Teign Estuary

Mussel Stock Assessment 2012

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1. Introduction

1.1 Objective

The objective of this project is to carry out a survey of the public mussel beds on the Teign Estuary in South Devon and to define where the mussel beds are and accurately map, using GIS, and the overall extent of each of the mussel beds. Devon and Severn Inshore Fisheries and Conservation Authority (IFCA) will undertake a stock assessment on each of the beds and estimate the density of mussels on the beds and the total stock of marketable mussels. This will help inform future management of the mussel beds on the Teign and the development of shellfisheries in this part of the Devon & Severn IFCA district. The data will create a baseline, against which future stock assessments can be compared.

1.2 *Mytilus edulis*

Mytilus edulis, blue mussels, are cold-water mussels which can occur in brackish water (Gardner, 1996). They are found on the north Atlantic and north Pacific coast of North America, Europe and in other temperate and polar waters. Blue mussels can occur intertidally and subtidally, and on a variety of substrates, from rocks to sediments, and in a range of conditions. Blue mussel beds on sediment are listed as a UK Biodiversity Action Plan (BAP) Priority Habitat (Maddock, 2008). This includes a range of sediments, such as sand, cobbles, pebbles, muddy sand and mud. *M. edulis'* ability to occupy such a range of habitats results from its ability to withstand wide variation in salinity, desiccation, temperature and oxygen concentration (Andrews et al., 2011).

M. edulis beds play an important role in the healthy functioning of marine ecosystems, having a role in coastal sediment dynamics, acting as food source to wading birds, and providing an enhanced area of biodiversity in an otherwise sediment-dominated environment (Maddock, 2008). Mussel beds support their own diverse communities as the mussel matrix, composed of interconnected mussels and accumulated sediments and debris, provides numerous microhabitats and an organically enriched environment (Andrews et al., 2011). Blue mussels are filter feeders, feeding primarily on micro-algae, suspended debris and zooplankton, and play a vital role in estuaries by removing bacteria and toxins.

The reproductive strategy of *M. edulis* is to deploy a large number of gametes, approximately three million eggs, into the surrounding water where fertilisation takes place (Andrews et al., 2011). Following fertilisation the zygotes, as planktonic larvae, undergo six stages of metamorphosis before settlement. Mussels can adapt their reproductive strategy depending on environmental conditions. For example, the release of gametes can be timed to complement favourable environmental conditions, and the planktonic phase can last between two and four weeks depending on temperature, food supply and availability of a suitable substrate to settle on (Andrews et al., 2011). Depending on temperature and

nutrient levels, spawning may occur just once or several times per year (Bayne & Worrall, 1980).

Current threats to *M. edulis* beds include commercial fishing, water quality, coastal developments, anchoring and bait digging (Maddock, 2008).

1.3 Site Description

The Teign Estuary is situated on the south coast of Devon, and consists of an east-west aligned, broad tidal river channel. There has been shellfish harvesting and farming in Devon's estuaries for hundreds of years. The main harvest has been mussels and oysters. Commercial harvesting of mussels (*Mytilus edulis*) and pacific oysters (*Crassostrea gigas*) occurs in the Teign under the River Teign Mussel Fishery Order 1966 and the River Teign Mussel Fishery (Variation) (Oysters) Order 1995, (Teign Estuary Partnership, 2004). Figures 1.1 - 1.3 show the classified shellfish waters of the Teign Estuary, and the harvesting areas for *M. edulis* and *C. gigas*. Both the Salty and Polly Steps beds, surveyed in this assessment, are outside the classified areas and are public fishery beds.

