Southern IFCA Survey Report

Poole Harbour Bivalve Survey, 2022

1. Introduction

The Poole Harbour Bivalve Survey contributes to assessing the sustainability of the Poole Harbour clam and cockle fishery by monitoring stocks of commercially important bivalve species in shellfish beds across the Harbour. The survey has been conducted annually since 2016 and surveys 27 shellfish beds. Data is collected on size (length) and Catch Per Unit Effort (CPUE) for the two most commonly harvested species, the Manila clam (*Ruditapes philippinarum*) and the common cockle (*Cerastoderma edule*). Additional size and abundance data is also collected for any other bivalve species retained in the dredge. The Poole Harbour clam and cockle fishery was awarded dual certification under the Marine Stewardship Council's Sustainability Standard and the Seafish Responsible Fishing Scheme in 2018. The annual stock assessment provides data upon which management of the fishery can be assessed and, if necessary, reviewed with the aim of maintaining and further developing the sustainable fishery.

2. Methodology

The survey took place between 20th – 21st April 2022 using local fishing vessel FV Karen Rose operating a pump-scoop dredge consistent with normal fishing practice (figure 1).

For 2022, one site (Site 2) was unable to be sampled due to unforeseen tidal constraints. Therefore, for the 2022 survey, dredge samples were taken from 26 sites (figure 2) using the methodology below.

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

1. Three dredge tows, timed at two minutes, within a radius of 20m of the central point of each site (pre-determined and consistent across all survey years)
2. After two minutes the dredge was brought inboard, and any bivalves were retained
3. Each bivalve was identified to species and the first 50 individuals of each species were measured along the widest axis (length) to the nearest millimetre
4. Manila clams and cockles were separated into above and below their minimum conservation reference size (MCRS) (35mm and 23.8mm respectively) and then weighed
5. All samples were returned to shellfish production areas with the same classification as that from which they had been taken after measuring

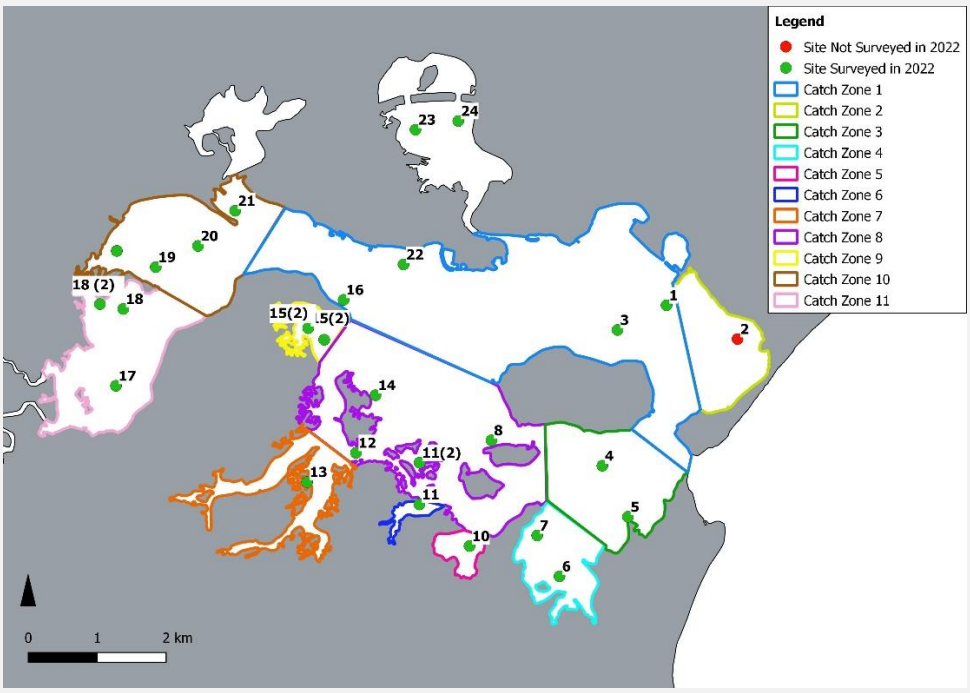

Figure 2. Map of Poole Harbour showing Poole Harbour Bivalve Survey sites, green marks indicate sites which were sampled during 2022, the red site indicates the site which was not sampled due to unforeseen tidal constraints. Catch zones are marked by coloured boundaries, the number of the catch zone is provided in the legend next to the corresponding colour. Holes Bay (sites 23 and 24) is not a catch zone as dredge fishing is not permitted in this area however is considered a separate zone for the purposes of survey data analysis.

