Teign Estuary
Cockle Stock Assessment 2018

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Devon & Severn IFCA
Inshore Fisheries and Conservation Authority

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1.0 Introduction

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 aquaculture 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* formally 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 and production areas of the Teign Estuary, and the harvesting areas for *M. edulis* and *C. gigas*.

Cerastoderma edule is present within the estuary and has known to be collected at low levels both historically and at the present-day (Edwards 1987, Cefas 2004). Unlike mussels and pacific oysters this population has never reached a large enough level to be deemed a prominent feature of the estuary. There are currently no conservation designations for cockles within the estuary, and the beds have not been classified for commercial exploitation by Cefas (Figure 2 and Figure 3, Cefas 2013), assessments carried out for the 2000 Water Frame Work Directive fail even to mention the presence of cockle within the estuary. However, cockle is present and concerns about its collection and potential over-exploitation particularly from 'the Salty' have been documented as far back as 2008 (Teign Estuary Partnership, 2008). These concerns retain particular current relevance.

Devon and Severn Inshore Fisheries and Conservation Authority (D&S IFCA) understands the communal and ecological importance of these beds and have undertaken survey work to establish the population structure, biomass, and distribution of cockles within the areas of the estuary where cockles are known to be present. This work will inform the Authority during its current review of Hand Gathering within the D&S IFCA's District.

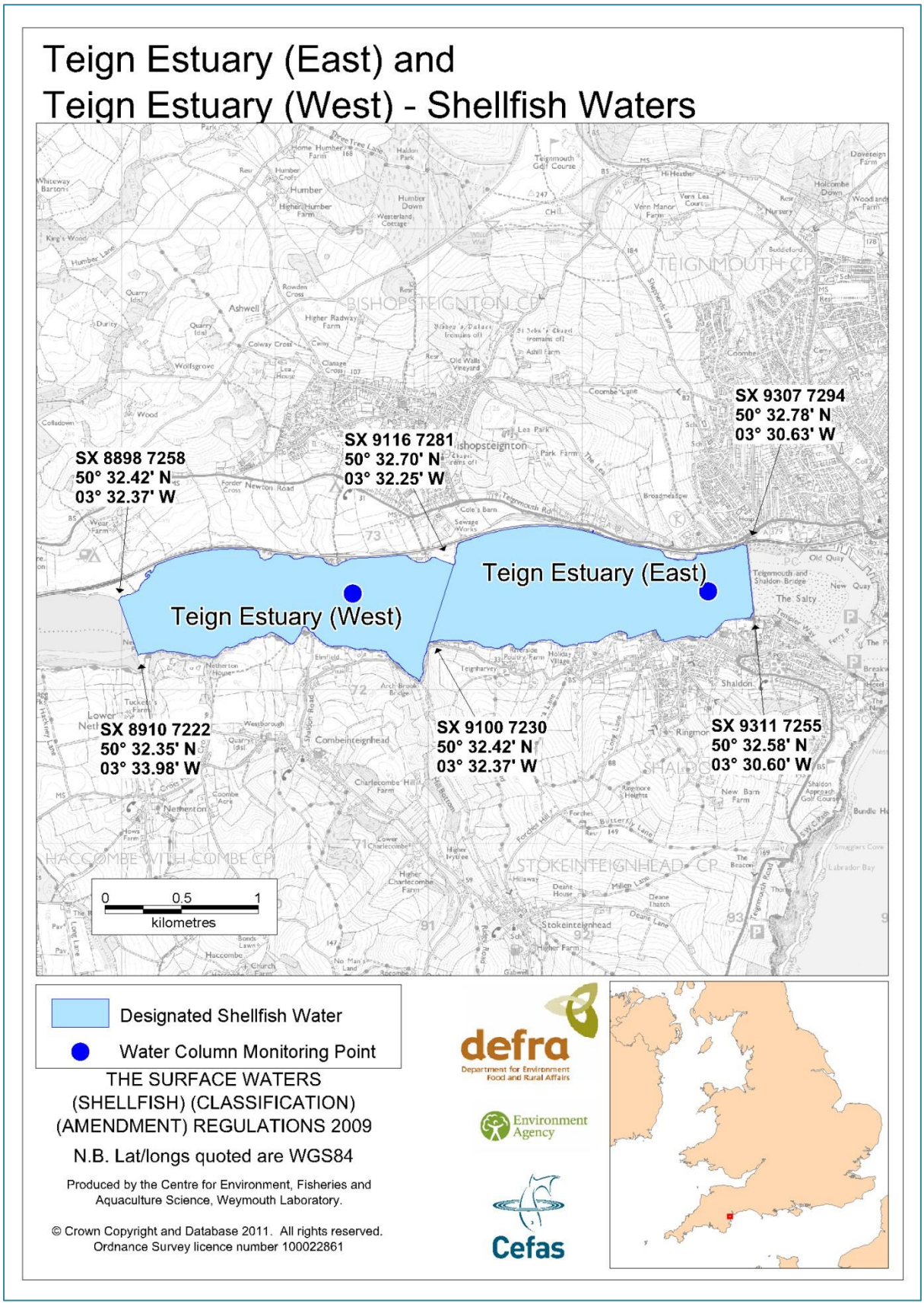
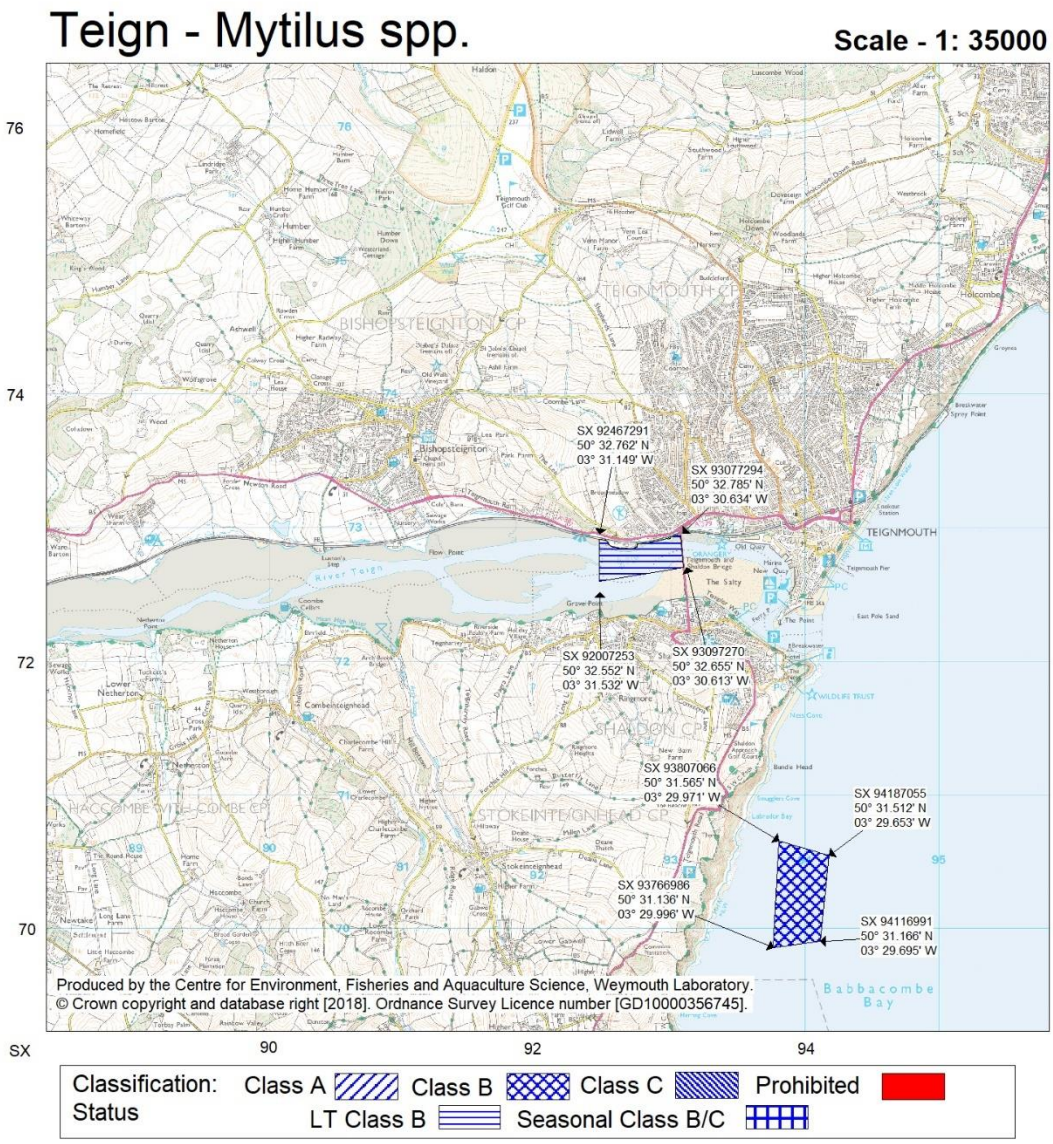


