Southern IFCA Poole Harbour Bivalve Stock Assessment 2019

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1. Introduction

1.1 Rationale

This report details the main findings of the Poole Harbour Bivalve Stock Assessment 2019. Background information regarding the biology and management of bivalves in Poole Harbour is provided, as well as a description of how the assessment was conducted.

Southern IFCA has conducted annual bivalve stock assessments since 2016 (using the current methodology). These surveys contribute to assessing the sustainability of the Poole Harbour Manila clam and cockle fishery. In 2018, the fishery was awarded certification by the Marine Stewardship Council under their Sustainability Standard. Later the same year the fishery was also certified by the Seafish Responsible Fishing Scheme, making it the first fishery in the world to be accredited with both certifications. Annual stock assessments provide data on which to assess management strategies aiming to maintain and further develop the sustainable fishery.

1.2 Biology

1.2.1 Manila Clam (*Ruditapes philippinarum*)

The Manila clam is native to south-east Asia, but it is now harvested globally. The first record of the species in the UK is from 1988, when 100,000 individuals were introduced to Poole Harbour. By 1994, the population had become naturalised; there are now at least 11 estuaries around the UK with established populations[1]. Manila clams broadcast spawn twice annually, once in June and again in September/October. The larvae are estimated to take 12-15 days to settle and up to a further 24 months to reach a sexually mature size of 20mm[1].

1.2.2 Cockle (*Cerastoderma edule*)

The common cockle is native to the UK and now has a wide distribution along the north-eastern Atlantic coastline. They are usually found in intertidal and shallow subtidal areas with a muddy-sand or gravel sediment. Spawning takes place in the summer months. The fecundity of one animal can reach 200,000-700,000 larvae per year, which take 3-5 weeks to settle[2]. Sexual maturity is reached after 18 months once they have reached the size of 15-20mm. Cockles can live up to 10 years, but life span is limited to 2-4 years in most populations.

1.3 Poole Harbour

Poole Harbour (Dorset, southern England) is the second largest natural harbour in the world, spanning approximately 36km^2. The entrance has a narrow bar mouth which creates a micro-tidal regime, with a range of 1.8m at spring tides and 0.6m at neap tides[3]. The regime is characterised by a double high water that maintains water levels above the mean tide level for around 16 out of every 24 hours[3]. Fine muds and sands compose most of the sediments, with coarser material being closer to the Harbour entrance. These create two main habitats; mudflats and sandflats. The area is home to internationally important populations of birds, so in 1999 it became a Special Protected Area (SPA) under the EC Birds Directive[4]. In the same year, Poole Harbour was designated as a Ramsar Site under the Ramsar convention because it supports 20,000 waterfowl and numerous invertebrate communities. The area is also a Site of Special Scientific Interest (SSSI) under section 28 of the Wildlife and Countryside Act 1981[5].

[1] Jensen *et al*. (2005), *Proceedings in Marine Science*, 7: 163-173.

[2] Honkoop and Meer (1998), *J. Exp. Mar. Biol. Ecol.*, 220: 227-246.

[3] Wardlaw (2005), In: *J. Humphreys & V. May, The Ecology of Poole Harbour*, Elsevier, Amsterdam, pp. 219-222.

[4] Langston *et al.* (2003), Poole: Marine Biological Association Occasional Publication No. 12.

[5] Wildlife and Countryside Act 1981, http://www.legislation.gov.uk/ukpga/1981/69/contents [Accessed 2019, July 27th].

1.4 Management

Southern IFCA is one of 10 Inshore Fisheries and Conservation Authorities in England, formed under the Marine and Coastal Act 2009[6]. The District stretches across the Dorset, Hampshire, and Isle of Wight coastline out to 6 nautical miles from baselines. Southern IFCA operates with the aim to use evidence based and appropriate measures to manage the sustainable exploitations of sea fisheries resources.

