Annex A **NWIFCA Cockle and Mussel Survey Results – Report to TSB October 2018**

For all cockle surveys:

1. Means were calculated from all stations with zero counts on the edge of the bed removed. Less than 5mm cockle was not used in the undersize figures due to the high variable survivability of cockle at this small size.
2. Maps were created showing the overall survey area, density of size cockle, density of undersize cockle (excluding cockles in the 0-5mm size range) and the density of the 0-5mm size class. 3. Biomass calculations - size cockle defined as cockle which will not pass through a square gauge 20 x 20mm in size.
3. The biomass of undersize cockle does not include any estimates of cockle less than 5mm due to the high variability of survival of this size class although there are large areas of with this size class on the bed.

Pilling cockle survey 28-08-2018

LW 07:43 1.5m (Liverpool tides)

Survey – Jumbo and 0.5m^2 quadrat

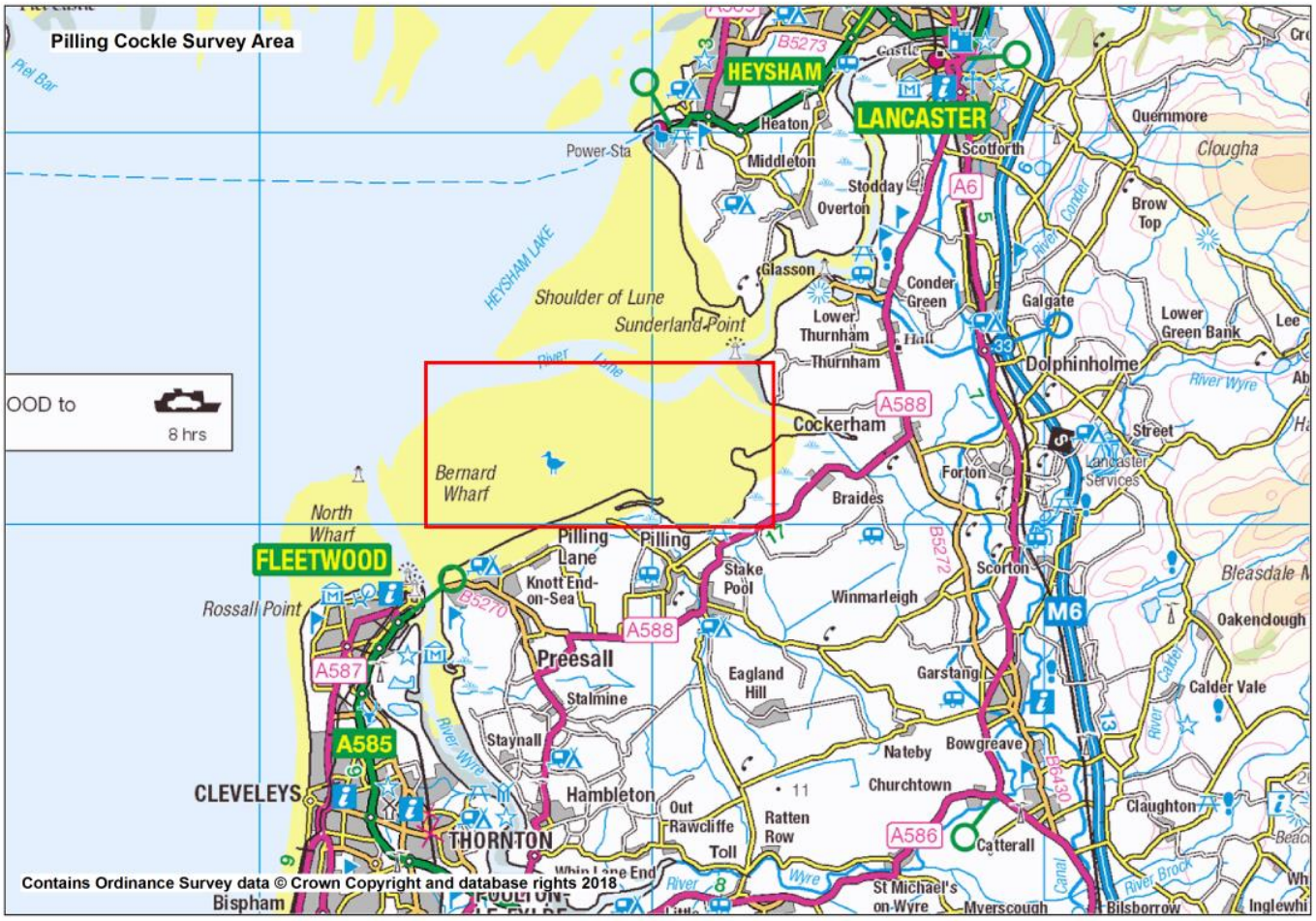
61 survey stations were sampled from a 500m grid, 5 additional points were added to explore the northern and western extent of the bed. Ground conditions were too soft for officers to further explore the bed edge on the eastern side. An area of more dense size cockle was identified towards the north eastern area of the bed but overall the density of size cockle was low. There was a good amount of spat across the bed, both in the 0-5mm and 5-15mm size classes. Oystercatchers and gulls were observed feeding on the bed.

Means

Mean number of size cockle:	21 per m²	(min 0, max 192)
Mean number of undersize cockle:	112 per m²	(min 0, max 762)

Biomass

	Area (ha)	Size Cockle (tonnes)[1]	Undersize Cockle (tonnes)[2]
Pilling	**1256**	**~2200**	**~500-1000**


