Tamar Estuary Sites Marine Conservation Zone (MCZ) blue mussel bed survey 2023

Survey field report for the 2023 Mussel bed survey within the Tamar Estuary Sites MCZ

Completed by: Cornwall Inshore Fisheries and Conservation Authority (Cornwall IFCA)

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Summary

This report summarises the intertidal mussel bed surveys in the River Lynher. The surveys were carried out over two days, 23rd February 2023 at Shillingham Point and 19th April 2023 at Jupiter Point.

The aim of the surveys were to map the extent of the intertidal mussel beds at Shillingham and Jupiter Point and carry out a mussel stock assessment of the mussel beds. The data was also compared to previous surveys carried out by Cornwall IFCA from 2012 onwards.

A total of 15 live mussels were recorded at Shillingham Point and four at Jupiter Point in 2023. The survey methodology was amended from previous surveys to take a sample every hit instead of every third hit due to the low number of mussels recorded on both beds. The mussel stock was estimated to be two tonnes at both sites. These values are the lowest recorded by Cornwall IFCA since the first surveys carried out on the beds in 2012.

The results of these surveys indicate that the beds are of very low quality, from a fishery point of view, due to a now ageing single year class structure and high percentage of dead mussel shell.

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1 Background and Introduction

Cornwall Inshore Fisheries and Conservation Authority (Cornwall IFCA) carried out surveys between February and April in 2023 of the mussel bed feature within the River Lynher in the Tamar Estuary Sites Marine Conservation Zone (MCZ) (Figure 1). Cornwall IFCA were contracted by Natural England to carry out the survey with an aim to monitor the extent of the mussel beds at Shillingham Point and Jupiter Point and carry out a stock assessment of the mussel beds. The data was compared to previous surveys which were carried out by Cornwall IFCA in 2012, 2014, 2015 and 2016 (Jenkin *et al*., 2016). The surveys were carried out to assess the value of the blue mussel beds and intertidal biogenic reefs as features of the Tamar Estuary Sites MCZ. The previous surveys by Cornwall IFCA from 2012 to 2016 found that the beds were of low quality, from a fishery point of view, due to a single year class structure and high percentage of dead shell. The extent of the beds between 2012 and 2016 were similar to that identified by the 2010 Ecospan surveys (Curtis, 2010), though extended further down the shore than expected.

The Natural England conservation advice describe the Tamar Estuary Sites MCZ blue mussel (*Mytilus edulis*) beds feature as (Natural England, 2021);

> "Blue mussel beds, a Priority Habitat, have been recorded on both the Lynher and the Tamar. In this site the feature comprises both intertidal and subtidal beds.
>
> The largest blue mussel bed within the site is located along the intertidal shore of the Tamar, adjacent to the Royal Naval Armaments Depot, Ernesettle. An adjacent smaller subtidal bed is also present, with a further set of small subtidal beds located up-river close towards Weir Point. On the Lynher the main blue mussel bed is present in the lower reaches just up-river of Jupiter Point (Curtis, 2010; Bunker *et al.,* 2002;). The Lynher mussel bed is present in the intertidal zone on both sides of the estuary (Jupiter Point and Shillingham Point) and is thought to join up subtidally (Latham and Trundle, 2016).
>
> On the intertidal blue mussel beds of the Tamar there are patches of the brown seaweed (*Fucus serratus*) with epiphytes including *Dynamena pumila* and *Alcyonidium gelatinosum*. The common cockle (*Cerastoderma edule*) and sand mason worm (*Lanice conchilega*) are present in locations where the beds have formed on muddier sediments (Bunker *et al*., 2002).
>
> In the Lynher various species have been recorded associated with the beds. These include the native oyster (*Ostrea edulis), the non-native Pacific oyster (Crassostrea gigas), the non-native barnacle (Austrominius modestus*), the non-native leathery sea squirt (*Styela clava*) and non-native slipper limpets (*Crepidula fornicata*). The sponges (*Hymeniacidon perlevis*, *Halichondria* (*Halichondria*) *panicea* and *Haliclona oculata*) and the barnacle (*Balanus crenatus*) are also present (Latham and Trundle, 2016; Curtis, 2010; Bunker *et al.,* 2002).
>
> The intertidal parts of blue mussel beds also come under the intertidal biogenic reef feature of this MCZ."

The Natural England conservation advice describe the Tamar Estuary Sites MCZ intertidal biogenic reefs feature as (Natural England, 2021);

> "Intertidal biogenic reefs are found in both the Lynher and Tamar-Tavy areas of the MCZ. In the Lynher the main intertidal biogenic reef is the blue mussel bed located just up-river of Jupiter Point. Although the majority of this bed is classed as subtidal, part of it is exposed during extreme low water springs. Another large blue mussel intertidal biogenic reef is located on the Tamar adjacent to the Royal Naval Armaments Depot Ernesettle. Here the bed extends from low water into the intertidal and is of a considerable size, extending for over 800m along the bottom of the intertidal mudflats (Bunker *et al.*, 2002).
>
> The fauna in the Lynher bed is dominated by the common mussel (*Mytilus edulis*) with other fauna including anemones (Curtis, 2010). The bed is made up of live and dead mussel shell held together by the mussels' byssal threads and by encrusting fauna such as sponges (Latham and Trundle, 2016). The mussels are found colonised with filamentous red algae along with an abundance of the sponge (*Halichondria* sp.) (Hiscock and Moore, 1986). Native oysters (*Ostrea edulis*), Pacific oysters (*Crassostrea gigas*) and non-native leathery sea squirts (*Styela clava*) are present on the intertidal biogenic reef. The orange sponge (*Hymeniacidon perlevis*) is abundant on the mussel bed (Latham and Trundle, 2016).
>
> In the Tamar the beds are situated on littoral mixed substrata, with fauna consisting predominantly of the common mussel (*Mytilus edulis*). The common cockle (*Cerastoderma edule*) is also present (Hiscock and Moore, 1986). Attached algae recorded amongst the mussels includes bladder wrack (*Fucus vesiculosus*) and egg wrack (*Ascophyllum nodosum*) (Hiscock and Moore, 1986)."