The Poole Harbour Dredge Permit Byelaw regulates wild Manila clam and cockle fisheries through the issue of permits. The permit outlines conditions for legal operation within the fishery, these include: catching restrictions and reporting, gear types, gear construction and restrictions, spatial and temporal restrictions, and the fitting of equipment to vessels. Some areas of the Harbour have been identified as bird sensitive areas (BSAs) for the roosting, feeding and breeding of internationally important bird populations. BSAs either have additional temporal dredging restrictions or a permanent prohibition to dredging activity.

2. Method

In 2016, 28 shellfish beds across Poole Harbour were identified for bivalve sampling through consultation with users of the fishery. Since 2017, 27 of these beds have been sampled each year. Site 9 was removed following the 2016 survey due to the habitat being unsuitable for sampling. Sampling dates and times were chosen to correspond with periods of high spring tides, allowing maximum access to the sampling sites. For the 2019 survey, all sampling took place in April.

A chartered fishing vessel (FV *Karen Rose*) was used to carry out survey work. Samples were collected using a trailed pump-scoop dredge (Figure 1). This consists of a rigid basket of 460mm x 460mm x 300mm, with bars that were spaced 19mm apart. At the mouth is a spray bar to direct the flow of water to the back of the basket. A toothbar is also attached at the mouth. Water flow is powered by a 15hp water pump with 3-inch inlet and outlet hoses. For each sample, the dredge was deployed from the side of the vessel using a hydraulic winch.

The following method was used to replicate the fishing method of local fishing vessels:

1. A stake was placed at the centre of each site using a pre-determined coordinate which is kept consistent each year.
2. Three dredges were taken within a radius of 20m of the stake.
3. For each tow, the dredge was deployed for two minutes, the start/end time and location were recorded from a hand held GPS unit along with the number of rotations made by the vessel.
4. After two minutes, the dredge was brought back on board. The contents of the dredge were sorted on a riddle and any bivalves were retained and placed into a container. Each container was labelled with the site name, site number, and dredge number.
5. Samples were transferred to the FPV *Endeavour* for processing by Southern IFCA Officers.
6. Each bivalve was identified to species, the species were grouped separately and measured. Measurements were taken along the widest axis of an individual to the nearest millimetre using Vernier callipers.

Figure 1. Photo of the trailed pump-scoop dredge used for bivalve sampling.

[6] HM (2009), *Marine and Coastal Act 2009,* United Kingdom: HM Government.

7. Once measured, Manila clams and cockles were separated into above and below their minimum conservation reference size (MCRS) (35mm and 23.8mm respectively) and then weighed.
8. All samples were returned to the water once they had been measured. Samples were returned to shellfish production areas with the same classification as that from which they had been taken.

After the survey for 2019 had been completed, it became apparent that there had been problems with the trailed pump-scoop dredge gear used to obtain the samples. It is estimated that the equipment was operating at a third of the efficiency that it should have been. The loss of efficiency could not be quantified so a correction factor could not be calculated. Consequently, analysis of data from 2019 could not be directly compared with data from surveys carried out in previous years.

The weight data collected was used to calculate catch per unit effort (CPUE) as weight per meter of dredge per hour. The dredge had an opening of 0.46m, so the weight data was standardised to an opening of 1m. Tows were carried out for 2 minutes, so the data was also standardised to a time of 60 minutes. CPUE for each site was statistically compared using an ANOVA on Ranks. Due to the nature of the dataset, and it not being normally distributed, it was necessary to carry out non-parametric tests. Pairwise comparisons were made between sites using Dunn's Method. From the 2019/20 fishing season onwards, catch data supplied by the permit holders under the permit byelaw will be divided into catchment zones. This has been implemented in order to be able to better relate catch data to the data obtained in the annual stock assessment. Therefore, this year's survey data was grouped into the same catchment zones for statistical analyses (Figure 2). Zones 5, 6, and 7 were further grouped and termed 'Sheltered Bays' as there was only one sample site in each of these zones. Sites 23 and 24 were also grouped together as 'Holes Bay', this is not a catchment zone as fishing is prohibited in this area.