Pilling Cockle Survey Area
HEYSHAM
LANCASTER
FLEETWOOD
CLEVELEYS
THORNTON
Bispham
Preesall
Pilling
Knott End-on-Sea
Cockerham
Dolphinholme
Scorton
Garstang
Catterall
Claughton
Bowgreave
Nateby
Churchtown
Winmarleigh
Oakenclough
Calder Vale
Bleasdale
Quernmore
Clougha
Brow Top
Lower Green Bank
Galgate
Conder Green
Glasson
Lower Thurnham
Thurnham
Braides
Forton
Lancaster Services
Street
Stake Pool
Eagland Hill
Stalmine
Staynall
Hambleton
Out Rawcliffe
Ratten Row
Toll
Whin Lane End
St Michael's on-Wyre
Myerscough
Bilsborrow
Inglewhi
Middleton
Heaton
Stodday
Overton
Scotforth
Power-Sta
Piel Bar
HEYSHAM LAKE
Shoulder of Lune
Sunderland Point
River Lune
Bernard Wharf
North Wharf
Rossall Point
OOD to
8 hrs
A588
A587
A585
A586
A6
M6
B5273
B5270
B5272
B6430
River Wyre
River Conder
River Calder
River Brock
Canal
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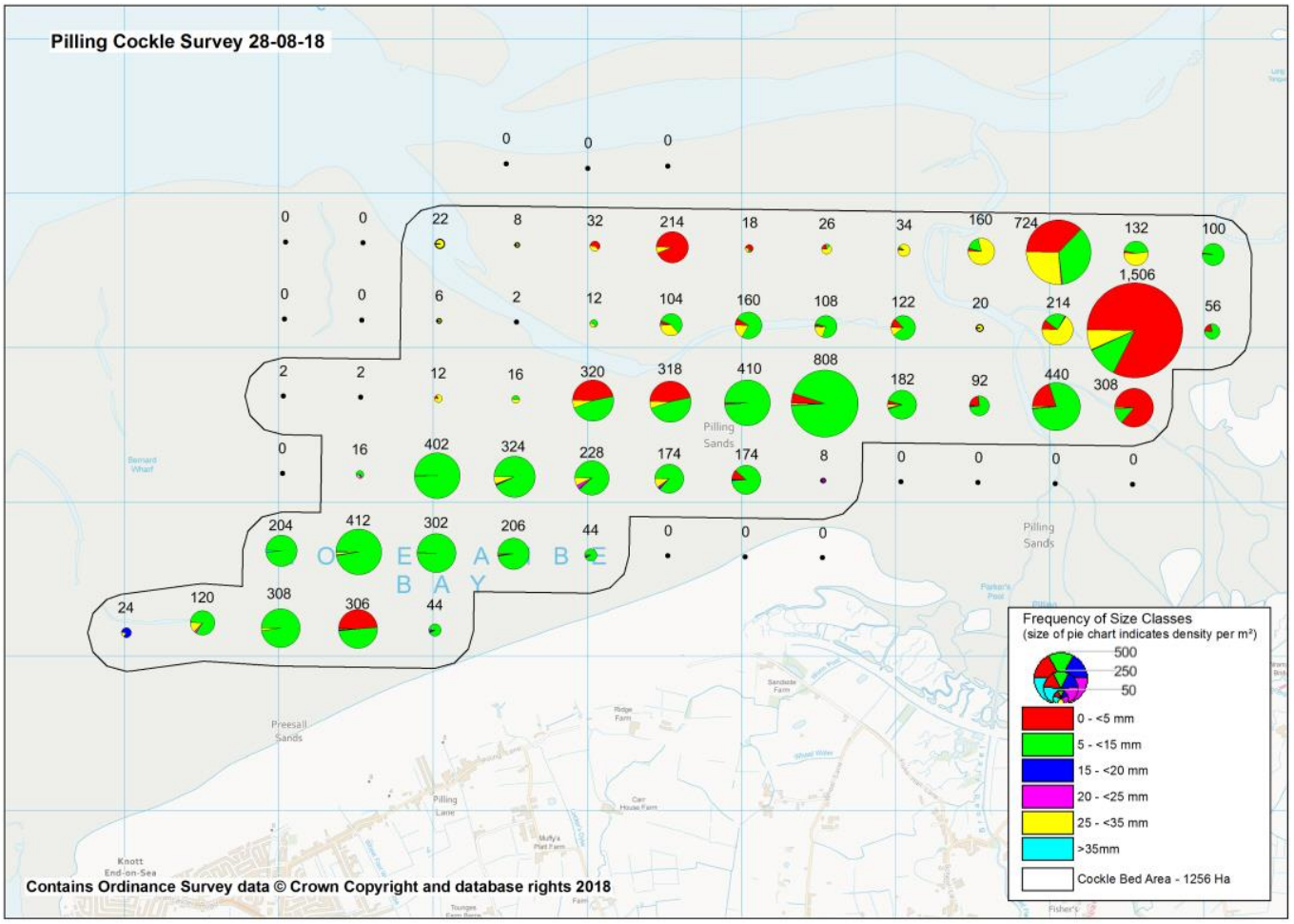
Pilling Cockle Survey 28-08-18
0 0 0
0 0 22 8 32 214 18 26 34 160 724 132 100
0 0 6 2 12 104 160 108 122 20 214 1,506 56
2 2 12 16 320 318 410 808 182 92 440 308
0 16 402 324 228 174 174 8 0 0 0 0
204 412 302 206 44 0 0 0
24 120 308 306 44
OCEAN BAY
Pilling Sands
Preesall Sands
Frequency of Size Classes
(size of pie chart indicates density per m²)
500
250
50
0 - <5 mm
5 - <15 mm
15 - <20 mm
20 - <25 mm
25 - <35 mm
>35mm
Cockle Bed Area - 1256 Ha
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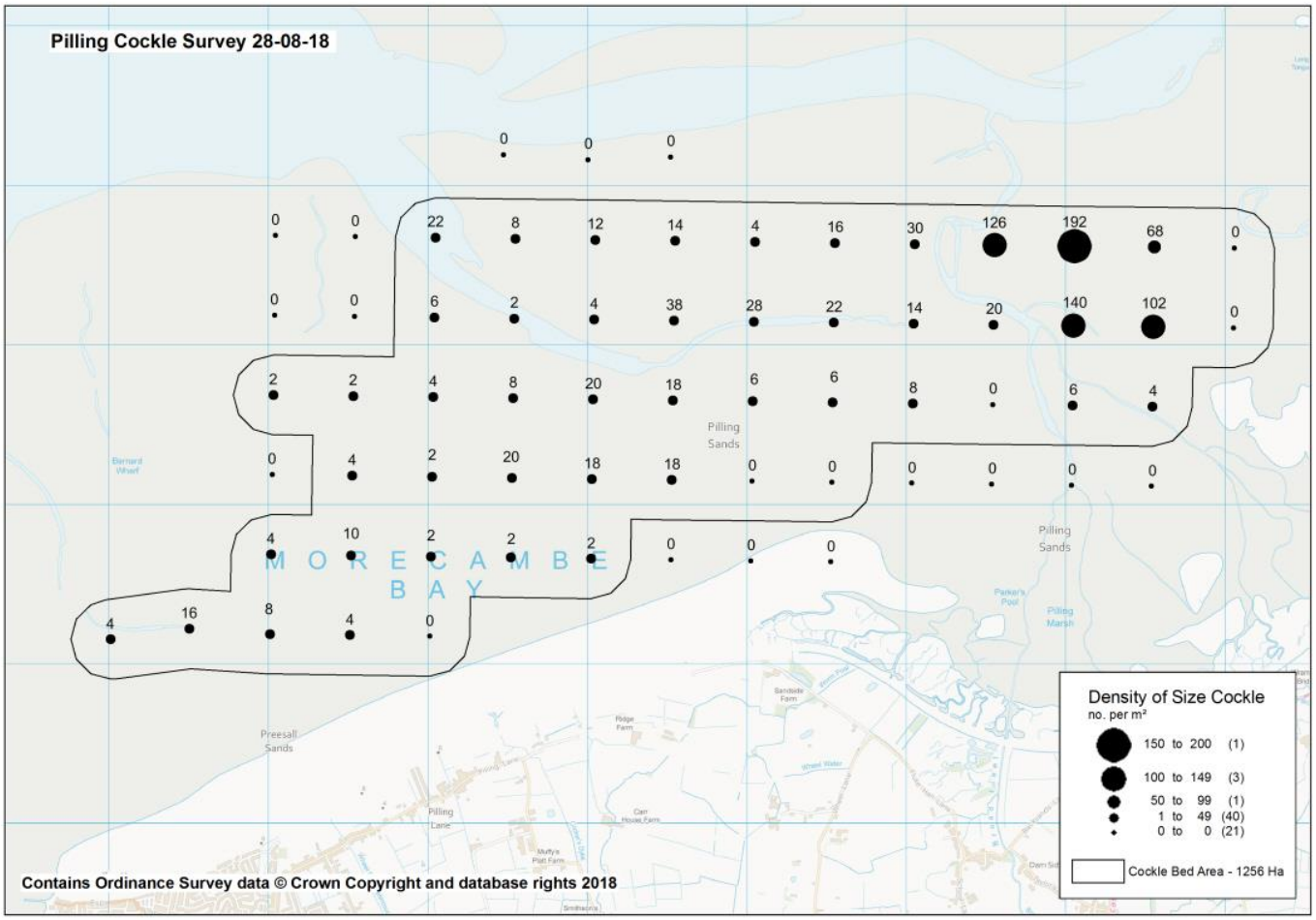
Pilling Cockle Survey 28-08-18
0 0 0
0 0 22 8 12 14 4 16 30 126 192 68 0
0 0 6 2 4 38 28 22 14 20 140 102 0
2 2 4 8 20 18 6 6 8 0 6 4
0 4 2 20 18 18 0 0 0 0 0 0
4 10 2 2 2 0 0 0
4 16 8 4 0
Pilling Sands
MORECAMBE BAY
Preesall Sands
Density of Size Cockle
no. per m²
150 to 200 (1)
100 to 149 (3)
50 to 99 (1)
1 to 49 (40)
0 to 0 (21)
Cockle Bed Area - 1256 Ha
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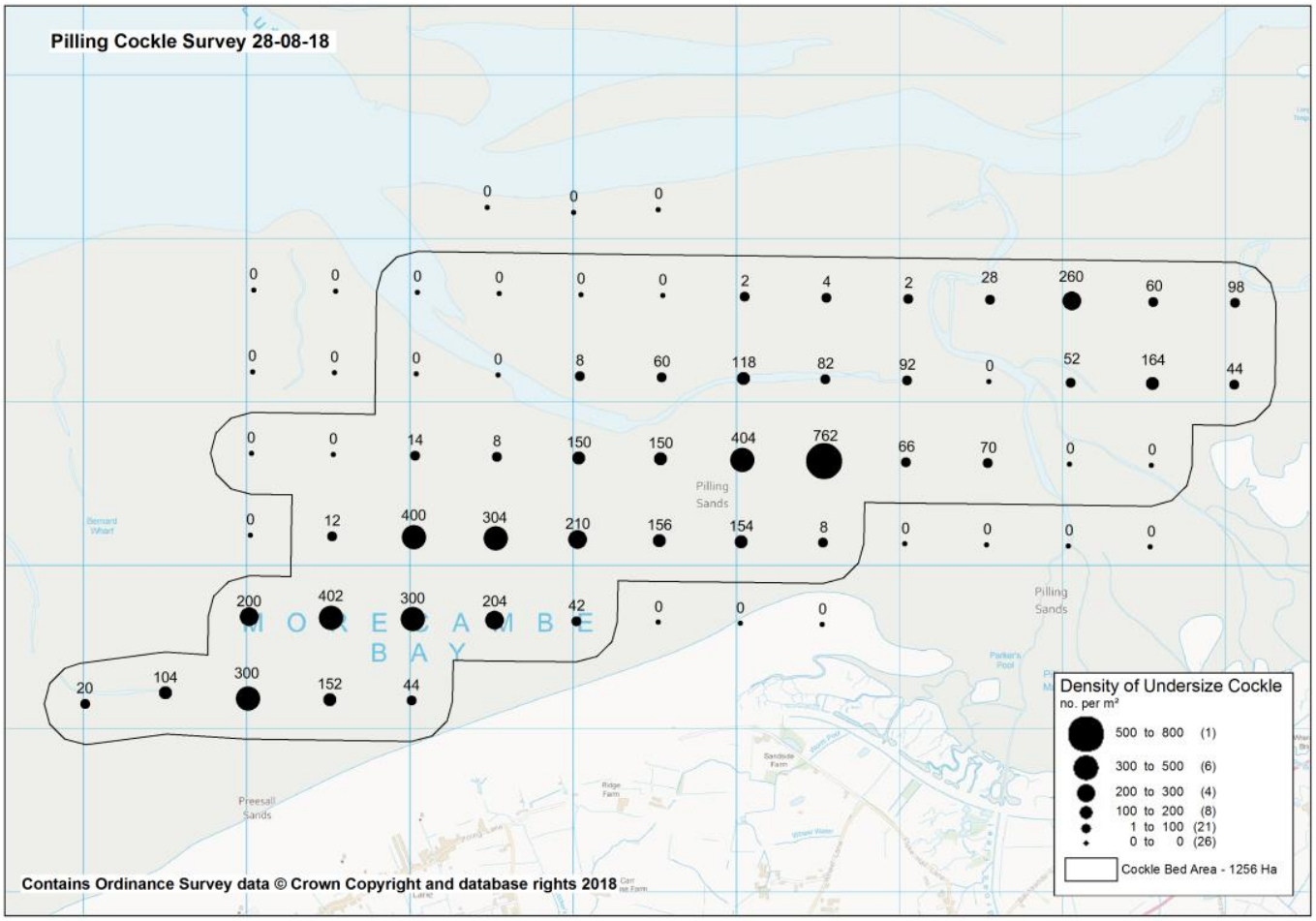
Pilling Cockle Survey 28-08-18
0 0 0
0 0 0 0 0 0 2 4 2 28 260 60 98
0 0 0 0 8 60 118 82 92 0 52 164 44
0 0 14 8 150 150 404 762 66 70 0 0
0 12 400 304 210 156 154 8 0 0 0 0
200 402 300 204 42 0 0 0
20 104 300 152 44
Pilling Sands
MORECAMBE BAY
Preesall Sands
Density of Undersize Cockle
no. per m²
500 to 800 (1)
300 to 500 (6)
200 to 300 (4)
100 to 200 (8)
1 to 100 (21)
0 to 0 (26)
Cockle Bed Area - 1256 Ha
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Middleton Cockle Survey 18-07-18

Tides: LW 10:40 1.1m (Liverpool tides)

Survey method - Jumbo and 0.5m^2 quadrat

53 stations were sampled from a grid 500m apart. Two additional stations were added to assess a dense area identified in a previous survey and one additional station to assess the extent of observed spat.

The density of size cockle across the bed is relatively low with a small area (4.2ha) of dense cockle that was present last year. Spat was observed across approximately three quarters of the bed at varying densities from less than 10 per m^2 to approximately 400 per m^2.

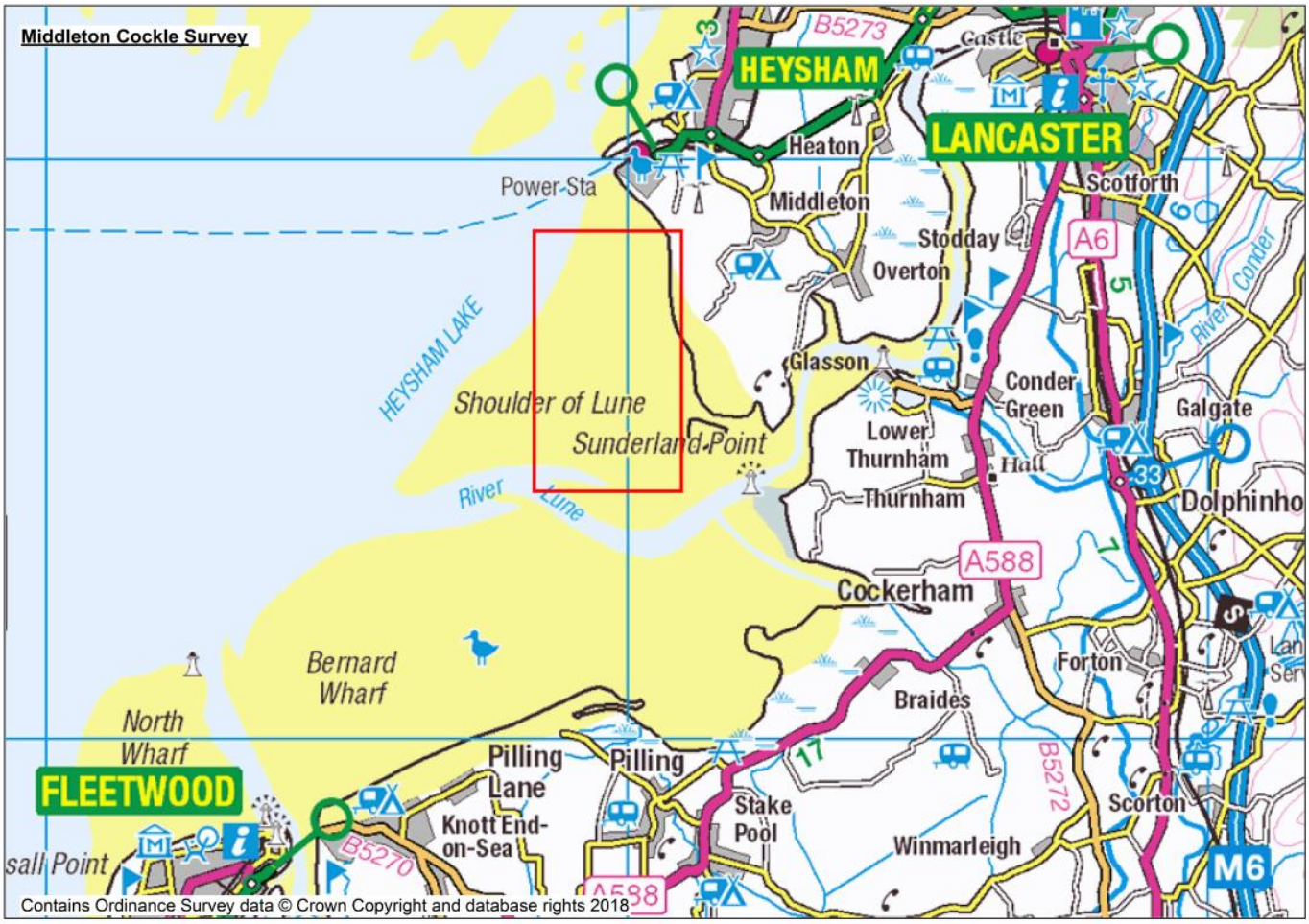
Means

The mean for size cockle has been split to show the density of the dense area and the rest of the bed.