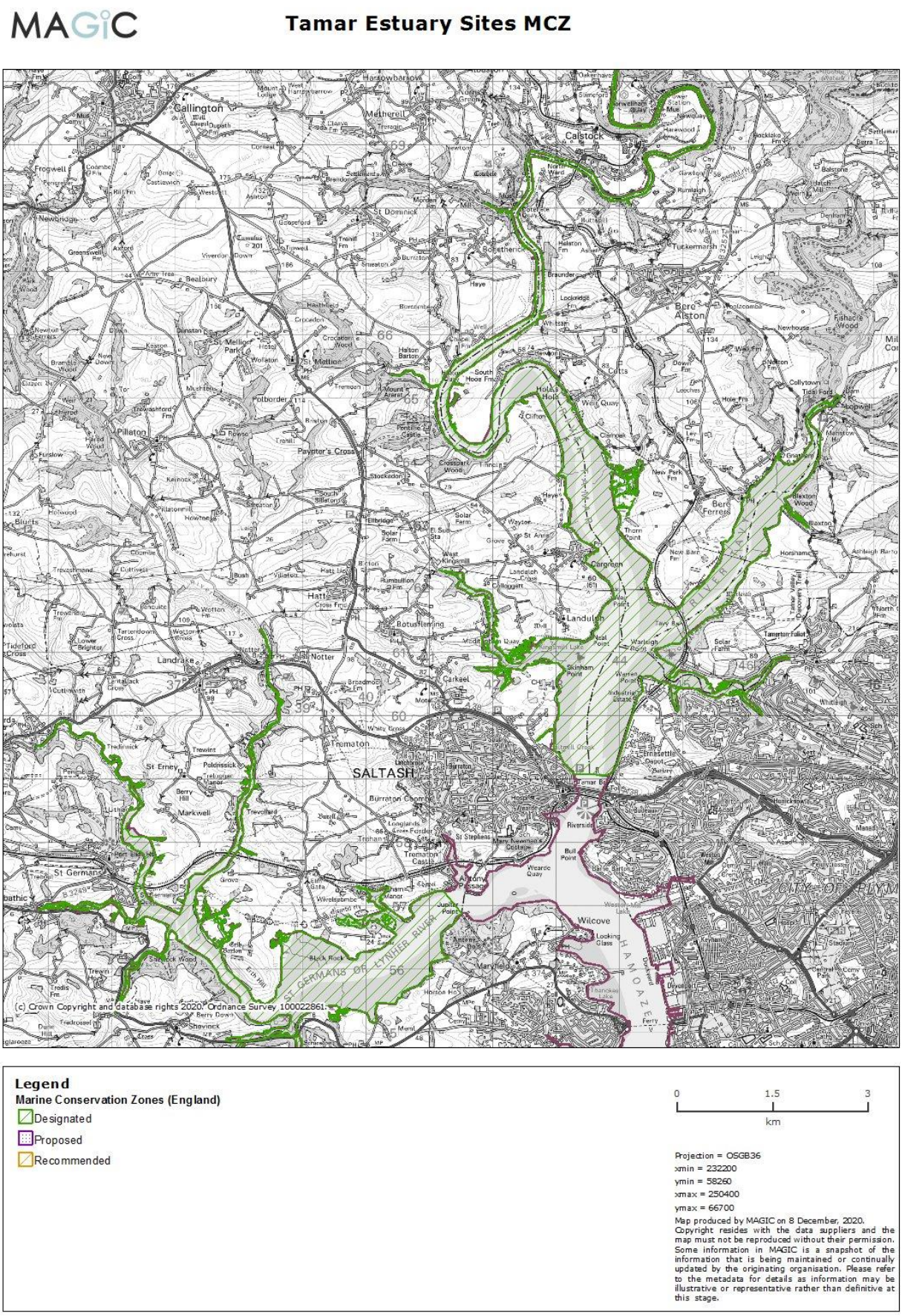

Figure 1: The Tamar Estuary Sites Marine Conservation Zone (Magic map, 2020)

1.1 Aims and objectives

1.1.1 Aims

- Monitor the extent of the intertidal mussel beds at Jupiter Point and Shillingham Point in the River Lynher within the Tamar Estuary Sites MCZ.
- Carry out a mussel stock assessment for Jupiter Point and Shilingham Point in the River Lynher within the Tamar Estuary Sites MCZ.
- Assess any changes to the extent of the mussel beds or stock size over time since reporting began in 2012.

1.1.2 Objectives

- Carry out survey transects and collect samples to enable a fishery stock assessment of the mussel.
- Verify the extent of the mussel beds by walking the perimeter of the mussel bed.
- Compare the current extent and stock size to previous years data.

2 Survey Operations

The survey was undertaken on foot. Survey operations are described below.

2.1 Personnel

Both survey days consisted of a principal scientific officer and two or three scientific officers from Cornwall IFCA. One member of staff from Natural England joined the survey at Jupiter Point.

2.2 Personal Protective Equipment (PPE)

While working in the intertidal all members of staff wore lifejackets, personal location beacons (PLBs) and steel toe capped waders. There were no reported accidents or near misses throughout the survey.

3 Survey Methodology

3.1 Survey area

The two survey areas were located in the River Lynher, one at Shillingham Point on the north side of the river and the other at Jupiter Point on the south side of the river (Figure 2).

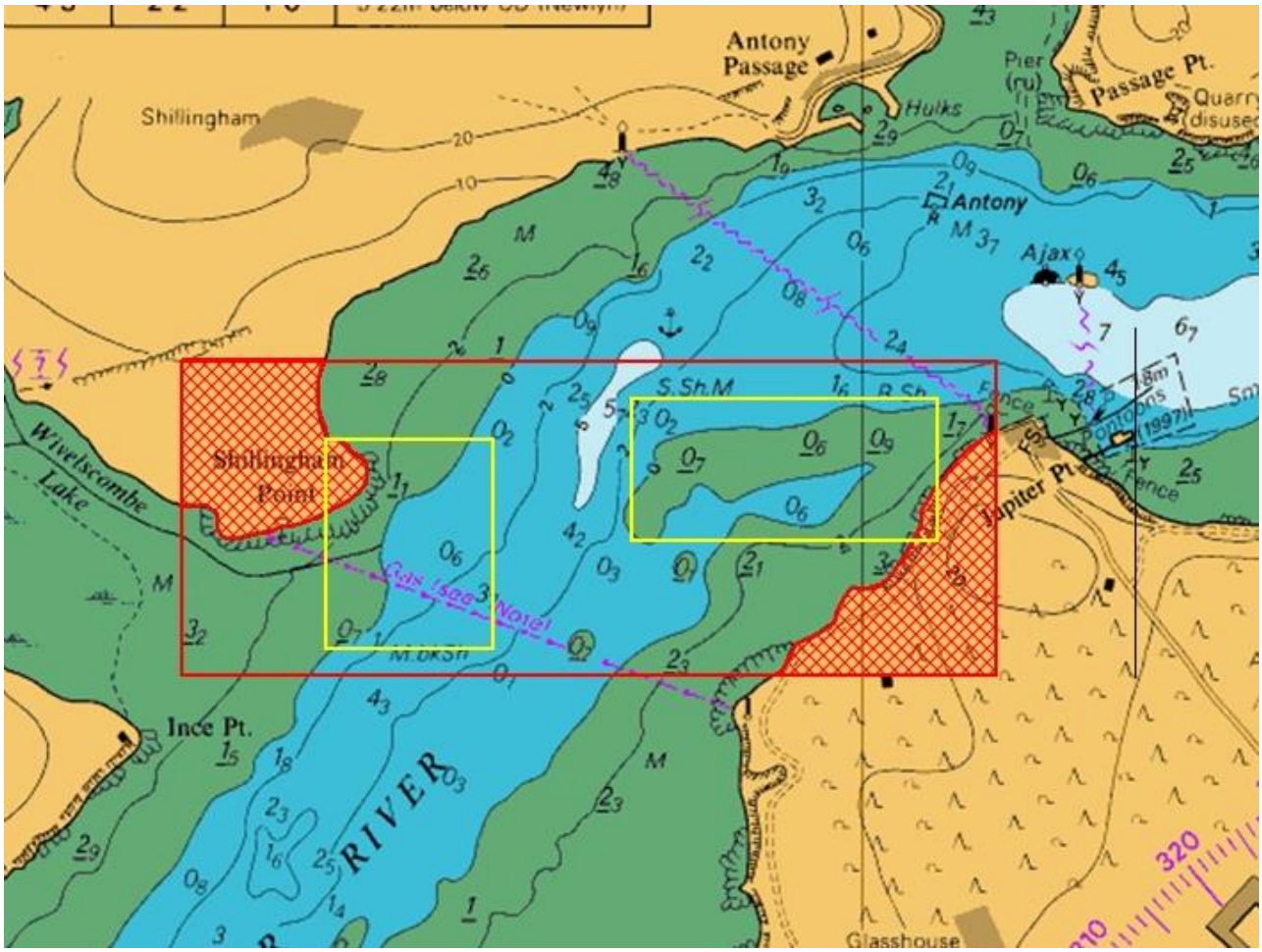

Figure 2: The two survey areas (yellow), Shillingham Point (North side) and Jupiter Point (South side) and broad scale survey area (red).

