Southern IFCA Survey Report

Solent Bivalve Survey

Autumn 2021 to Spring 2022

1. Introduction

The Solent Bivalve Survey is carried out twice each year to assess the distribution and abundance of bivalve species[1] in three bivalve Management Areas defined under the Solent Dredge Permit Byelaw, namely Area 4 (Southampton Water), Area 5 (Portsmouth Harbour) and Area 6 (Langstone Harbour). The survey in spring provides information on the stock following the closure of the dredge fishing season and the survey in autumn on the stock prior to the opening of the fishing season in November. The results of the survey focus on the two main bivalve species harvested commercially in these Management Areas, the Manila clam (*Ruditapes philippinarum*) and the common cockle (*Cerastoderma edule*). The results from the survey provide data which can be used as a baseline against which to monitor trends in stock levels and potential changes in the population of commercial bivalve species which will feed into the future development of management for the Solent Dredge Permit Fishery.

2. Methodology

The spring 2022 survey took place between 22nd – 24th March using three local fishing vessels, familiar with each management area, operating a box clam dredge consistent with normal fishing practice (figure 1).

Figure 1. Photo of the box clam dredge used in the survey.

Each management area has defined survey sites which represent areas of different fishing intensity and habitat type. The areas surveyed also span a range of classifications for shellfish species as defined by the Food Standards Agency. The survey sites for each management area are shown in Figure 2.

Shellfish samples were obtained using the following methodology.

1. Three dredge tows, timed at one minute, within each survey site area (consistent across all survey years)
2. After one minute the dredge was brought inboard, and any bivalves were retained
3. The presence/absence of different sediment types and other habitat identifiers including weed and slipper limpet (*Crepidula fornicata*) were recorded and abundance scored on a scale of 1-5
4. 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
5. Manila clams and cockles were separated into above and below their minimum conservation reference size (MCRS) (35mm and 23.8mm respectively) and then weighed
6. All samples were returned to shellfish production areas with the same classification as that from which they had been taken after measuring

[1] This survey collects information on all bivalve species obtained, however the methodology mirrors that used to target clam and cockle species primarily. Scallops are an important bivalve for this fishery however the stock of this species is surveyed separately using a different gear type.

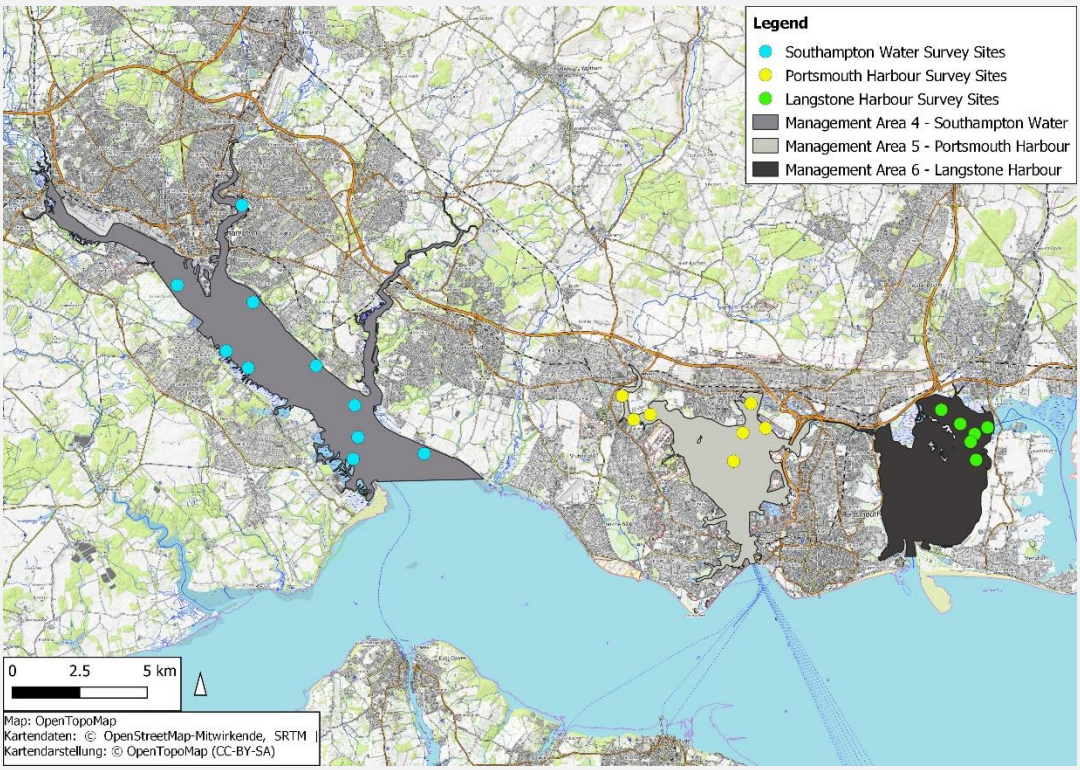

Figure 2. Map showing each of the three management areas surveyed and the location of survey sites within each area.