Mean number of size cockle (dense area)	473 per m^2	(min 454, max 492)
Mean number of size cockle (rest of the bed)	7 per m^2	(min 0, max 32)
Mean number of undersize cockle:	3 per m^2	(min 0, max 16)

Biomass

Not Assessed


Middleton Cockle Survey
HEYSHAM
LANCASTER
B5273
Heaton
Middleton
Power Sta
Scotforth
A6
Stodday
Overton
HEYSHAM LAKE
Shoulder of Lune
Sunderland Point
River Lune
Glasson
Conder Green
Galgate
Lower Thurnham
Thurnham Hall
Thurnham
Dolphinho
A588
Cockerham
Forton
Bernard Wharf
North Wharf
FLEETWOOD
Braides
Pilling Lane
Pilling
Knott End-on-Sea
Stake Pool
B5272
Scorton
Winmarleigh
M6
B5270
A588
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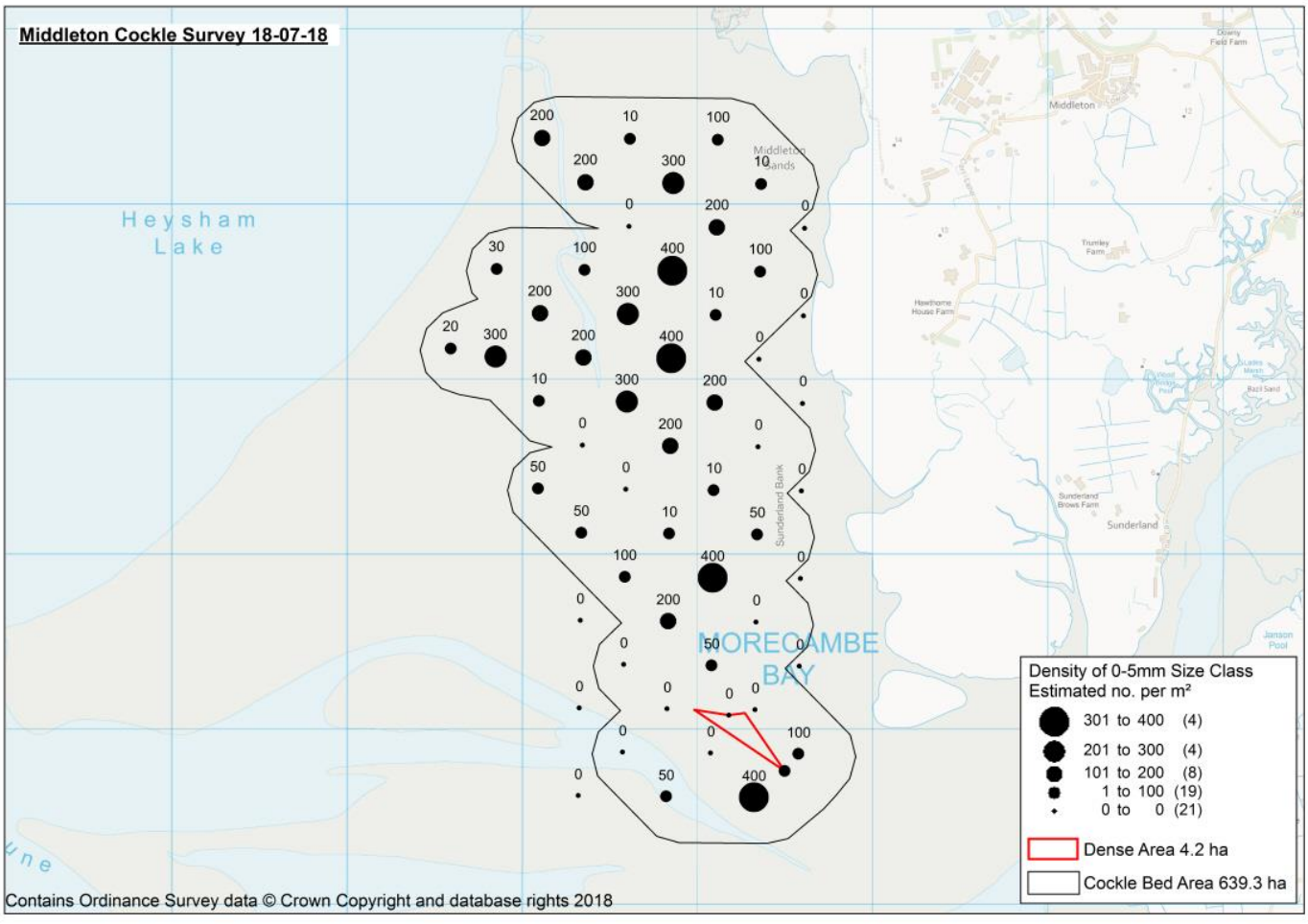
Middleton Cockle Survey 18-07-18
Heysham Lake
MORECAMBE BAY
Density of 0-5mm Size Class
Estimated no. per m²
301 to 400 (4)
201 to 300 (4)
101 to 200 (8)
1 to 100 (19)
0 to 0 (21)
Dense Area 4.2 ha
Cockle Bed Area 639.3 ha
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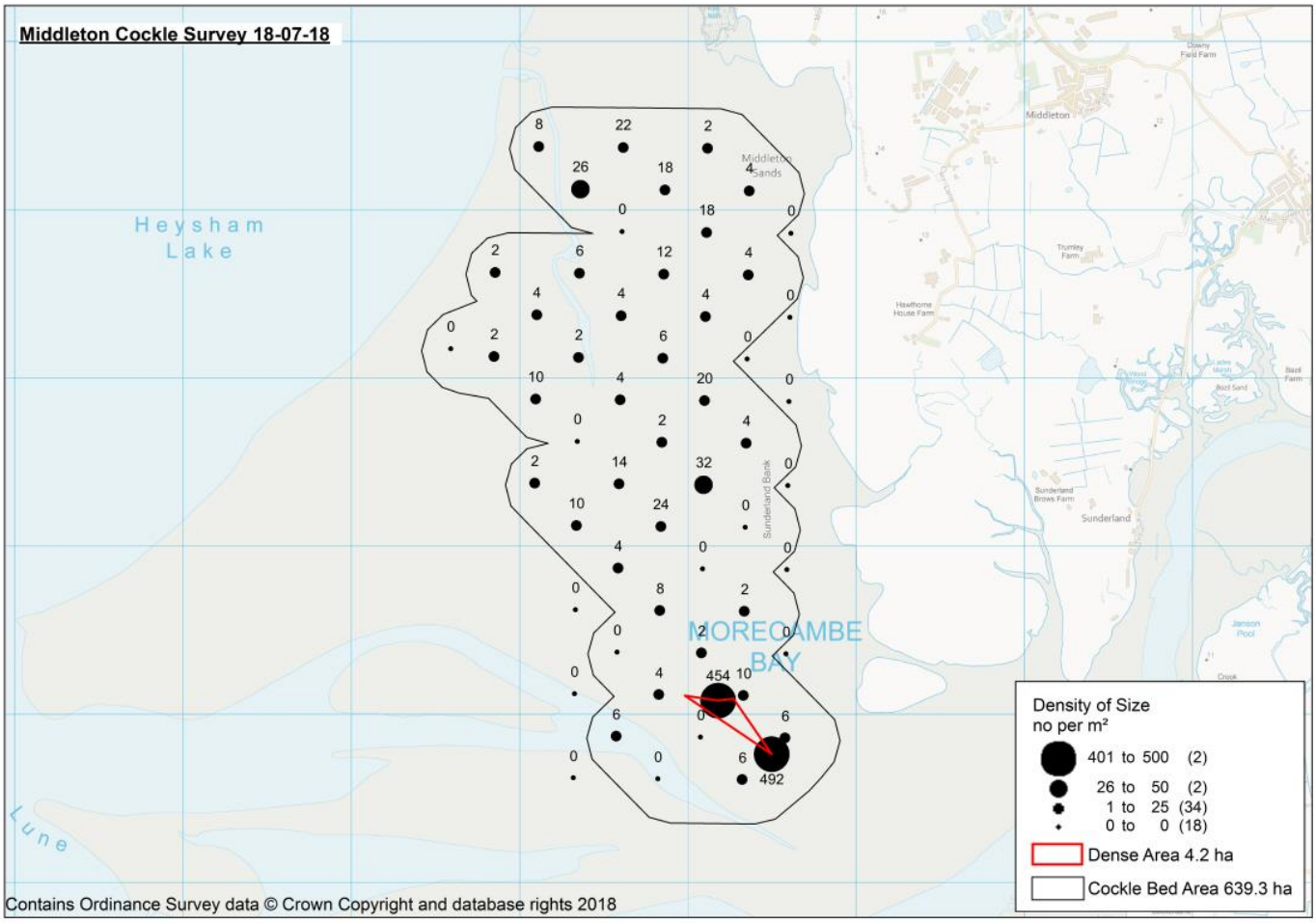
Middleton Cockle Survey 18-07-18
Heysham Lake
Middleton Sands
Sunderland Bank
MORECAMBE BAY
Lune
Density of Size
no per m²
401 to 500 (2)
26 to 50 (2)
1 to 25 (34)
0 to 0 (18)
Dense Area 4.2 ha
Cockle Bed Area 639.3 ha
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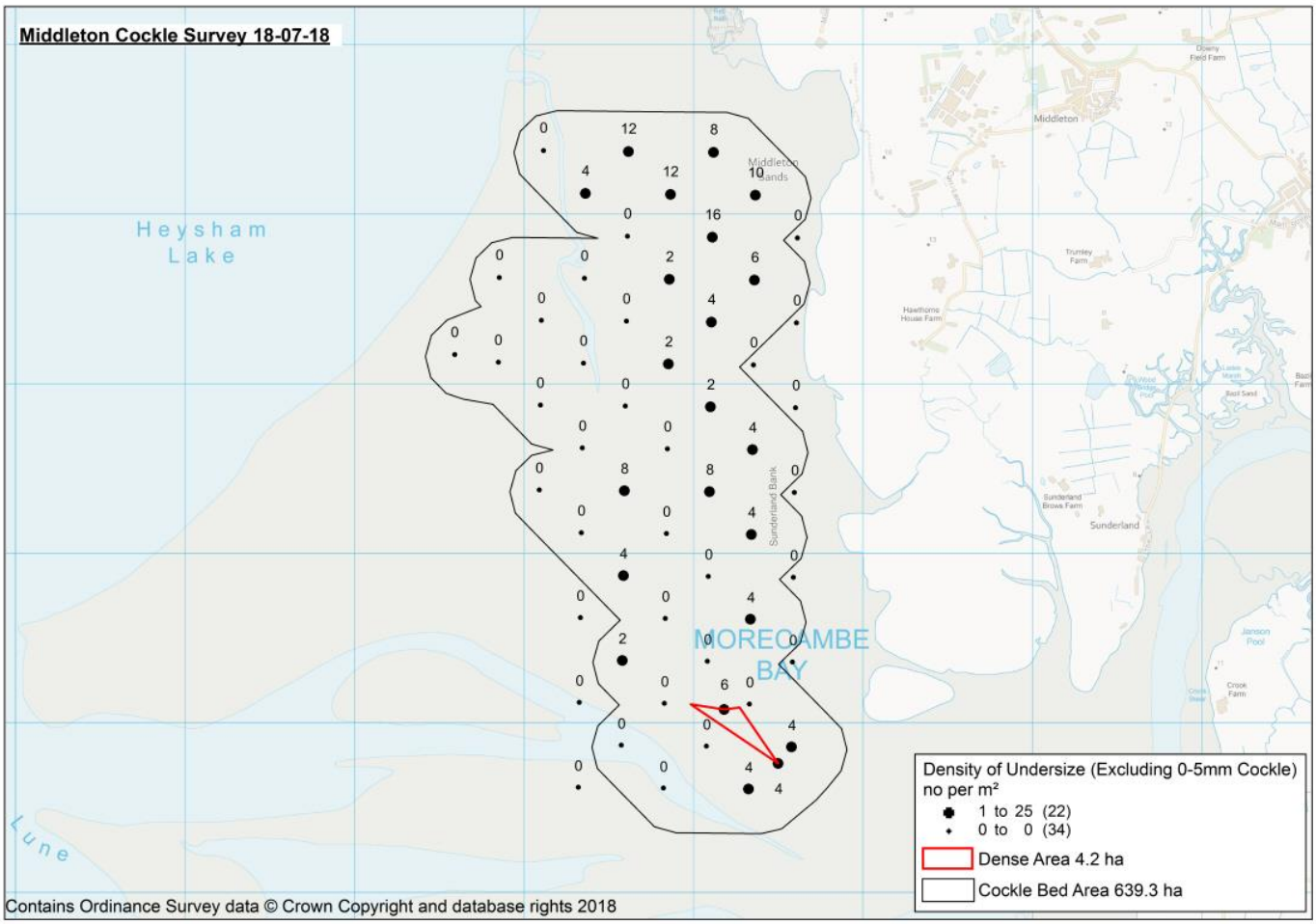
Middleton Cockle Survey 18-07-18
Heysham Lake
Middleton Sands
Sunderland Bank
MORECAMBE BAY
Lune
Density of Undersize (Excluding 0-5mm Cockle)
no per m²
1 to 25 (22)
0 to 0 (34)
Dense Area 4.2 ha
Cockle Bed Area 639.3 ha
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Flookburgh Cockle Survey 13-08-18 & 12-09-18

