



Stock Assessment of the Edible Mussel (*Mytilus edulis*) Beds in Blyth Estuary

2018



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Abstract

The purpose of this report is to assess the state of the mussel bed in the Blyth estuary. The perimeter of the mussel bed was mapped, and percentage cover of mussels was estimated using the MarinX 'Dutch Wand' survey technique. Samples of mussels were collected, and total shell length and weight were measured.

In 2018, the mussel bed at Blyth estuary covered an area of 24, 980 m² however percentage cover and density varied across the site. The length distributions for mussels were skewed towards larger mussels and mean length of mussels sampled was 35.87 mm.

This report aims to summarised data obtained during NIFCA surveys and to provide insight into the health and distribution of the mussel bed in the Blyth estuary to inform future management of the site.

Introduction

The edible mussel (*Mytilus edulis*) is widely distributed, occurring in boreal and temperate waters, in both the southern and northern hemispheres (OSPAR, 2010). *M. edulis* is tolerant of a wide range of environmental conditions (FAO, n.d.) including fluctuations in salinity (Andrews *et al.*, 2011), and therefore occurs in both marine and brackish waters (Gardner, 1996). Mussels can form dense beds on estuarine flats (Fenton, 1978) attaching to substratum using byssus threads (Babarro *et al.*, 2008). Spat (juvenile mussels) settles on existing beds, hard substrates (such as shells or stones) or may be washed as clumps to other parts of the estuary (Verwey, 1952).

M. edulis beds are included in the OSPAR (Annex V) list of threatened and declining species and habitats and are listed as a UK biodiversity action Plan (BAP) Priority Habitat (Maddock, 2008). Threats to mussel beds include bait collection (Maddock, 2008), gathering for human consumption (Fenton, 1978), pollution (Hilgerloh, 1997), coastal development, anchoring (Maddock, 2008) and wash out due to adverse weather conditions. It is currently unknown whether mussel beds are declining because of the aforementioned threats, due to bird predation or a combination of factors (Hilgerloh, 1997).

Blyth Estuary is part of the Northumberland Shore SSSI and provides important feeding and roosting grounds for overwintering waders, such as redshank, dunlin and turnstone as well as resident species such as oystercatcher, ringed plover, curlew and eider duck (Holliday, 2000). Mussels are an important dietary component for Turnstones (*Arenaria interpres*) and Oystercatchers (*Haematopus ostrelegus*) at Blyth (Eaton, 2000). There is a concern that a decline in mussels on the Blyth estuary may have negative impacts on the bird populations at the site.

In late 2014 the Northumberland Inshore Fisheries and Conservation Authority (NIFCA) was approached by Blyth Boat Club about unregulated hand gathering and bait digging amongst the mussel beds on the Blyth Estuary. Due to the importance of the site for important birds and concerns from the public, in March 2015, NIFCA began monthly stock assessment surveys of the mussel beds to assess stock health. Baseline data was collected in 2015-2016 (Wallace, 2016) and further surveys were carried out during 2016-2017 as NIFCA continue to monitor the site.

Methods

Surveys were conducted in March 2017 and April 2018 following a series of surveys every 3 months between March 2016 and December 2016. These surveys were a continuation of monthly surveys undertaken by NIFCA at the site between March 2015 and February 2016. From March 2017 onwards the bed will be monitored with an annual basis. Surveys are conducted by NIFCA staff, committee members and volunteers from partner organisations.

Study Site

The study site is located on the Blyth Estuary in Northumberland. The mussel bed extends from the Blyth Boat Club slipway upstream to just beyond the sewage outfall beneath Cowley Road. The mussel bed has been divided into six sectors. Sectors 1 to 4 are based on the feeding/roosting sites defined in Holliday (2000) (Figure 1) and were in the 2015-16 surveys. An additional 2 areas of mussel bed have been identified and added to the survey as sectors 5 and 6.



Figure 1 Survey area Blyth Estuary showing the location of the six sectors and the access point at Blyth boat club (star).

Survey Methods

To map the area of the mussel bed, officers walked the perimeter of the mussel bed with a handheld GPS during each survey.