3. Results

The results of the survey focus on the two main commercial species, the Manila clam and the common cockle. Other species found during the survey in smaller quantities included the American Hard-Shelled clam (*Mercenaria mercenaria*), the Native clam (*Ruditapes decussatus*), the native oyster (*Ostrea edulis*), the Pacific oyster (*Magallana gigas*), the spiny cockle (*Acanthocardia aculeata*) and the blue mussel (*Mytilus edulis*).

3.1 Length Data

The average length (mm) of Manila clam and common cockle across the three dredges for each site are shown in figure 3.

3.1.1 Manila clam

- The average length varied between 44mm at site 3 (n=4) and site 22 (n=9) to 34mm at sites 18(2) (n=585), 19(2) (n=951), 23 (n=664) and 24 (n=1147).
- The average length was above the MCRS of 35mm at all but four sites. These are the four sites above which showed an average length of 34mm.

3.1.2 Common cockle

- The average length varied between 38mm at site 1 (n=72) to 25mm at sites 6 (n=10), 18 (n=193), 18(2) (n=84), 19(2) (n=64) and 24 (n=85).
- The average length was above the MCRS at all sites.

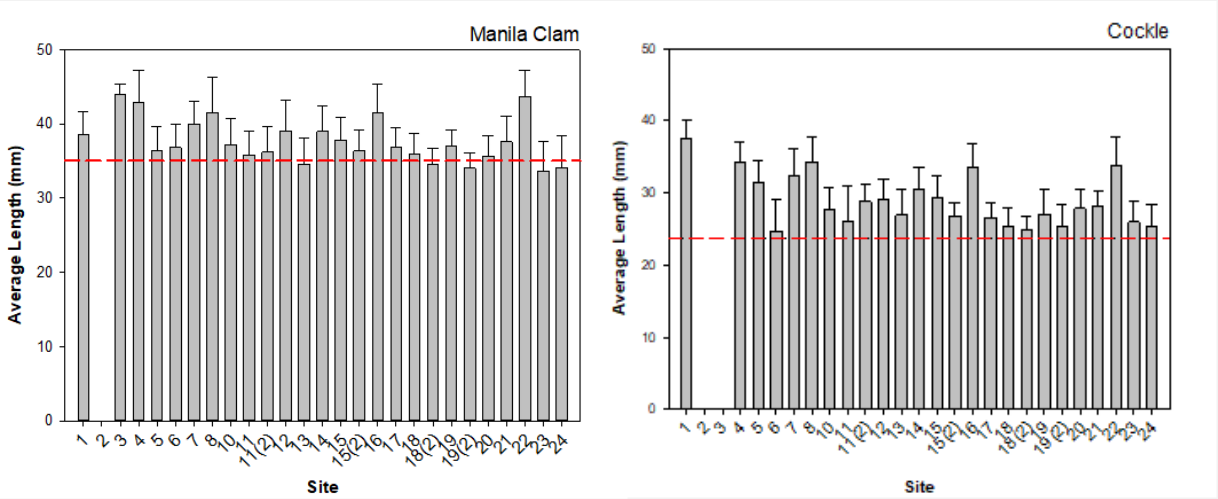

Figure 3. Average length (mm) for Manila clam (left) and common cockle (right) for the 26 sites sampled in Poole Harbour. For common cockle, site 3 was sampled but no cockles were present. The dashed red line represents the Minimum Conservation Reference Size (MCRS), error bars represent the standard deviation. *(*note that the dredge bar spacing of 19mm influences the size range caught, therefore sampling more accurately reflects the proportion of the population 'available' to commercial fishers).*

3.2 CPUE Data

A measure of Catch Per Unit Effort (CPUE) was calculated as weight of shellfish (kg) per metre of dredge per hour both above and below the MCRS for each of the two species. The Harbour is divided into 11 catch reporting zones under the Poole Harbour Dredge Permit Byelaw (figure 2) therefore CPUE data from the survey has been grouped according to the zone in which the survey site is located (figure 4). Data has been analysed for 2022 and also in comparison to data from the previous two surveys in 2019 and 2021 (there was no survey in 2020 due to the Covid-19 pandemic). Statistical analyses were performed using a non-parametric Kruskal-Wallis test with subsequent Dunn's method.