Figure 1. Classified shellfish waters of the Teign Estuary.



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.

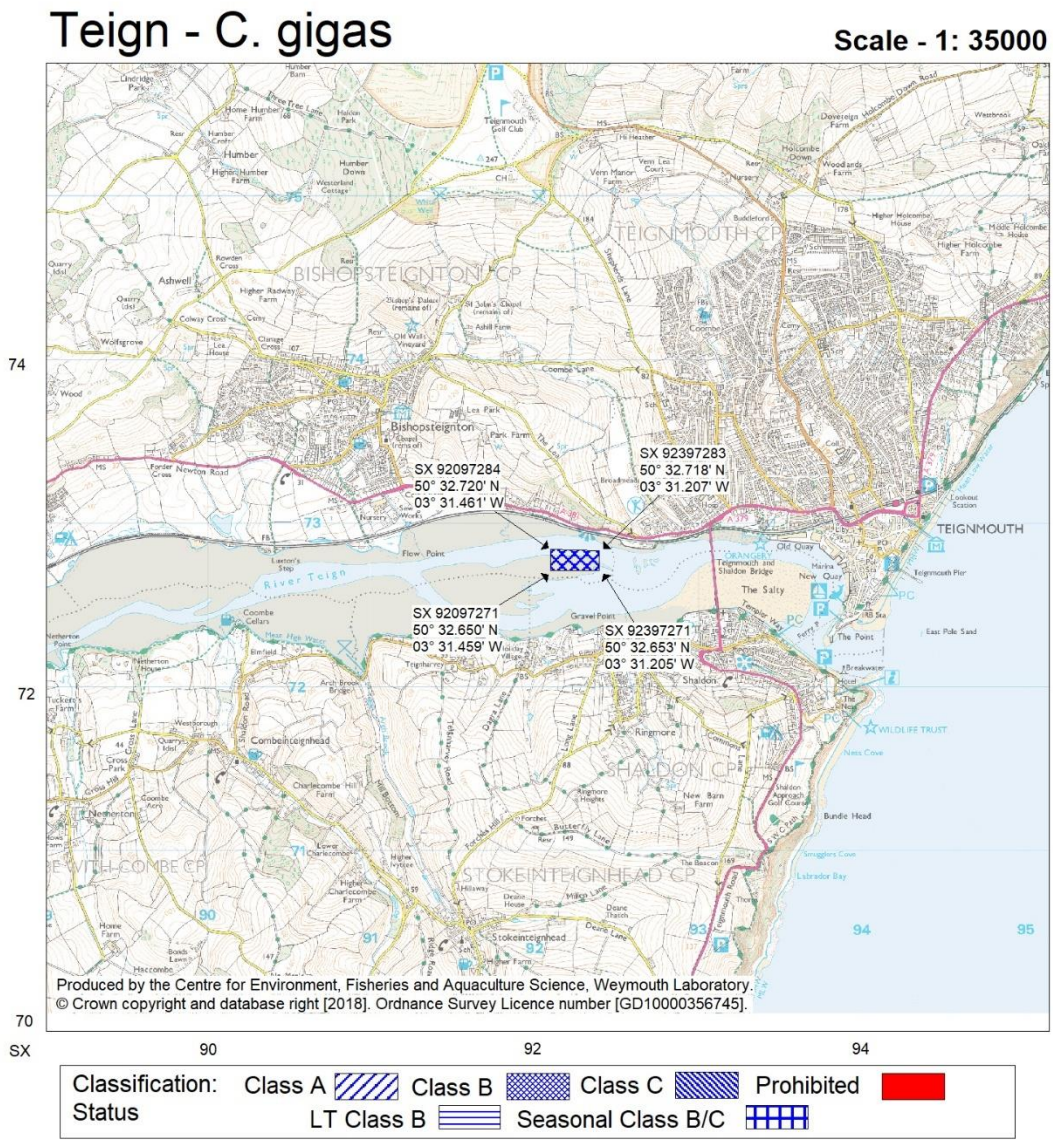
Further details on the classified species and the areas may be obtained from the responsible Food Authority. Enquiries regarding the maps should be directed to: Shellfish Microbiology, CEFAS Weymouth Laboratory, Barrack Road, The Nothe, Weymouth, Dorset DT4 8UB.
(Tel: 01305 206600 Fax: 01305 206601)

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

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



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Separate map available for Mytilus spp. at Teign

Food Authority: Teignbridge District Council

Figure 3. Classified harvesting areas for *Crassostrea gigas*.

2.0 Methods

The survey was carried out in November 2018. The survey took place in two areas of the Teign – the Salty which is a large intertidal bed downstream of the Shaldon Bridge (Figure 5) and a smaller bed found upstream of the Bridge between Shaldon and Ringmore (Figure 6). The intertidal survey area for both sites was designated over the areas historically known to contain cockle. Stations were then placed at fixed lateral and linear distances between adjacent stations roughly covering the chosen section of intertidal zone (Figure 4). For stations in the Salty this distance was 115.4m and for stations upstream of Shaldon Bridge this distance was 73.3m. For both sites a handheld GPS was used to locate the first station e.g. A1 and a quadrat was randomly placed within 10m of the target position for that station. Using a trowel, the sediment was dug out of a 0.1m^2 quadrat, to a minimum depth of 6cm. This was then placed into a sieve and then sifted in water nearby. The cockles were put into a sample bag with a label of the station name (one bag per station). If no cockles were found or the station was unable to be surveyed it was noted. This was repeated at all stations.

For each station sample, cockles were measured using callipers to the nearest millimetre for length and width. After measuring, cockles were sorted into age classes by determining how many annual growth rings were present on the shell , which are usually put down each winter e.g. 0 rings = current year, 1 ring = 1st winter /1 year, 2 rings = second winter/ 2 years and so on. Each year group from that station was weighed separately (to the nearest 1g) and recorded. This was repeated for all station samples and once finished all the cockles were returned to the estuary. Some stations were unable to be sampled due to tidal constraints and areas of deep soft mud.