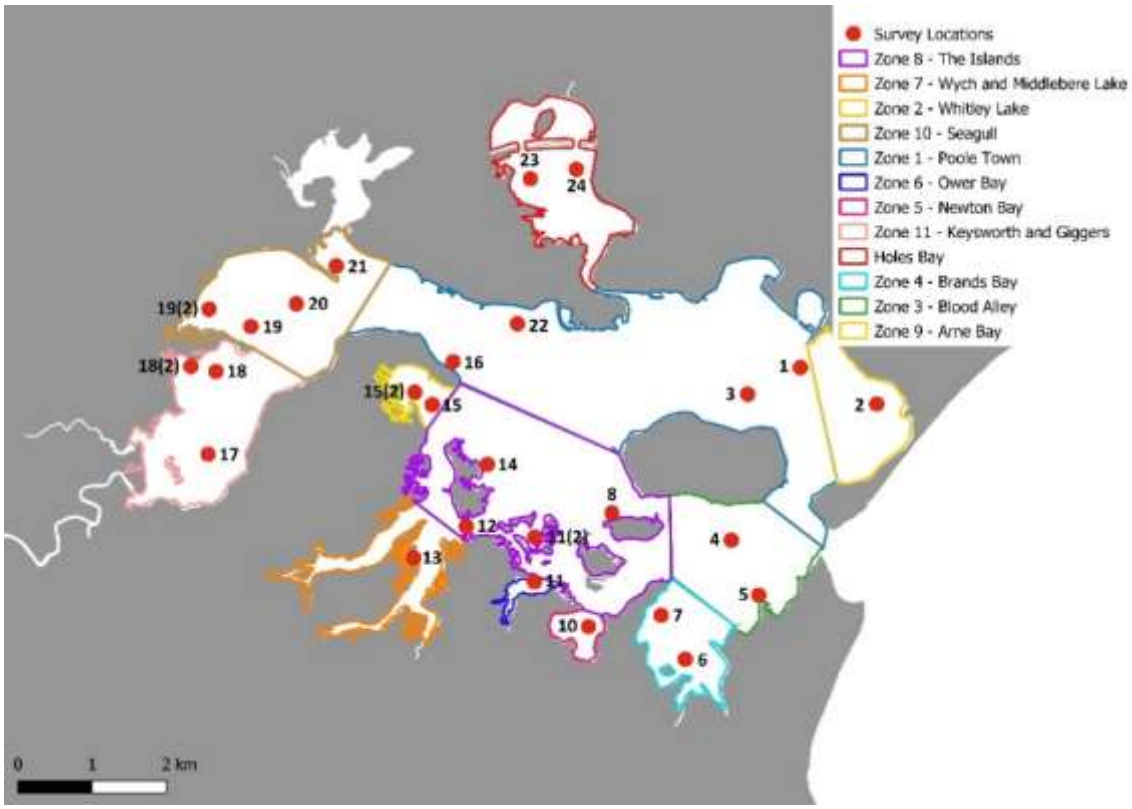

Figure 2. Map of Poole Habour showing the sampling sites for the 2019 stock survey (red dots) and the catchment zones (1 to 11) under the Poole Harbour Dredge Permit byelaw.