3.2.1 Manila clam

- For the 2022 survey, zones 6 (Ower Bay), 7 (Wych and Middlebere Lake), 10 (Seagull) and Holes Bay showed the highest average total CPUE (above and below MCRS combined) at 219.6, 184.0, 116.1 and 244.7 kg m of dredge^{-1} hr^{-1} respectively.
- For zones 6, 7 and Holes Bay the CPUE was greater for Manila clam over MCRS at 197.9, 100.5 and 143.22 kg m of dredge^{-1} hr^{-1} respectively. For site 10, the CPUE was greater for Manila clam under MCRS at 59.1 kg m of dredge^{-1} hr^{-1}, however the CPUE for Manila clam over MCRS was similar at 57.1 kg m of dredge^{-1} hr^{-1}.
- Statistical analysis showed a significantly higher average CPUE under MCRS in Holes Bay (101.4 kg m of dredge^{-1} hr^{-1}) and Zone 11 (54.6 kg m of dredge^{-1} hr^{-1}) than Zones 1 (23.3 kg m of dredge^{-1} hr^{-1}) and 4 (21.6 kg m of dredge^{-1} hr^{-1}) ($P<0.001$). For CPUE over MCRS there was a significant difference between zones ($P<0.05$), but there was not enough variance between groups to show significant differences in post-hoc testing.
- Statistical comparisons between the last three survey years for each zone (2019-2022) (figure 4) showed that the average CPUE for the 2022 survey for over MCRS was significantly higher than the 2019 survey for Zones 11 ($P<0.001$), 10 ($P<0.05$) and 8 ($P<0.05$) and for under MCRS for Holes Bay ($P<0.05$). For Zone 10 the average CPUE over MCRS was also significantly higher in 2022 than in 2021 ($P<0.05$). The only other significant difference for the 2022 survey data was in Zone 1 where the average CPUE under MCRS was significantly higher in 2021 than either 2019 or 2022 ($P<0.001$). Other