3. Results

The results of the survey focus on 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*), king scallop (*Pecten maximus*), Chlamys (*Chlamys islandica*) and the blue mussel (*Mytilus edulis*).

3.1 Catch Per Unit Effort

Data on the abundance and distribution of Manila clam and common cockle is presented as catch per unit effort, defined as kg of shellfish per metre of dredge per hour, for each sampling site. CPUE is provided for each species at or above the minimum conservation reference size and below the minimum conservation reference size (MCRS). It should be noted that, given the sampling method is size selective, data for stock below MCRS will not be representative of the full portion of the stock of each species in these size classes, however consistency in survey methodology between years allows for comparisons. The use of CPUE consistently between survey years and pre/post fishing season allows for statistical comparisons to identify if there are any significant changes to the stock of these two species. These comparisons are made for each management area.

3.1.1 Comparison between pre and post the 2021-22 fishing season

CPUE data from autumn 2021, as a representation of pre-fishing season conditions, has been compared to CPUE data from spring 2022, as a representation of post-fishing season conditions for each management area considering CPUE at or above MCRS and below

MCRS. The average CPUE for each species at or above MCRS and below MCRS for each management area for the autumn 2021 and spring 2022 surveys is shown in Figure 3. Results showed that for the management areas as a whole:

Manila Clam[2]

- For Southampton Water, there was no significant difference in CPUE at or above MCRS (P=0.804) or below MCRS (P=0.087) between the autumn 2021 survey and the spring 2022 survey.
- For Portsmouth Harbour, there was no significant difference in CPUE at or above MCRS (P=0.876) or below MCRS (P=0.513) between the autumn 2021 survey and the spring 2022 survey.
- For Langstone Harbour, there was no significant difference in CPUE at or above MCRS (P=0.340) or below MCRS (P=1.000) between the autumn 2021 survey and the spring 2022 survey.

Common Cockle[2]

- For Southampton Water, there was no significant difference in CPUE at or above MCRS (P=0.168) between the autumn 2021 survey and the spring 2022 survey. The CPUE below MCRS was significantly higher in spring 2022 (average 0.5 kg per metre of dredge per hour) than autumn 2021 (average 0.1 kg per metre of dredge per hour) (U=318.5, P<0.01).
- For Portsmouth Harbour, there was no significant difference in CPUE at or above MCRS (P=0.449) between the autumn 2021 survey and the spring 2022 survey. The CPUE below MCRS was significantly higher in spring 2022 (10.7 kg per metre of dredge per hour) than autumn 2021 (0.2 kg per metre of dredge per hour) (U=25.5, P<0.001).
- For Langstone Harbour, there was no significant difference in CPUE at or above MCRS (P=0.182) or below MCRS (P=0.216) between the autumn 2021 survey and the spring 2022 survey.

[2] Analysis was performed using a non-parametric Mann-Whitney U-Test as the data failed a normality test.