3. Results

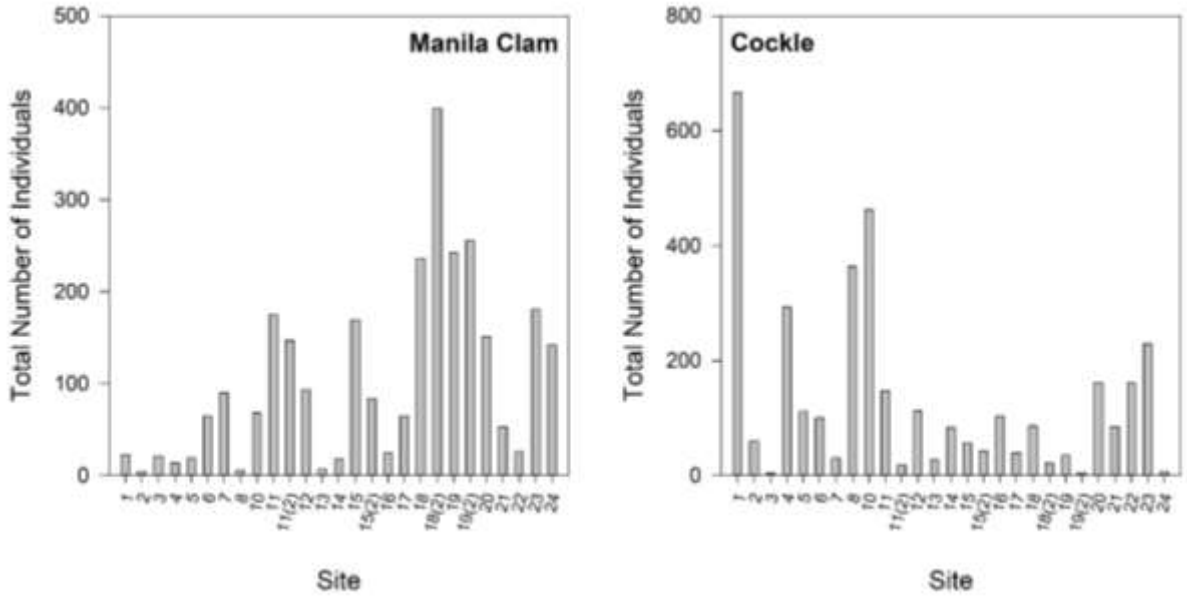

Figure 3. The total number of individuals for Manila clam (left) and common cockle (right) for the 27 sample sites in Poole Harbour. The number of individuals for the three dredges were combined per site to give the total.

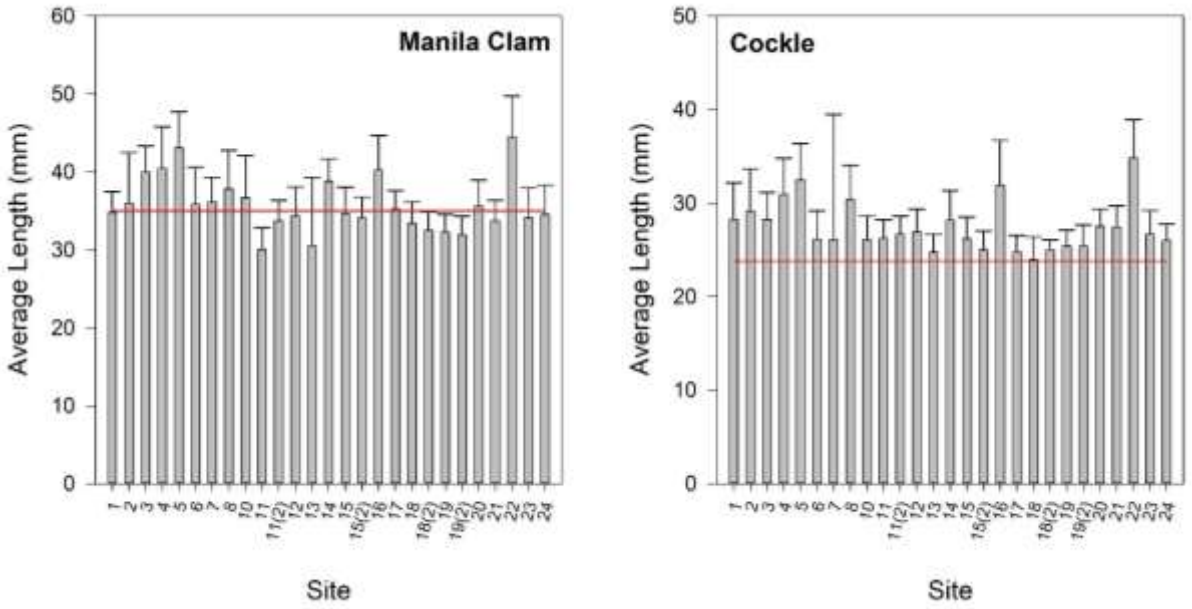

Figure 4. The average length (mm) for Manila clam (left) and common cockle (right) for the 27 samples sites in Poole Harbour. The average was calculated from the lengths of all individuals measured from the three dredges carried out at each site. The solid red line represents the Minimum Conservation Reference Size (35mm for Manila clams, 23.8mm for cockles). Error bars represent standard deviation.