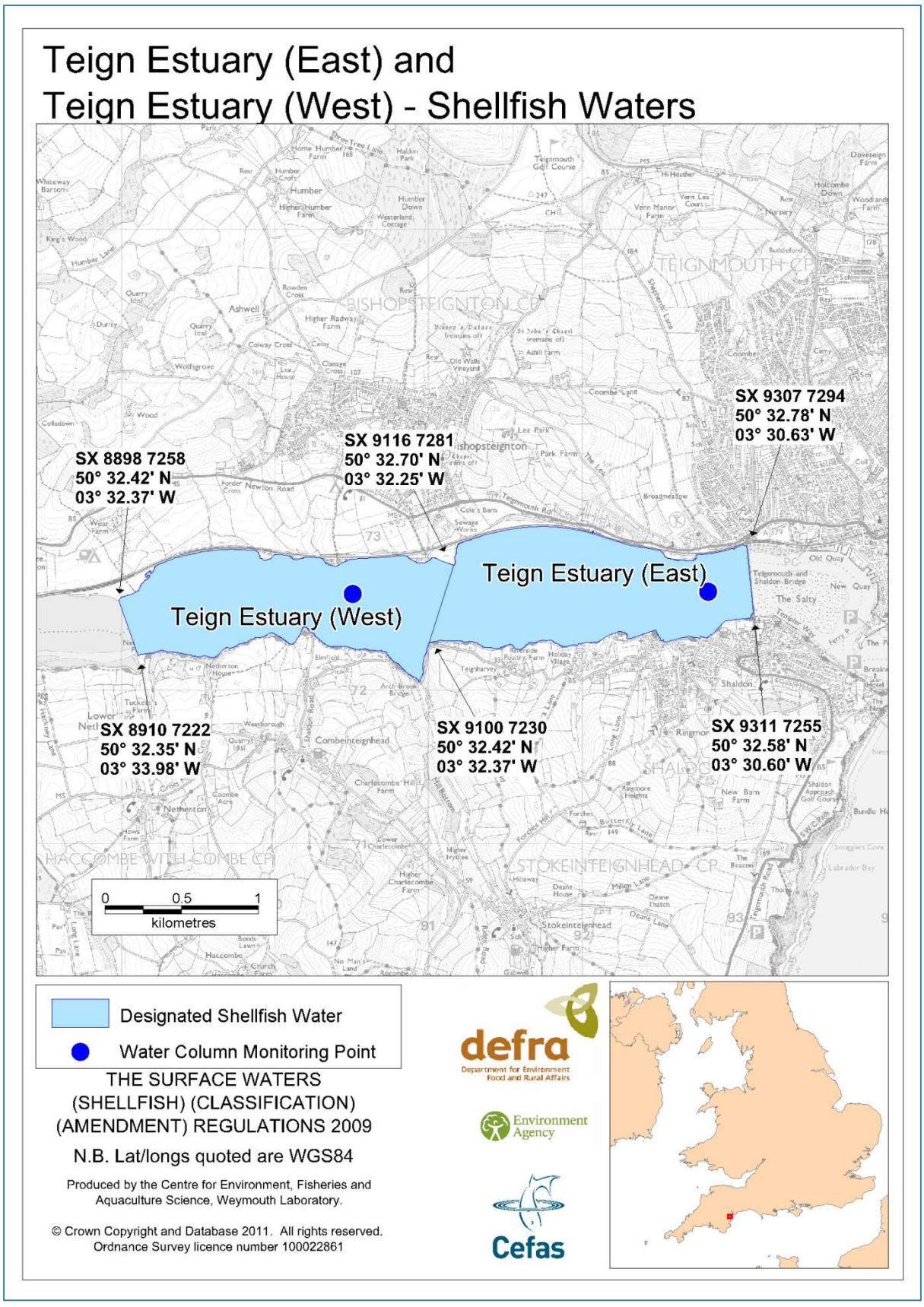
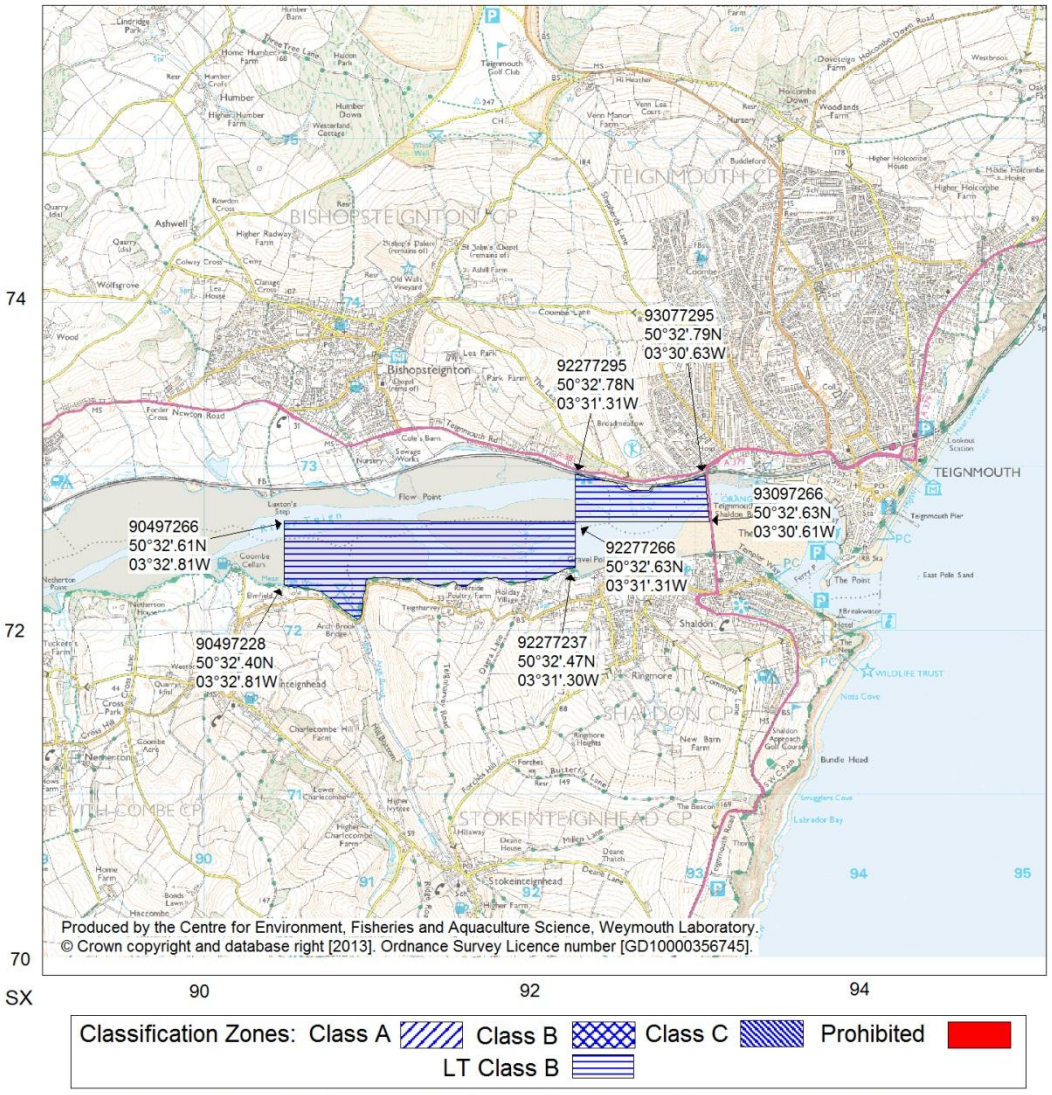


