b>Scenario – 2022 cockle fishery is not opened</b>							
<p><b>Threat to other fisheries due to displacement</b></p> <p>Traditionally the vessels with entitlements for the Wash cockle fishery have also targeted the mussel and brown shrimp fisheries. More recently, several have also targeted the whelk fishery. Closure of the 2022 cockle fishery could result in displacement of fishing effort to these other fisheries that could be detrimental to the long-term sustainability of those fisheries (and/or the environmental features the fishery interacts with).</p> <p>Mussels – Traditionally, the regulated mussel beds supported productive fisheries both for direct harvesting and for relaying seed onto lays. Historically, however, these intertidal beds have been susceptible to overfishing, so could not support widespread displacement. Since 2010 the beds have suffered high mortalities and poor recruitment, leading to their general decline and poor condition. In recent years, therefore, these beds have only been able to support small relaying fisheries. There is potential for 900 tonnes to be opened this year for relaying, but no opportunity for a harvesting fishery. As such, this fishery would require investment this year and not realise net income for at least a year.</p> <p>Brown Shrimp – This fishery has traditionally absorbed a lot of displacement when the cockle and mussel fisheries have been poor. Stock assessments suggest that due to the biology of brown shrimp, as a species they are able to absorb this displacement quite well. However, the HRA for this fishery could not rule out significant adverse</p>	4	4	16	<p>While displacement into the other fisheries is likely to occur if the cockle fishery isn't opened in 2022, most have management measures in place to protect their stocks from overfishing if displacement does occur. These, however, will limit the amount of displacement that can be absorbed by those fisheries, thus limiting the benefit that can be gained from them.</p> <p>Mussel - The mussel fishery is heavily regulated. If management measures are followed, overfishing should not occur. However, these measures prevent significant displacement into this fishery. There is potential for a 900 tonne seed relaying fishery to be opened, but this would require investment during 2022 rather than providing net income.</p> <p>Brown Shrimp – To prevent the shrimp fishery causing significant adverse impacts to the site's environmental features, management measures were introduced to cap fishing effort within the site. Effort in recent years has been lower than average, which means there is some opportunity for increased effort this year while remaining within the 5-year rolling mean cap. However, it is unlikely this fishery would be able to absorb widespread displacement from the cockle fishery without the cap being quickly exceeded. Also, significant increased effort above the 5-year mean would reduce the size of the following four years' fisheries.</p> <p>Whelk – Usually fishing effort for the whelk fishery is lower at times when the cockle fishery is open so closure of the cockle fishery could result in significant displacement to the whelk fishery. Effort for this fishery is currently limited by imposing a 500 pot limitation but there are no limitations on the number of permits that are allowed. As such, displacement could cause effort to significantly increase in this fishery</p> <p>Crab/lobster – There are currently no measures in place that could prevent displacement to these fisheries.</p>	3	3	9

Implications	Risk before mitigation			Mitigation	Risk after mitigation		
	L	C	RR		L	C	RR
<p>effect on the site's environmental features if effort exceeded levels occurring at the time of assessment. Large-scale displacement to this fishery, therefore, could cause significant impact to the site's environmental features.</p> <p>Whelk – The low mobility and absence of a planktonic larval stage make whelks particularly susceptible to localised overfishing. Trends in Landings Per Unit Effort (LPUE) for this fishery have started to fall indicating the stock is declining. This is particularly so for the Wash fishery, where decreases in LPUE are the highest in the district. As effort already appears too high in this fishery, further displacement from the cockle fishery could not be absorbed.</p> <p>Crab/lobster – Cefas Southern North Sea stock assessments indicate both of these species are currently being overfished. On a more localised level, LPUE trends indicate the stocks are not currently on a <i>cliff-edge</i> but are slowly declining. It is believed some minor localised management would rectify this. Neither fishery would cope well with large-scale displacement from the cockle fishery, however.</p>				<p>Of the main fisheries likely to be targeted by vessels displaced from the cockle fishery, the mussel and brown shrimp fisheries have sufficient regulation current in place to prevent over-fishing occurring. The same is not the case for the whelk or crab/lobster fisheries, however, which could face even more displacement activity if extra effort cannot be directed towards the mussel and brown shrimp fisheries. The risk of overfishing to these fisheries is such that should the cockle fishery not open, further management would be required to prevent displacement activity causing overfishing to other fisheries.</p>			
<p><b>Some businesses will face bankruptcy and/or loss of skippers and crews from fishery.</b></p> <p>The cost of fuel, vessel maintenance, licencing and other overheads are currently very high, as are general living costs. While some vessels will be able to target other fisheries if the 2022 cockle fishery is not opened, the opportunity for displacement into these other fisheries is limited. Changing to a new fishery can involve a large</p>	4	4	16	<p>The only available mitigation to this risk would be to open the 2022 cockle fishery, which would provide an income for those involved in it. Opening the fishery would also reduce the displacement impact to other fisheries.</p> <p>The surveys indicate stocks are poor, however, which will limit the overall value of the fishery to those targeting it. Fuel and overheads also remain high, which will reduce profits. Further, should the fishery target the Year-0 stocks, the value of the 2023 fishery will also be reduced.</p>	2	3	6