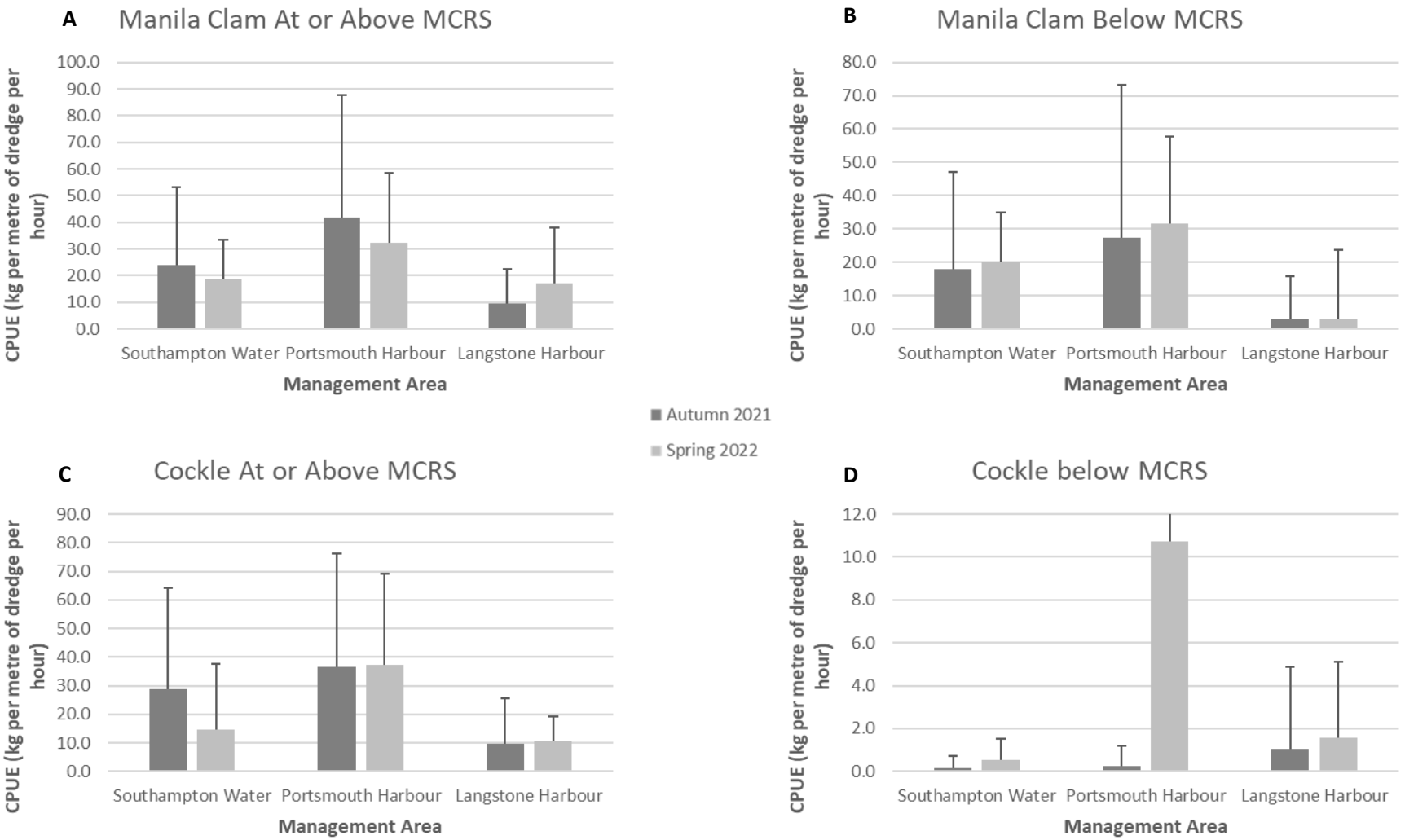

Figure 3: CPUE (kg of shellfish per metre of dredge per hour) for A) Manila clam at or above MCRS, B) Manila clam below MCRS, C) Cockle at or above MCRS and D) Cockle below MCRS for the three management areas; Southampton Water, Portsmouth Harbour and Langstone Harbour for the survey in Autumn 2021 (dark grey) and Spring 2022 (pale grey). Error bars show the standard deviation.

3.1.2 Comparison between survey years for spring (post-fishing season) surveys

CPUE data for surveys carried out in the spring, representing post-fishing season conditions, has been compared between survey years. For Manila clam CPUE data is available for 2018-2020 and 2022 and for common cockle for 2020 and 2022 (weight data for cockle was not collected prior to 2020), please note there is no survey data available for spring 2021 due to the Covid-19 pandemic. The average CPUE for each species at or above MCRS and below MCRS for each management area for each available year is shown in Figure 4. Results showed that for the management areas as a whole:

Manila Clam[3]

- For Southampton Water, CPUE data was not available for spring 2018 as survey conditions were too rough to take weight data for samples. Comparisons for 2019, 2020 and 2022 showed that the CPUE at or above MCRS was significantly higher in 2020 (average 28.6 kg per metre of dredge per hour) compared to 2019 (average 18.9 kg per metre of dredge per hour) ($P<0.05$). CPUE below MCRS was significantly higher in 2020 (average 40.7 kg per metre of dredge per hour) than in 2022 (20.1 kg per metre of dredge per hour) ($P<0.05$).
- For Portsmouth Harbour, there was no significant difference between years for CPUE at or above MCRS ($P=0.058$). CPUE below MCRS was significantly higher in 2022 (average 31.6 kg per metre of dredge per hour) compared to 2018 (average 8.3 kg per metre of dredge per hour) ($P<0.05$).
- For Langstone Harbour, there was no significant difference between years for CPUE at or above MCRS ($P=0.567$). CPUE below MCRS was significantly higher in 2019 (average 1.8 kg per metre of dredge per hour) than 2018 (average 0.3 kg per metre of dredge per hour) ($P<0.05$).

Common Cockle[2]

- For Southampton Water, there was no significant difference in CPUE at or above MCRS ($P=0.325$) or CPUE below MCRS ($P=0.426$).
- For Portsmouth Harbour, there was no significant difference in CPUE at or above MCRS ($P=0.592$) or CPUE below MCRS ($P=0.865$).
- For Langstone Harbour, there was no significant difference in CPUE at or above MCRS ($P=0.669$) or CPUE below MCRS ($P=0.093$).