3.2 Fishery assessment of the mussel beds

The intertidal mussel surveys were conducted during daytime periods of low spring tide with a pressure of at least 1020 mb. This allows the lower beds to become fully exposed.

Officers (surveyors) used the same 'Dutch wand' methodology as employed in previous surveys in 2012, 2014, 2015 and 2016. All positions taken used the WGS84 projection.

The method involved using a bamboo cane with a 110 mm ring attached to one end in such a way that it rests flat on the sediment when the cane is held at approximately 45º. Facing along the transect, the ring was placed on the

mussel bed at approximately 90° (out to the side of the surveyor) then walked forward until the ring was approximately 45° behind the surveyor. The cane was then lifted and moved to approximately 45° in front of the surveyor; this point was the sample point or 'sample event'. The surveyor then walked forwards again until the cane pointed 45° behind them. This method is then repeated across all transects. At every sample point a second surveyor recorded whether it was a 'hit' (live mussel present) or a 'miss' (live mussel absent). This method was taken from Dutch marine consultants, MarinX, and previously used at Eastern Inshore Fisheries and Conservation Authority (Jessop *et al.*, 2013).

In previous years a physical sample was taken at every 3rd or 5th sampling point hit (containing live mussel), which was considered the best sampling regime for the beds from previous surveys. However, in 2023 due to the low number of live mussels recorded, physical samples were taken at every sampling point which provided a hit, although initially at Shillingham only two samples were taken out of the first three hits and were not collected for further analysis because surveyors were not aware of the low mussel stock at the start of the survey. Samples were collected using a 100 mm diameter, 150 mm long corer twisted into the mussel bed. The samples were collected in plastic zip bags, labelled and stored temporarily in a bucket. Transects of the mussel beds were recorded with a handheld Garmin GPS 73 unit. The track was set to record every ten seconds and a GPS point was taken at each sample event (hit/ miss) with a handheld GARMIN GPS 60 unit. Images of the surveys being carried out are shown in Figure 3.

To process the physical samples, each sample was individually washed on a riddle. The live mussel was separated, individually measured and collectively weighted. The remaining shell (including any slipper limpets) was weighed. The method employed to assess the mussel stock is fully described in Annex 1.

Figure 3: Survey operations during the Cornwall IFCA mussel surveys at Jupiter Point and Shillingham Point (Credit Cornwall IFCA and Esther Hughes (Natural England))

3.3 Extent of the mussel beds

The extent of both beds was obtained by walking around the furthest possible perimeter of the visible habitat, including mussel shell, or to a depth that was safe to do so (not above knee height) whilst feeling shell underfoot. The area was recorded using the track function set to record every ten seconds on a handheld Garmin GPS 60 unit and taking waypoints routinely and at any change of direction.

4 Data handling

Data was recorded in waterproof notebooks and recording sheets. It was then uploaded into a Microsoft Excel spreadsheet for analysis. GPS tracks and waypoints were uploaded into MapInfo Professional Version 17.0.2 then overlaid onto charts.

5 Survey Narrative

Shillingham Point

The survey was carried out on the 23rd February 2023 by the principal scientific officer and three scientific officers. The low water at Saltash was predicted to be 0.35 m at 14:15 (UTC) and the air pressure 1020 mb. Weather

conditions were typical for February with a light NNE wind (Beaufort scale 3) and 7/8 cloud coverage. The survey commenced at 13:54 and was completed at 14:57. A total of 23 transects were completed and the perimeter of the bed was marked using GPS waypoints and recording the track.

Jupiter Point

The survey was carried out on the 19th April 2023 by the principal scientific officer, two scientific officers and one member of staff from Natural England. The low water at Saltash was predicted to be 0.51 m at 11:24 (UTC) and the air pressure 1021 mb. Weather conditions were recorded as E wind of 10-25 mph and 8/8 cloud coverage. The survey commenced at 11:13 and was completed at 11:50. A total of nine transects were completed and the perimeter of the bed was marked using GPS waypoints and recording the track.

6 Results

Initial observations showed that there was a lot less mussel on the ground compared to previous years and a higher number of larger pacific oysters.

A summary of the results of the two survey days are shown in Table 1.

Table 1: A summary of the results of the mussel bed surveys at Shillingham Point and Jupiter Point in 2023.

	Shillingham Point	Jupiter Point
Area Surveyed	0.6 ha	1.2 ha
Number of transects	23	9
Number of hits	16	4
Number of misses	212	100
Number of samples	14	4
Number of mussels	15	4
Average length of mussel (mm) (± S.D.)	64.93 (± 12.45)	68.75 (± 2.50)
Average weight of mussel (g)	36.27	44.00
Mussel cover	7%	4%
Density in samples (kg/m^2)	4.66	5.28
Density in sample events (hits and misses) (kg/m^2)	0.33	0.20
Total stock	**2 tonnes**	**2 tonnes**

6.1 Extent of the mussel beds

6.1.1 Shillingham Point

The transect lines and suitable habitat extent for Shillingham Point are shown in Figure 4.