The percentage cover of mussels on the mussel bed was estimated using the MarinX 'Dutch Wand' survey technique (McGrorty *et al.*, 1990). Surveyors walked in a zigzag across the mussel bed, in a randomly determined direction. The Dutch wand (a 4ft bamboo cane with an 11cm ring attached to the end) was placed out to one side every three steps and the result of either a 'hit' (if the ring contained live mussels) or a 'miss' (if the ring did not contain live mussels) was recorded. Percentage cover was then calculated using the Equation:

$$\text{Percentage Cover} = \frac{\text{Number of Hits}}{\text{Number of Hits} + \text{Number of Misses}} \times 100$$

A mussel sample was taken from inside the 11cm ring at the site of every third 'hit'. All mussel samples from the same transect were collected together and the total number of samples taken per transect was recorded. The samples were sieved (6mm mesh size) and cleaned in estuarine water. Total shell lengths of all the mussels sampled were then measured (to the nearest millimetre) using a vernier caliper and divided into the following size groups: <25mm, 26-49mm and >50mm. The total weight (in grams) of mussels in each size category was also recorded for each sample. The density of mussels on the mussel bed was then calculated using the following equation:

$$\text{Mussel Density} = \frac{\text{Number of mussels per m}^2}{\text{Percentage Cover}}$$



Results

Mussel Bed Extent

The mussel bed at Blyth estuary covered an estimated area of 24,980 m² in April 2018 (Table 1).

Table 1 Summary of the results obtained during the Blyth Estuary mussel survey April 2018.

Location	Area (m ²)	Number of samples	Number of mussels in samples	Weight (g)	Percentage Cover (%)	Density (mussels/m ²)
Blyth Estuary	24980	15	153	1680	36.97	396.8
Sector 1	5510	3	16	317	22.13	124.2
Sector 2	4640	2	8	174	20.91	88.0
Sector 3	2560	3	40	153	23.79	333.78
Sector 4	1770	2	23	168	41.31	499.9
Sector 5	4900	3	50	610	61.10	1071.6
Sector 6	5600	2	16	258	54.55	459.2

Percentage Cover

Percentage cover varies between the sectors surveyed (Table 1), sectors 5 and 6 have the highest percentage cover.

Percentage cover increased in all sectors from March 2017 to April 2018 (Figure 2), the most notable increase was in sector 5 where the percentage cover increased by 20%. Mean percentage cover was above the site average in sector 4, 5 and 6. This is similar to the results found in 2015-2016 surveys of the site, with sector 5 and 6 above the average

percentage cover for the whole site. Percentage cover of sector 4 has increased by 12% from 2016 to 2018.

It is important to note that the sector areas recorded in the 2018 survey were used in analysis of 2017 results as 2017 area measurements are inaccurate. Sector 6 was not included in the 2017 survey.

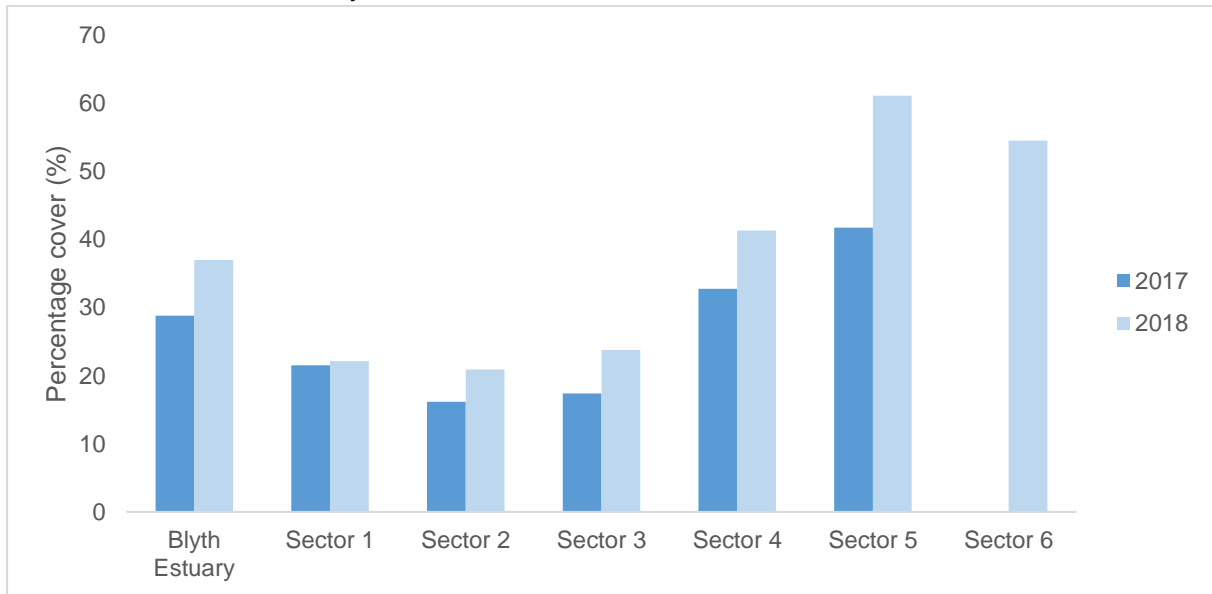


Figure 2 The percentage cover per sector and overall for 2017 and 2018.