3.1.3 Comparison between survey years for autumn (pre-fishing season) surveys

CPUE for surveys carried out in the autumn, representing pre-fishing season conditions has also been compared between survey years. This is only possible for Manila clam as cockle weight data was not collected prior to 2020 and there is no autumn data for 2020 due to the Covid-19 pandemic therefore autumn 2021 is the only survey with CPUE data for cockle. For Manila clam, CPUE data is available for 2018, 2019 and 2021. The data is shown in Figure 5.

Manila Clam[3]

- For Southampton Water there was no significant difference between years for either CPUE at or above MCRS ($P=0.826$) or below MCRS ($P=0.116$).
- For Portsmouth Harbour there was no significant difference between years for either CPUE at or above MCRS ($P=0.267$) or below MCRS ($P=0.196$).
- For Langstone Harbour there was no significant difference between years for either CPUE at or above MCRS ($P=0.468$) or below MCRS ($P=0.959$).

[3] Analysis was performed using a non-parametric Kruskall-Wallis Test as the data failed a normality test.

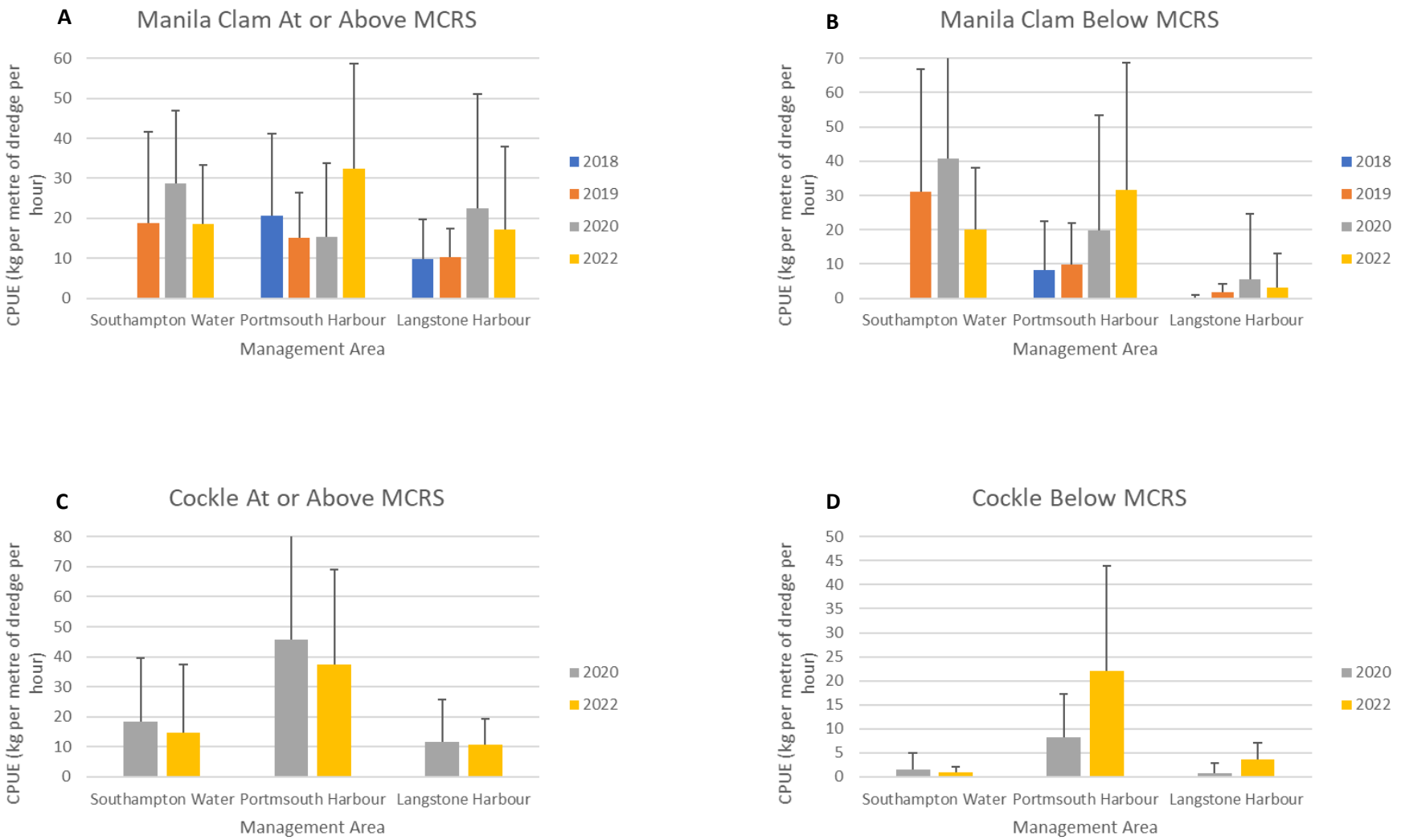

Figure 4: CPUE (kg of shellfish per metre of dredge per hour) for A) Manila clam at or above MCRS, B) Manila clam below MCRS, C) Cockle at or above MCRS and D) Cockle below MCRS for the three management areas; Southampton Water, Portsmouth Harbour and Langstone Harbour for surveys carried out in the spring. For Manila clam data is available for 2018-2020 and 2022 (except for Southampton Water where there is no data available for 2018). For common cockle data is available for 2020 and 2022. There is no survey data from spring 2021 due to the Covid-19 pandemic. Error bars show the standard deviation.