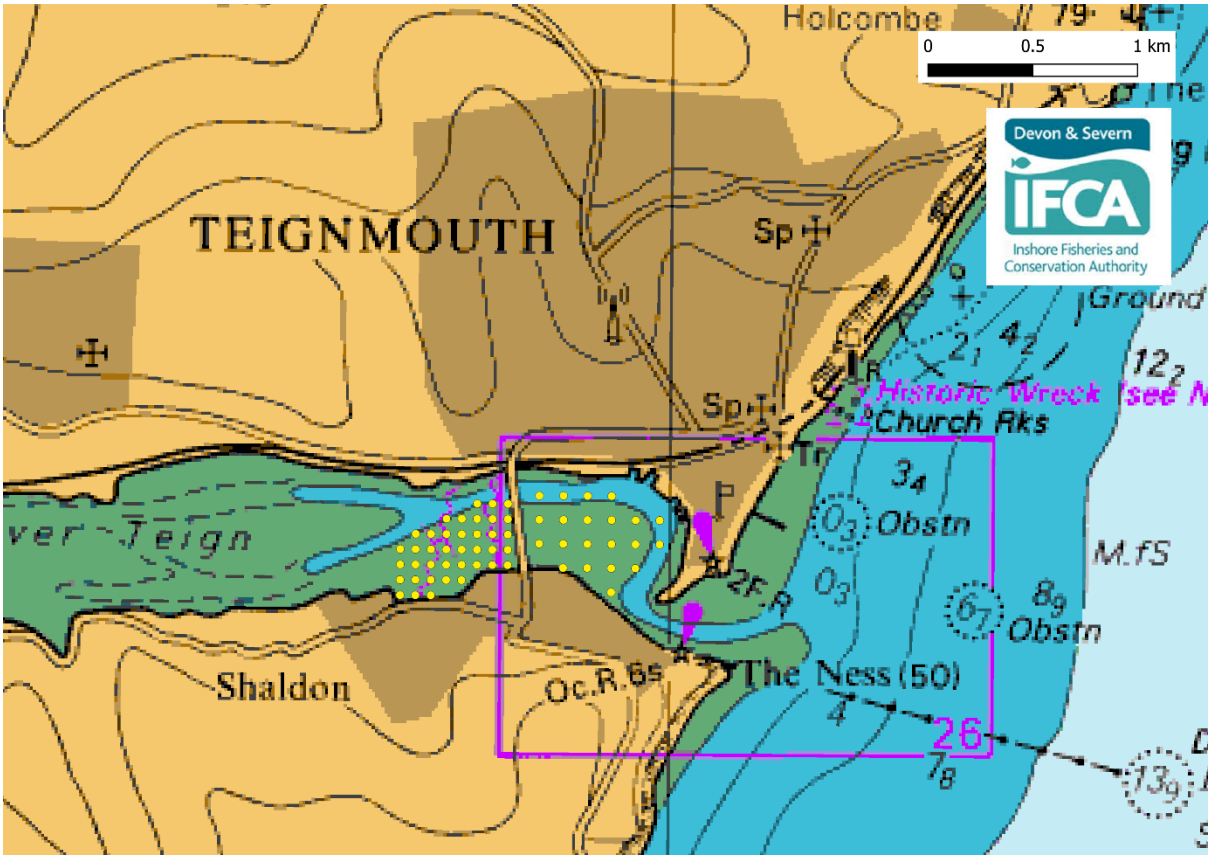


Figure 4 All cockle Survey stations in the Teign (yellow)