Implications	Risk before mitigation			Mitigation	Risk after mitigation		
	L	C	RR		L	C	RR
<p>investment in equipment and training that not all businesses could afford. Further, restrictions already in place for those other fisheries restrict the amount of displacement that can take place. Closure of the 2022 cockle fishery will, therefore, result in significant financial hardship to all of those usually involved in the fishery.</p> <p>The cockle fishery is the mainstay fishery for many of the boats involved in it, particularly the smaller business models. Some of these won't have sufficient resilience to survive a complete closure of the cockle fishery which would lead to bankruptcy and permanent loss of those vessels from the fishery.</p> <p>Some skippers and vessel owners have announced that due to the rising living costs and uncertainty over their future, some crews have already left the fishery and others are threatening to leave if the cockle fishery does not open. Once in alternative employment, most will not return in the future.</p>				See also the risk assessment for cockle fishery sustainability below.			
<b>Scenario – 2022 cockle fishery is opened</b>							
<p><b>The cockle stock is reduced to levels whereby the stock cannot recover.</b></p> <p>In many species, the stock will not survive if the population is reduced below critical densities below which the breeding population is too small to provide adequate recruitment or other factors (e.g. bed erosion or a shift in predator/prey balance) come into effect. The Wash is thought to be a closed system for cockle stocks, so if the species is totally removed, recruitment from outside of the system wouldn't occur. Despite this, the cockle population in the Wash has frequently recovered from some very low stock levels, with exceptional</p>	1	4	4	If the fishery is opened, it will be limited to a Total Allowable Catch of 2,833 tonnes out of 14,178 tonnes present. The fishery will also be subject to extensive closures that will protect 29% of the total cockle biomass and 44% of the Year-0 biomass.	1	4	4

Implications	Risk before mitigation			Mitigation	Risk after mitigation		
	L	C	RR		L	C	RR
<p>spatfalls often occurring from very low spawning stocks. This ability to recover from low stock levels means the risk of the fishery reducing the cockle stocks to unrecoverable levels is unlikely to occur.</p> <p>The dredge fisheries, which could still viably operate in low cockle densities did reduce stock levels several times between 1986-2008. The hand worked cockle fishery, however, requires a higher minimum density to remain commercially viable. This density is higher than the cockle population requires to remain sustainable, so the risk of the hand worked cockle fishery reducing cockle stocks to unrecoverable levels is extremely remote.</p>							
<p><b>The cockle stock is reduced to levels whereby the fishery is no longer sustainable</b></p> <p>Although it is unlikely that the hand worked cockle fishery will reduce cockle stocks to a level where the cockle stocks are unable to recover, it could reduce the cockle densities to levels that are too low to support a viable fishery. The surveys suggest the current low stock densities are barely sufficient to support a viable fishery without targeting Year-0 juvenile stocks. Targeting those juveniles this year will reduce their densities for future fisheries and also impact on the spawning potential. Targeting juvenile cockles this year would, therefore, be detrimental to the success of next year's fishery. Persistent targeting juvenile cockles in this and future fisheries will make the fishery totally reliant on receiving good annual spatfalls to replenish those denser patches. At best, however, good spatfalls only occur once every two years and frequently less so. If the fishery continues to target Year-0 cockles, therefore, the threat of future</p>	4	4	16	<p>The 2022 cockle fishery will be limited to a TAC of 2,833 tonnes and extensive closures will be put in place to protect juvenile stocks. The closure of some entire beds should enable sufficient Year-0 cockles to survive to facilitate a small hand worked fishery in 2023. Opening a fishery this year will be at the cost to the size of next year's fishery, however. This will particularly be so if Year-0 cockles are preferentially targeted from within the open areas this year. Reducing the densities of Year-0 stocks this year will reduce the opportunities where fishing will be viable next year.</p> <p>Industry representatives have suggested ways of reducing the quantity of juvenile cockles landed in their catches, including the use of nets and rakes rather than shovels for harvesting their catch and potentially closing beds (or the whole fishery) if the landing of Year-0 cockles occurs at problematic levels. However, it is uncertain how effective these measures would be in practice, particularly as previous fisheries have shown there is a financial incentive in landing juvenile cockles. Further, from conversations with some fishermen, there appears to be lack of understanding as to what a Year-0 cockle is, or the importance of protecting them.</p>	3	3	9

Implications	Risk before mitigation			Mitigation	Risk after mitigation		
	L	C	RR		L	C	RR
annual closures will be high. Over time the financial gains from the fishery will be sub-optimal, which could lead to some of the business models going bankrupt.							
<p><b>The fishery caused a significant impact on the site's conservation species</b></p> <p>Nationally important populations of resident and overwintering wader rely on the shellfish stocks in The Wash for their survival. Crashes in the shellfish stocks in the 1990's resulted in large declines in the oystercatcher numbers, which took many years to recover. It is likely, therefore, that overfishing the cockle and/or mussel stocks could have a detrimental impact on the site's protected bird species.</p> <p>Harbour seals are also a named protected species in The Wash. Their populations are currently in decline, although this is thought to be due to interspecific competition from the increasing numbers of grey seals rather than fishing activities. Nevertheless, disturbance during pupping season can result in pups being separated from their mothers.</p>	4	4	16	<p>The cockle fishery must undergo a Habitats Regulations Assessment (HRA) to ensure the proposed fishery will not have a significant adverse effect on the site's conservation features and if needed, mitigation must be implemented. The management of the fishery is also guided by a suite of measures described in the Wash Hand worked Cockle Fishery Management Plan, which if followed also prevent the cockle fishery from having a significant adverse effect on the site's conservation features.</p> <p>The management measures that the 2022 cockle fishery will operate under if it opens all follow the guidance in the Management Plan, and the proposed closures exceed those required. The proposed fishery, therefore, should not impact the site's conservation features</p>	2	3	6