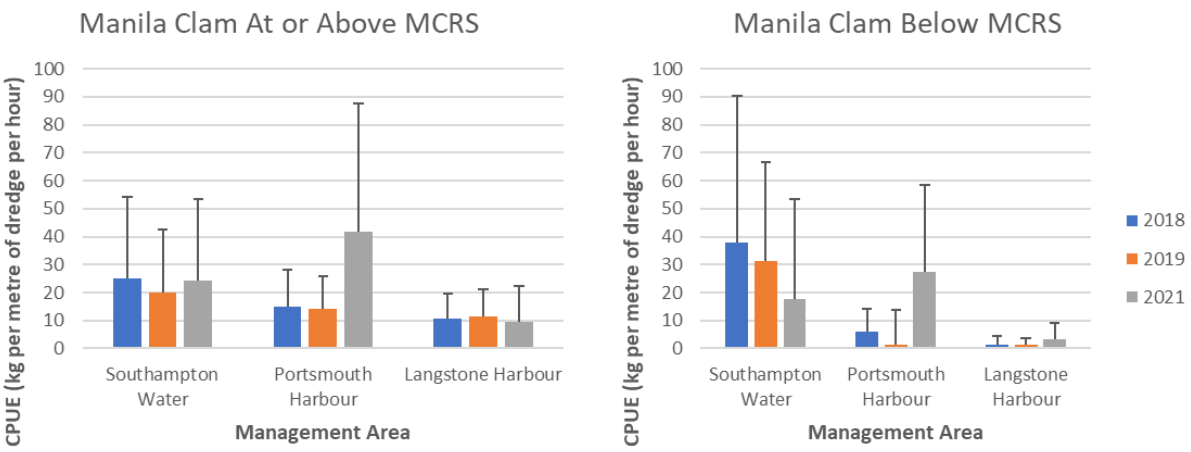

Figure 5: CPUE (kg of shellfish per metre of dredge per hour) for Manila clam at or above MCRS and Manila clam below MCRS for the three management areas; Southampton Water, Portsmouth Harbour and Langstone Harbour for surveys carried out in the autumn. Data is available for 2018, 2019 and 2021. There is no survey data from the autumn 2020 survey due to the Covid-19 pandemic. Error bars show the standard deviation.

3.2 Average Length

3.2.1 Comparison between pre and post the 2021-22 fishing season

The average length of each species was compared between the Autumn 2021 survey as a representation of conditions pre-fishing season and the Spring 2022 survey as a representation of conditions post-fishing season. The average length for each species in each management area for each survey is shown in Figure 6.

Manila Clam

- For Southampton Water and Portsmouth Harbour there has been a slight decrease in the average length in the spring 2022 survey compared to the autumn 2021 survey. For Southampton Water this was a decrease of 0.6mm from 35.7mm in the autumn 2021 survey to 35.1mm in the spring 2022 survey and for Portsmouth Harbour this was a decrease of 0.4mm from 35.7mm in the autumn 2021 survey to 35.3mm in the spring 2022 survey.
- For Langstone Harbour there was a slight increase in the average length in the spring 2022 survey (40.3mm) compared to the autumn 2021 survey (39.2mm).
- In all cases the average length was above the MCRS of 35mm.

Common Cockle

- For all three management areas, the average length decreased from the autumn 2021 survey to the spring 2022 survey. This decrease was most pronounced in Southampton Water with a decrease of 2mm from 29.2mm in autumn 2021 to 27.2mm in spring 2022, and Portsmouth Harbour with a decrease of 1mm from 27.9mm in autumn 2021 to 26.9mm in spring 2022.
- For Langstone Harbour the decrease in average length was only by 0.2mm from 28.9mm in autumn 2021 to 28.7mm in spring 2022.
- In all cases the average length was above the MCRS of 23.8mm.

3.2.2 Comparison between survey years for spring (post-fishing season) surveys

The average length of each species was visualised for each spring survey from 2018 to 2022 (there is no data for 2021 due to the Covid-19 pandemic) and is shown in Figure 7.