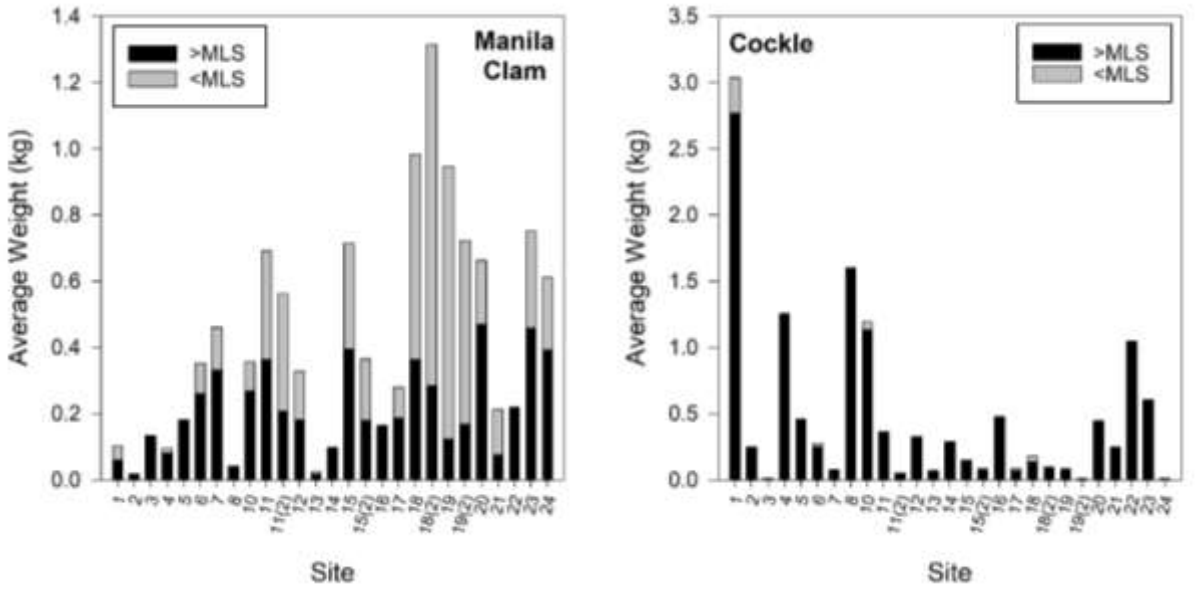

Figure 5. The average weight of Manila clam (left) and common cockle (right) greater than (black) or less than (grey) the Minimum Conservation Reference Size (35mm for Manila clam, 23.8mm for cockle). Average weight is shown for each of the 27 sites sampled, calculated as an average of the weight across the three dredges completed at each site.