Fig. 1.1 Classified shellfish waters of the Teign Estuary.



Classification of Bivalve Mollusc Production Areas: Effective from 1 September 2013

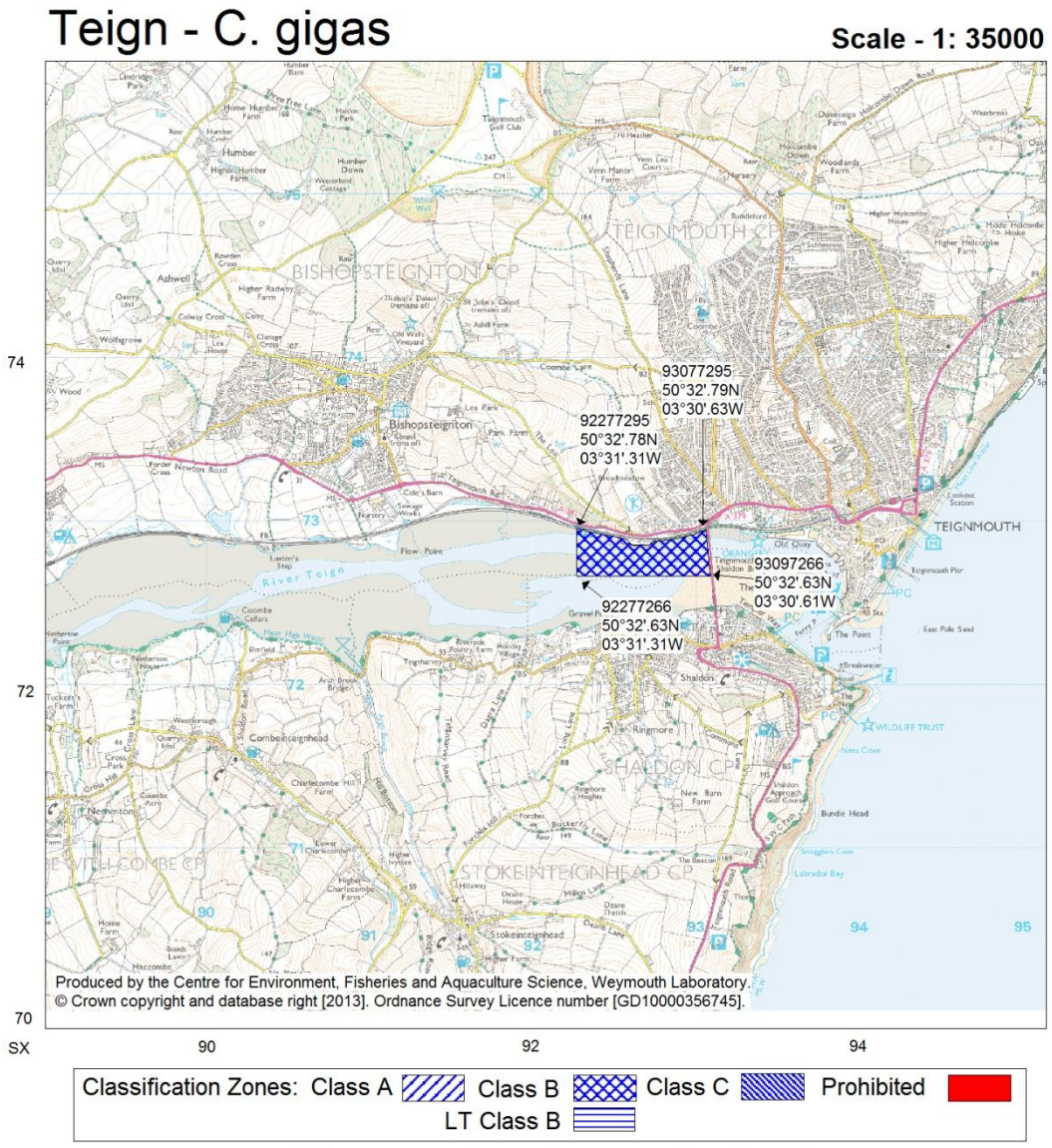
The areas delineated above are those classified as bivalve mollusc production areas under EU Regulation 854/2004.