Survey completed over two days

Tides:	13-08-18	LW 08:04 0.3m (Liverpool tides)
	12-09-18	LW 08:26 0.4m (Liverpool tides)

Survey method - Jumbo and 0.5m^2 quadrat

156 stations were sampled from a grid 500m apart. One additional station was added to ensure full coverage. A further 7 points were added within the grid to include specific areas which were highlighted by industry as having large cockle present.

The density of size cockle across the bed is relatively low with a small areas with a higher density of size cockle. The bed has received a good settlement of spat, which varies from 5mm at the top of the bed to 15-17mm at the bottom of the bed.

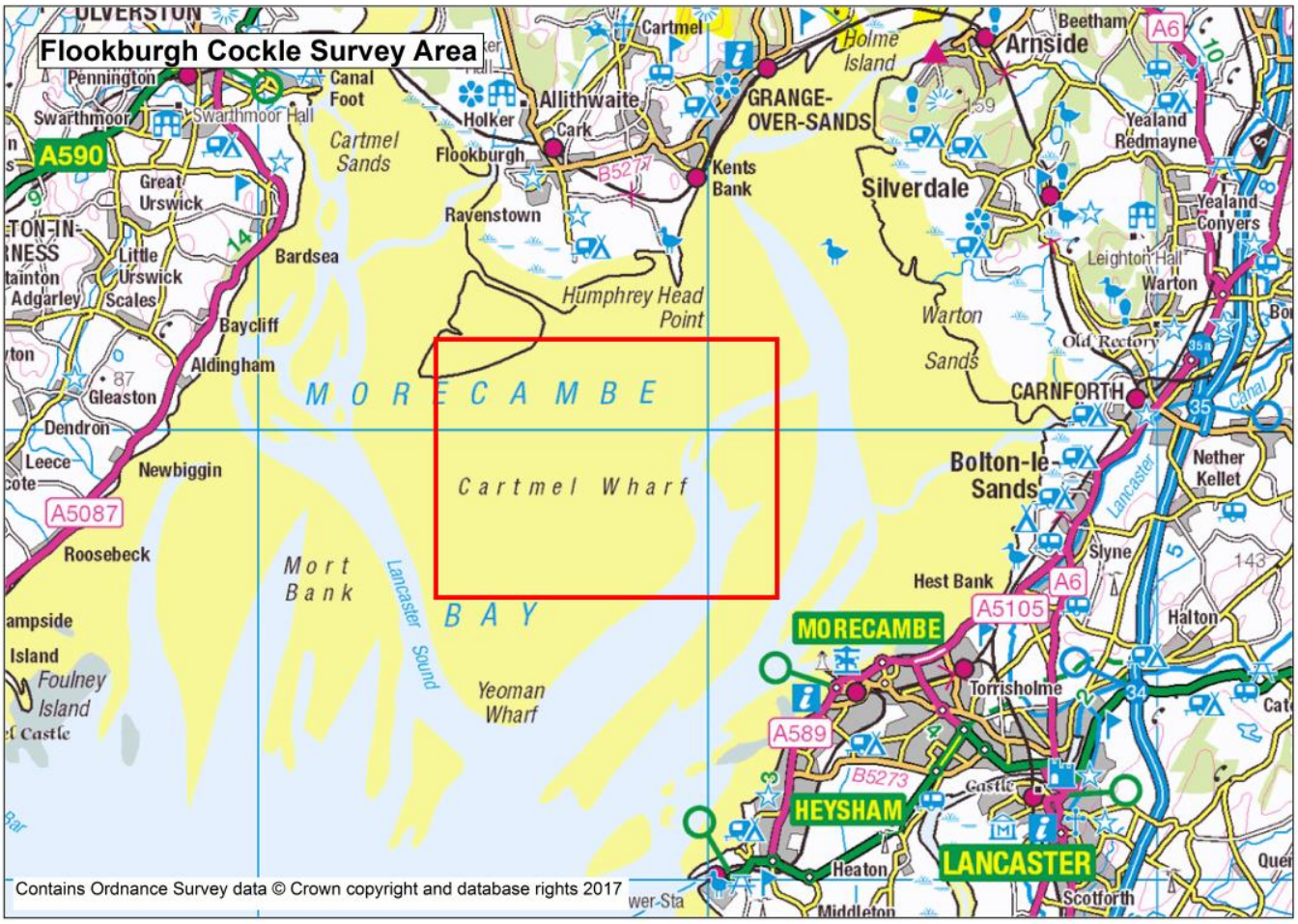
Means

The mean of 5mm cockle has been included as a separate figure.

Mean number of size cockle	7 per m²	(min 0, max 70)
Mean number of undersize cockle	267 per m²	(min 0, max 3600)
Mean number of 0-5mm cockle	50 per m²	(min 0, max 600)

Biomass

	Area (ha)	Size Cockle (tonnes)[1]	Undersize Cockle (tonnes)
Flookburgh	**3614**	**~2700**	**~9600**


