Teign Estuary
Cockle Stock Assessment 2011

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 *M. 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) and continues to date.

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 report has been created using previously unavailable data, and its findings will be used as a base line for future cockle reports (2019 onwards) and will inform the Authority during its current review of Hand Gathering within the D&S IFCA's District.

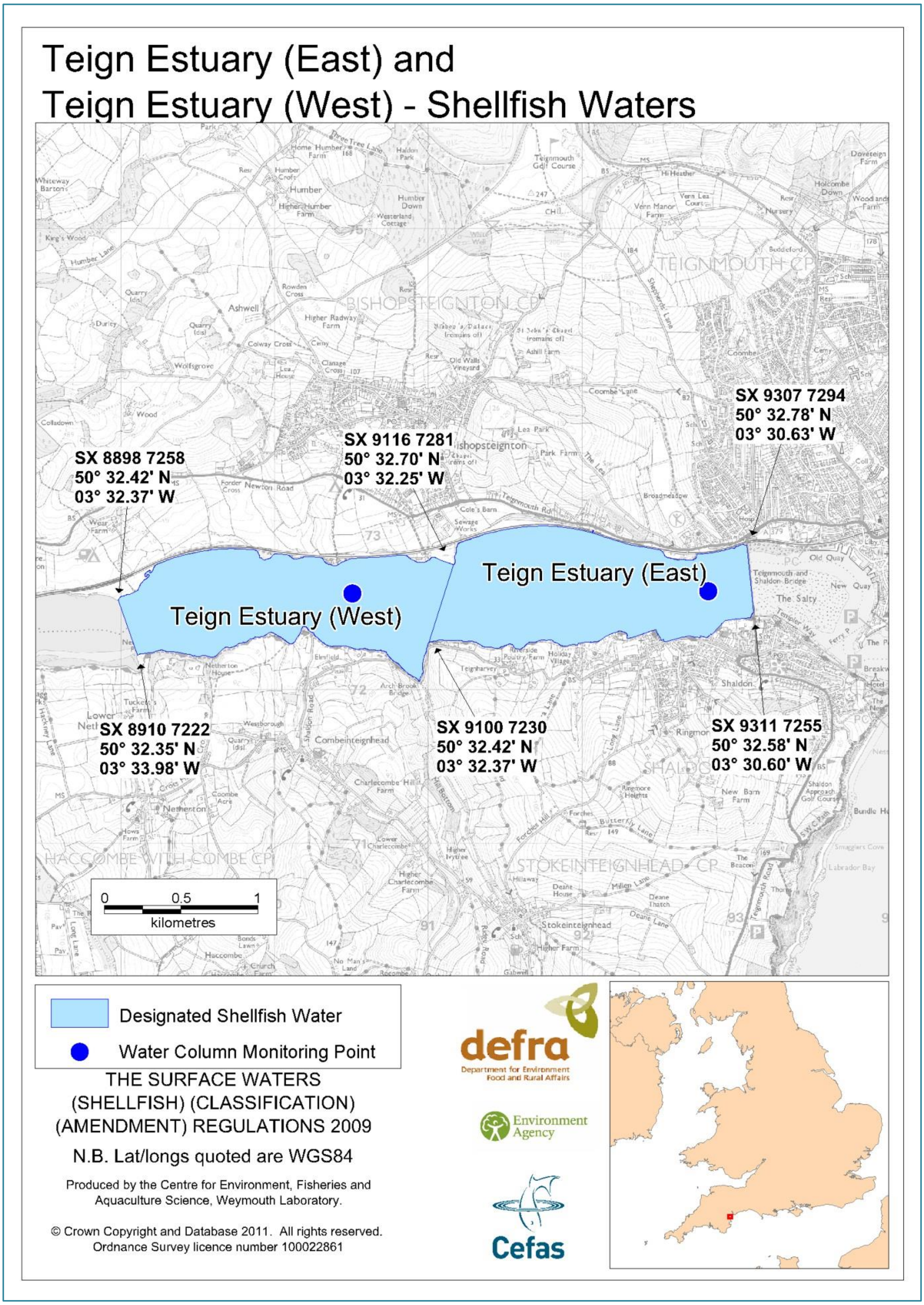


Figure 1. Classified shellfish waters of the Teign Estuary.