Further details on the classified species and the areas may be obtained from the responsible Food Authority. Enquiries regarding the maps should be directed to: Shellfish Microbiology, CEFAS Weymouth Laboratory, Barrack Road, The Nothe, Weymouth, Dorset DT4 8UB.
(Tel: 01305 206600 Fax: 01305 206601)

N.B. Lat/Longs quoted are WGS84
Separate map available for C. gigas at Teign

Food Authority: Teignbridge District Council

Fig. 1.2 Classified harvesting areas for *Mytilus edulis*.



Classification of Bivalve Mollusc Production Areas: Effective from 6 November 2013

The areas delineated above are those classified as bivalve mollusc production areas under EU Regulation 854/2004.

Further details on the classified species and the areas may be obtained from the responsible Food Authority. Enquiries regarding the maps should be directed to: Shellfish Microbiology, CEFAS Weymouth Laboratory, Barrack Road, The Nothe, Weymouth, Dorset DT4 8UB.
(Tel: 01305 206600 Fax: 01305 206601)

N.B. Lat/Longs quoted are WGS84
Separate map available for Mytilus spp. at Teign

Food Authority: Teignbridge District Council

Fig 1.3 Classified harvesting areas for *Crassostrea gigas***.**

2. Methodology

2.1 Equipment

1 x 4’ cane, with 11cm ring attached to one end
1 x 11cm corer
2 x GPS units
2 buckets
Plastic bags
Sieve
Digital scales
Survey forms
Callipers

2.2 Method

The area of the bed is recorded by walking its perimeter and marking points with a handheld GPS, which are then plotted onto MapInfo GIS software.

To determine coverage and patch density transects are walked in a zig-zag across the bed, right up to the perimeter, to provide optimum coverage through the bed (Figure 2.1.). A 4’ bamboo cane with an 11cm ring attached to the end, so that the ring sits flat on the ground when held out to one side, is used to determine the mussel coverage for each transect. Every three paces along each transect the cane is flicked out to one side and it is recorded whether it is a “hit” if the ring contains live mussel, or a “miss” if the ring doesn’t contain live mussel. On every fifth hit the contents of the ring is taken as a sample, using an 11cm diameter corer. All mussel samples from the same transect are collected together in a tub, but kept separate from those of other transects.