Density

Mussel density is highly variable between sectors in both years (Figure 3). Mussel density increases in each sector between 2017 and 2018 and across the estuary overall. The largest increase is in Sector 3 where density in 2017 was 79 mussel/m² compared to 2018 where 334 mussel/m² were recorded.

Inspection of the ground by officers during the 2017 survey found the mussel to be sparse with 'clumps' off aggregations of individuals in sectors 1-4.

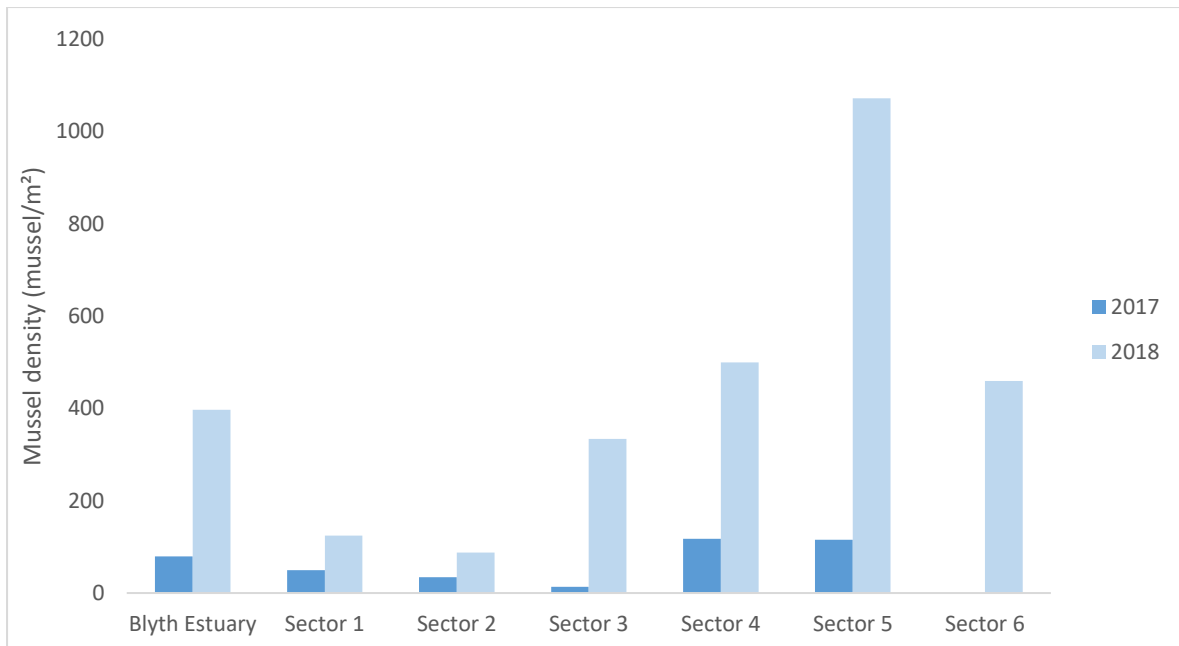


Figure 3 Mussel density per sector and overall for 2017 and 2018.

Length Frequency

A total of 76 mussels were sampled in the 2017 survey, and 153 in the 2018 survey. Mean length of mussels sampled in 2017 was 46.09 mm, and 32.89 mm in 2018. The proportion of mussels sampled in each size class (<25, 26-49 and >50mm) is shown in Figure 4. In 2017, the length frequency is skewed towards larger size classes of >45 mm with very few individual <25 mm (Figure 5). In 2018, the skew is towards smaller lengths with the highest frequency in the <25 mm size class and a lack of mussels in the mid-range size class (Figure 6).