Manila Clam

- For Southampton Water the average length for the management area varied from 33.8mm in spring 2019 to 35.1mm in 2022. However, the average size in the 2022 survey was influenced by one site having an average length over the minimum size of 35mm which was site 8 in the River Itchen (39.4mm based on 30 individuals), without this site included, the average length for the management area is 34.2mm. The average length is seen to increase in 2020 and 2022 compared to 2018 and 2019 but only in 2022 (with the inclusion of site 8) is the average size above the MCRS of 35mm.
- For Portsmouth Harbour the average length for the management area varied from 35.3mm in 2022 to 38.9mm in 2020. The average length has been consistently above MCRS for all spring surveys but there has been a noticeable decrease in average length in the most recent survey.
- For Langstone Harbour the average length for the management area varied from 39.5mm in 2020 to 41.1mm in 2018. The average length has been consistently above MCRS for all spring surveys, numbers of individuals are lower than in the other two management areas, varying from 175-370 individuals (2019 and 2022).

Common Cockle

- For Southampton Water the average length for the management area varied from 26.1mm in 2018 to 27.2mm in 2022. The average length has remained consistently above the MCRS of 23.8mm for all spring surveys. The 2022 survey showed the longest average length of all survey years.
- For Portsmouth Harbour the average length for the management area varied from 26.7mm in 2020 to 28.2mm in 2018. The average length has remained above MCRS for all spring surveys, the average length in 2020 and 2022 was lower than in 2018 and 2019 but there has been a slight increase in 2022 compared to 2020.

For Langstone Harbour the average length for the management area varied from 27.8mm in 2020 to 29.8mm in 2019. The average length has remained above MCRS for all spring surveys, as with Portsmouth Harbour, the average length in 2020 and 2022 was lower than in 2018 and 2019 but there has been an increase in the average length between 2020 and 2022.

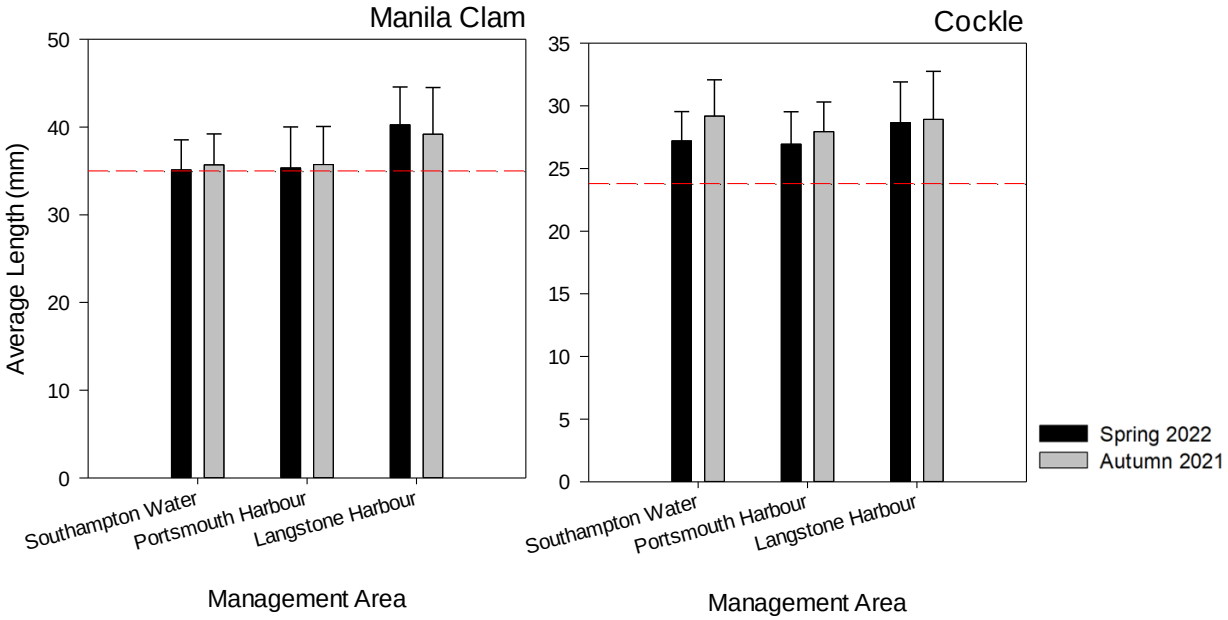

Figure 6: Comparison of average length of Manila Clam and Cockle between the Spring 2022 Solent Bivalve Survey and the Autumn 2021 survey. Data is shown for each management area and a reference line is provided to show the Minimum Conservation Reference Size for each species (35mm for Manila clam and 23.8mm for cockle). Error bars represent the standard deviation.