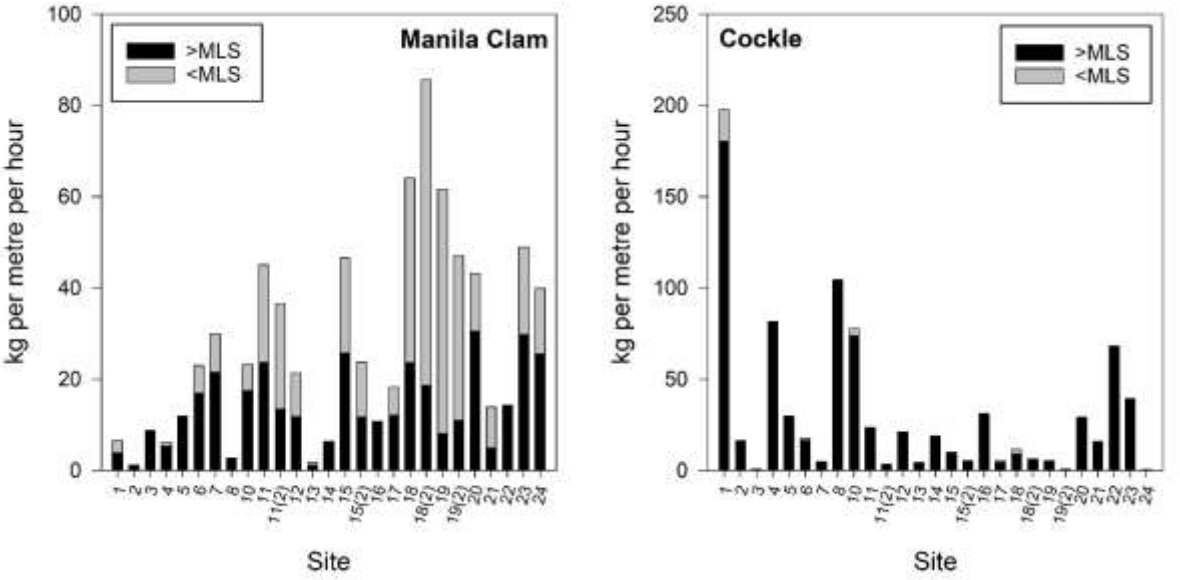

Figure 6. CPUE of Manila clam (left) and cockle (right) greater then (black) or less than (grey) the Minimum Conservation Reference Size (35mm for Manila clam, 23.8mm for cockle). CPUE is calculated as the weight of individuals (above or below MCRS) per meter of dredge per hour. The Average for each of the 27 sites sampled was calculated as the average of the CPUE across the three dredges completed at each site.

3.1 Findings

Manila clam (*Ruditapes philippinarum*) and common cockle (*Cerastoderma edule*) appear to have contrasting distributions. Manila clams were more abundant in western regions of the Harbour, peaking at 399 individuals at site 18(2) (Inner Holton Mere, Wareham Channel). Cockles were more abundant in the eastern areas towards the mouth of the Harbour, peaking at 667 individuals at site 1 (Middle Ground). CPUE analyses confirm the distributions. There were significant differences in CPUE between sites for both Manila clam ($p<0.001$) and common cockle ($p<0.05$) although these differences were only seen between a select number

of sites. Pairwise comparisons showed that the differences for Manila clam were between zone 11 (Keysworth and Giggers) and zone 2 (Whitley Lake) ($p<0.05$), and Holes Bay and zone 2 (Whitley Lake) ($p<0.05$) with zone 11 and Holes Bay showing a significantly higher CPUE (Figure 2). The only significant difference for cockles was between zone 10 (Seagull) and zone 2 (Whitley Lake) ($p<0.05$) with CPUE for zone 2 being significantly higher.

The average size of both bivalve species remained consistent between sites. Across all sites sampled, the average size for common cockle was at or above the MCRS of 23.8mm. Manila clam was more variable with 14 sites showing an average size below the MCRS of 35mm. The CPUE and weight data also show more variation in size for Manila clam with 5 sites showing a higher proportion of Manila clam under MCRS. This was predominantly focused in one area of the Harbour, the Wareham Channel, with sites 18, 18(2) (Inner and Outer Holton Mere) and 19 and 19(2) (Inner and Outer Keysworth) showing a high proportion under MCRS. This corresponds with some of the areas which are most heavily fished during the fishing season. Common cockle however showed a higher proportion of individuals above the MCRS for all sites.

Other species were found during the survey including American Hard-Shelled clams (*Mercenaria mercenaria*), Native clam (*Ruditapes decussatus*) and native oyster (*Ostrea edulis*), however these species were only found in small quantities and so are not included as part of the analysis in this report.