Flookburgh Cockle Survey Area
Pennington
Canal Foot
Swarthmoor
Swarthmoor Hall
A590
Great Urswick
Little Urswick
Scales
Adgarley
Baycliff
Aldingham
Gleaston
Dendron
Leece
Newbiggin
A5087
Roosebeck
Bardsea
Cartmel Sands
Flookburgh
Holker
Cark
Allithwaite
Cartmel
Holme Island
GRANGE-OVER-SANDS
Kents Bank
B5277
Ravenstown
Humphrey Head Point
MORECAMBE BAY
Cartmel Wharf
Mort Bank
Lancaster Sound
Yeoman Wharf
Foulney Island
Beetham
Arnside
A6
Silverdale
Yealand Redmayne
Yealand Conyers
Leighton Hall
Warton
Warton Sands
Old Rectory
CARNFORTH
Bolton-le-Sands
Nether Kellet
Lancaster Canal
Slyne
Hest Bank
A5105
MORECAMBE
Torrisholme
Halton
A589
B5273
HEYSHAM
Castle
LANCASTER
Heaton
Scotforth
Middleton
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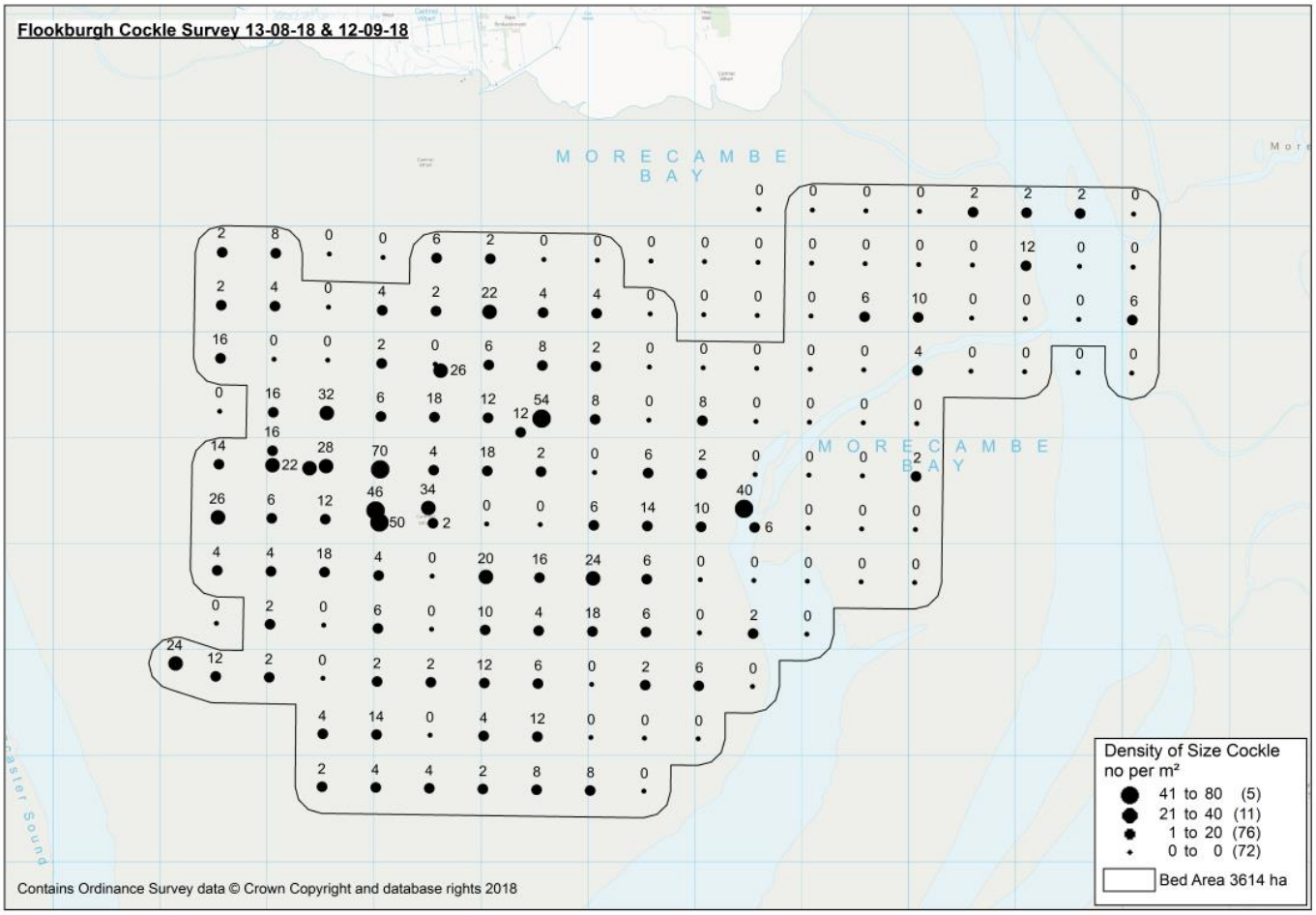
Flookburgh Cockle Survey 13-08-18 & 12-09-18
MORECAMBE BAY
Density of Size Cockle no per m²
41 to 80 (5)
21 to 40 (11)
1 to 20 (76)
0 to 0 (72)
Bed Area 3614 ha
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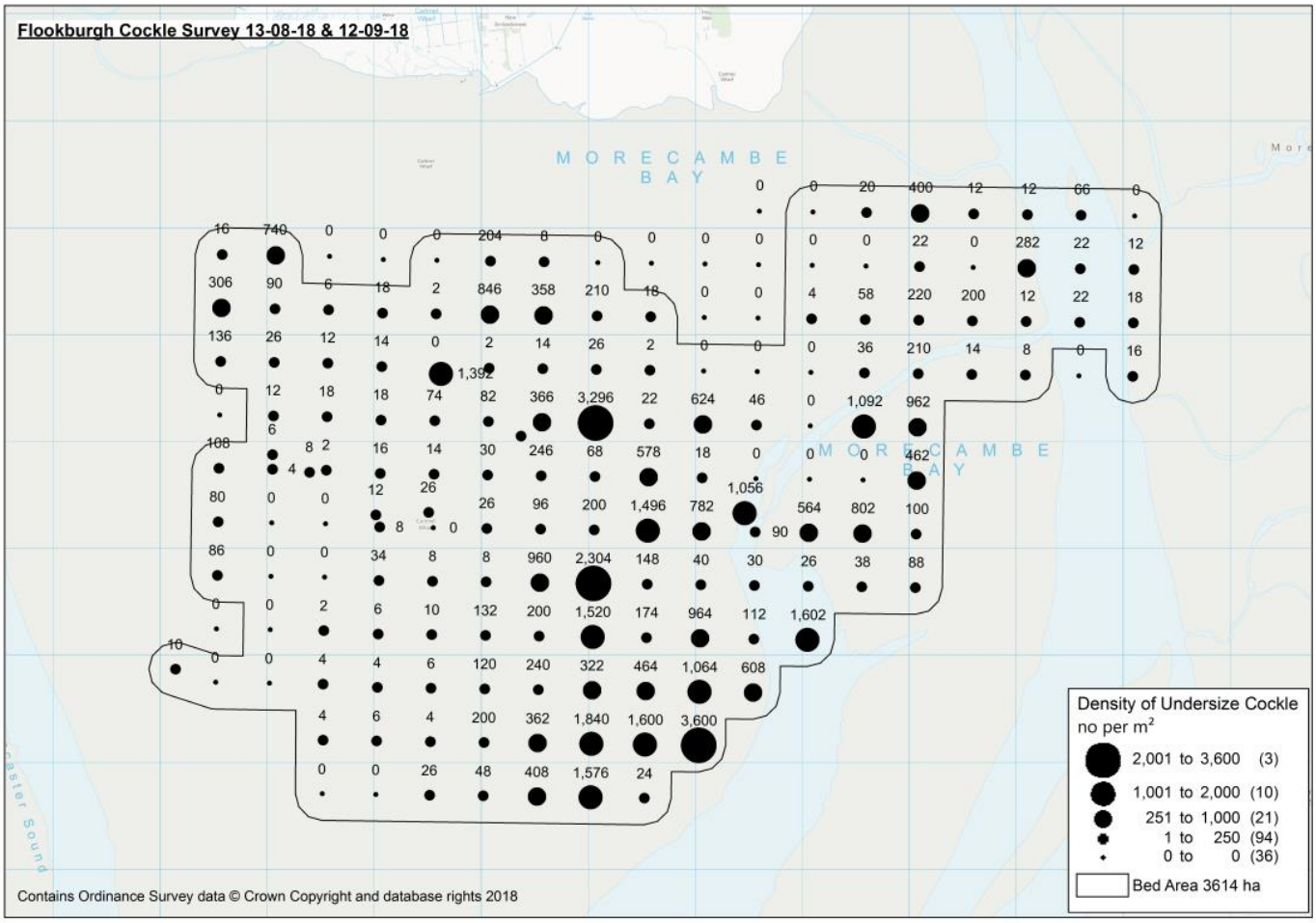
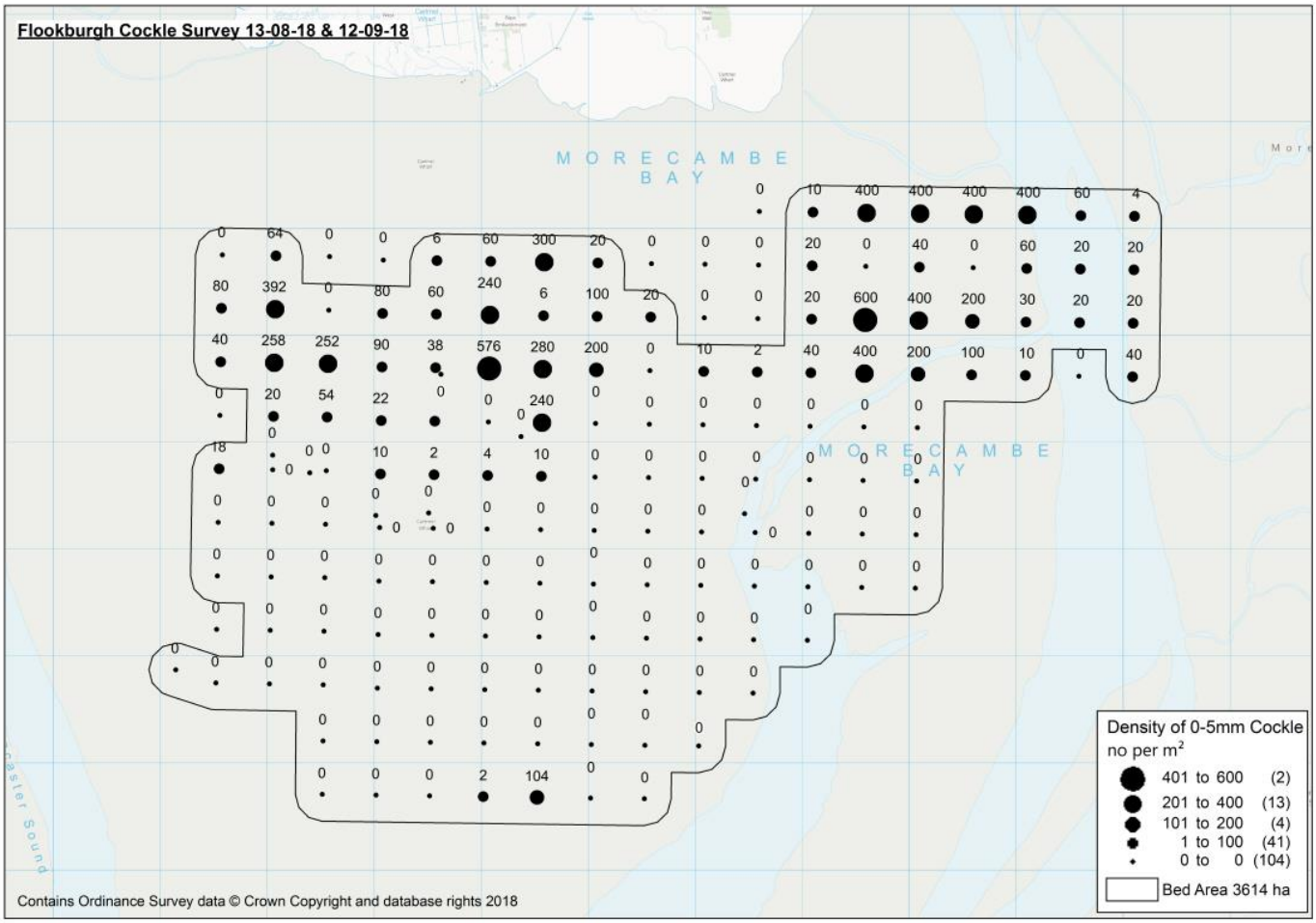
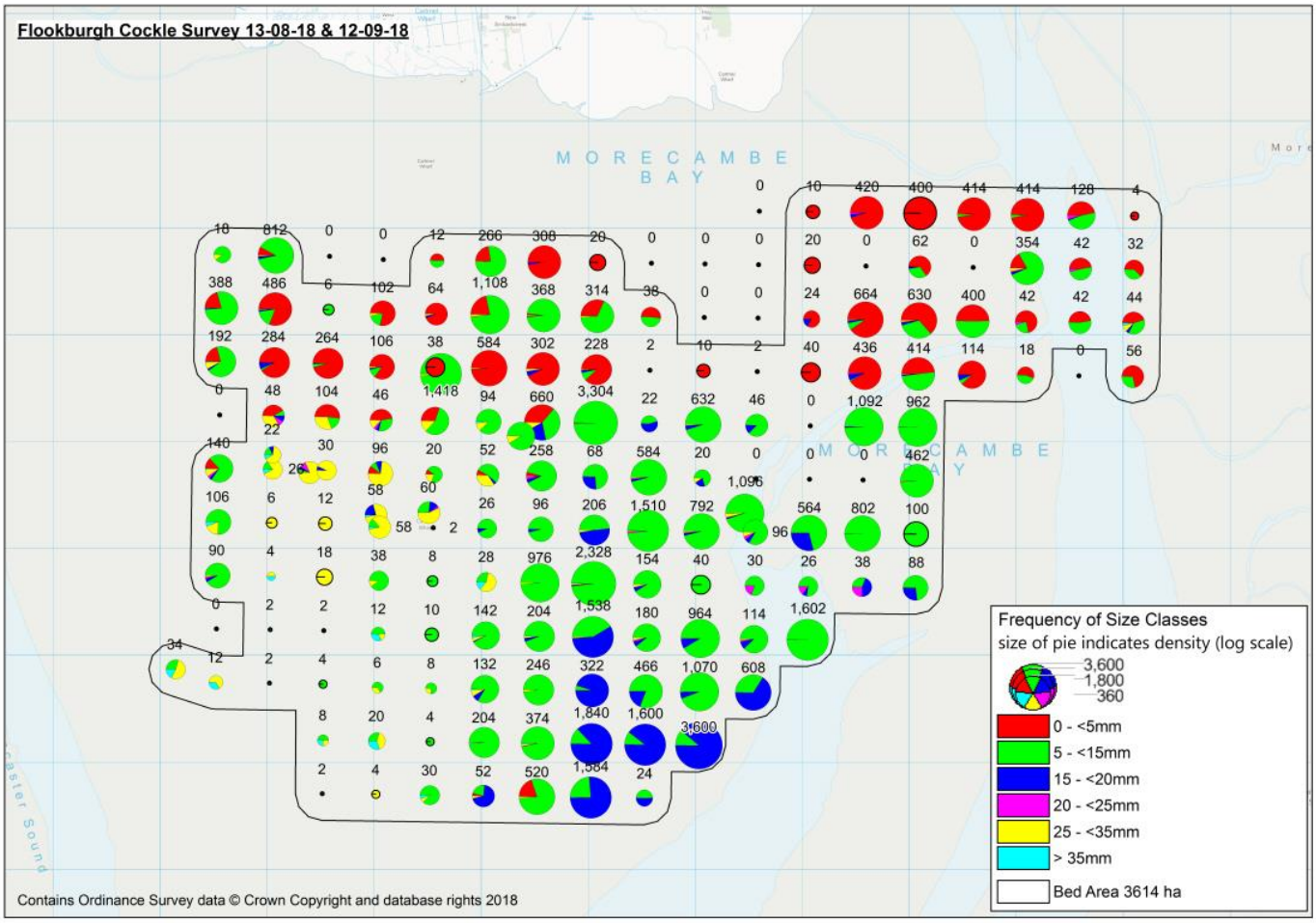
Flookburgh Cockle Survey 13-08-18 & 12-09-18