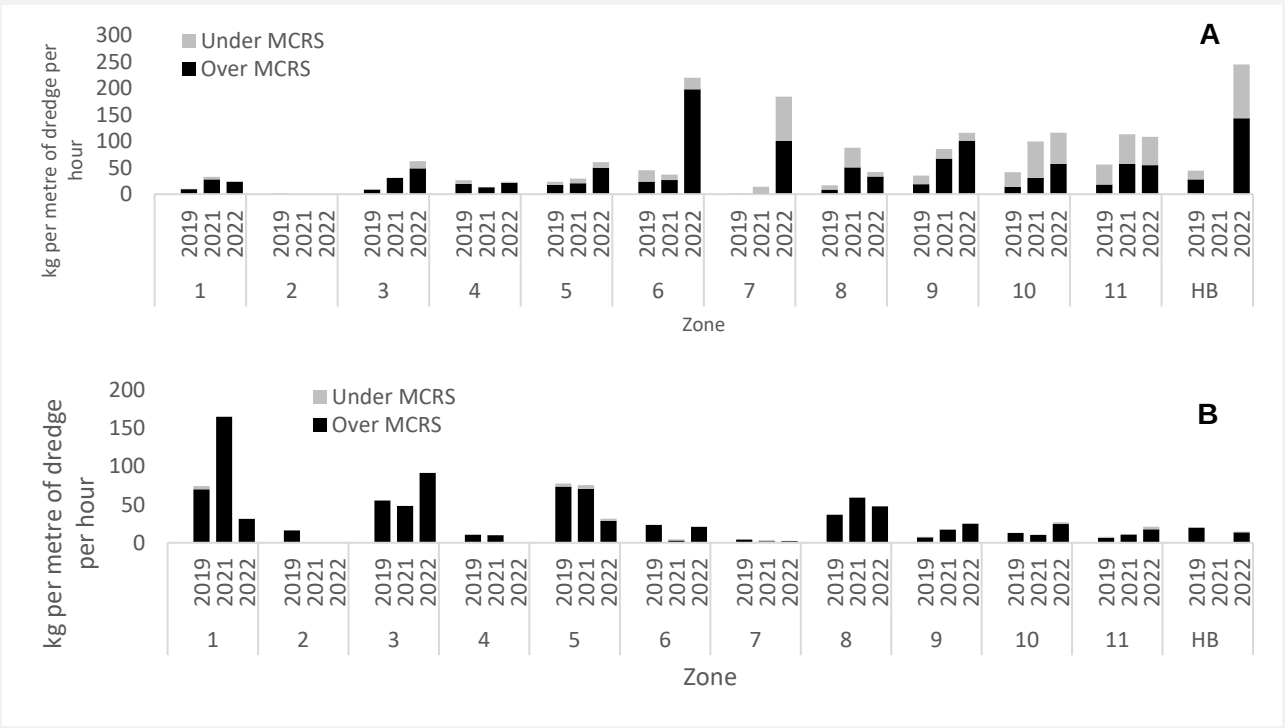

Figure 4. Catch per unit effort (CPUE) expressed as kg of shellfish per metre of dredge per hour for A) Manila clam and B) Common cockle, black bars represent shellfish above the MCRS and grey bars represent shellfish under the MCRS. Data is grouped into 11 catch zones and is shown for survey years 2019, 2021 and 2022. Note that for 2021, due to an amended Covid-19 methodology there is no data for zone 2 (Whitley Lake) or zone HB (Holes Bay) and for 2022 due to tidal constraints there is no data for zone 2 (Whitley Lake).

significant differences were noted for average CPUE over MCRS in Zones 3 and 7 (both $P<0.05$), however there was not enough variance between groups to show significant differences in post-hoc testing. The visualisation of the data indicates that the average CPUE over MCRS for Zones 3 and 7 was higher in 2022 than in the previous two years. Zone 4 showed a significant difference for average CPUE under MCRS ($P<0.05$), however again there was not enough variance between groups to show significant differences in post-hoc testing.

3.2.2 Common Cockle

- For the 2022 survey, zone 3 (Blood Alley) showed the highest average total CPUE (above and below MCRS combined) at 91.6 kg m of dredge^{-1} hr^{-1}. Sites 5 (Newton Bay) and 8 (The Islands) showed the next highest average CPUE values at 31.5 and 48.3 kg m of dredge^{-1} hr^{-1} respectively.
- All sites were dominated by cockles over MCRS. For cockles under MCRS the highest CPUE values were at site 5 (2.8 kg m of dredge^{-1} hr^{-1}), site 10 (2.3 kg m of dredge^{-1} hr^{-1}) and site 11 (3.3 kg m of dredge^{-1} hr^{-1}). All other sites had a CPUE value under 1.0 kg m of dredge^{-1} hr^{-1}.
- A statistical comparison of CPUE between catch zones for 2022 indicated a significant difference between sites for both above and under MCRS ($P<0.05$), however there was not enough variance between groups to show significant differences in post-hoc testing.
- Statistical comparisons between the last three survey years for each zone (2019-2022) (Figure 4) showed significant results only for Zones 7, 10 and 11. For Zone 7, average CPUE under MCRS was significantly different between years ($P<0.05$), however there was not enough variance between groups to show significant differences in post-hoc testing. For Zone 10, the average CPUE over MCRS was significantly higher in 2022 than 2019 ($P<0.05$) and for under MCRS was significantly higher in 2022 than 2019 or 2021

(P<0.001). For Zone 11, average CPUE under MCRS was significantly higher in 2022 than in 2021 (P<0.05).

4. Catch Data for the Poole Harbour Dredge Permit Fishery

The Poole Harbour Dredge Permit Byelaw permit conditions require permit holders to provide monthly catch data, which is analysed to provide an indication of spatial and temporal patterns of fishing activity. This information can then be related to the survey data to provide an indication of whether the fishery is operating sustainably. Quantities of Manila clam and common cockle caught each month by the fishery for the 2019, 2020 and 2021 fishing seasons are shown in figure 5. The fishing season runs from 25th May to 23rd December each year.

4.1 Manila clam

- The quantity of Manila clam (kg) landed by the fishery saw a sharp increase in 2020 compared to previous years. The quantity landed in 2020 was significantly higher than in 2019 (P<0.05), however the quantity landed in the most recent season 2021 was not significantly different from either 2020 or 2019.
- The peak quantity of catch landed during the 2021 season was in August (93,773 kg) which is consistent with the peak landing month for the 2020 season (108,288 kg). The quantity landed during the 2021 season varied from the peak level in August to 15,504 kg in May.
- As with previous years, catch levels generally rise to a peak in mid-summer before experiencing a steady decline to the end of the season in December.

