Teign Estuary

Mussel Stock Assessment 2018

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1. Introduction

1.1 Objective

The objective of this research is to carry out annual surveys of the public mussel beds on the Teign Estuary, to define where the mussel beds are and accurately map, using GIS, the overall extent of each of the mussel beds. Devon and Severn IFCA (D&S IFCA) will undertake a stock assessment on each of the beds to estimate the density of mussels on the beds and the total stock of marketable mussels. Results of these surveys can be compared on an annual basis. This will help inform future management of the mussel beds on the Exe and the potential development of shellfisheries in this part of the D&S IFCA's District.

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 (*Magallana gigas* formerly known as *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- 3 show the classified shellfish waters of the Teign Estuary, and the harvesting areas for *M. edulis* and *M. gigas*. Both the Salty and Polly Steps beds, surveyed in this assessment, are outside the classified areas and are public fishery beds.

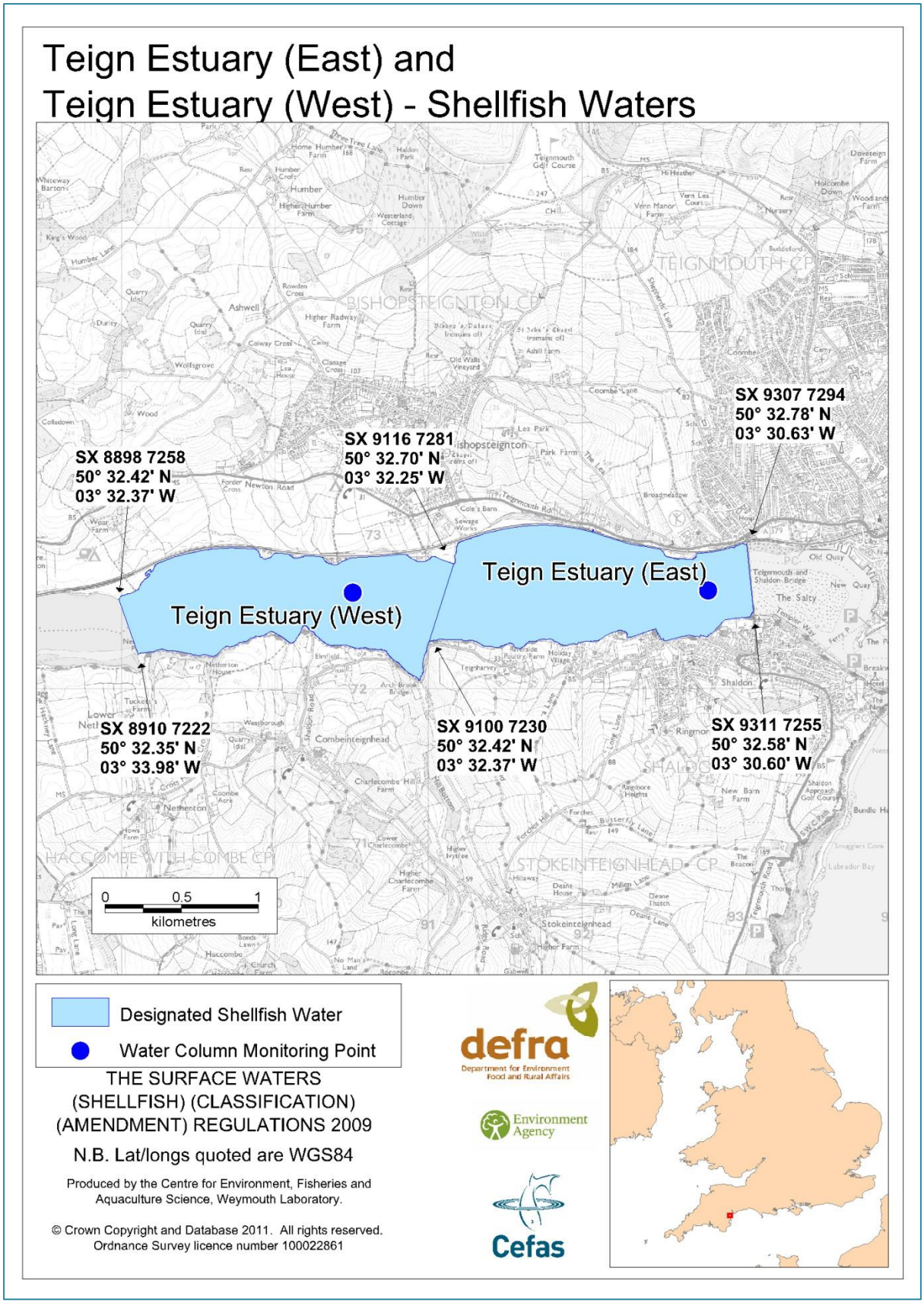
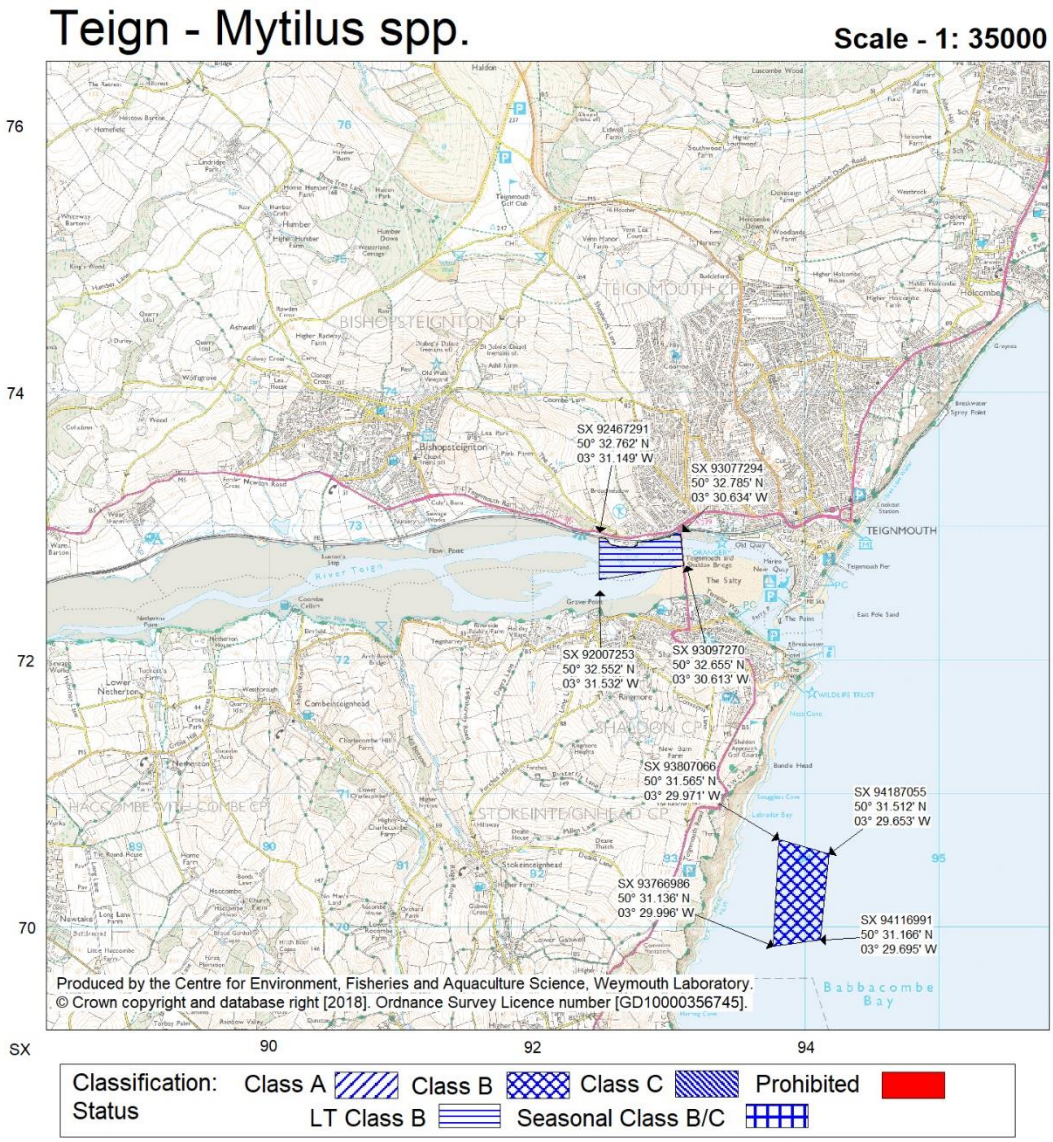