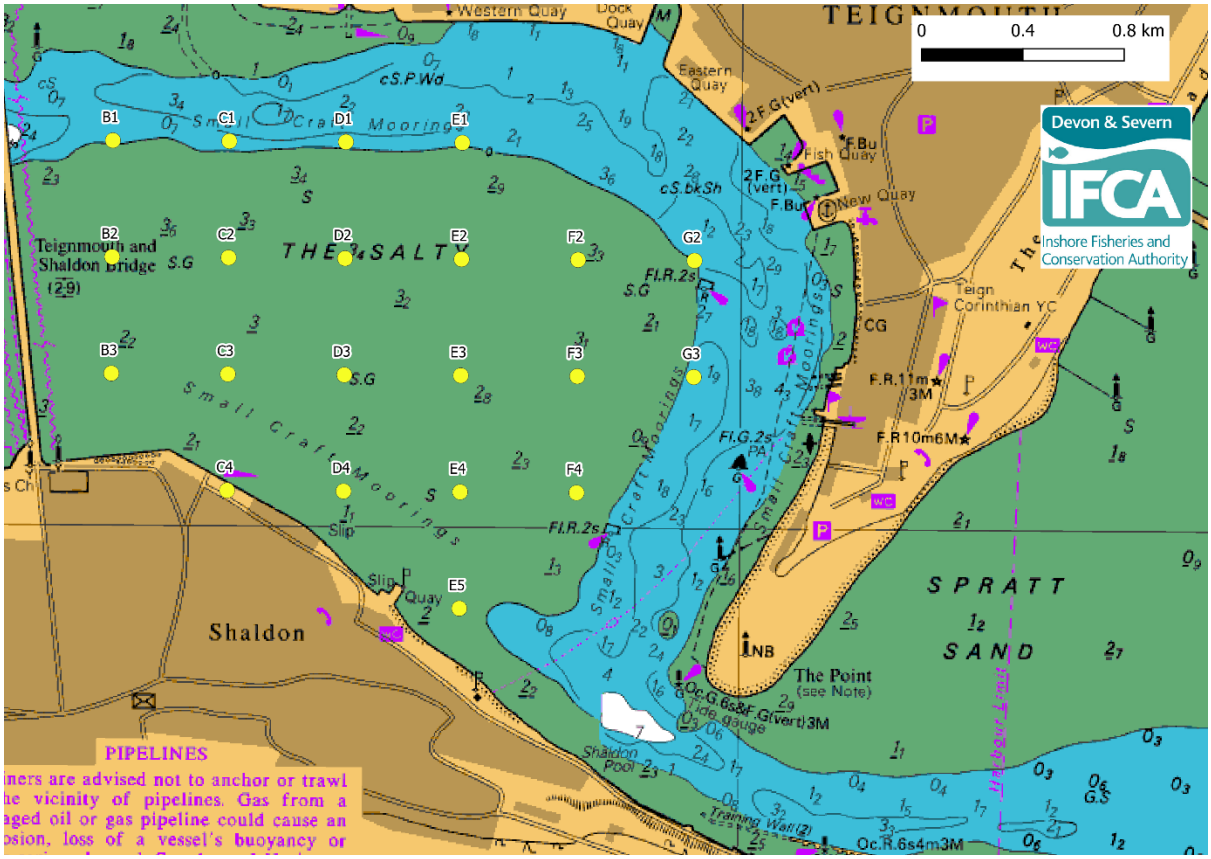


Figure 5. Survey stations at The Salty

Figure 6. Survey stations - Upstream of Shaldon Bridge.

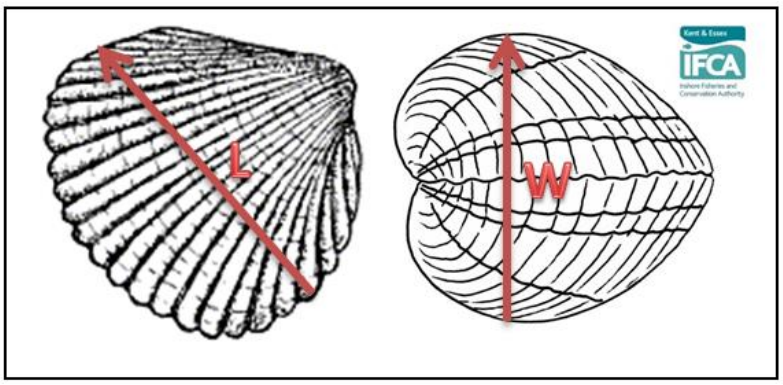


Figure 7. Cockle length and width measurements.

Data from these surveys were entered into Microsoft Excel and size-frequency and year-class graphs were produced. To determine cockle density, the data were transferred into QGIS V3.4 software to produce the density maps seen in Figure 11 to Figure 12 which were made using custom ranges. The minimum density used to determine the extent of coverage on the bed was 10 cockles per m². The biomass has been calculated from the mean weight and cockle bed area. Although there is no Minimum Conservation Reference Size (MCRS) applied to cockles in the D&S IFCA's District, the stock is divided into two size groups (cockles that are 16mm width and over, and those that are under 16mm) in accordance with other IFCAs' MCRS (Haywood *et al.* 2017; Jessop, 2015).