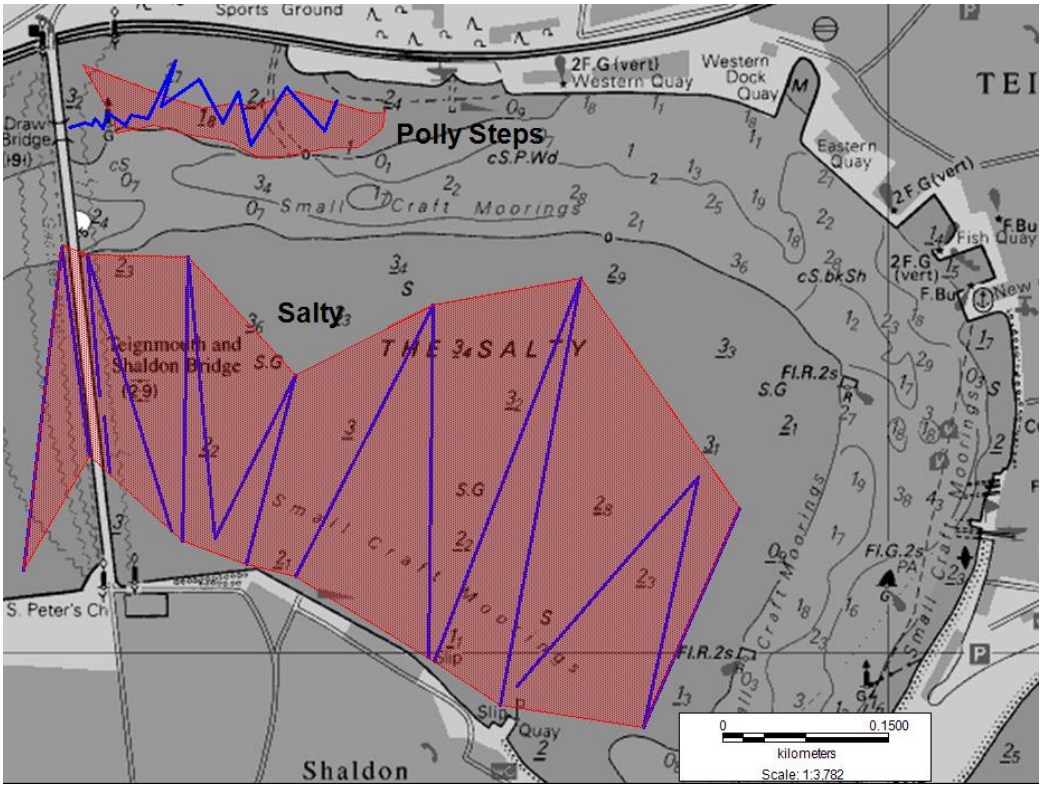


Fig. 2.1 Transects walked (blue) within the perimeter of each bed (red).

Once all transects are complete the mussel samples are sieved and cleaned. For each transect the number of samples taken is recorded, all mussels are measured and then divided into size groups; ≤25mm, 26-49mm, and ≥50mm. These size ranges were chosen because 50mm is the minimum landing size for mussel, so anything above that is marketable, and any mussels under 25mm could be considered seed. The total weight of each group is recorded. The data collected are used to calculate the coverage, density and area of the mussel bed (Figure 2.2), which are then used to estimate the mussel tonnage on each bed. Size distribution is obtained from the length measurements of mussels in the retained samples. The hit/miss data is also pooled, to calculate the average coverage and patch density for the whole bed, compensating for the possibility of some transects being longer than others.

$$\text{\% cover} = \frac{\text{no. hits}}{\text{no. hits + no. misses}}$$

$$\text{Density across bed} = \frac{\text{total mussel weight/surface area sampled}}{\text{\% cover}}$$

Fig. 2.2 Calculations used for mussel coverage on bed, and density of mussels across bed.

The survey method used is a procedure developed by MarinX, Dutch marine consultants. This method was chosen in place of the method used by Cefas in 2001, which uses footfall

to determine hits/misses and the throwing of a quadrat to determine coverage, as it is deemed to be more accurate. Using a pre-determined ring size for hits/misses, removes the potential for inaccuracies caused by surveyors having different sized feet. It is also easier to see whether the ring contains live mussel instead of looking at a footprint. The flicking of the ring at the end of the cane provides a random sample which is not subject to human error by trying to select a "representative" quadrat.

3. Results

3.1 Polly Steps

- Area: 1.0 hectares
- Coverage: 35%
- Mean Density: 7.09 kg/m^2
- Total Stock: 68 tonnes
- Stock ≥50mm: 64 tonnes

The Polly Steps bed was surveyed on 22nd May 2012. Samples were taken from every fifth "hit", producing 6 samples from 17 transects. The stock of marketable sized mussels was estimated to be 64 tonnes out of a total 68 tonnes on the bed, i.e. 94%. Figure 3.1 shows the size frequency of mussels taken from samples, while Figure 3.2 shows the size distribution of mussels across the bed.