Fig. 1 Designated shellfish waters of the Teign Estuary.



Classification of Bivalve Mollusc Production Areas: Effective from 1 July 2019

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

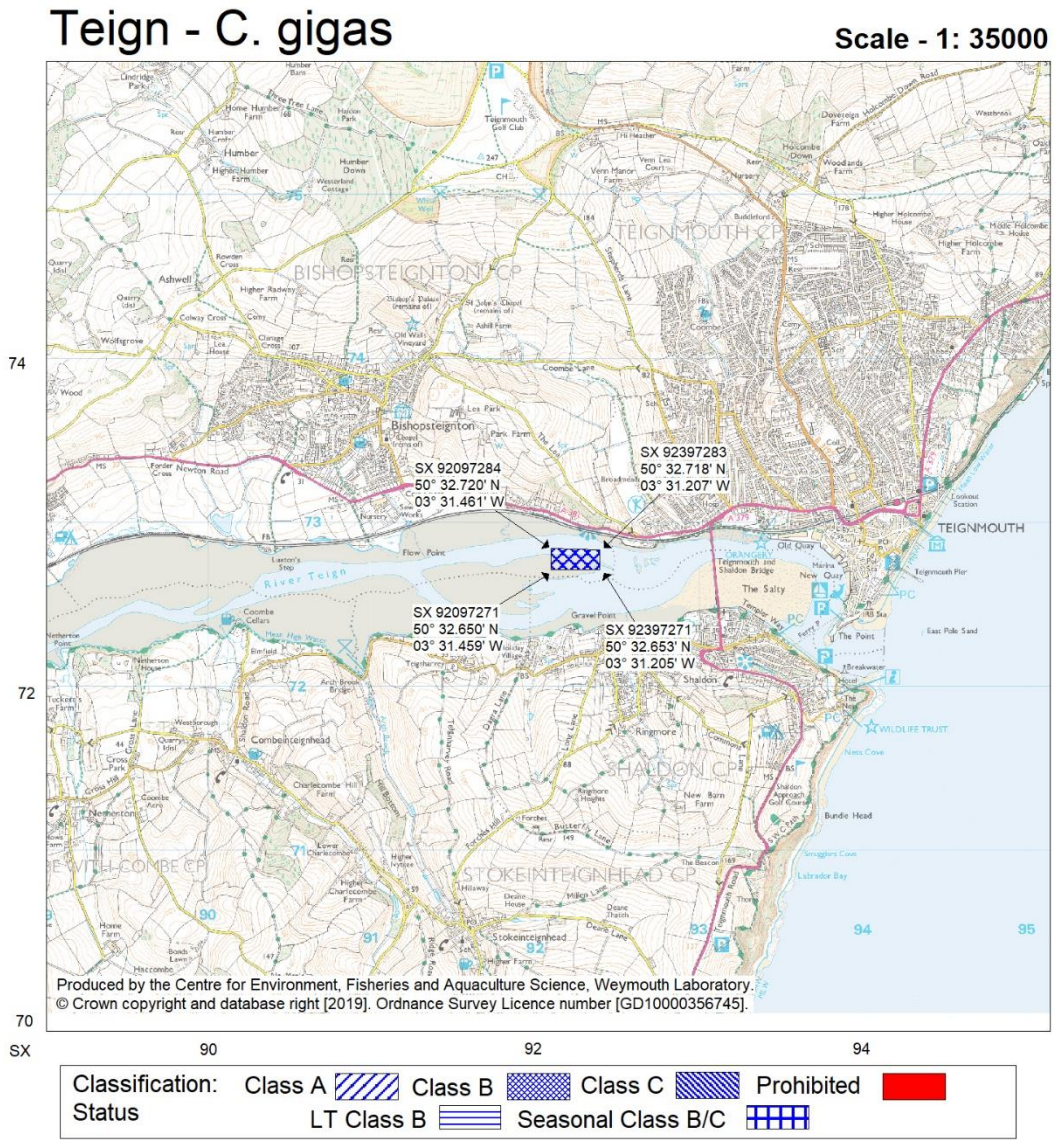
Further details on the classified species and the areas may be obtained from the responsible Food Authority. Enquiries regarding the maps should be directed to: Shellfish Microbiology, CEFAS Weymouth Laboratory, Barrack Road, The Nothe, Weymouth, Dorset DT4 8UB.
(Tel: 01305 206600 Fax: 01305 206601)