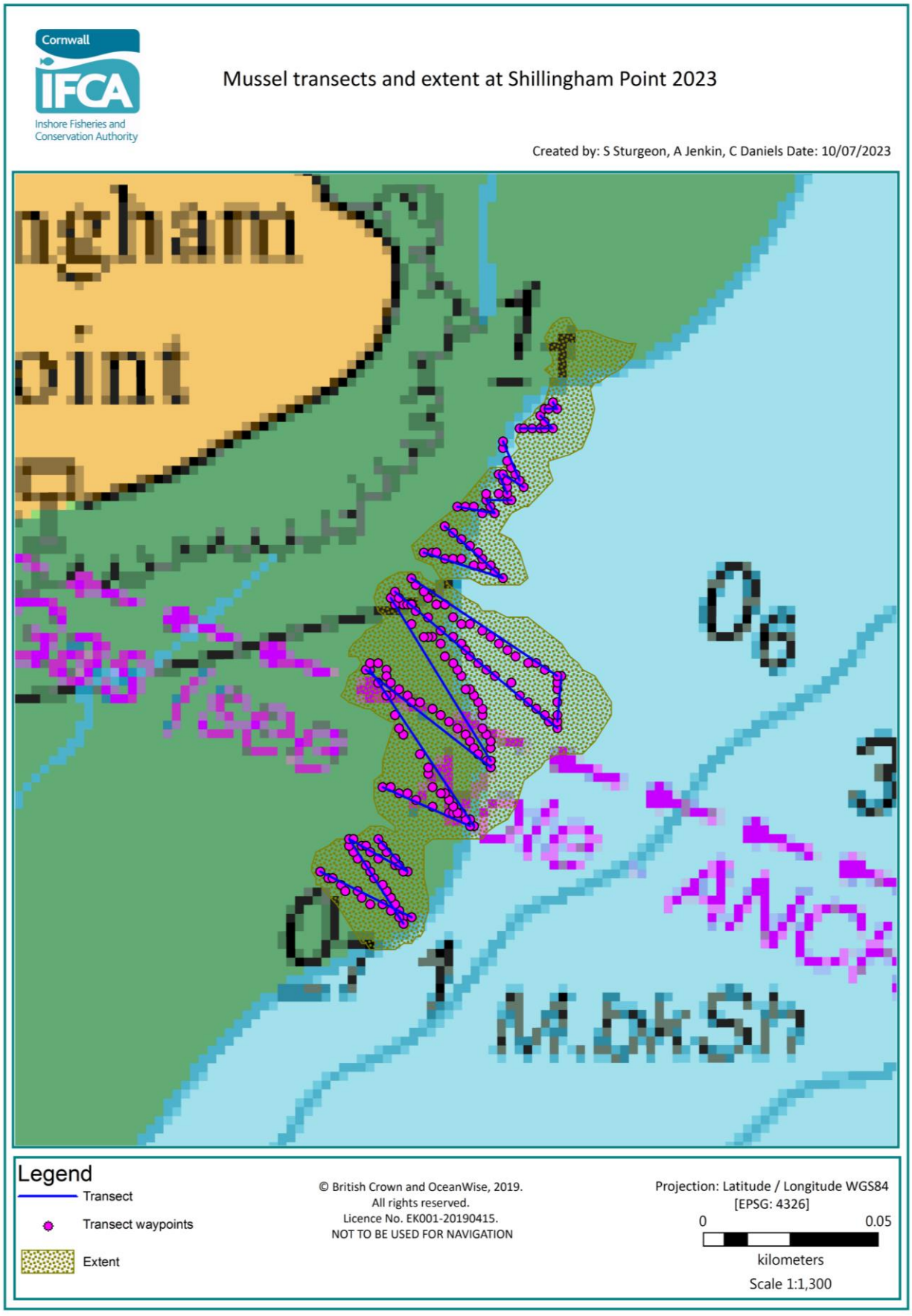

Figure 4: The transect lines and suitable habitat extent for Shillingham Point

6.1.2 Jupiter Point

The transect lines and suitable habitat extent for Jupiter Point are shown in Figure 5.

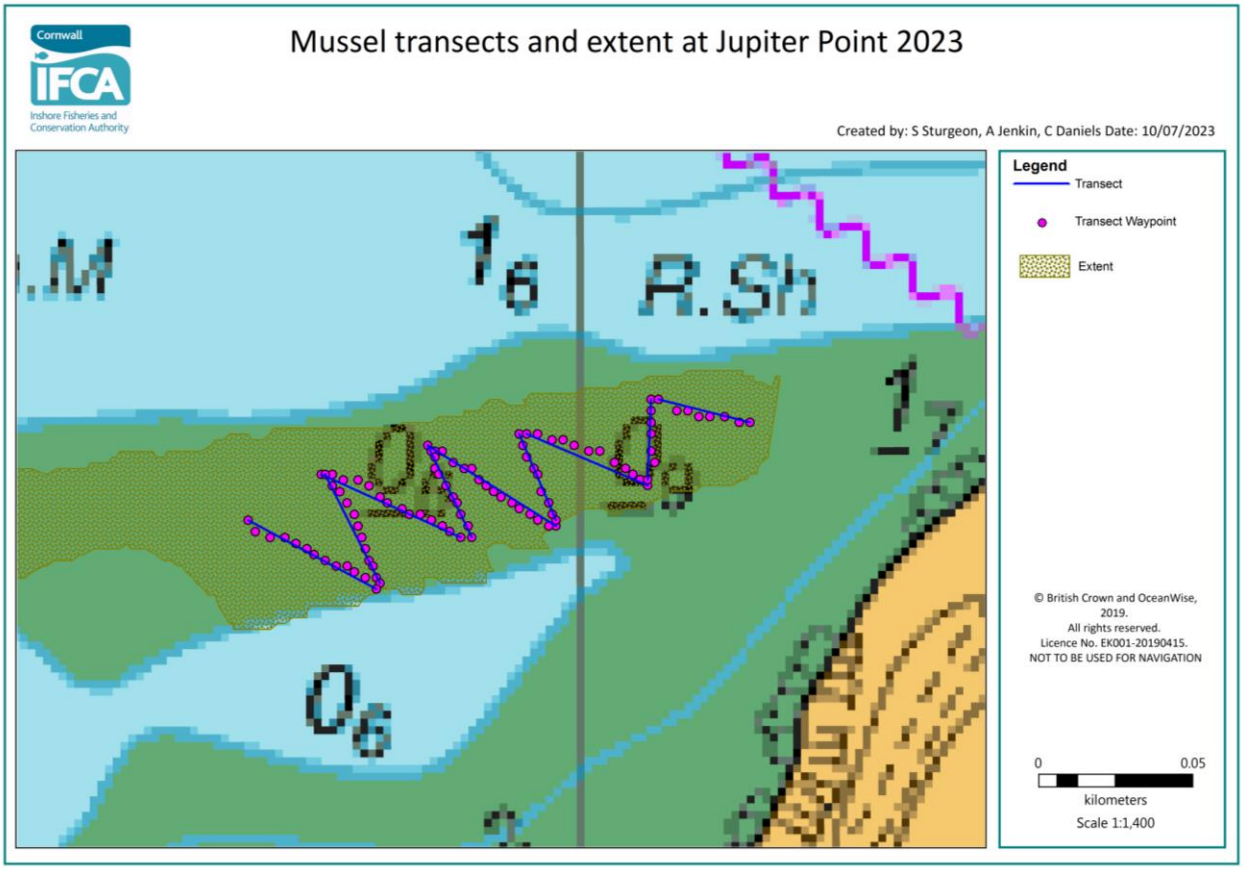

Figure 5: The transect lines and suitable habitat extent for Jupiter Point.

6.2 Mussel stock assessment

The stock availability of mussel for both beds was the same (two tonnes) despite the Jupiter Point bed being slightly larger (1.2 ha) than Shillingham Point (0.6 ha). The estimated percentage mussel cover was low at both beds, 7 % at Shillingham Point and 4 % at Jupiter Point.

6.3 Mussel size and size/frequency distribution

The average length of mussel at Sillingham Point was 64.93 mm (± S.D. 12.45) and 68.75 mm (± S.D. 2.50) at Jupiter Point. The mussels at both beds were nearly all from a single age class (Figure 6) consisting of adult mussels with very little spat or juvenile mussels recorded.