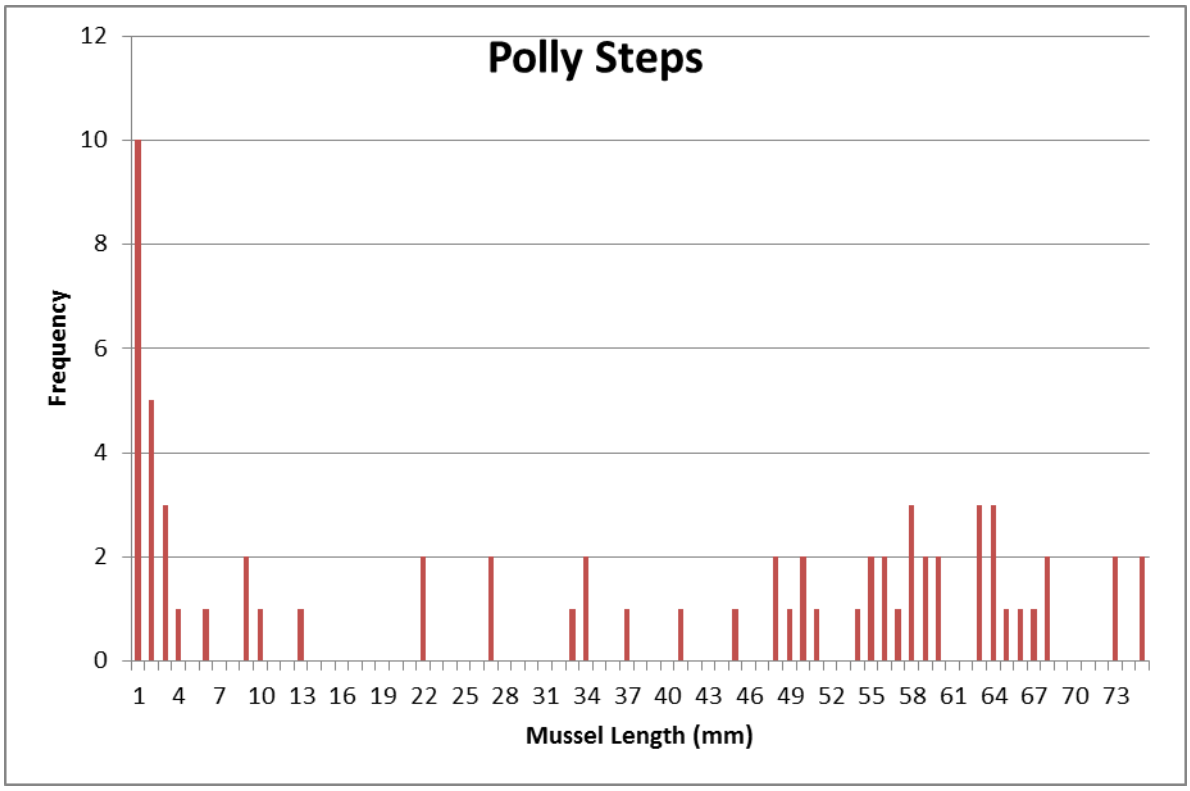


Fig. 3.1 Size frequency of mussels across the Polly Steps bed.