N.B. Lat/Longs quoted are WGS84
Unless otherwise stated, non-straight line boundaries between co-ordinates follow the OS 1:25,000 mean high water line.

Separate map available for C. gigas at Teign

Food Authority: Teignbridge District Council

Fig. 2 Classified harvesting areas for *Mytilus edulis*.



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Separate map available for Mytilus spp. at Teign

Food Authority: Teignbridge District Council

Fig. 3 Classified harvesting areas for *Magallana gigas*.

2. Methodology

2.1 Method

The area of the bed is recorded by walking its perimeter and marking points with a handheld GPS, which are then plotted onto 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. (Figure 4.). A 4 foot bamboo cane, with an 11cm ring attached to the endso 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 does not 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 container for analysis. Each sample from individual transact are kept separate from each other.

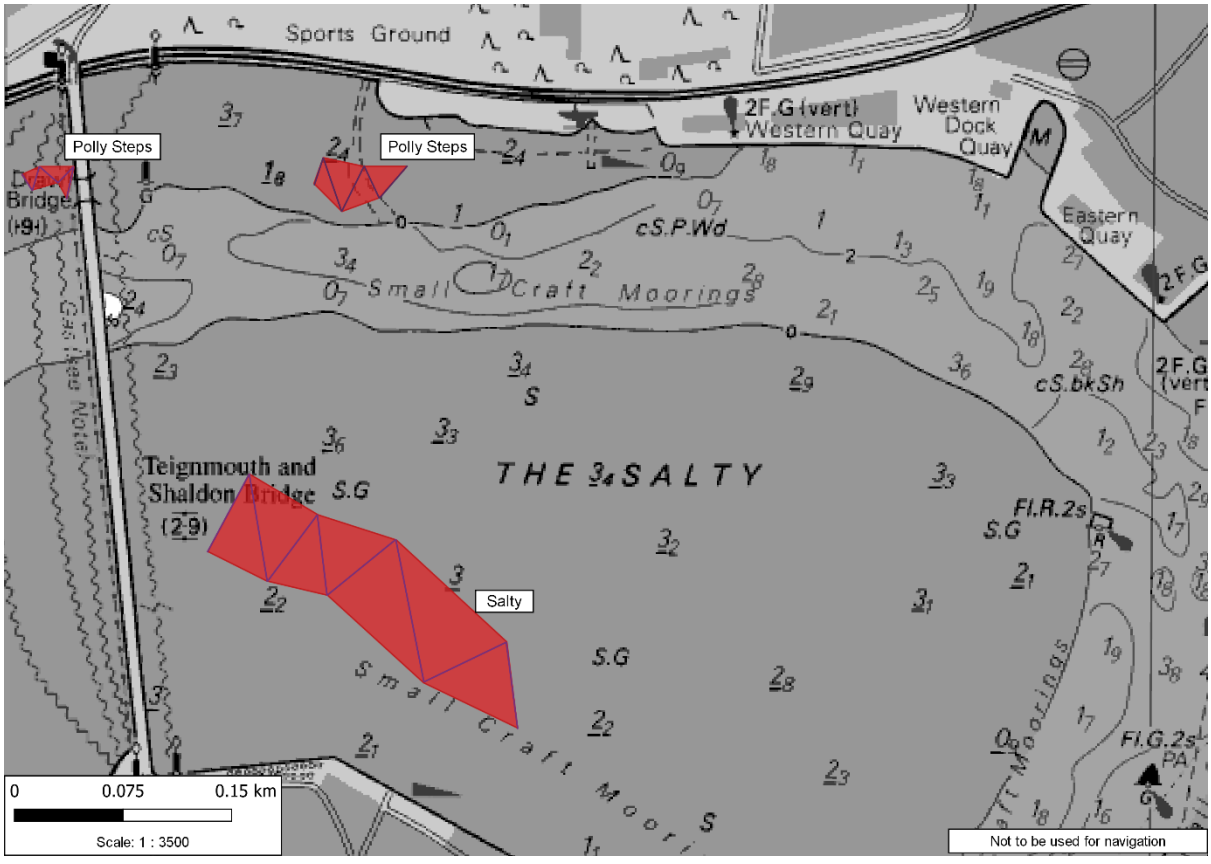

Fig. 4 Transects walked (purple) within the perimeter of each bed (red).

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 recording sizes on the survey form, and divided into size groups; 1-10mm, 11-20mm, 21-30mm, 31-40mm, 41-50mm, 51-60mm, 61-70mm, 70+mm. The data collected are used to

calculate the coverage, density and area of the mussel bed (Figure 4), 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 are 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. 5 Calculations used for mussel coverage on bed, and density of mussels across bed.

3. Results

3.1 Polly Steps

- Area: 0.2 hectares
- Coverage: 16%
- Mean Density: 0 kg/m^2
- Total Stock: 0 tonnes
- Stock ≥51mm: 0 tonnes

The Polly Steps bed was surveyed on 11th Sept 2018. No samples were taken as there were only a total of nine hits from 12 transects. Table 3.1 shows difference between surveys for both years.

Table.1 Differences between mussel surveys for Polly Steps bed.

	2012	**2018**	Difference since last survey
Area (ha)	1	0.2	- 80%
Density (kg/m^2)	7.09	0	-100%
Total stock (tonnes)	68	0	-100%

3.2 Salty

- Area: 1.3 hectares
- Coverage: 6%