Teign - Mytilus spp.

Scale - 1: 35000

Classification: Status	Class A	Class B	Class C	Prohibited
	LT Class B	Seasonal Class B/C		

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.

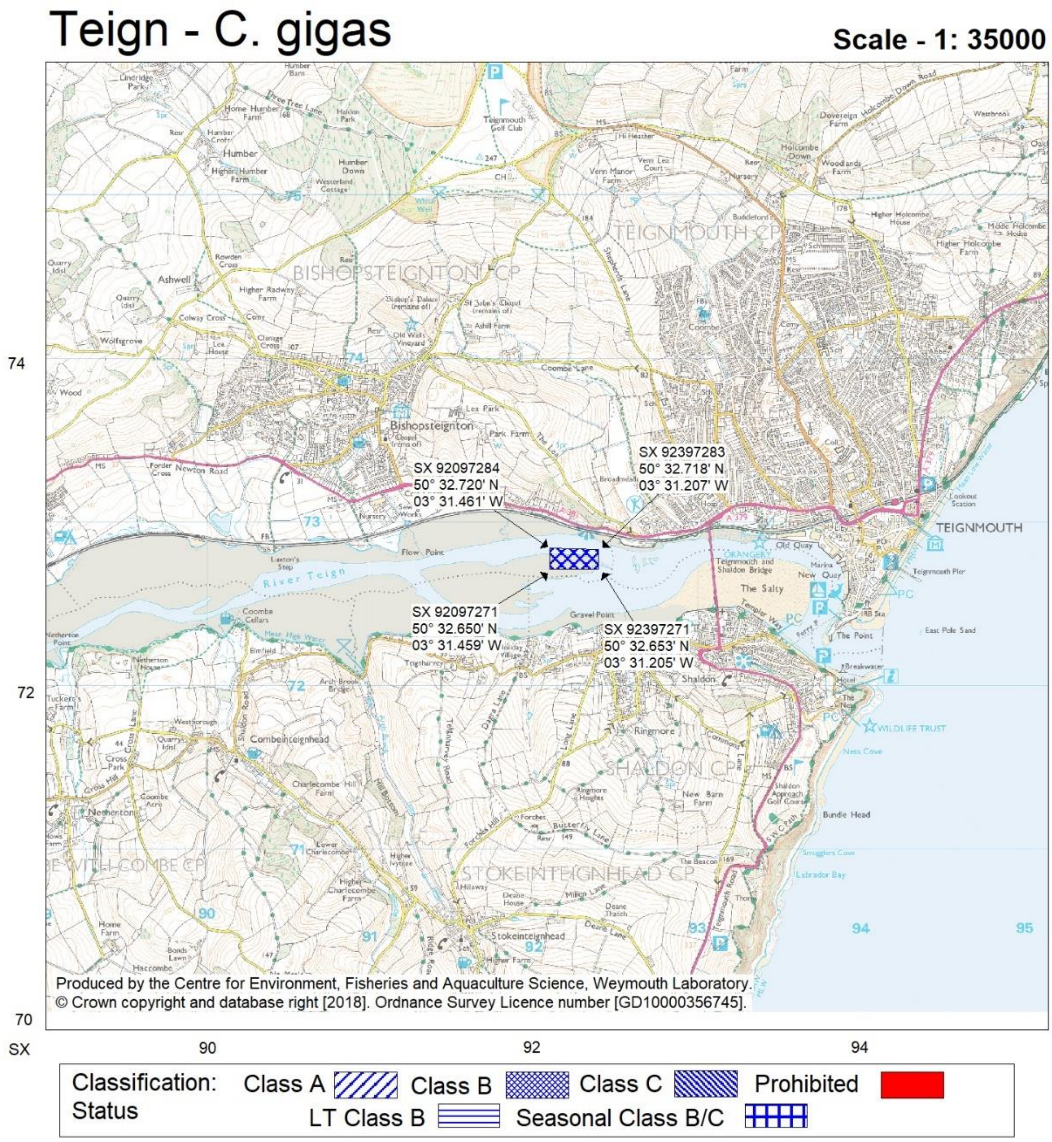
Further details on the classified species and the areas may be obtained from the responsible Food Authority. Enquiries regarding the maps should be directed to: Shellfish Microbiology, CEFAS Weymouth Laboratory, Barrack Road, The Nothe, Weymouth, Dorset DT4 8UB.
(Tel: 01305 206600 Fax: 01305 206601)