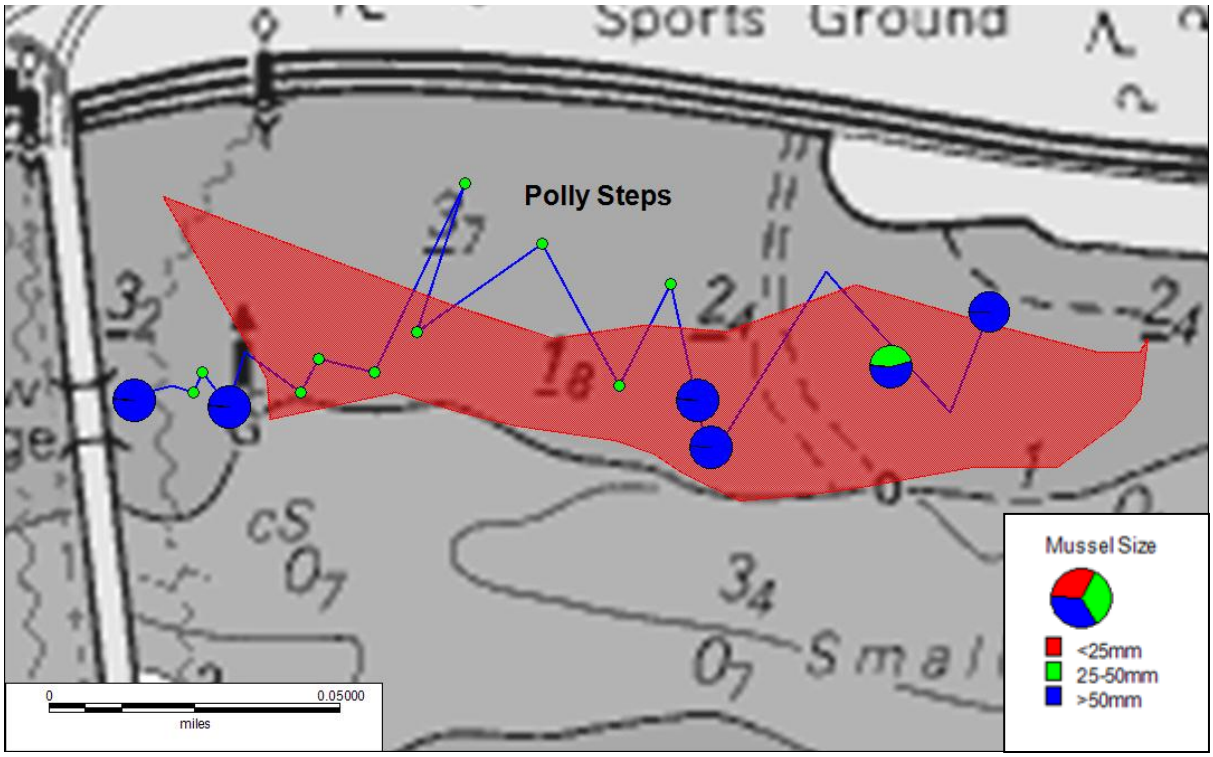


Fig. 3.2 Mussel size ratios, by weight, per transect across the Polly Steps bed.

3.2 The Salty

- Area: 16.1 hectares
- Coverage: 42%
- Mean Density: 7.12 kg/m^2
- Total Stock: 1148 tonnes
- Stock ≥50mm: 773 tonnes

The Salty was surveyed over several days in July and August 2012. Samples were taken from every fifth "hit", producing 80 samples from 15 transects. The stock of marketable sized mussels was estimated to be 773 tonnes out of a total 1148 tonnes on the bed, i.e. 67%. Figure 3.3 shows the size frequency of mussels taken from samples, while Figure 3.4 shows the size distribution of mussels across the bed.