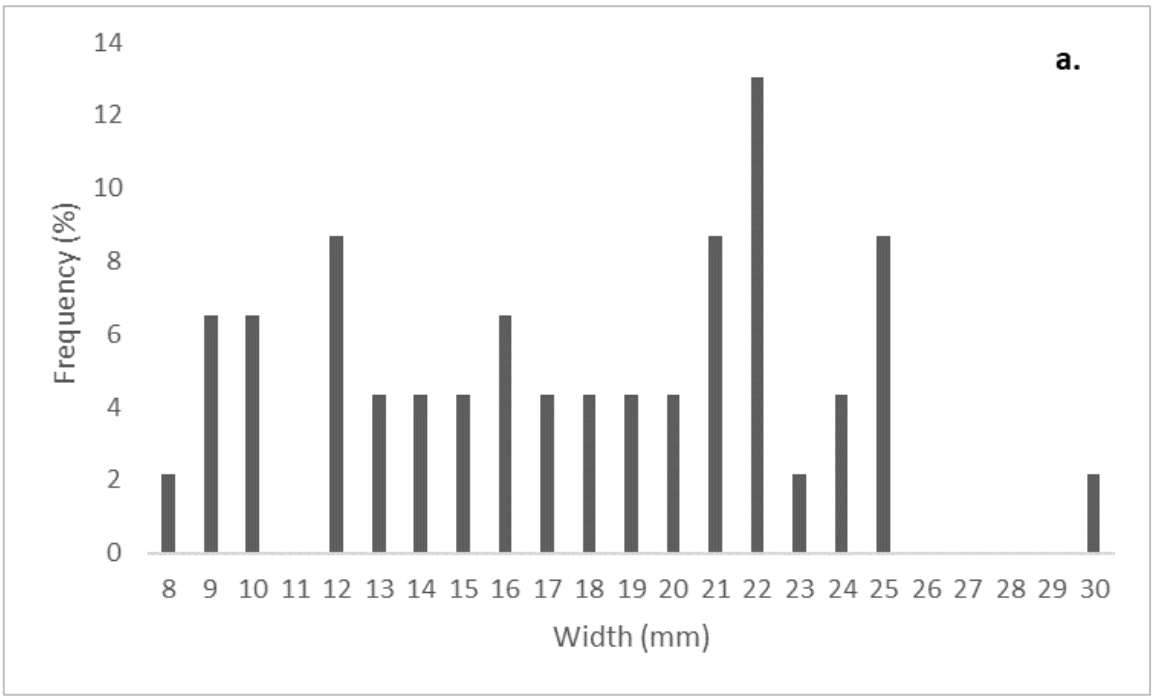
3.0 Results

3.1 The Salty

Of the 20 total stations within the sample area 16 stations were surveyed. Of these total sampled cockles ranged from 8-30mm (width), with a mean size of 17.6mm (Figure 8a). Mean Cockle density was 3.71 per m^2, of which 63% were ≥16mmn (225.2kg), the estimated mean density of which was 2.33 per m^2. The estimated biomass was 357.1 kg/ha. Mean density was highest around the 2014-15 and 2016 age classes, mean biomass (g/m^2) mirrored this with highest biomass being recorded for the 2014-15 and 2016 classes (Figure 9). Spatial density was relatively low across all stations with only one site displaying cockle density's ≥100. All other surveyed stations ranged from 0 to <200 (Figure 11).

3.2 Upstream of Shaldon Bridge

Of the 39 total stations within the sample area 12 stations were surveyed. Of these total sampled cockles ranged from 11-24mm (width), with a mean size of 17.64mm (Figure 8b). Mean Cockle density was 3.89 per m^2, of which 64% were ≥16mm (135.2kg), the estimated mean density of which was 2.5 per m^2. The estimated biomass was 210.3 kg/ha. Mean density was highest around the 2017-16 and 2015 age classes, mean biomass (g/m^2) whereas highest biomass was recorded for the 2016-15 and 2014 classes (Figure 9). Spatial density of the sampled sites was low with mean density's ranging from 0-50 per m^2 (Figure 12).



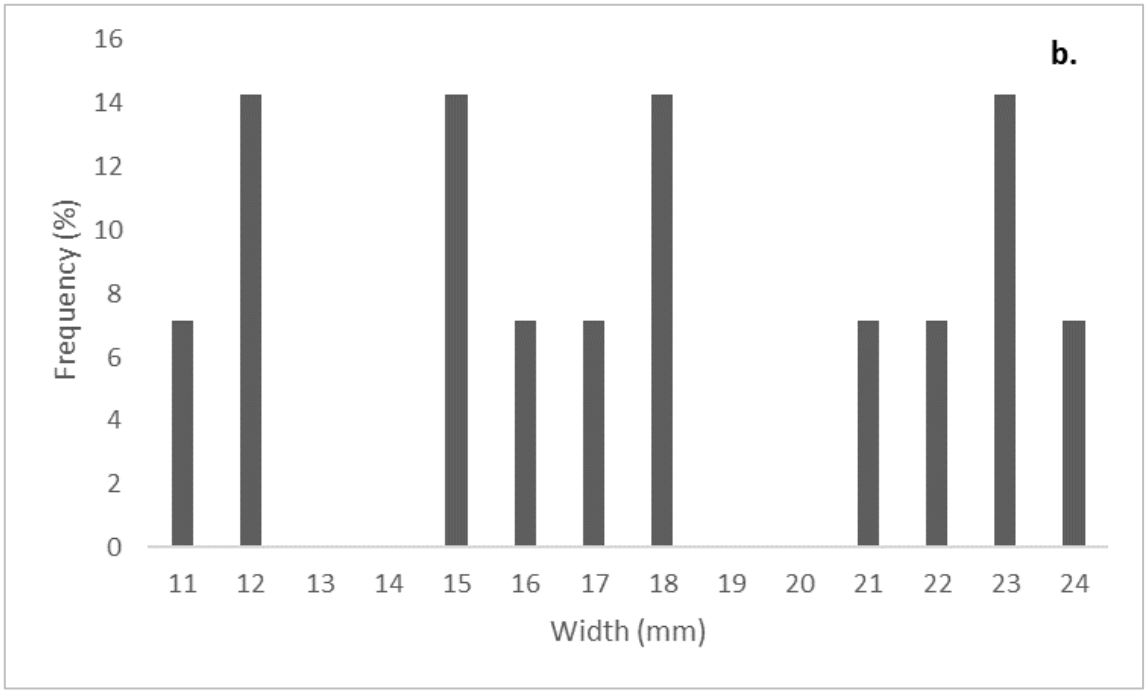


Figure 8. Cockle size frequency graph: (a) Salty, number of sampled cockles = 46., (b) Upstream of Shaldon Bridge number of sampled cockles = 14.