Flookburgh Cockle Survey 13-08-18 & 12-09-18




Flookburgh Cockle Survey 13-08-18 & 12-09-18
MORECAMBE BAY
MORECAMBE BAY
Frequency of Size Classes
size of pie indicates density (log scale)
3,600
1,800
360
0 - <5mm
5 - <15mm
15 - <20mm
20 - <25mm
25 - <35mm
> 35mm
Bed Area 3614 ha
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Mussels:

Foulney Dutch Wand Mussel Survey 10-09-18

Low water: 07:00 0.5m (Liverpool Tides)

Survey method: Dutch Wand

Line transects were completed across the mussel bed using a Dutch Wand, transects start and finish at the edge of the bed. The number of hits and misses of live mussel were recorded to give percentage cover. The bed area was calculated from the start and end of transects and from observations of officers whilst surveying. It was not possible to walk the perimeter of the bed due to time restraints and the soft nature of the bed. A mussel sample was taken every 50 hits using a 10 cm diameter corer. Twenty transects were completed and 26 samples collected. Total weight of live undersize and size mussel was recorded as well as the size frequency of each sample.

From the transect and sample data the total mussel bed surveyed was **53.9 hectares**, of which **45.7 hectares** was on the main skear and **8.2 hectares** on Foulney Island.

Biomass

Main skear - **5735 tonnes undersize mussel** and **835 tonnes size mussel**

Foulney Island - **2176 tonnes undersize mussel** of a single year class.

Length frequencies

Total length frequency for the surveyed beds are provided in figures below.

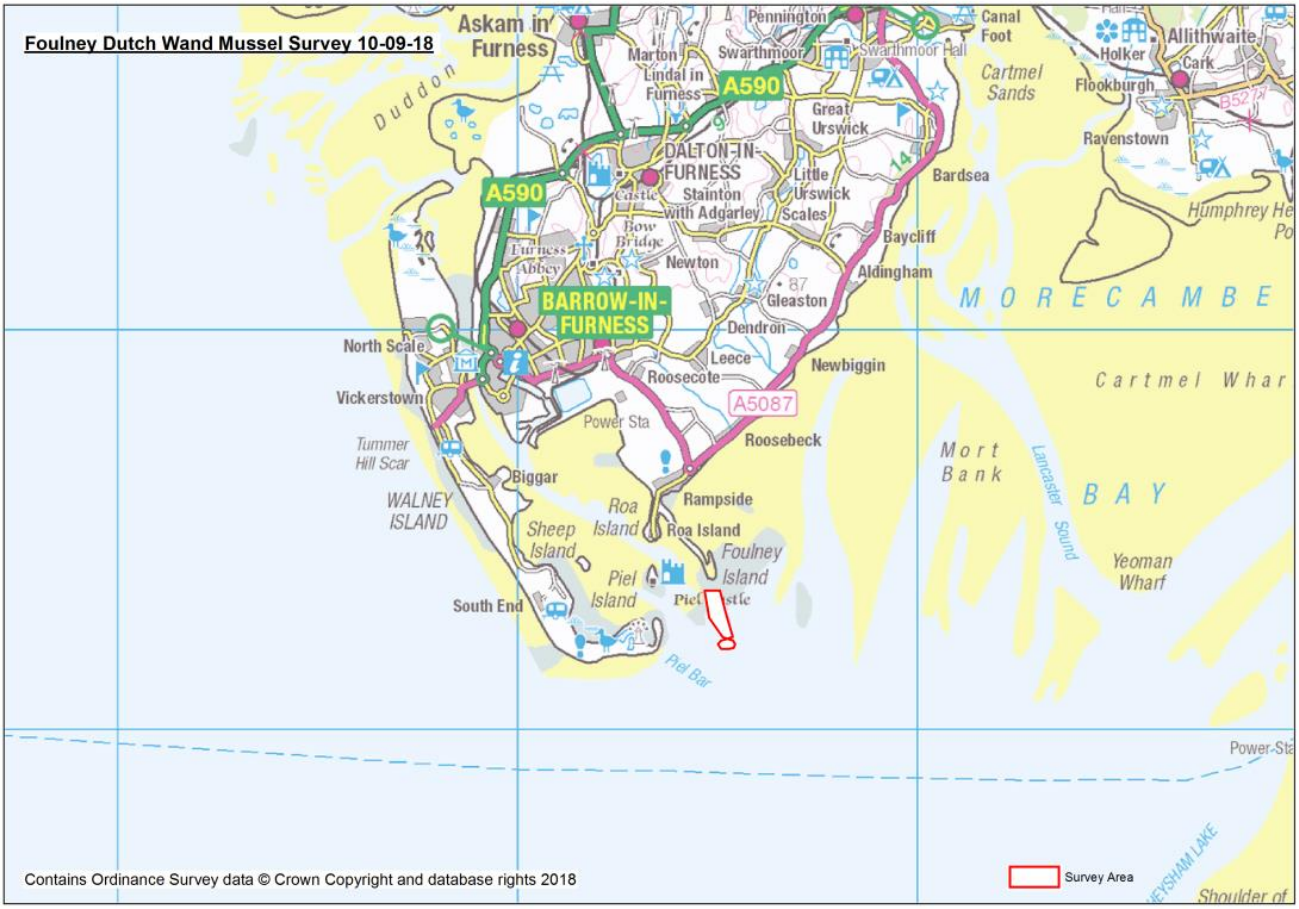
Highest frequency of mussel on main skear was in 30 - 42 mm size range with a peak at 40mm.

Highest frequency of mussel on Foulney Island was in 23 - 31 mm size range with a peak at 27mm.

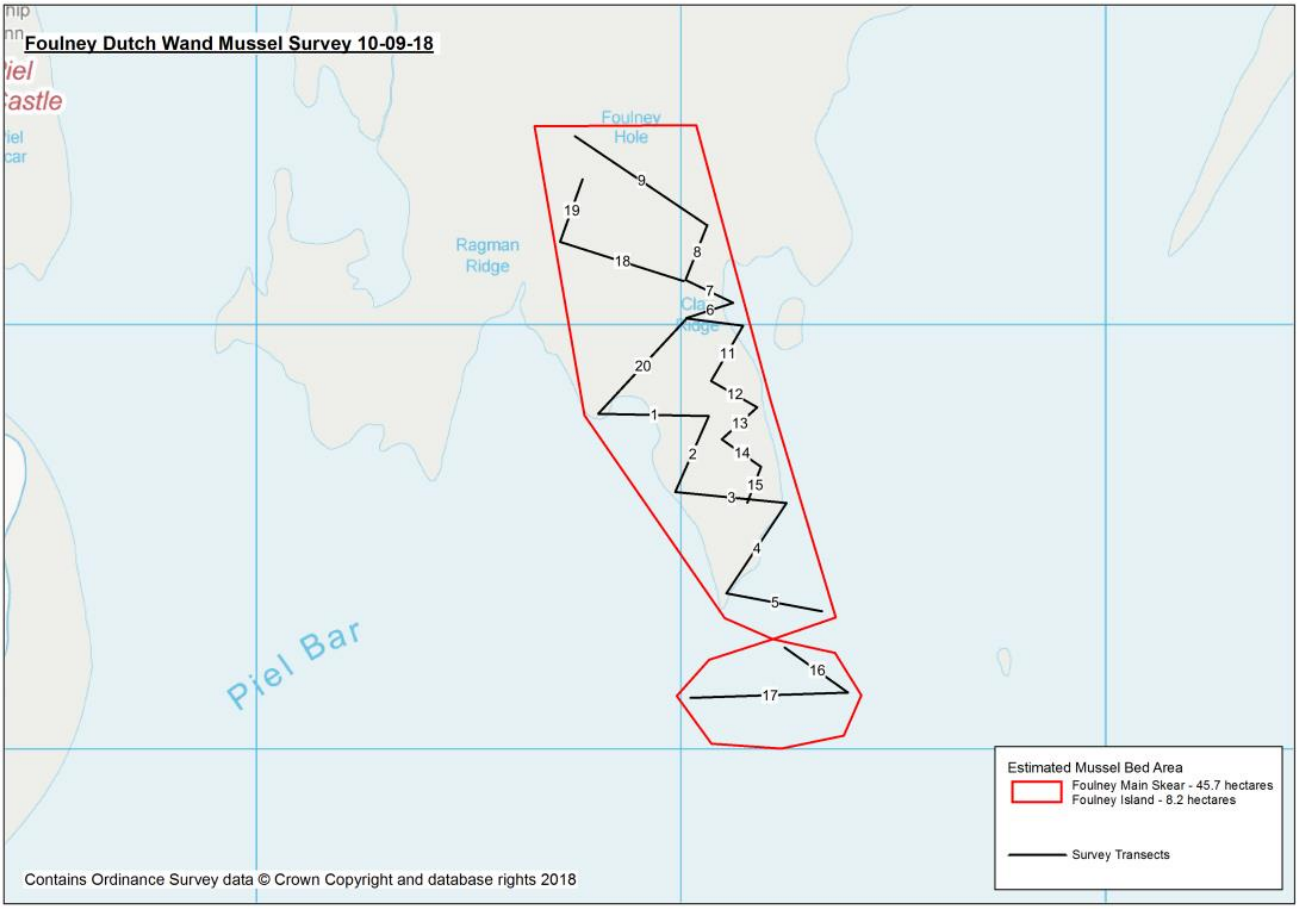
Maps

The frequency of each size class of mussels per sample has been standardised per m^2 and represented using pie charts in the map below. The size of the pie chart is proportional to the total number of mussels per m^2. It can be seen on the map that the most abundant size class is the 25-45 mm which makes up the majority of the samples with some size mussel (>45mm) mixed in.