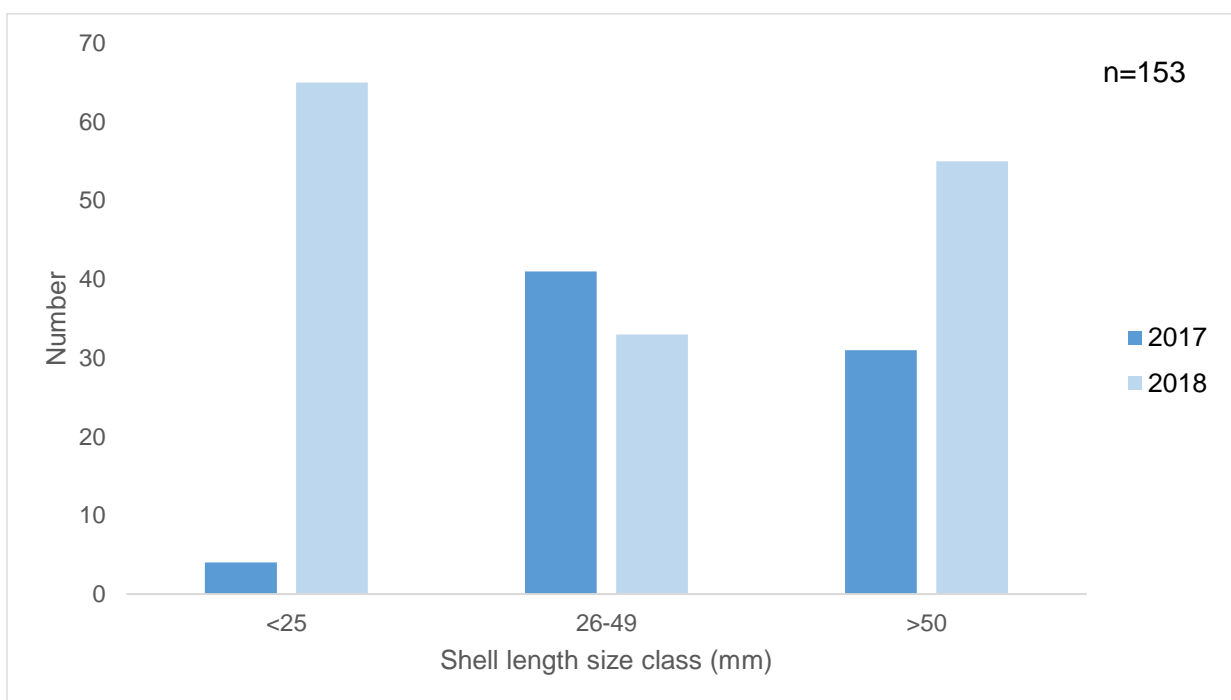


Figure 4 The frequency of mussels in each size class in Blyth Estuary overall for 2017 and 2018.