4.2 Common Cockle

- The quantity of common cockle (kg) landed by the fishery was significantly lower in 2020 compared to both 2019 and 2021 (both P<0.05). For the 2019 data this is likely to be caused in part by the large peak in landings during August which has not been seen in subsequent years. Catch levels for 2021 were higher than 2020 for all months fished.
- Quantity landed during the 2021 season varied from 542 kg (May) to 6,206 kg (September).

Hours fished by permit holders (encompassing all species) showed no significant difference between the three years.

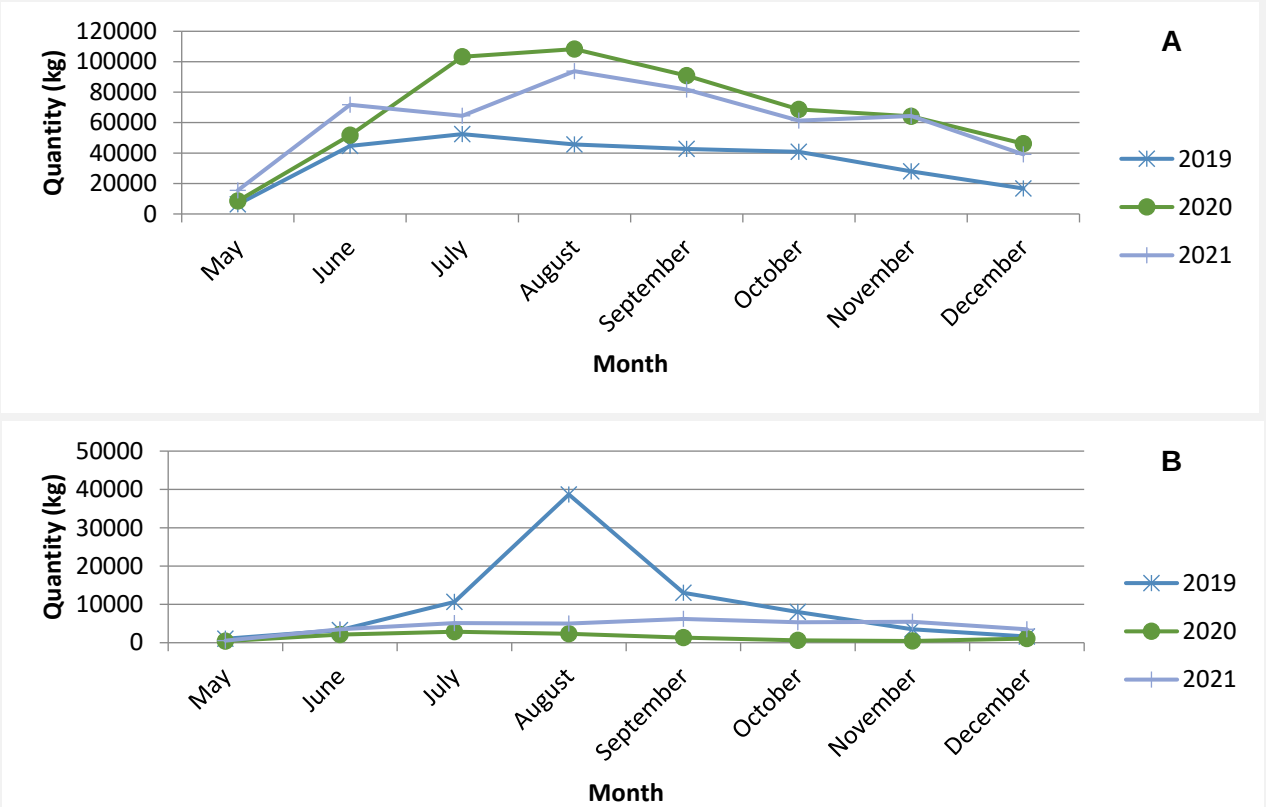

Figure 5. Quantities of A) Manila clam and B) common cockle recorded on the monthly catch return forms submitted by permit holders under the Poole Harbour Dredge Permit Byelaw for the 2019, 2020 and 2021 fishing seasons.

4.3 Comparisons of zoned catch data (2019-2021)

The requirement for fishers to report the fishing zone in which they have been fishing each day alongside the catch weight (defined by species) was first introduced for the 2019 fishing season. Therefore, the ability to analyse catch data by fishing zone, and the ability to compare between fishing years is available for 2019-2021.