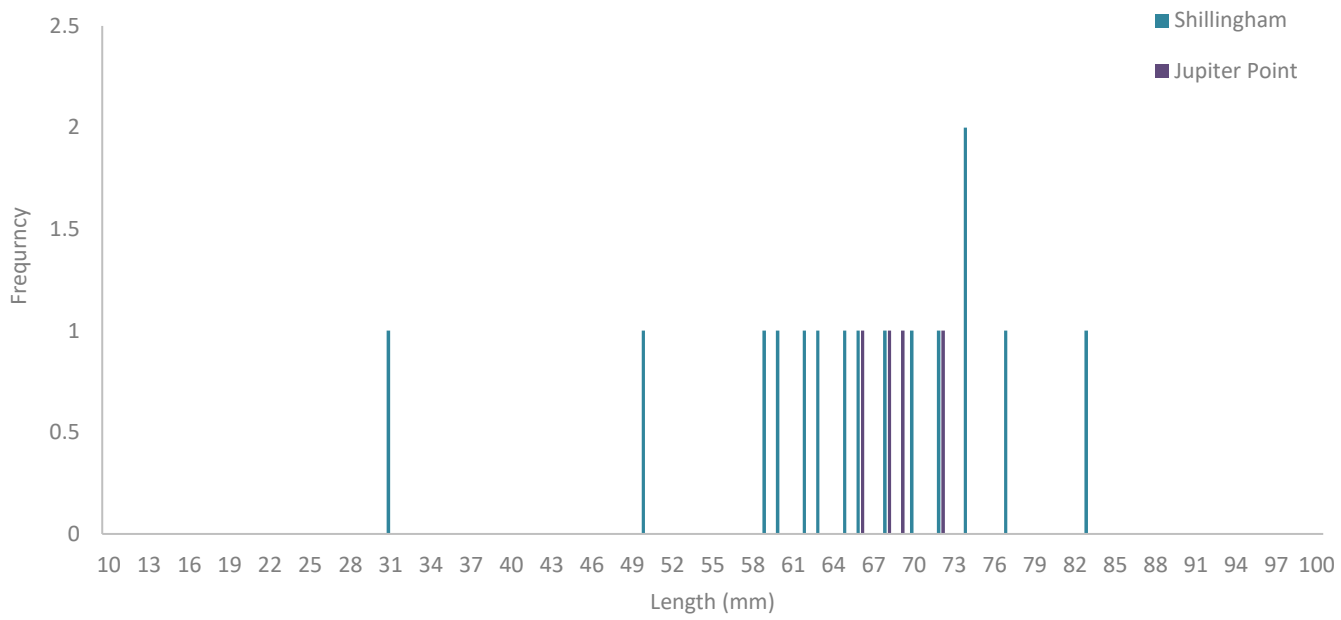

Figure 6: Size frequency distribution for Shillingham Point and Jupiter Point in 2023

6.4 Mussel weight

The total weight of live mussel sampled at Shillingham Point was 0.54 kg, with an average weight of mussel weighing 23.65 g (from 15 mussels). At Jupiter Point the total weight of live mussel sampled was 0.18 kg with an average weight of mussel weighing 19.56 g (from four mussels). Given the low sample numbers the outputs should be treated with caution.

6.5 Historic data

Surveys were carried out at Shillingham Point in 2012, 2013, 2015, 2016 and 2019, and at Jupiter Point in 2014 and 2016.

After discussion by Cornwall IFCA officers, it was decided that comparing the extent of the mussel beds from previous years could be mis-leading as the results are dependent on climatic and tidal conditions at the time of survey and due to the beds extending into the subtidal making the true extent difficult to assess. It was agreed that a consistent area (ha) would be used for the extent on both beds to enable a more accurate stock assessment to be carried out. To enable an assessment of the mussel stock on the beds across the survey years, the extent from the drone survey in 2016 was used as for Shillingham Point as this is considered to be the most accurate extent of the bed, and the extent was assumed to have not greatly changed over the reporting period. The drone data is reported by Jenkin *et al*., 2016. The perimeter of the bed at Jupiter Point could not be depicted from the aerial imagery due to the patchy nature of the bed so the 2016 extent from the perimeter walk was used which was the same as recorded in 2023

6.5.1 Shillingham Point

A summary of the previous surveys at Shillingham Point is shown in Table 2.

Table 2: A summary of the previous surveys from 2012 to 2023 at Shillingham Point

	24/07/2012	23/08/2013	20/02/2015	10/02/2016	10/03/2016	19/09/2019	23/02/2023
Area calculated by 2016 aerial imagery (ha)	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Number of hits	37	32	64	66	61	52	16
Number of misses	42	22	71	27	91	65	212
Mussel cover (%)	47	59	47	71	40	44	7
Density of events (hits and misses) (kg/m^2)	4.5	2.6	4.0	4.6	3.5	3.5	0.3
Total stock (tonnes)	27	15	24	28	21	21	2
Mean size (mm) (± S.E.)	55.8 (± 5.45)	57.3 (± 5.27)	57.3 (± 5.27)	60.7 (± 14.6)	65.5 (± 11.43)	61.03 (± 7.87)	64.93 (± 12.45)

Stock

The estimated tonnes of mussel at Shillingham Point from 2012 to 2023 is shown in Figure 7.

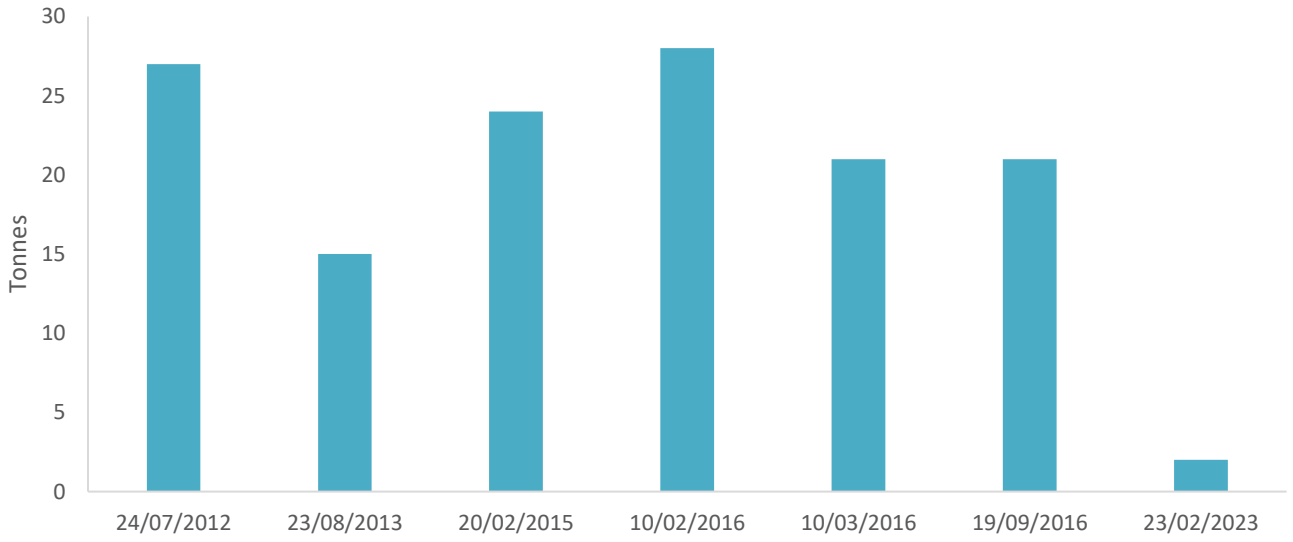

Figure 7: Estimated stock of mussels on the mussel bed at Shillingham Point, the River Lynher, from 2012 to 2023.

Density of all events (hits and misses)

The density (kg/ m^2) of mussel in all events (hits and misses) at Shillingham Point is shown in Figure 8.