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*.



Classification of Bivalve Mollusc Production Areas: Effective from 1 September 2018

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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 March 2011. The survey took place on The Salty which is a large intertidal bed downstream of the Shaldon Bridge. The intertidal survey area was chosen to cover the area historically known to contain cockle. Stations were placed at fixed lateral and linear distances 75m between adjacent stations roughly covering the chosen section of intertidal zone (Figure 4). On site 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 (Figure 5). After measuring, cockles were sorted into age classes by determining how many annual growth rings were present on the shell. These 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 not able to be sampled due to tidal constraints and areas of deep soft mud.

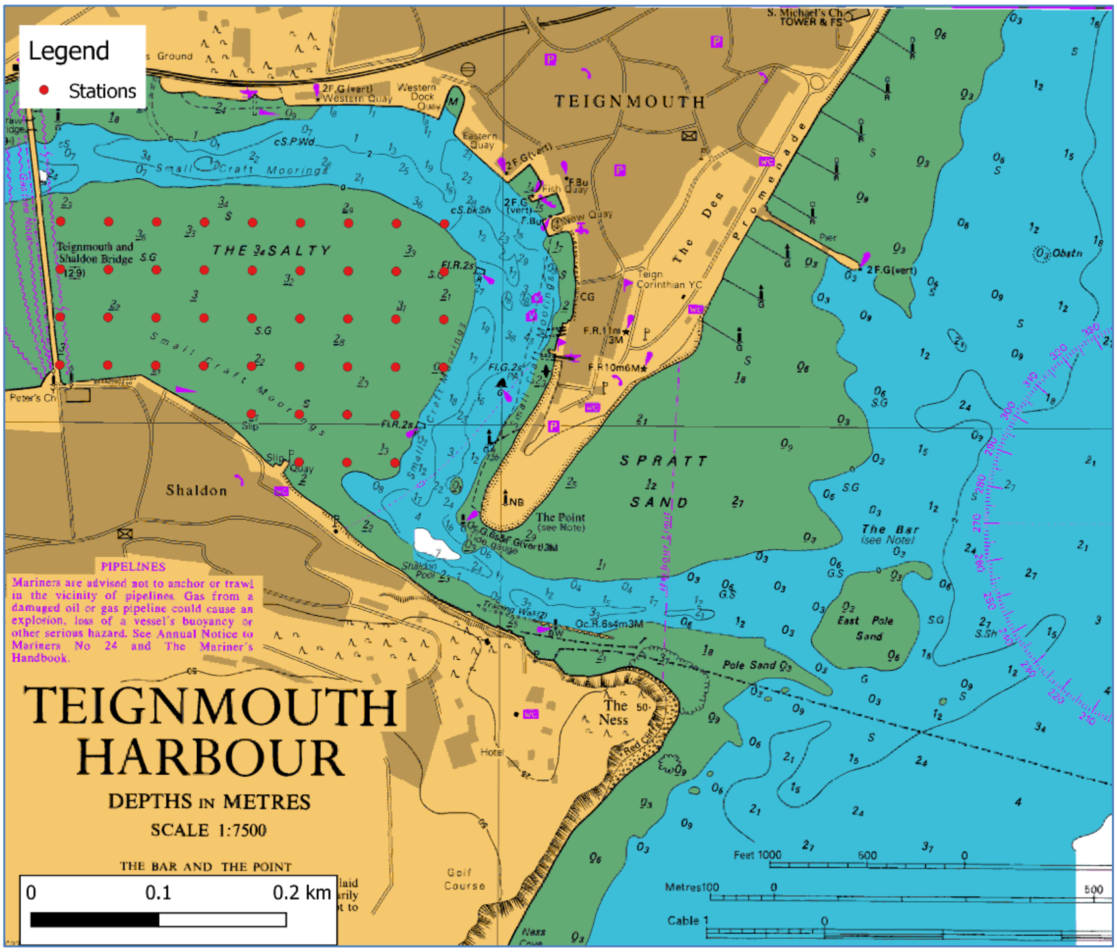

Figure 4 All cockle survey stations on the Teign (red)

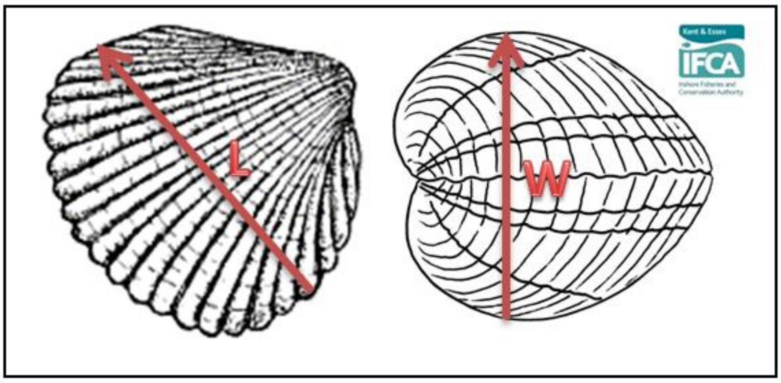

Figure 5. Cockle length and width measurements.

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 8 which was made using custom ranges. The minimum density used to determine the extent of coverage on the bed was 10 cockles per m^2. 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 43 total stations within the sample area 36 stations were surveyed. Of these; total width of sampled cockles ranged from 6-32mm, with a mean width of 17.1mm. 62.5% of the sampled cockles were ≥16mm (Figure 6). Mean Cockle density was 3.09 per m^2. The estimated mean cockle biomass within the salty was 36.4 tonnes, or 0.56 tonnes/ha. Mean biomass (g/m^2) was highest around the 2008-2010 age classes, mean density was highest for the 2008 year class followed by 2007. Densities in 2009 and 2010, although high in biomass, declined compared to the 2008 age class (Figure 7).

Spatial density was relatively high across the survey stations. The spatial density was more strongly concentrated within stations closer to The Salty's northerly intertidal extent, Station D3 and adjacent stations mostly showing >100-500 cockles per m^2, with lower densities <10 individuals per m^2 towards the Salty's south-eastern extent (Figure 8).