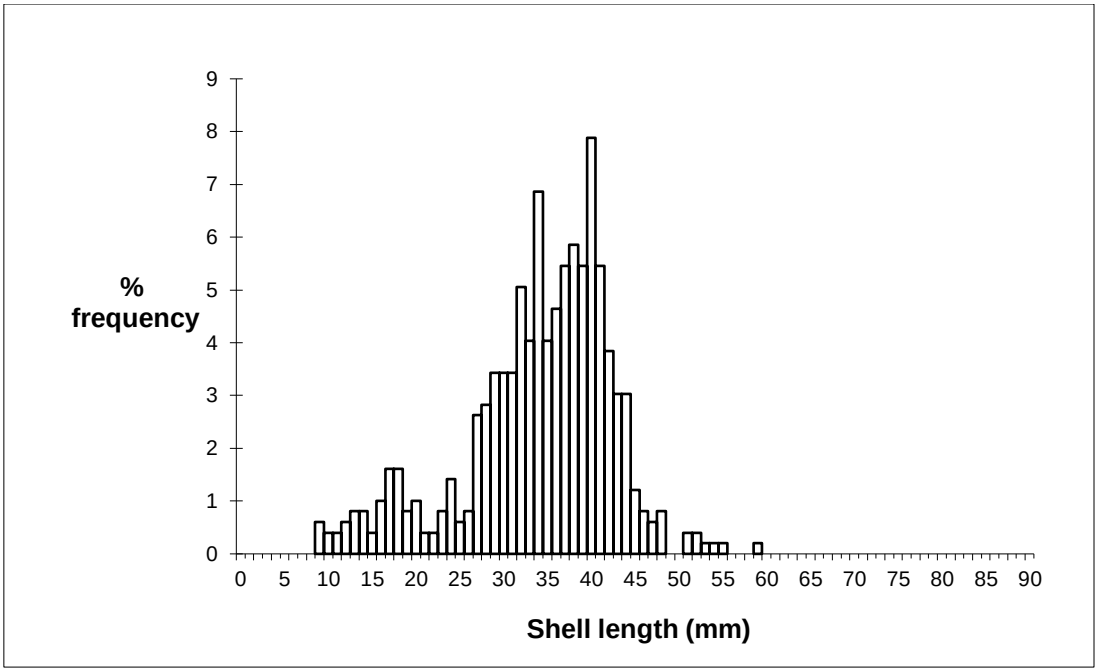
The weight of each sample has been standardised and is represented as kg of mussel per m^2, the proportion of size and undersize is shown as pie charts in the map below.



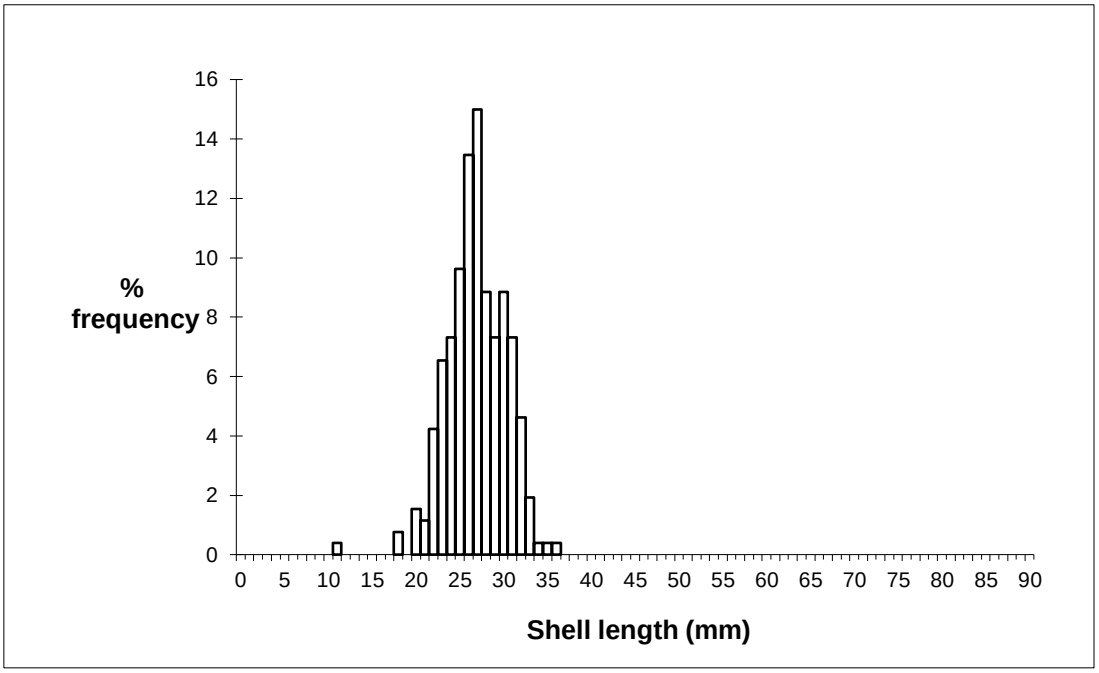
Location of Foulney Mussel Survey Area



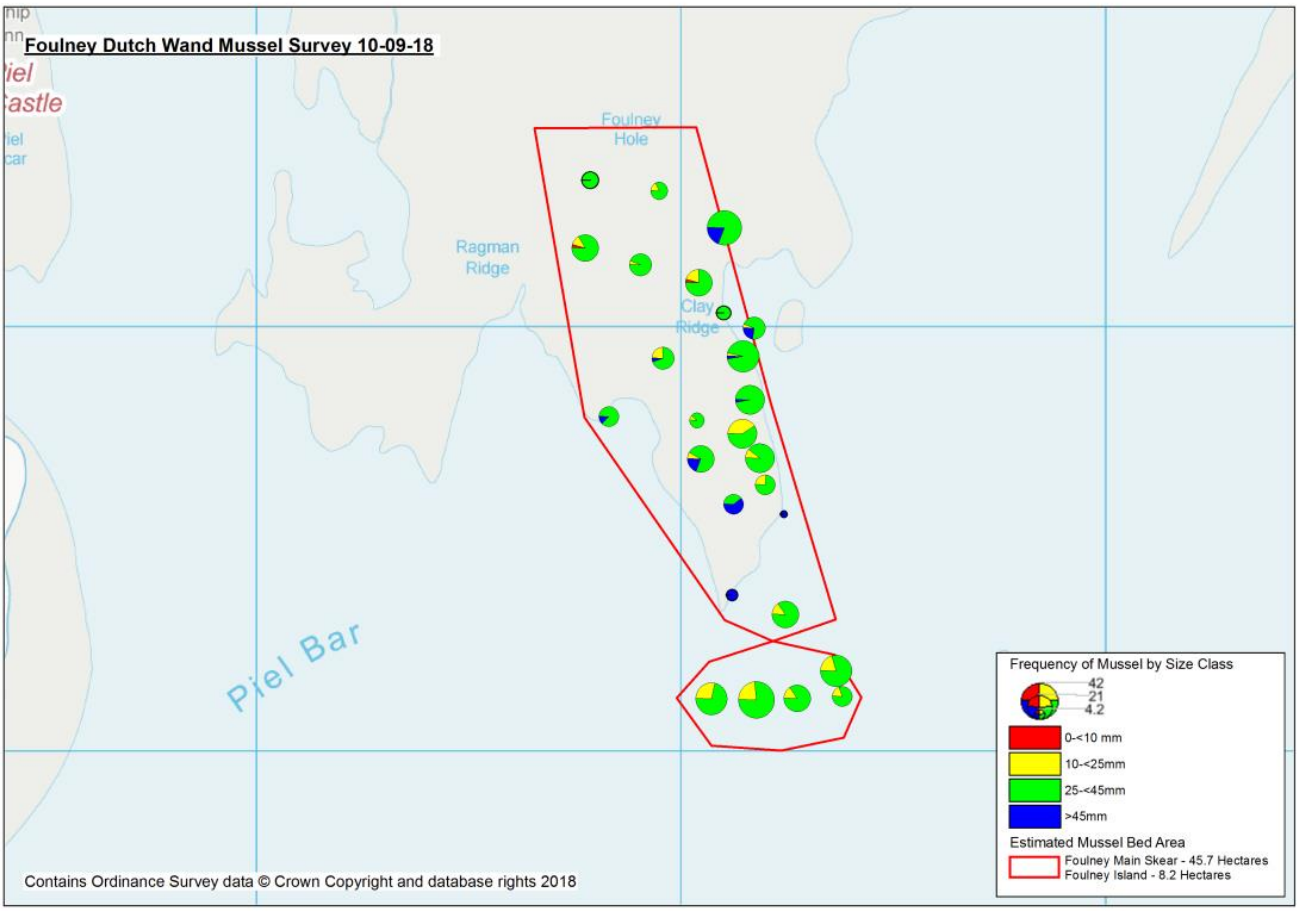
Foulney Dutch wand survey transects and estimated bed area



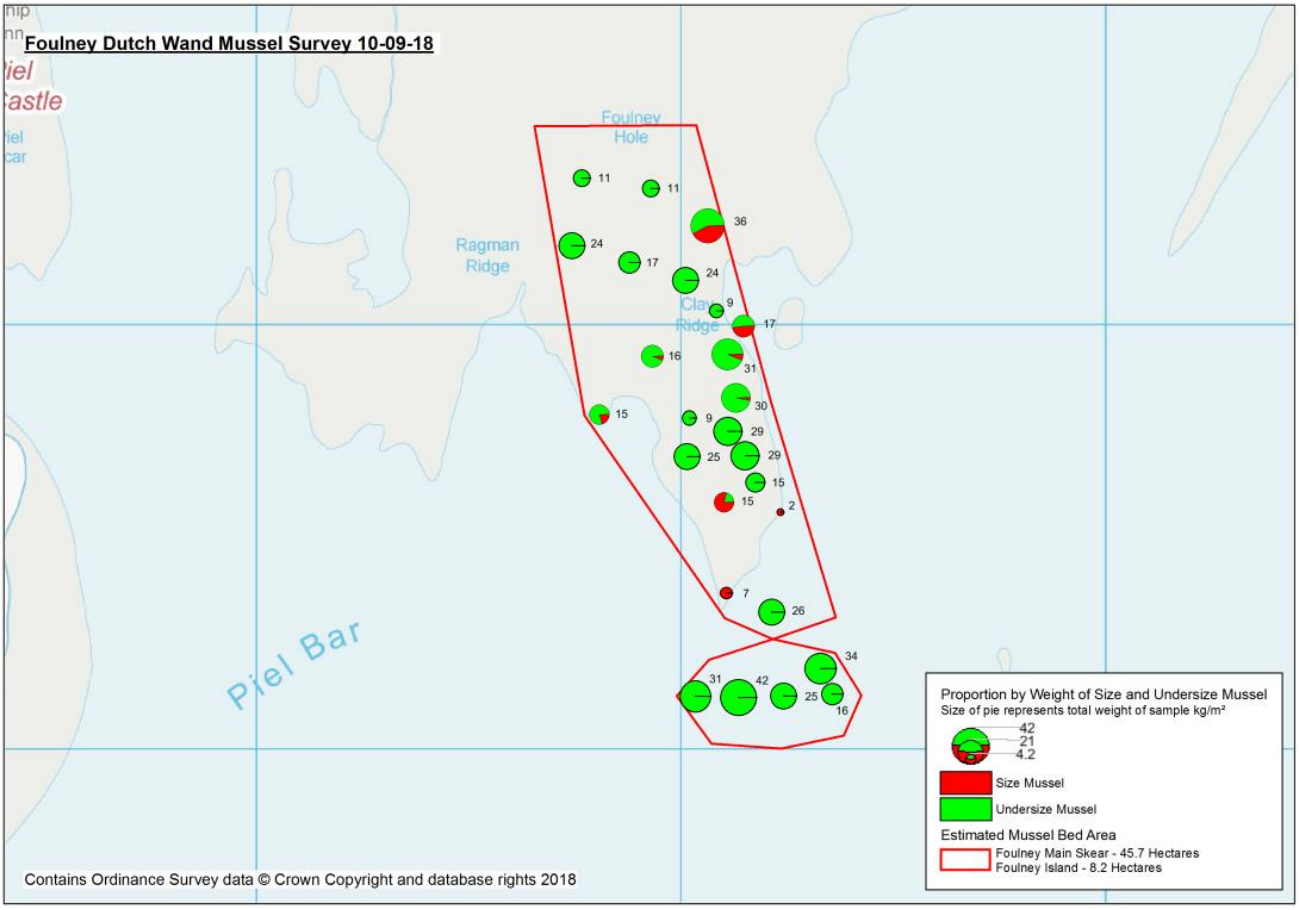
Histogram showing percentage length / size frequency of mussel shell from all samples from Foulney main skear.