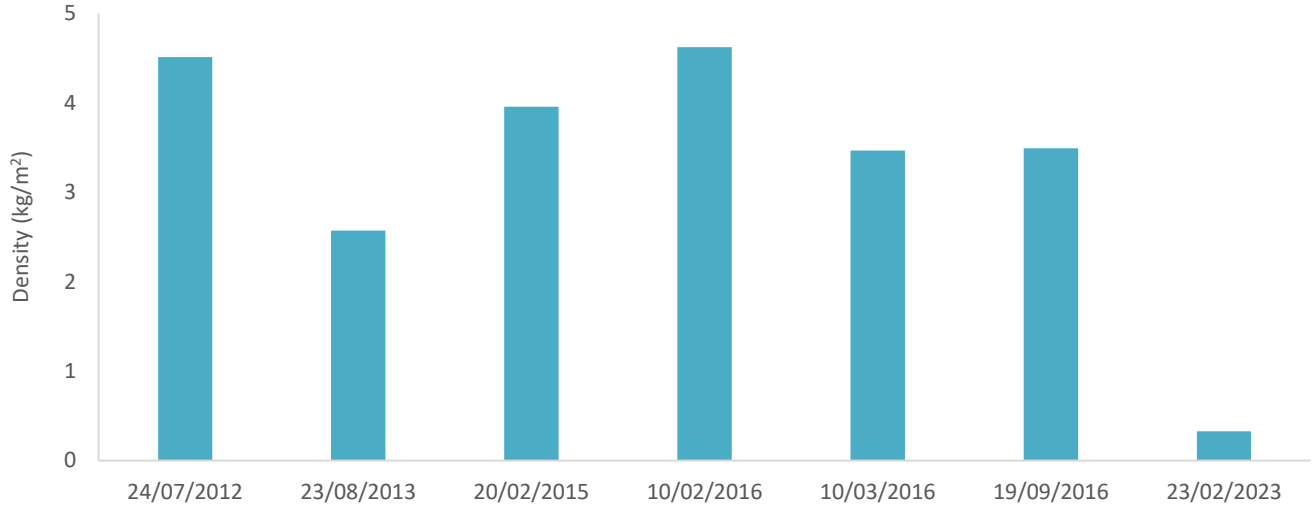

Figure 8: The density (kg/m²) of all events (hits and misses) at Shillingham Point from 2012 to 2023.

Length frequency

The length frequency of mussels from 2012 to 2023 at Shillingham Point is shown in Figure 9. The length frequency does not seem to have changed across the years.

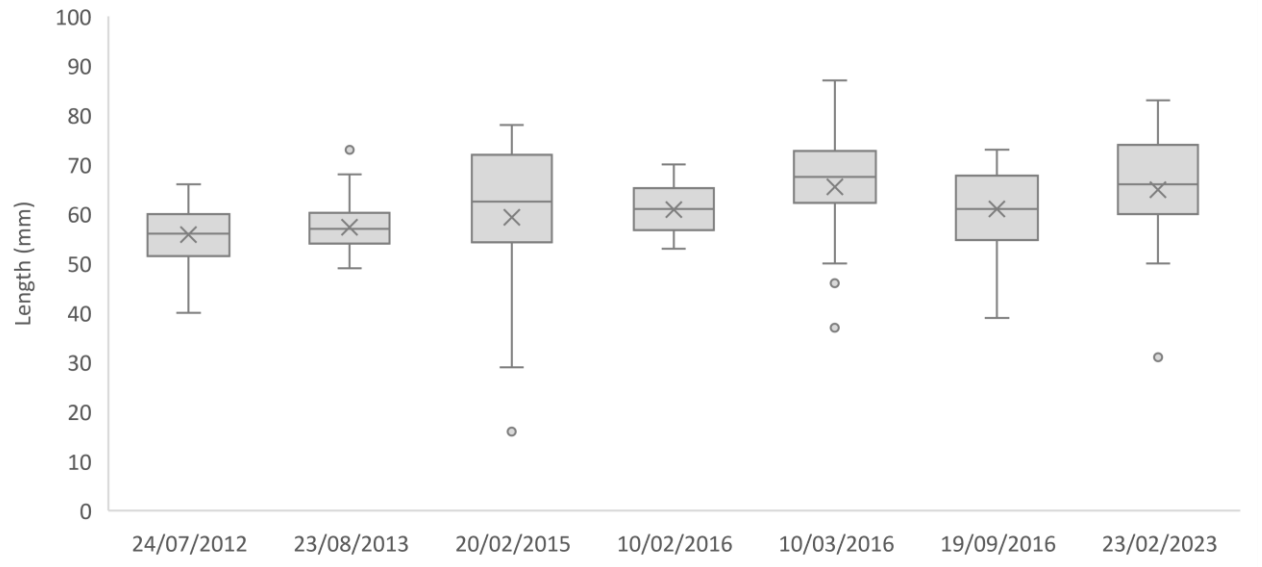

Figure 9: Length distribution plot for all mussel (*Mytilus edulis)* at Shillingham Point from 2012 to 2023. Data is grouped by year. X represents the mean, the line represents the median, boxes represent the interquartile range, whiskers represent 1.5* interquartile range, and the filled circles represent outliers.

6.5.2 Jupiter Point

A summary of the previous surveys at Jupiter Point is shown in Table 3.

Table 3: A summary of the previous surveys from 2014 to 2023 at Jupiter Point

	10/09/2014	19/09/2016	19/04/2023
Area Surveyed (ha)	1.2	1.2	1.2

Number of hits	26	16	4
Number of misses	49	146	100
Mussel cover (%)	35	10	4
Density of events (hits and misses) (kg/m^2)	2.28	0.82	0.20
Total stock (tonnes)	**41**	**10**	**2**
Mean size (mm) (± S.E.)	65.3 (± 11.8)	58.80 (± 8.08)	68.75 (± 2.50)

Stock

The estimated tonnes of mussel at Jupiter Point from 2014 to 2023 is shown in Figure 10.

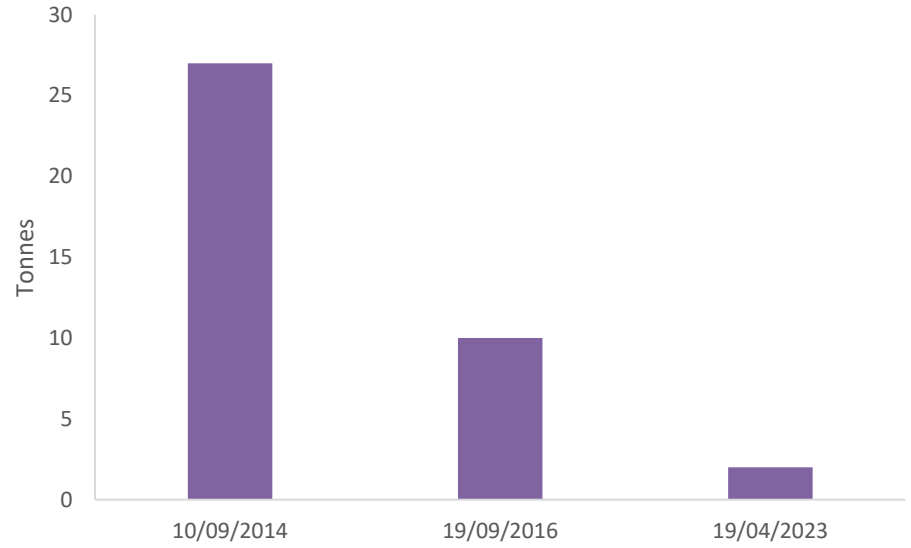

Figure 10: Estimated stock (tonnes) of mussel at Jupiter Point, the River Lynher, from 2014 to 2023.

Density of all events (hits and misses)

The density (kg/ m^2) of mussel in all events (hits and misses) at Jupiter Point is shown in

Figure 11.