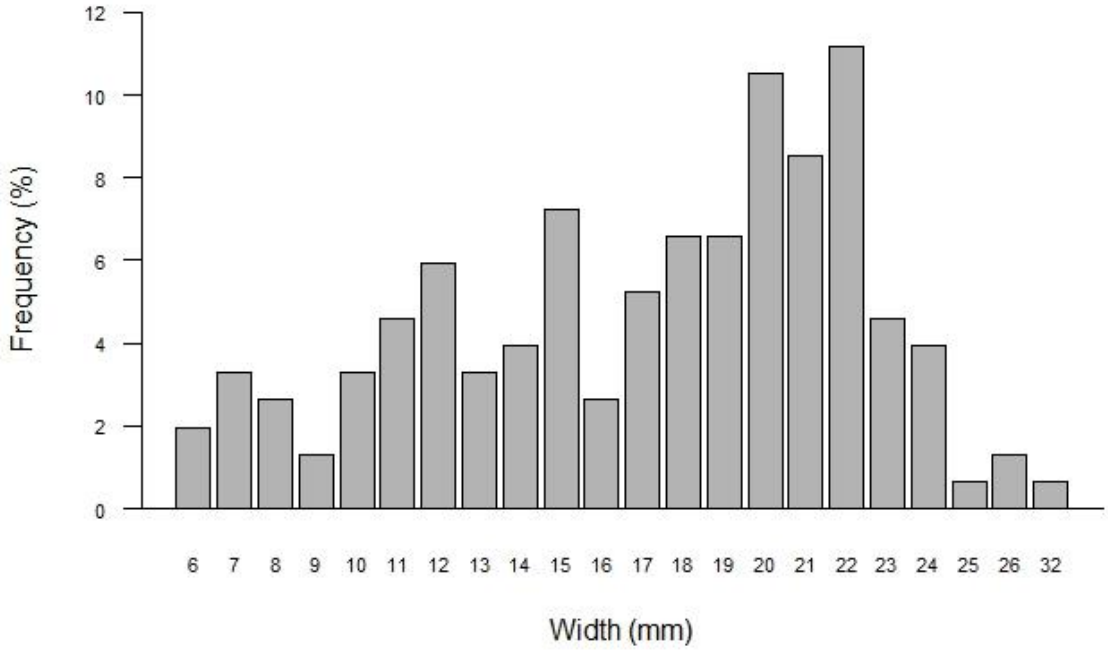

Figure 6. Size frequency of sampled cockles from The Salty, n of sampled cockles = 152.