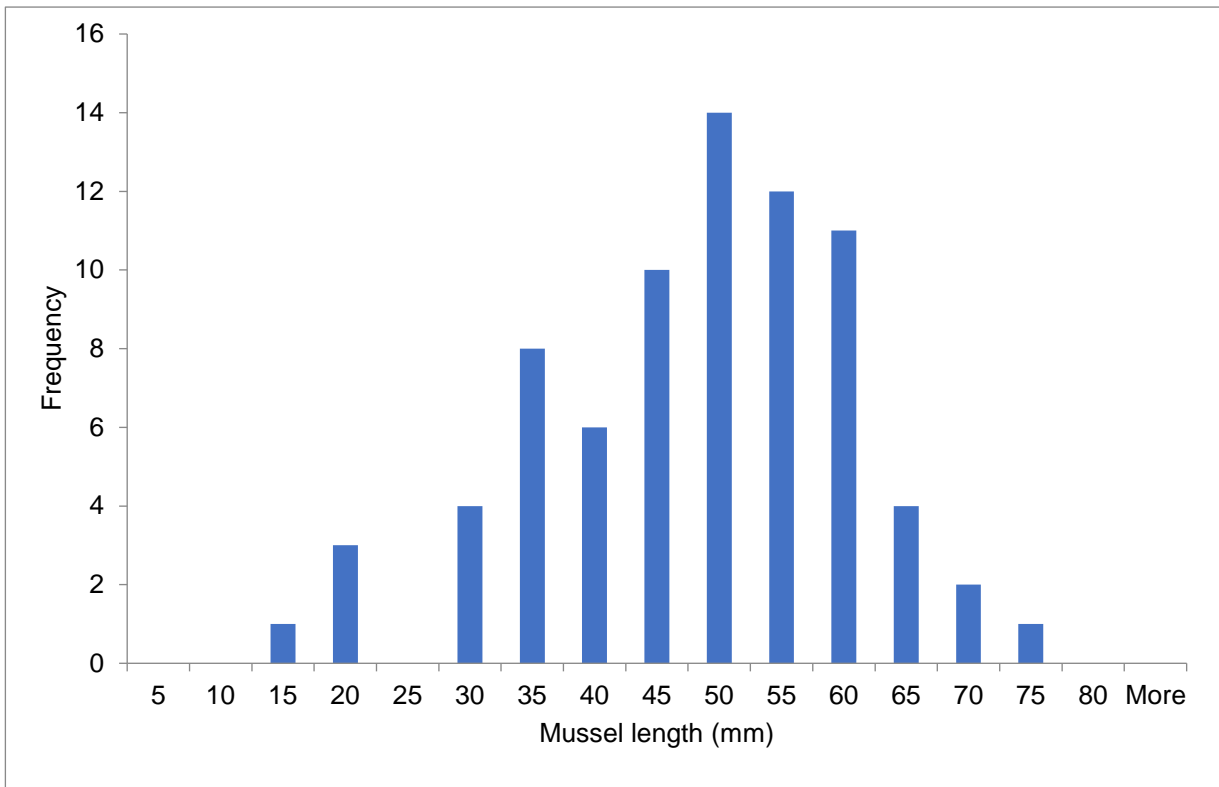


Figure 5 Length frequency distribution of mussels sampled during the Blyth Estuary survey 2017.

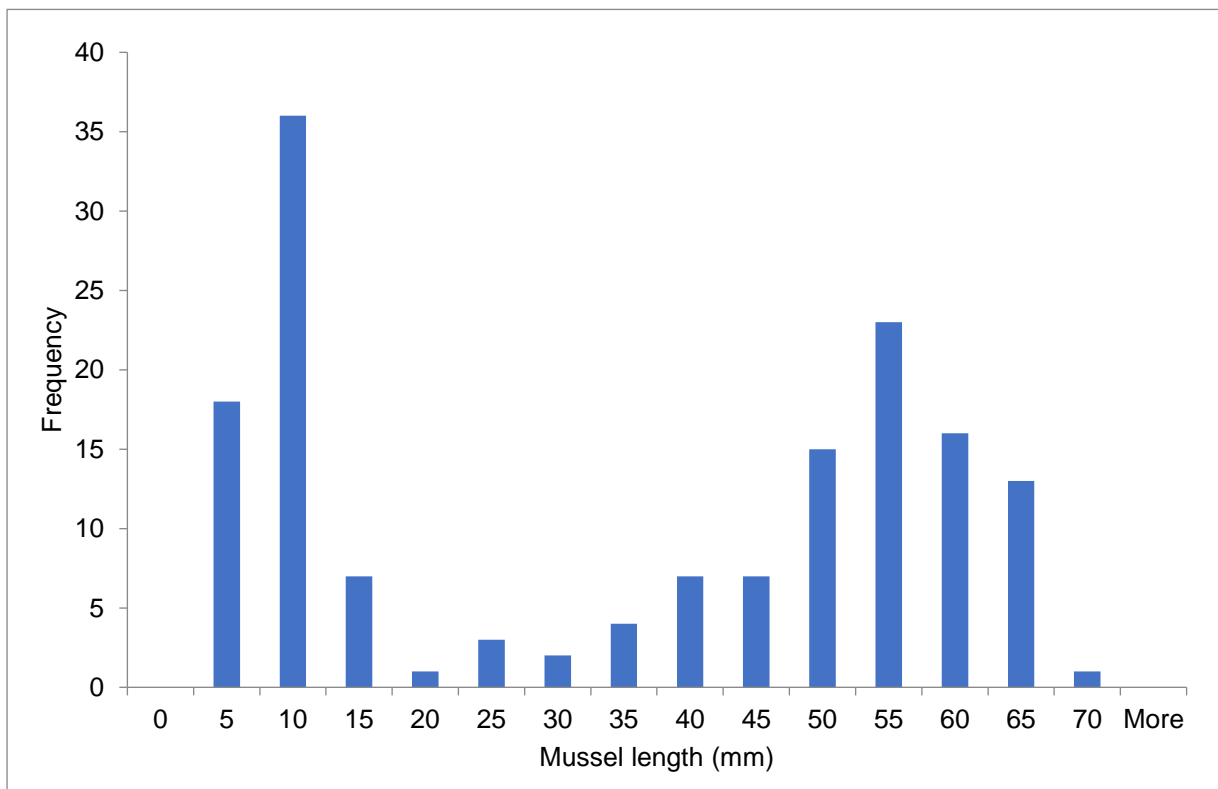


Figure 6 Length frequency distribution of mussels sampled during the Blyth Estuary survey 2018.