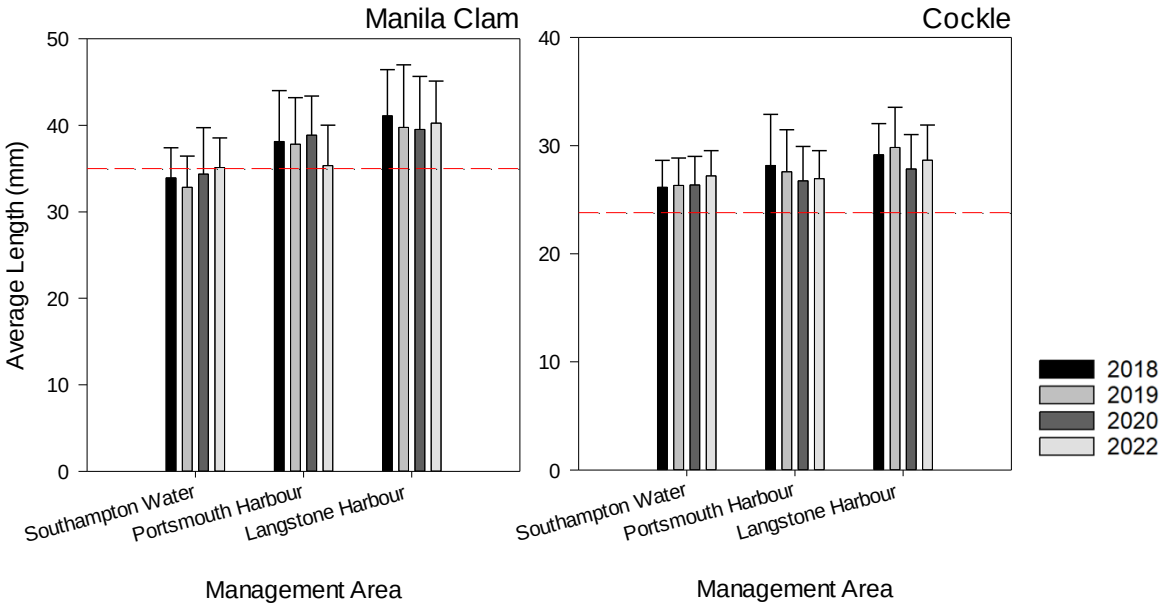

Figure 7: The average length of Manila clam and Cockle for spring Solent Bivalve Surveys between 2018-2022 (there is no data for 2021 due to the Covid-19 pandemic). Data is shown for each management area and a reference line is provided to show the Minimum Conservation Reference Size for each species (35mm for Manila clam and 23.8mm for cockle). Error bars represent the standard deviation.

3.2.3 Comparison between survey years for autumn (post-fishing season) surveys

The average length of each species was visualised for each autumn survey from 2018 to 2021 (there is no data for 2020 due to the Covid-19 pandemic) and is shown in Figure 8.

Manila Clam

- For Southampton Water, the average length varied from 32.8mm in 2019 to 35.7mm in 2021. The survey in 2021 is the first time that the average length was above the MCRS and shows an increase of 2.9mm from the previous autumn survey (2019).
- For Portsmouth Harbour, the average length varied from 35.4mm in 2019 to 37.0mm in 2018. Average length has been consistently above MCRS for all years with no distinct pattern in change of length with year.
- For Langstone Harbour, the average length varied from 33.3mm in 2019 to 42.1mm in 2018. For both 2018 and 2021 the average length was above MCRS and there has been an increase in average length of 6mm between 2019 and 2021.

Cockle

- For Southampton Water, the average length varied from 25.42mm in 2018 to 29.19mm in 2021. There has been a progressive increase in average length each year with an increase of 2.7mm between 2019 and 2020. In all years the average length was above MCRS.
- For Portsmouth Harbour, the average length varied from 26.6mm in 2019 to 27.9mm in 2021. In all years the average length has been above MCRS but the pattern is inconsistent between years.
- For Langstone Harbour, the average length varied from 28.1mm in 2018 to 28.9mm in 2021. In all years the average length has been above MCRS and there has been a small increase in average length each year.
- In all management areas, the data from the autumn 2021 survey showed the longest average length.