3.2 Interpretations

The distribution of bivalves appears to be primarily influenced by habitat preference. Manila clams prefer muddy, fine-grained sediments located by the riverine inputs in the western regions of Poole Harbour[7]. These areas are more sheltered from natural disturbance arising from wind and wave action and are also subject to lower levels of anthropogenic disturbance from activities other than fishing. The areas around the Wareham Channel, particularly the inner sites at Holton Mere and Keysworth demonstrate this type of sheltered muddy habitat which may explain the higher overall numbers of individuals of Manila clam at these sites. The sheltered nature of these sites may also provide a more suitable habitat for spat settlement which may explain the higher proportions of undersized individuals at these sites. The survey was carried out in April so the undersized individuals may represent a spat fall from 2-3 years previous.

The higher number of undersized individuals at these sites may also be a reflection of the increased levels of fishing effort in the Wareham Channel area. This is the preferred location for dredging activity during the season, therefore, when sampling in April it is likely that the reduced numbers of oversized Manila clam are partly resulting from extensive removal during the previous fishing season which finished on 23rd December. While there may have been some recovery during the three months that the fishery was closed prior to the survey taking place the lower temperatures at that time of year will mean that growth rates are slower. If samples were to be taken in late May prior to the fishery opening it would be expected that the proportion of oversized individuals would have increased as temperatures are more likely to be over the threshold for the Manila clam to be actively growing.

The higher abundance of Manila clam in the Holes Bay area is likely to be a function of the fact that the area is permanently closed to dredging activity. This may also explain the higher proportion of oversized clams at these sites as they are not being removed by the fishery and so the population is able to maintain a more heterogenous size range.

[7] Humphreys *et al.* (2015), *J. Mar. Biol. Assoc. U.K.*, 151: 2255-2270.

The pattern of abundance for the Common cockle is also likely to be habitat dependent. The common cockle tends to prefer coarser sediments which are located nearer to the mouth of the Harbour[8], this corresponds to the higher numbers of individuals of this species found in these areas when compared to the muddier sites.

The difference in average sizes between the Manila clam, with the population showing higher proportions of undersized individuals, and the common cockle, with individuals almost entirely above the minimum conservation reference size, is likely to be a function, in part, of the sampling method combined with the way in which these species grow. Manila clam has been observed to grow differently in different areas of the Harbour which some individuals growing along the widest axis and remaining thin with others growing in depth but remaining fairly narrow on the width. This means that undersized individuals which have grown in depth will be retained by the dredge although they are undersized in terms of the width (the measurement which is used to determine if a bivalve is of minimum conservation reference size). Cockles however tend to grow more uniformly on all axis therefore fewer undersized individuals are likely to be caught when targeting those of a commercial size. The dredge gear and riddle used are selective (both with bar spacing of 19mm) therefore a proportion of the population will not be retained. The second part of the survey, using grab samples to obtain juveniles of both species provides more information on this part of the population, the results from this part of the survey do not form part of this report.

The introduction of catchment zones into the monthly catch return forms completed by fishers will help to improve spatial analysis of bivalve populations. Catch data from 2019-20 will be able to be related to the stock assessment results in 2020 giving a quantification of the areas which are most heavily fished. This will also aid management of the fishery and give the potential for further spatial management in the future if stock levels were to indicate that this is required.

Unfortunately, due to problems arising from the reduced efficiency of the dredge in this year's survey, biomass and abundance comparisons cannot be made with surveys from other years. Temporal changes in Manila clam and common cockle stocks will be unknown until subsequent annual assessments are conducted. This information is important for determining the sustainability of bivalve stocks. However, the findings from the 2019 stock assessment do not suggest that either species is being exploited unsustainably. Data from the second part of the survey on the juvenile portion of the population of each species was collected using a different method therefore these results will be able to be compared to previous years data.

[8] Tyler-Walters (2007), http://www.marlin.ac.uk/species/detail/1384 [Accessed 2019, July 27th].