Discussion

Percentage cover

The mussel bed was not evenly distributed across the site, percentage cover varied between the six sectors (Table 1). The high mussel density and percentage cover recorded in sector 5 across all survey years, and sector 6 in 2018 may be explained ease of access for bait collectors to mussels in sectors 1-4. These areas are located within a short walk from a road with vehicular access, where collecting mussel for bait has been sighted previously. NIFCA officers monitored bait digging activity on Blyth Estuary, recording numbers of hand gatherers and bait diggers at the site at low tide. In 2017 and 2018, 20 sightings of mussel collectors were recorded by officers in 44 inspections of the area suggesting that this mussel bed is popular area for mussel collection activity.

Percentage cover increased in all sectors from 2017 to 2018. Levels of predation by birds and collection of mussels for bait are likely to be the largest determinant factors of percentage cover and density found at Blyth Estuary. Severe storms have been identified as a limiting factor in the distribution of mussel beds (Nehls and Thiel, 1993). The 2018 survey took place after a storm event in early 2018, the results would indicate that this weather event has not significantly influenced the mussel bed. This may be due to the sheltered location of the bed within an estuary.

Length Frequency

In 2017, the length frequencies are fairly evenly distributed around the mean length with few individuals in the smaller size classes suggesting there may not have been a settlement of spat for some time. In 2018, the length frequency is skewed toward smaller size classes which could mean there was a settlement of spat or smaller mussel March 2017 and April 2018. The results from the 2018 survey display a bimodal pattern with two peaks: one at the smaller size classes and one at the larger which was also seen in 2016 (Wallace, 2017). Several studies have identified bimodal length distributions for mussels (Hilgerloh, 1997; Gray, 2011) one theory for this is the predation of medium sized mussels (between 25 and 38mm) by birds (Gray, 2011). Meire and Ervynck (1986) found that oystercatchers select mussels between 30mm and 45mm in length. Hilgerloh (1997) suggests that dominance by one size class of mussels occurs due to larger mussels growing out of the size range exploited by predators.

This change in distribution between 2017 and 2018 could be attributed to 1) improved detection of smaller mussels by surveyors or 2) increased recruitment at the site. It is more likely to be the latter as results from 2015 and 2016 follow a similar trend with a peak in smaller size classes in 2016 and a lack of smaller size classes in 2015 (Wallace, 2017).

Despite this change, the number of smaller individuals is still lower than expected; therefore recruitment may still be low at the site. However, an increase in the frequency of smaller size classes in 2016 and 2018 could suggest a pattern of settlement and recruitment that could be monitored in the future.

Density

Mussel density has increased significantly between 2017 and 2018 with only sector 3 showing the largest increase. The storm event experienced in March 2018 does not seem to have had a negative impact on the mussel bed this change in density could be due to: 1)

exploitation i.e. bait collection, 2) predation by birds, 3) other natural variation, 4) randomness of the survey technique.

Further analysis could be conducted on the level of bait collection recorded at the site in 2016 and 2017 and a comparison made between the two is required to understand the level of pressure exerted on the bed. Predation by birds may be a factor in the densities observed in the results however, as above, birds are known to target a size range and so changes in density cannot be completely explained by this. Other natural variation including patterns in settlement, conditions such as temperature and pollution levels (Jones et al., 2010), and the amount of suitable ground to settle on may affect the density of the mussel at the site (Seed, 1969). These factors could be taken into account in future analysis at the site.

Conclusion

The purpose of this report is to continue assessments of the state of the mussel bed in Blyth estuary by comparing 2017 data to the 2018 data. This study has provided an ongoing assessment of the size and distribution of the mussel bed, length frequencies and densities of the mussels and levels of bait collection at the site and compared the results with those obtained in earlier years (Wallace, 2016). Results show a lack of mussels at the site, however do indicate a settlement which may influence the size and structure of the bed in the future. Predation and collection of mussels at this site will continue, the site will be surveyed annually to continue to monitor the effects of this and other pressure on the bed at Blyth Estuary.

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