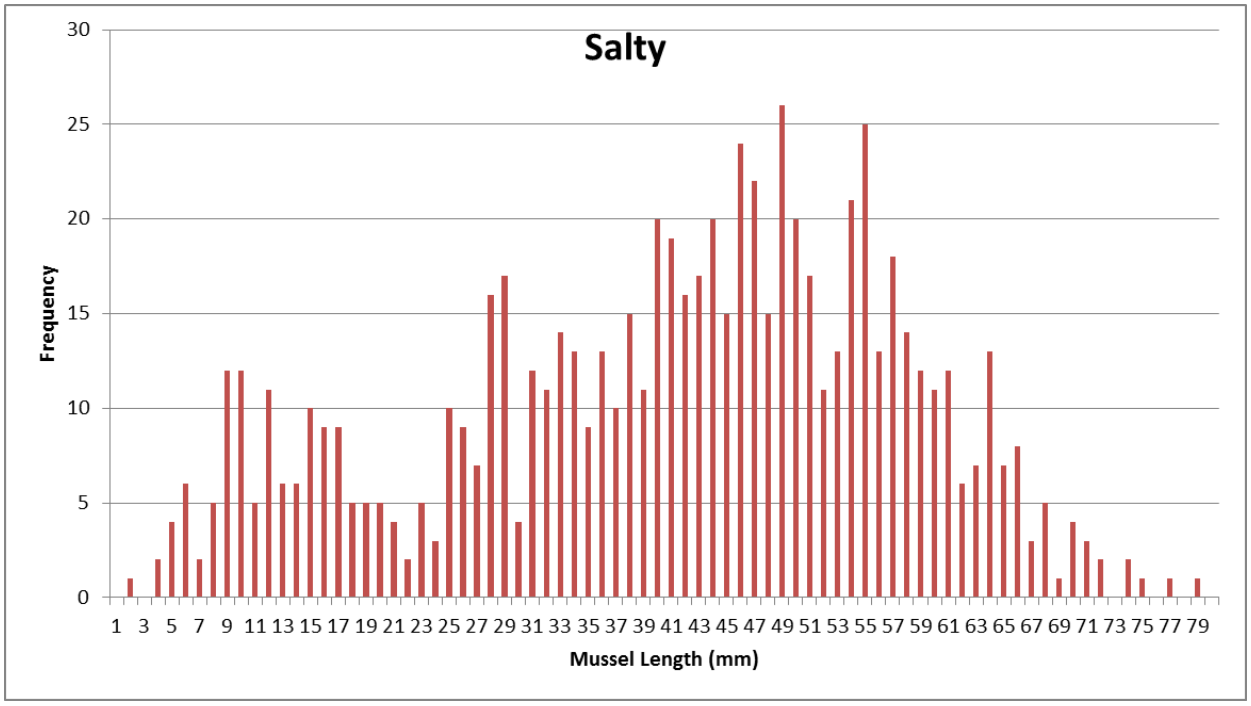


Fig. 3.3 Size frequency of mussels across the Salty bed.

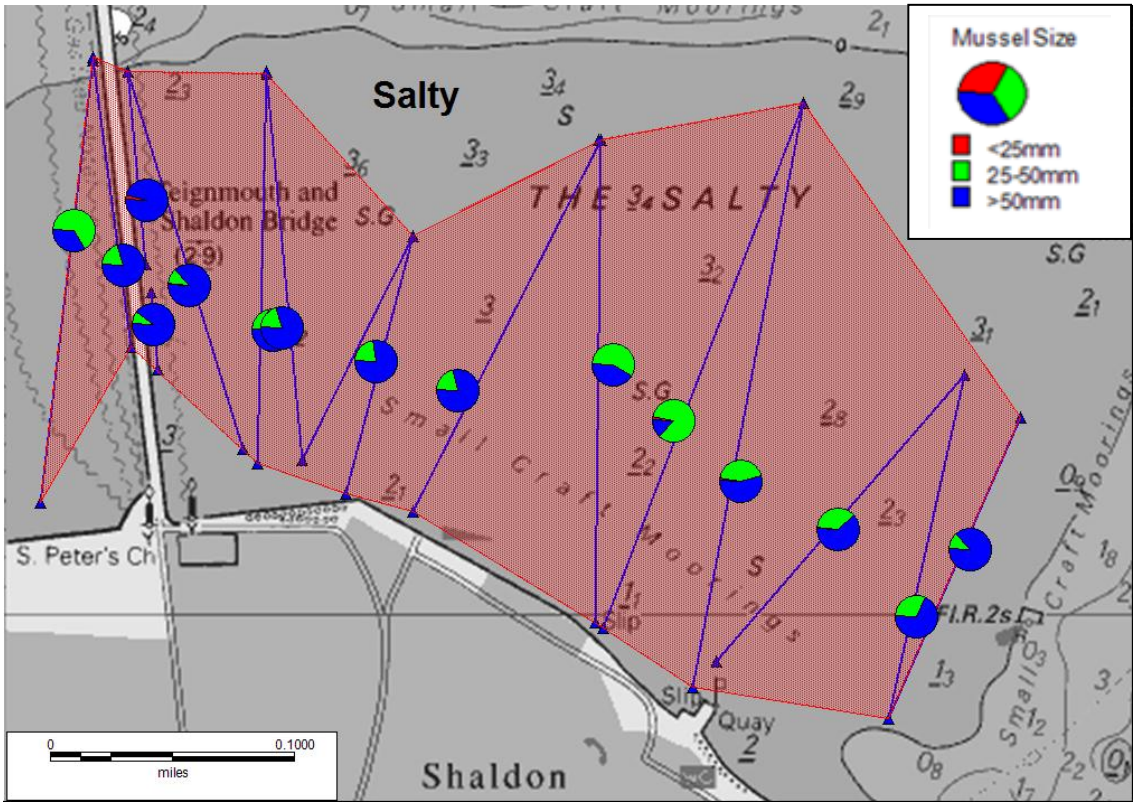


Fig. 3.4 Mussel size ratios, by weight, per transect across the Salty bed.

4. Discussion

This survey creates a baseline of data for the Teign Estuary mussel stocks, and it is recommended that the survey is repeated annually to monitor any changes in the stock.

It was noted by the surveyors that there are areas of seed mussel on the Polly Steps bed. This can be seen in the size frequencies (Figure 3.1). However, the areas are not reflected in the stock map (Figure 3.2). It is therefore recommended that a separate survey is conducted to map the seed mussel areas, and to monitor their development over the next few years.

5. References

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