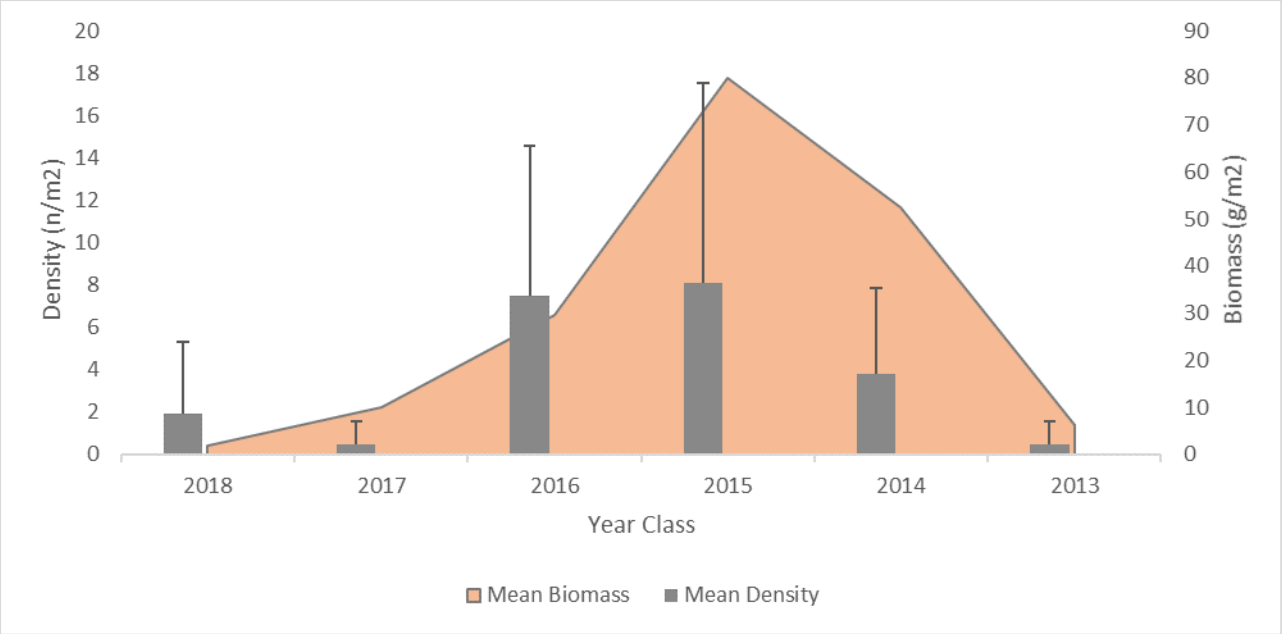


Figure 9. The Salty mean cockle density and mean biomass plotted over year class (bars represent standard deviation).

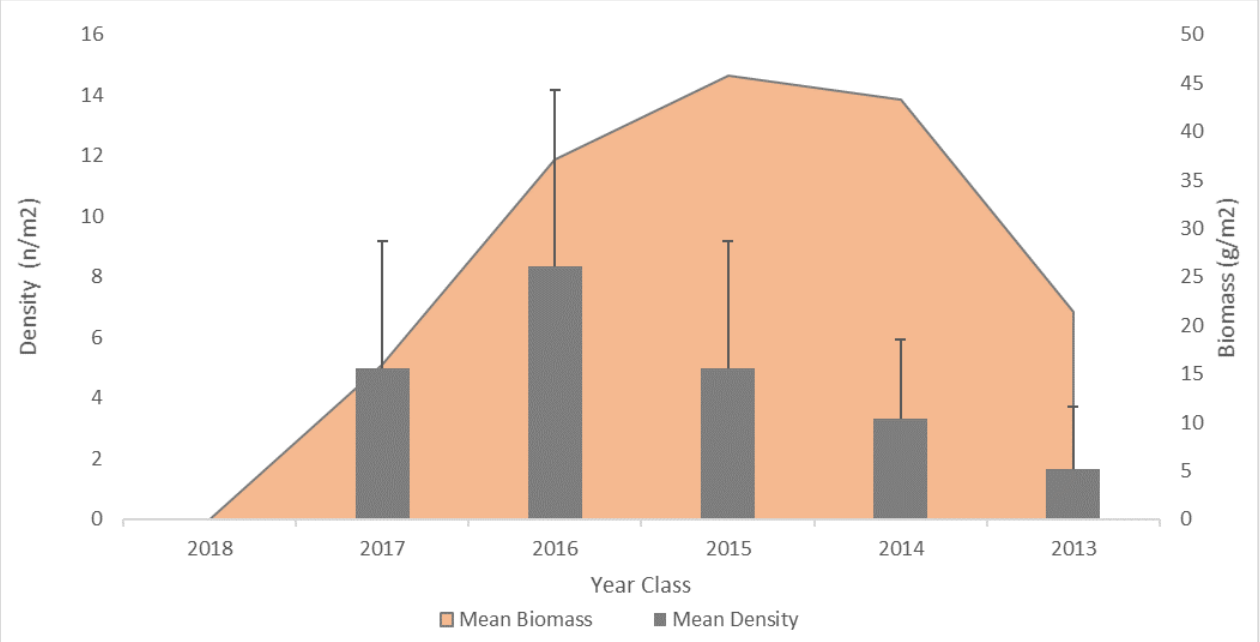


Figure 10. Upstream of Shaldon Bridge mean cockle density and mean biomass plotted over year class (bars represent standard deviation).