- Mean Density: 0kg/m^2
- Total Stock: 0 tonnes
- Stock ≥51mm: 0 tonnes

The Polly Steps bed was surveyed on 12th Sept 2018. No samples were taken as there were only a total of two hits from 9 transects. Table 3.1 shows difference between surveys for both years.

Table. 2 Differences between mussel surveys for Salty bed.

	2012	**2018**	Difference since last survey
Area (ha)	16.1	1.3	-92%
Density (kg/m^2)	7.12	0	-100%
Total stock (tonnes)	1148	0	-100%

4. Discussion

Mussel stocks in the Teign Estuary appear to have collapsed since D&S IFCA's last survey of the beds in 2012. In 2012 the combined stock for both beds was estimated at around 1216 tonnes, this is now zero. The sites previously occupied by the beds could not now be classed as a true reflection of 'mussel beds', this is because the mussel communities in the areas surveyed are now too low in density and non-homogeneous in structure to be classed as typical 'mussel beds'. The area surveyed for both sites is therefore not representative of true 'mussel beds'.

Lack of annual data makes it difficult to draw exact conclusions to the nature of the stocks' decline. A possible hypothesis is that the collapse of stocks could be related to large mussel loss which was reported around the UK during 2013/14. This affected both Wales and in estuaries on the East coast of England. The decline in mussel stocks could be the result of poor spat settlement over the last few years, which has resulted in aging beds. This factor coupled with increased water flow and wave action through estuaries during the storms of winter 2013/2014 could have led to the mussel in the Teign being scoured away. Whatever the cause the mussels have evidently not recovered and there are currently no signs of spat settlement.

It is recommended that stock assessments continue to be carried out on an annual basis, to monitor any future changes to the stock of the beds and particularly to detect any signs of recovery. This will help to inform any future management Devon & Severn IFCA may bring in for the collection of mussels, as part of their review of existing byelaws.

5. References

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