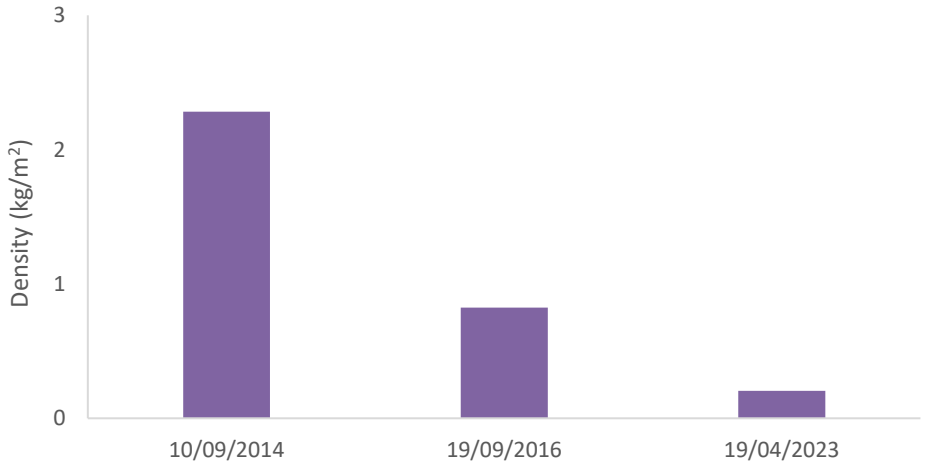

Figure 11: The density (kg/m^2) of sample events (hits and misses) at Jupiter Point from 2014 to 2023.

Length frequency

The length frequency of mussels from 2014 to 2023 at Jupiter Point is shown in Figure 12. The length frequency does not seem to have changed across the years.

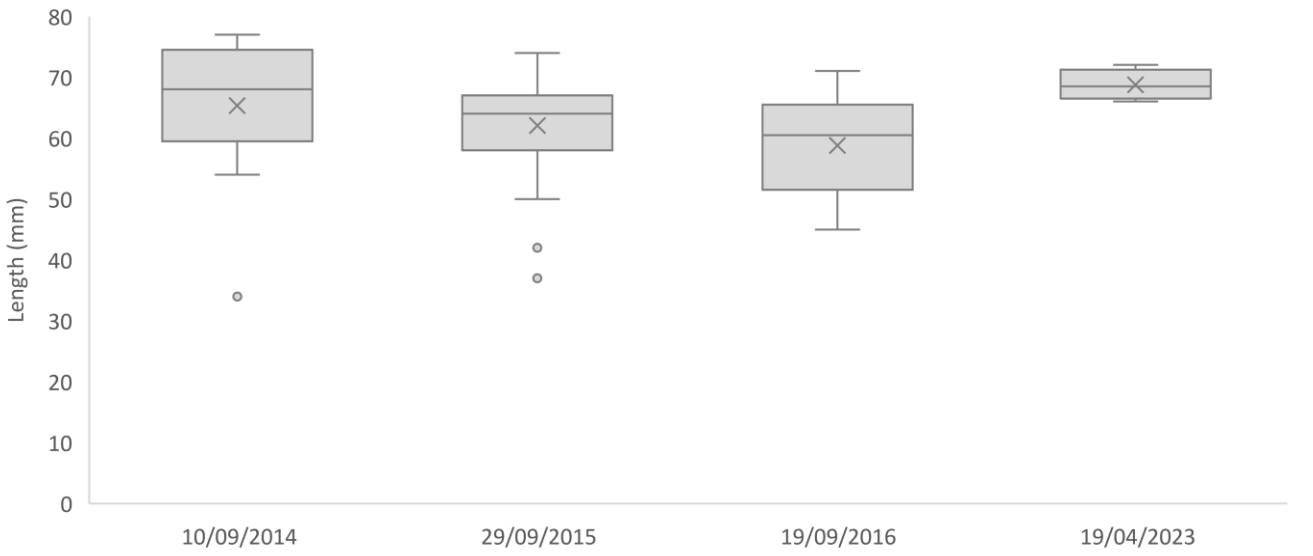

Figure 12: Length distribution plot for all mussel (*Mytilus edulis)* at Jupiter Point from 2014 to 2023. Data is grouped by year. X represents the mean, the line represents the median, boxes represent the interquartile range, whiskers represent 1.5* interquartile range, and the filled circles represent outliers.

6.6 Additional species and non-native species

Surveyors noted other species present on the mussel beds at Jupiter Point and Shillingham Point, although on initial observation there appeared to be fewer conspicuous fauna than previous years. Species observed included;

- Native oysters, *Ostrea edulis*. A total of three native oysters (*O. edulis*) were recorded at Shillingham Point and seven at Jupiter Point in all sample events (hits and misses) from all transects.
- An orange sponge, possibly *Hymeniacidon perlevis*

Non-natives

- Pacific oyster, *Magallana gigas.* These were noted on both mussel beds. They were present as large individuals and densely populated (Figure 13). No juveniles were observed on either bed. They were estimated to be present at a density of 20/m^2.
- Slipper limpets, *Crepidula fornicata*

Figure 13: Pacific oysters (*Magallana gigas*) recorded at Shillingham Point.

7 Discussion

The results of the surveys indicate that the beds are now of very low quality, with very little live mussel on the ground and a high percentage of dead shell (Figure 14). Both Shillingham Point and Jupiter Point consist of an area of suitable habitat rather than mussel beds. The mussels that are present appear to be dominated by a single year class structure. It is likely that the mussels on both beds failed to recruit due to the size of the single year class present. The beds are currently unclassified and commercial exploitation is prohibited by the Confirmed Notice of designation (CND) for *Martelia refringens*.

Figure 14: Examples of the habitat at Shillingham Point in 2023.

The area of suitable habitat is not the true extent of the beds, as both beds extend into the sub-tidal on the seaward boundary. It is thought that the beds might connect in the sub-tidal.

The comparison with previous years shows that the mussel stock has decreased with less live mussel recorded. The exact reason for this is unknown, although it could be due to the cyclical nature of the beds, that recruitment has failed or a parasite which is currently impacting mussel beds in other parts of the country.

Two non-native species, Pacific oyster (*Magallana gigas*) and slipper limpet (*Crepidula fornicata*), were found during these surveys. The surveys did not record the abundances of non-native species but serve as a record of the presence of these species on the mussel beds.

8 Limitations

The main limitation of the survey is that the extent of the mussel beds is an estimate, as mussels were not recorded near the perimeter of the extent and should therefore not be considered a bed but an area of suitable habitat. Shell on both beds was recorded beyond the depth considered safe to walk so the suitable habitat continued further than was recorded. There is potential for Jupiter Point and Shillingham to join sub-tidally, the extent of which is unknown.

The same transects are not followed each year so the results should not be considered a direct comparison.

The entire area is not surveyed due to time constraints posed by accessing the intertidal and although the transects cover an extensive area, it is possible that patches of dense mussel are not properly sampled by this survey methodology.

9 Recommendations

Due to the difficulties in establishing the lower extent of the mussel beds, it is suggested that a side scan survey conducted at high water may be more appropriate to establish the lower limits of the beds.

Ideally, the mussels will be tested for disease, however due to the low number of mussels on the beds this was not possible as a minimum of 100 individuals are required for such testing. Snapshot testing would also not always provide a definitive answer, as the parasite may not be present after a mortality event.

As commercial exploitation of the beds is currently prohibited and has been since Cornwall IFCA started carrying out surveys in 2012. It is unlikely that any changes to the density or extent of the bed are a result of fisheries activity. It is therefore suggested that annual surveys are not required; however the baseline that has been established in these surveys can be monitored against in the future.