4.3.1 Manila Clam

Figure 6 shows the weight of Manila clam taken from each of the eleven catch zones for the 2019-2021 fishing seasons. Comparing between years for each zone showed that for Zone 1 the quantity landed in 2020 was significantly higher than in 2021 ($P<0.05$), for Zone 5 the quantity landed in 2021 was significantly higher than in 2019 ($P<0.05$) and for Zone 8 the quantity landed in 2021 was significantly higher than in 2019 ($P<0.05$). Zone 7 also showed a significant difference between years but there was not enough variance between groups to show significant results in post-hoc testing.

4.3.2 Common Cockle

Figure 7 shows the weight of Common cockle taken from each of the eleven catch zones for the 2019-2021 fishing seasons. Comparing between years for each zone returned no statistically significant results.

For both Manila clam and common cockle, there were some zones where it was not possible to compare the data due to there being less than three data values. For Manila clam this was Zone 6, for common cockle this way Zones 5, 6 and 7.

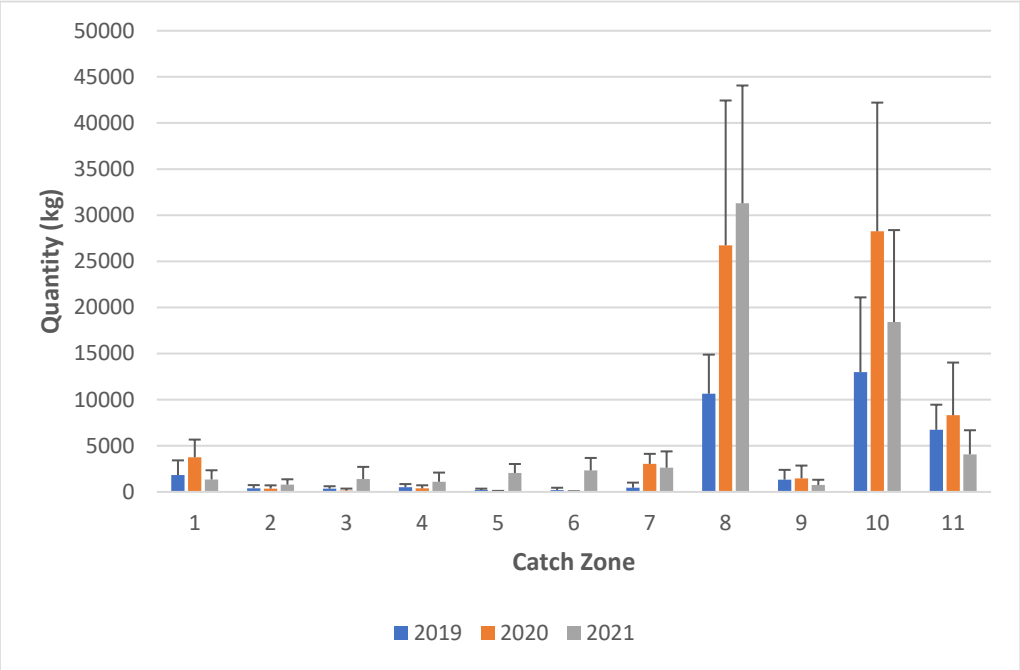

Figure 6: Total catch (kg) of Manila clam for each of the catch zones, 1 to 11, for 2019 to 2021. The error bars represent the standard deviation.