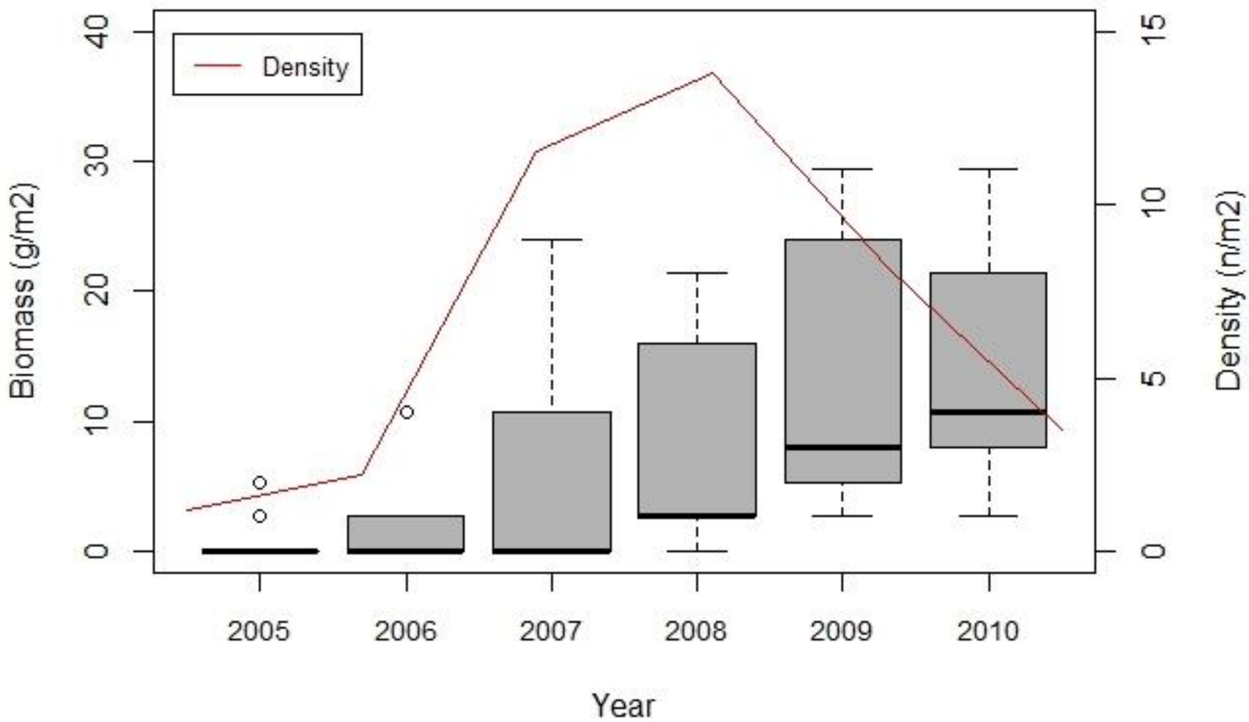

Figure 7. Mean sampled cockle density per size class and mean biomass plotted over year class (Whiskers represent standard deviation).