Histogram showing the percentage length / size frequency of mussel shell from all samples from Foulney Island.



Frequency of mussel by size class



Proportion of size and undersize mussel by weight represented as kg/m^2

Heysham Flat – Inspection 13-09-18

LW – 0.8m 0905hrs

A walk on inspection was carried out on the main skear and Knott End skear (across Dallam Dyke). Southern area of main skear had experienced a significant amount of scour and loss of top layer of mussel, with some areas having lost mud also.

Other than that the whole of main skear and the entirety of Knott End skear held superabundant seed mussel. The majority of it was hard in – the only area with any mud under was in the upper skear where the abundant mussel was of around 20mm shell length and very soft shelled. The superabundant mussel on the lower areas of the skear and Knott End skear was of around 30mm shell length. The bottom skears could not be accessed but they appeared still 'black' and had numerous birds – oystercatcher and gulls – feeding on them which suggests they still held mussel.

Looking at the layer under an area that had been raked by gatherers there was live mussel which presumably following next tide cover would be clean and sitting on top.

The main area of *Sabellaria alveolata* was to the north in the channel – so off the skears. It looked healthy from a distance but no detail on it. The area of Sabellaria on the north of the main skear was also still in evidence. Small clumps of Sabellaria on the main skear were inspected and appeared to not hold any live worms. Small clumps on Knott End skear were inspected and did hold some live worms.

<u>Summary in terms of Conservation Features:</u>

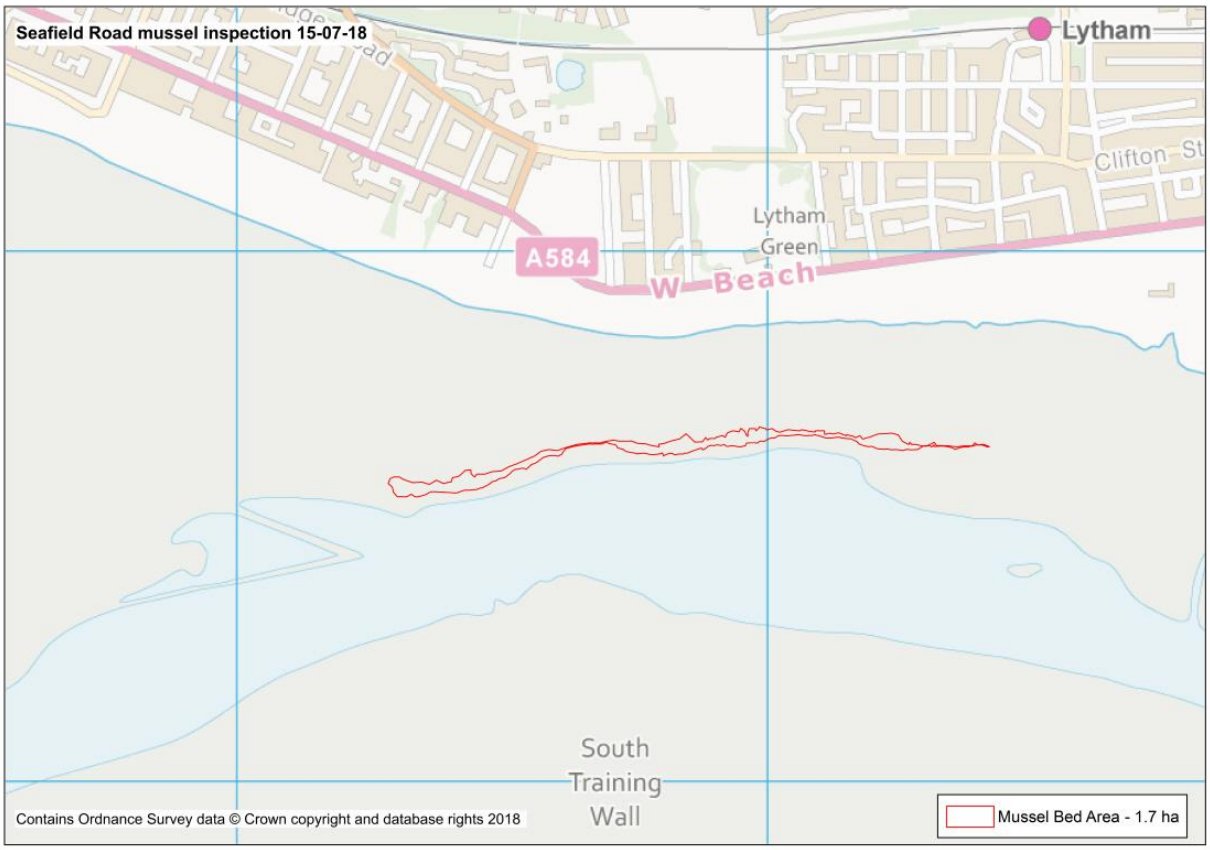
Superabundant mussel ranging from 20-30mm mussel available across the main skear and Knott End skear. Appeared also to be on bottom skear (Little Out skear).

Historic *Sabellaria alveolata* reef still very degraded. Healthy Sabellaria in evidence in northern part of main skear and off the skear in the channel – and therefore out of the influence of gatherers.

Seafield Road Inspection 15/07/18

Tides: LW 8:18 0.5m (Liverpool tides).

Officers patrolled the low water line at Seafield Road where a dense band of mussel spat had settled. The band was estimated at 1.1km in length and around 30m at its widest point. Officers also patrolled along the training wall, where the presence of size mussel, which was covered by barnacles, was recorded. There had also been a settlement of spat on top of the size mussel and boulders in some areas of the training wall, which had begun to put down a layer of mud approximately half an inch deep.



Map of the band of spat covering approximately 1.7 ha at Seafield Road, Lytham

Spat settlement along the low water line.

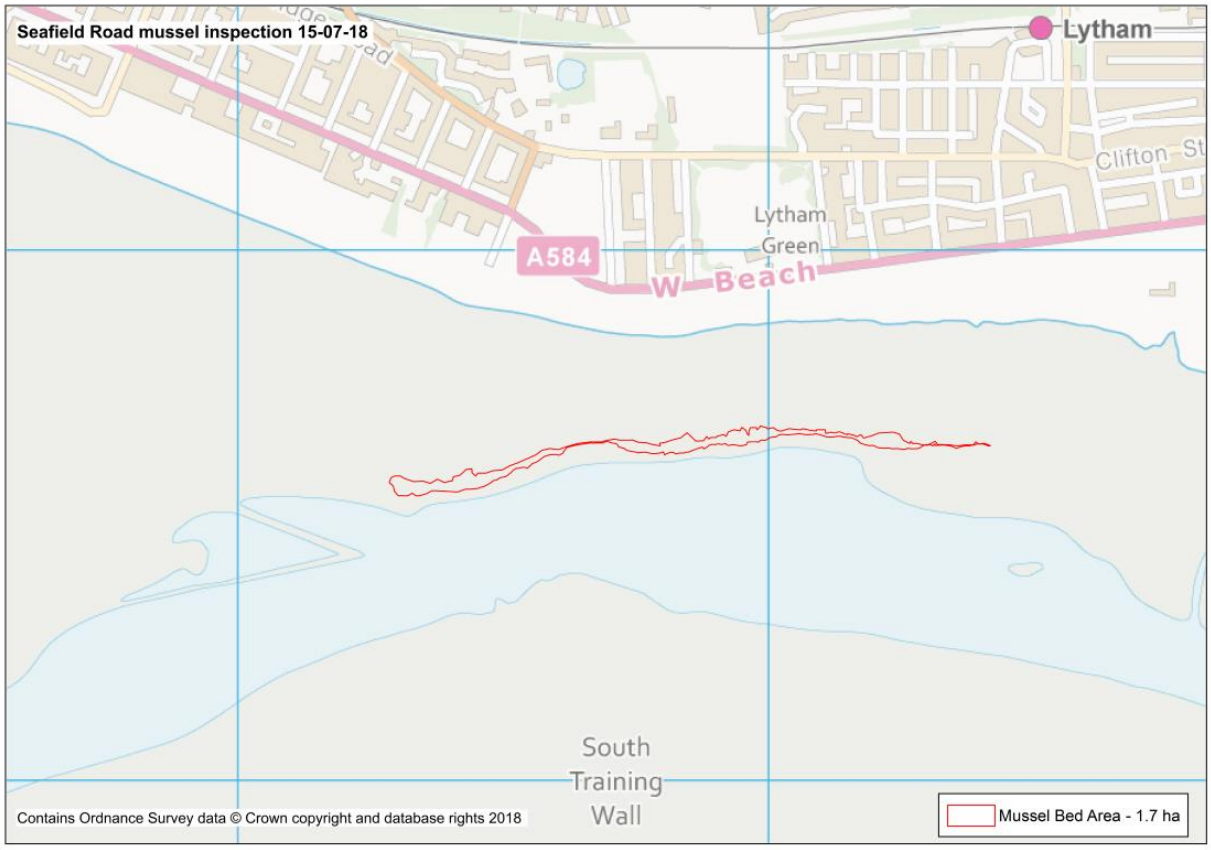
Size mussel covered in barnacles along the training wall.

Spat settlement on the boulders along the training wall, which had put down approximately half an inch of mud.

Seafield Road Mussel Inspection 11-09-18

Tides: LW 07:45 0.3m (Liverpool tides).

Officers patrolled along the low water line at Seafield Road slipway and the V training wall to inspect the area of mussel previously inspected on the 15-07-18. The mussel bed area was largely unchanged from the previous inspection, although there were some areas showing scouring and washing out. The mussel is growing steadily with some reaching 8-12mm, with some areas where the mussel is hard into the substrate and areas where the mussel is building up on mud 5-10cm deep. Spat settlement on the training wall had been washed away from the outer-side exposed to the river.



Estimated mussel bed area at Seafield Rd slip, map from previous inspection on 15-07-18.

Mussel hard in with cobble substrate.

Mussel building up mud.

Areas showing scouring and washing out of mussel.