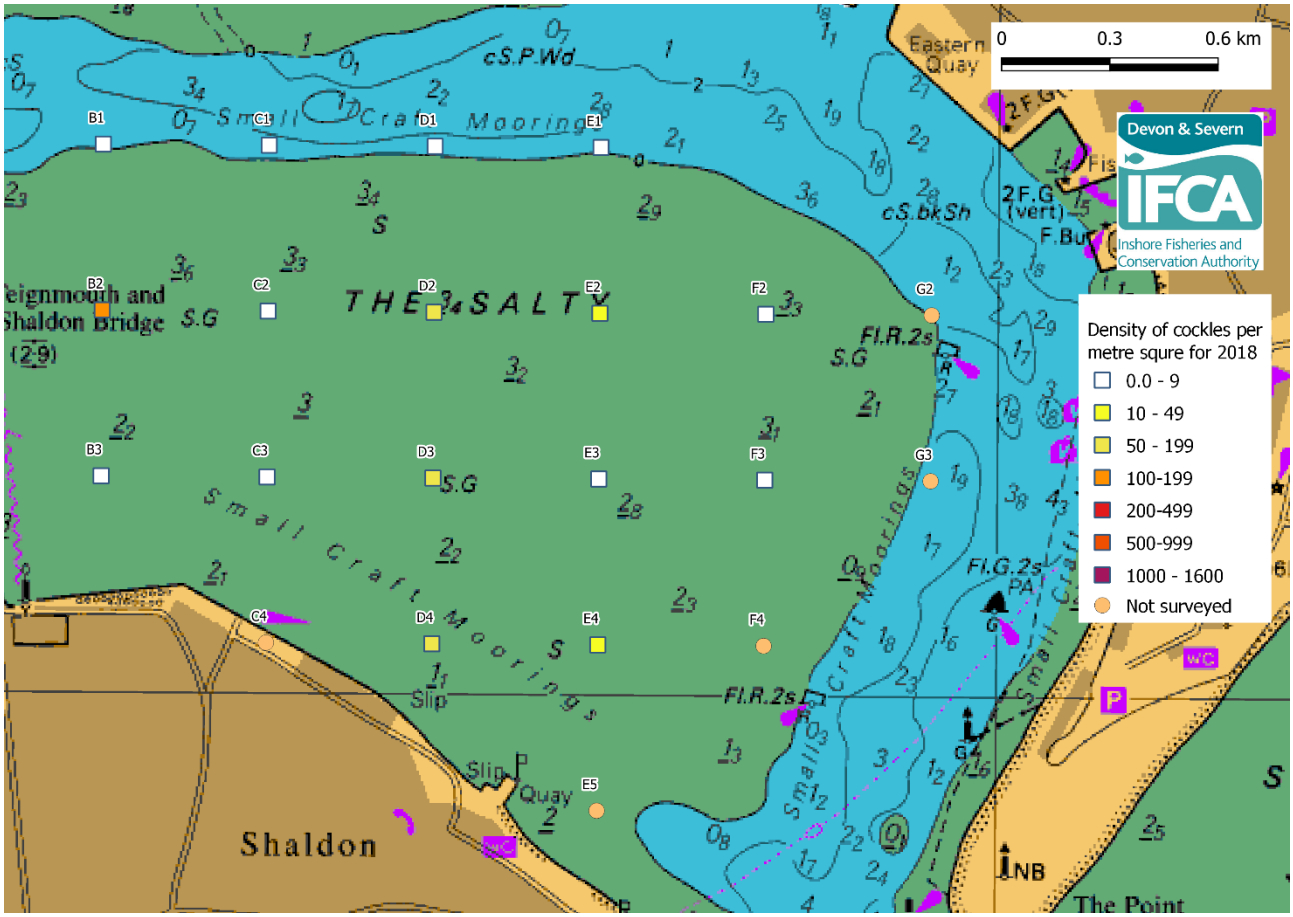


Figure 11. Cockle density per m² on The Salty

Figure 12. Cockle density per m² Upstream of Shaldon Bridge

4.0 Discussion

Density and biomass of cockles were consistently low across both of the surveyed sites. The spatial distribution of the cockles across both sites was patchy, however stations with cockles present were generally adjacent. For the Salty this population is centred towards the mid intertidal zone with reduced densities towards the low intertidal limit where the beds are less exposed. The main population Upstream of Shaldon Bridge lies parallel and adjacent to the bridge's western extent with the population extending from the mid intertidal to the extent of the low intertidal limit.

The age of the cockle for both sites varied slightly with the cockles at The Salty being slightly older than those at Upstream of Shaldon Bridge, which were a year class behind. Recruitment of juvenile cockles was relatively low at both sites. There was no new juvenile settlement at Upstream of Shaldon Bridge. Without new recruitment there may be a subsequent decrease in cockle biomass over time as the older year classes die off. This decline may be relatively rapid considering that 360kg of the total surveyed cockle biomass of 567kg is estimated to be over >16mm. Both sites displayed the highest levels of biomass within the 2015 year class suggesting that cockle growth accounts for most of the biomass within the sampled populations.

Generally, with increasing densities for age classes on both sites there was also an increase in variability. This variation of both population density and spatial distribution is considered a normal feature of *Cerastoderma edule* populations and not necessarily an indication of population decline (Jensen 1993; Whitton et al., 2015). Despite this, due to the lack of temporal comparative data, gauging the population health of the beds based purely on this report is not currently possible. Rather the data gathered will serve as a new baseline upon which further population change can be compared.

Recommendations for this year's (2019) survey include:

- Increasing the survey area of both sites to fully include the areas directly adjacent/under the bridge to ensure greater coverage of potential population hotspots.
- Decreasing the distance between stations on downstream side of the bridge to increase the resolution of data collected from within the sample site, given the relatively low spatial coverage of the cockle bed.

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