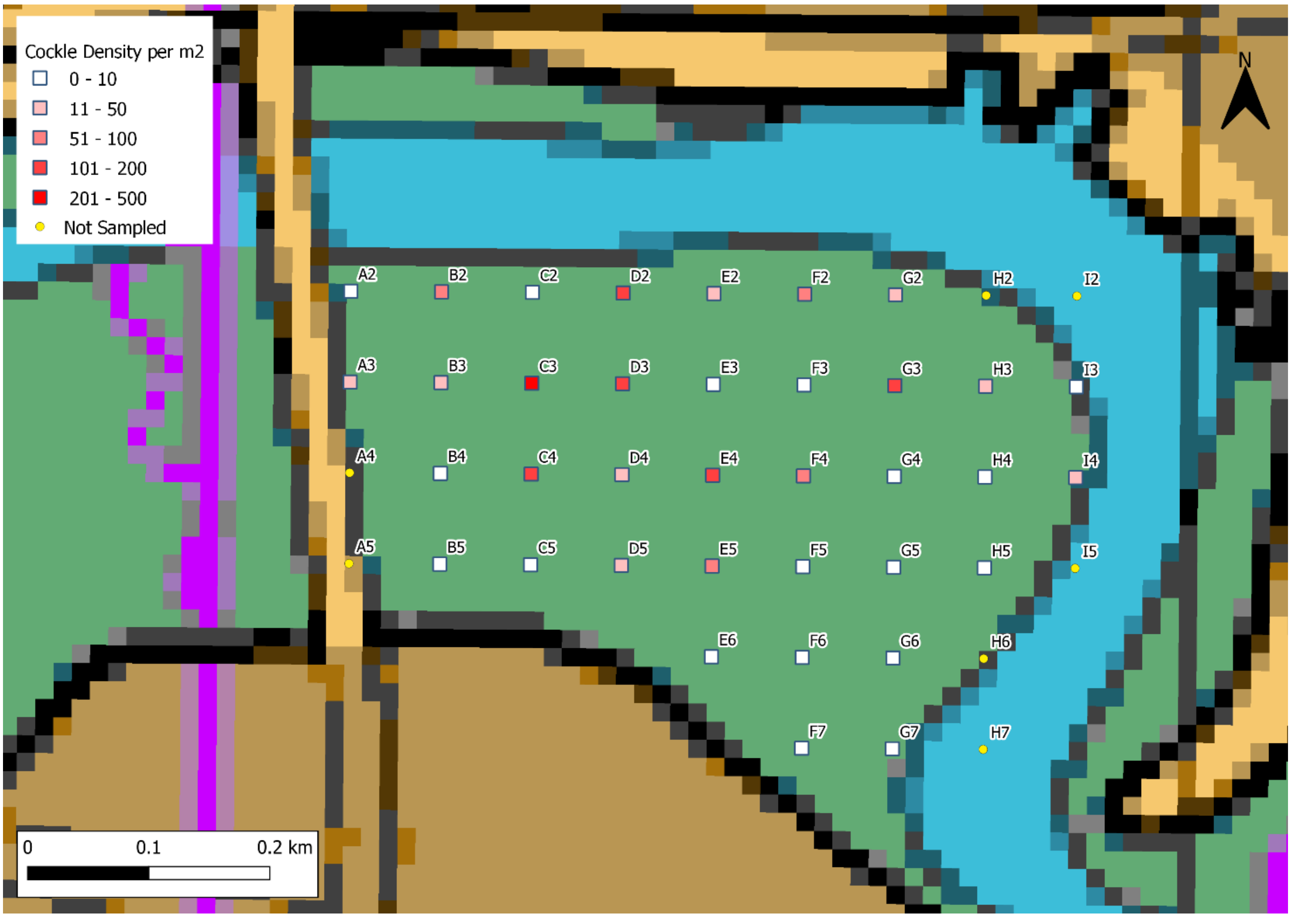

Figure 8. Cockle density per m² on The Salty (note that station E3 did have LF data, but no weight data, meaning that the density per m² though likely higher than presented, could not be estimated accurately and was there for excluded)

4.0 Discussion

Higher cockle densities in the centre of The Salty compared to the fringes suggest that the central nature of the location provides optimal cockle habitat. The sediment (a mix of sandy gravel) in the centre by location is more stable than the sediment by the bridge and seaward extent of the sand bank. These fringing sediments are subject to increasing scour by the tide and as a result are more mobile than the packed sediment towards the centre of the sandbank (Dalrymple & Rhodes, 1995). There are also reduced densities towards the terrestrial extents of The Salty, this is most likely due to decreased submergence time, and therefore decreased food availability. Cockles typically display preference towards stable submerged or intertidal muddy and sandy habitats, where if conditions are favourable, (salinity, access to food, temperature etc.) populations can thrive (Boyden & Russell, 1972; Brock, 1979, Whitton et al, 2015).

Cockles, from the 2008 class, seem to dominate the population both in abundance but also in biomass. Subsequently, in the later year classes of 2009-10, there is a sharp decline in abundance despite no declines in biomass. This is quite natural and simply the effects of growth and mortality. Whilst cockles in the UK are capable of living up to nine years on average, this figure is typically lower with an average life span of around 2-4 years. To note this figure does vary geographically and even within populations there can be spatial growth rate discrepancies (Ducrotoy *et al*., 1991, Fretter & Graham, 1964, Whitton et al., 2015). The decline in abundance for classes post 2008 is therefore quite normal, the surviving individuals, although fewer in number, will keep growing and increasing in biomass, sometimes many times greater than several individual cockles from smaller year classes.

Recruitment of juveniles, in terms of both abundance and biomass, seemed, in relation to the other year classes, relatively low (classes 2005-2006). With the absence of data between 2011-2018 it is difficult to establish exactly whether this low recruitment had any effect on subsequent populations. The literature would imply that low recruitment would lead to declines in the population over time, until conditions improve, and a high-density settlement and subsequent successful recruitment is possible (Olaffsson *et al.*, 1994). Reasons for low recruitment occurrences may include, but are not limited to, physical disturbance, such as increased sediment loading smothering juveniles and spat, and high mortality of planktonic larvae in the water column, which will subsequently affect juvenile settlement rates (Olaffsson *et al.*, 1994).

Generally, with increasing densities for all age classes, the results of the survey indicated an increase in variability (Figure 7). 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 possible. Rather the data gathered will serve as a new baseline upon which further population change can be compared to. A full comparison of the data with current population levels (2019) will be available int the 2019 Teign cockle report in due course, this will include data from this report, the 2018 D&S IFCA Teign Cockle Report and include data collected in 2019.

5.0 References

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