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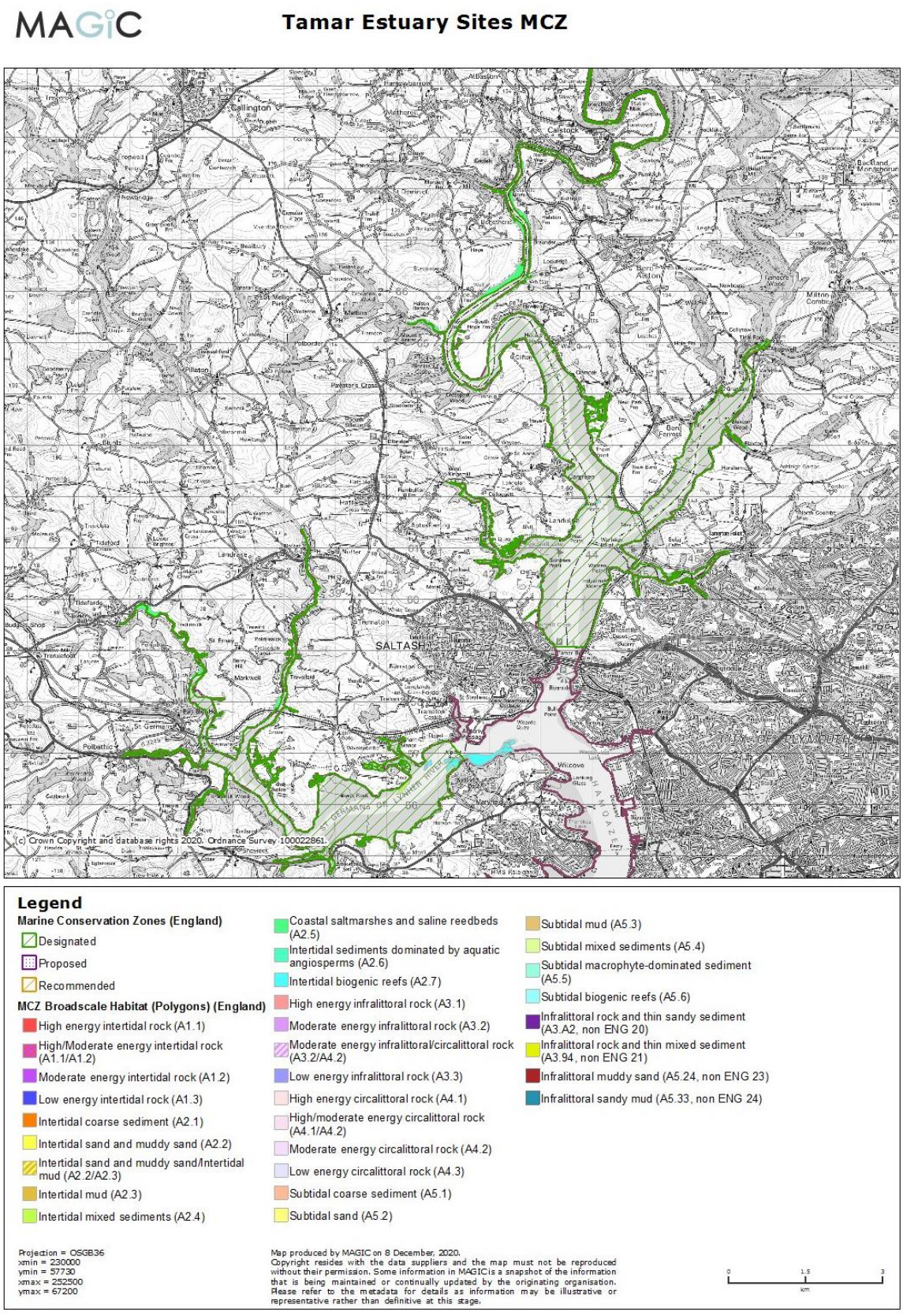
11 Appendices

Annex 1 – MCZ site feature map



Annex Figure A: Tamar Estuary Sites MCZ Site feature map (Magic map, 2020)

Annex 2 - Mussel Assessment Method

Equipment

- Handheld GPS x 2
- Approximately 1.2m bamboo cane with an 110mm ring attached to the end (so that the ring sits flat on the ground when the cane is held out to one side)
- Sample corer (made from a 150mm length of the same pipe as the ring therefore the same diameter as the ring)
- Riddle
- Container /bucket
- Electric Scales
- Zip lock bags
- Waterproof labels
- Weather writer
- Pencils
- Waterproof notepads
- Spare batteries

Field Method

1. Identify the perimeter of the bed; use the handheld GPS to mark waypoints around the perimeter.
2. To measure coverage and patch density assign transect lines through the bed to provide optimum coverage through the bed. *Note: transect lines do not need to be the same length as the spreadsheet can account for this later.*
3. Decide roughly how many samples to take from the bed; this will dictate how often you take a sample. For example; one sample to be taken on every 7th hit, or on smaller beds where there will be less total hits, one sample to be taken ever 2nd hit.
4. Ring method for transect lines:

a. Identify your transect line with either a bearing or a fixed position to walk towards. Mark a waypoint of the start of the transect and the bearing (if you want this level of data)

b. At the start of your transect line stand with the bamboo cane out to your side at a 90° angle, with the ring flat on the ground. As you start to walk along the transect line maintain the position of the ring on the ground until the cane is at a roughly 45° angle behind you (at this point you can feel the cane start to tug) then 'flick' the ring forwards to approximately 45° in front of you. Continue walking at a steady pace until again you feel the cane tug slightly as the ring is 45° behind you then repeat the flick forward, repeat the process along the transect line. There should be roughly a 1.8 -2.0m spread between the points where the ring lands.

c. As the ring is placed on the ground an assistant will record whether it was a *hit* or a *miss* within the ring area. A *hit* is recorded when there is one or more mussels within the ring, or if a mussel is partially in the ring it is a hit if more than 50% of the mussel falls within the ring. A *miss* contains no live mussel.

d. For recording data, use the 15 X10 grid on waterproof paper. A *miss* is recorded with a strike '/'. A *hit* is recorded as a number, starting at 1, and then increasing by one until the sample station is reached (as predetermined in point 3.)

e. When a sample is needed to be taken place the corer in the same spot that the ring was. *Twist* the ring into the mussel bed (*twist* rather than push so that any mussels falling slightly in or out of the area will naturally move into or out of the sample, rather than being pushed into the mud out of the sample).

f. All of the mussels within the corer are placed in the bucket as a sample as well as any shell. All samples from one transect can be collected together, as the totals can be calculated for the whole transect line, or pool samples from all transect lines to reflect the whole bed.

Example recording sheet where a sample is to be taken on every 5th hit, after the sample is taken on the 5th hit the next hit is recorded at 1 again. Identify the sample hits by circling them to make it easier to see when counting the samples.

/	/	/	1	/	2	3	4	/	5
/	1	/	/	2	/	…	…	…	…

5. Continue the method in point 4 for each transect until all transects are completed.
6. Use the riddle to clean the mud off the sample as best as possible.
7. Separate the shell from the live mussel.
8. Measure the length of each mussel and record on the recording sheet. Separate the mussels under 25mm and over 25mm.
9. Weigh and record, in grams, the:

a. total shell
b. mussel under 25mm
c. total mussel

Data analysis Method

1. Enter the waypoints from the GPS into MapInfo to create a polygon of the area and calculate the area of the bed (ha)
2. Enter all of the data in to the mussel survey spread sheet; the yellow boxes indicate where data needs to be entered. The following data needs to be entered in the relevant fields:

a. Diameter of ring
b. Area of bed (ha)
c. Weight of mussels in samples (whole sample weight, <25mm sample weight, and shell weight).
d. Number of samples taken in transect
e. Number of hits in transect
f. Number of misses in transect

If the samples were not divided into separate samples treat as one transect, otherwise enter the data for each transect.

3. The spreadsheet will then automatically calculate the % coverage, patch density, overall density and tonnes of stock.