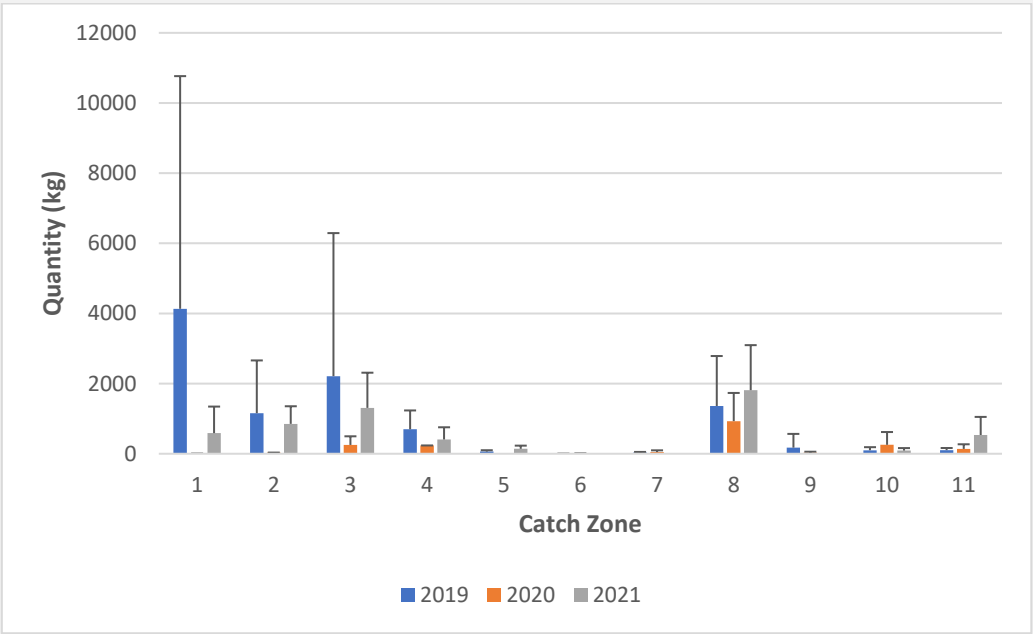

Figure 7: Total catch (kg) of Common cockle for each of the fishing zones, 1 to 11, for 2019 to 2021. The error bars represent the standard deviation.

5. Discussion

- Sites 18(2) and 19(2), with an average size below MCRS for Manila clam, fall within the preferred fishing location in the Harbour, the Wareham Channel. The proportion of Manila clams over MCRS will have been greatly reduced during the preceding fishing season (May to December), with these sites falling within the second and third most fished areas of the Harbour for the 2021 fishing season. In addition, the period between this and the 2022 survey being carried out is likely to have seen temperatures below the threshold for active growth. It is expected that by early-mid summer during the 2022 fishing season there would be a greater proportion of Manila clam over MCRS at these sites.
- An average size below MCRS was also noted for the two sites in Holes Bay. These sites have been closed to fishing activity under the Poole Harbour Dredge Permit Byelaw since July 2015 so there should be no influence of fishing activity on the stock. The average size in this area was also at or slightly below the MCRS in 2019 (sites not surveyed in 2020) so there is some consistency noted in the average length for these sites. Due to an absence of fishing effect, it may be that variation in growth allometry may account for the results in Holes Bay. Manila clam is noted to grow differently in different areas of the Harbour with some areas having clams that are longer with a narrower depth and some areas showing increased depth but smaller length. The growth pattern of clams in Holes Bay is not known but given the differences observed in other areas of the Harbour it may be that clams in this area are growing more in depth than length explaining the length results seen in the survey.
- As in previous years, the average size of common cockle was above the minimum size for all sites. Quantities of cockle harvested by the fishery are consistently lower than Manila clam therefore it is likely that a proportion of stock above MCRS was maintained after the fishing season and is then captured during the survey.
- Higher CPUE values for both Manila clam and cockle are consistent with popular fishing areas for each species and reflects a habitat driven distribution with Manila clam showing a higher CPUE in muddy, fine-grained sediments and cockle showing a higher CPUE in sandy, coarse-grained sediments. The higher levels of Manila clam under MCRS in Zones 10 and 11 is also consistent with preferred habitat type and areas within those zones which are sheltered and potentially provide a suitable area for settlement of larvae.
- Where significant differences in CPUE for both species were noted between survey years, the 2022 survey data showed a higher CPUE than at least one of the previous two years (except in Zone 1 for Manila clam under MCRS). This indicates that the stock appears to be robust to the fishing pressure exhibited in the previous season. For Manila clam in particular, the stock appears to be able to withstand the observed increase in fishing pressure in 2020 and, although slightly lower, in 2021 compared to landings in 2019 and previous years.
- The ability to quantify CPUE for both species through the survey and the ability to quantify landings from the fishery through the catch return data provided by fishers allows for the survey results to be analysed against the level of fishing. The zonation of the Harbour, introduced in 2019, allows for direct comparisons and has the potential to allow for zoned stock management in the future if this was deemed to be required.
- The next step for this fishery is to explore the ability to define empirical reference points for stocks of Manila clam and common cockle based on the timeseries dataset that has been created. In this way stock could be managed through a monitoring and control plan with thresholds set for review and management action, adding an additional method of monitoring sustainability alongside monitoring of the fishery in relation to conservation objectives.