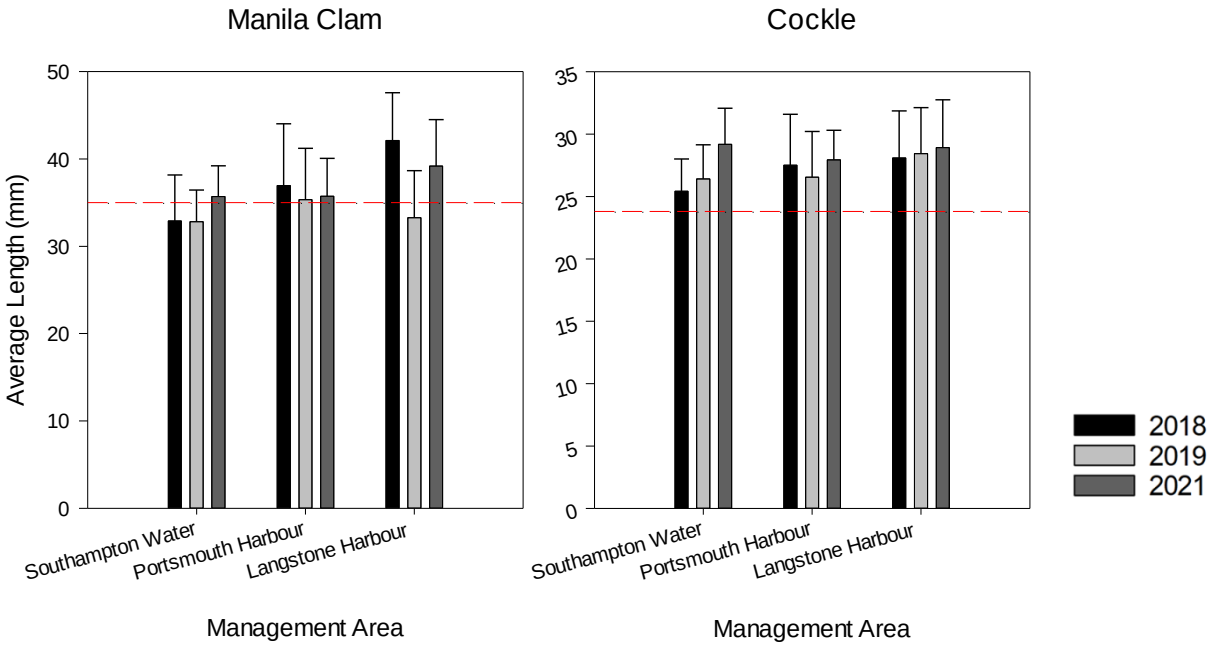

Figure 8: The average length of Manila clam and Cockle for autumn Solent Bivalve Surveys between 2018-2021 (there is no data for 2020 due to the Covid-19 pandemic). Data is shown for each management area and a reference line is provided to show the Minimum Conservation Reference Size for each species (35mm for Manila clam and 23.8mm for cockle). Error bars represent the standard deviation.

4. Discussion of Results

CPUE

- Comparing CPUE for Manila clam and Common cockle between the pre-fishing season conditions and post-fishing season conditions does not suggest that the activity of the dredge fishery has had a negative impact on the stock in any of the three management areas.
    - For Common cockle there may have been a good spatfall in 2020/2021 which has led to significant increases in individuals below MCRS in both Southampton Water and Portsmouth Harbour.
- Comparing CPUE between years for pre-fishing season surveys showed no significance between years for CPUE for any management area.
    - This may suggest that the fishery is able to recover sufficiently from previous fishing pressures during the closed season and that varying effort levels have not impeded this recovery process. Utilising catch data in the future will allow for comparisons to fishing effort from previous seasons and it is likely that factors additional to fishing pressure will be governing the results seen but these are outside the scope of this survey.
- Comparing CPUE between years for post-fishing season surveys there has been a significant increase in Manila clam below MCRS in Portsmouth Harbour, the CPUE values showing an increase year on year. Again, this may reflect good spatfalls for this species. Although not significant, there has also been an increase in Manila clam at or above MCRS in Portsmouth Harbour.
    - Anecdotally it has been suggested that fishing levels in this management area were lower during the 2021/22 season that previously which may explain the higher CPUE. With the introduction of the Solent Dredge Permit Byelaw in November 2021, permitted fishers are now required to submit catch data to the Southern IFCA which includes data on hours fished and species caught in each area. The 2021/22 fishing season is the first season where catch data has been required so comparisons cannot yet be made on fishing effort between years, however the data shows that only 80kg of Manila clam was harvested from Portsmouth Harbour during the season (November 21 to March 22) which suggests a low level of fishing effort.
- For Southampton Water, CPUE of Manila clam is lower in 2022 than in 2020 but is at a similar level to CPUE from 2019 so has not shown a decrease below previously recorded levels.
    - Catch data from the 2021/22 dredge season shows that the highest quantity of Manila clam was taken from Southampton Water (55.3 tonne), however the lack of significant difference between the CPUE value for post-fishing and pre-fishing season suggests that fishing effort is not the only influencing factor on stock levels.

Average Length

- Average length of each species is seen only to differ by small amounts between pre-fishing and post-fishing conditions and between years for spring and autumn surveys. For the autumn surveys comparing between years, in all management areas for both Manila clam and cockle, the average length had increased in 2021 compared to the previous survey in 2019 suggesting that fishing pressure is not having an impact that is noticeable following the closure period for the fishery. The only noticeable decline was seen in Portsmouth Harbour between spring survey years for Manila clam where the average length declined by 3.6mm.
    - As above, catch data indicates that fishing effort in this area was low therefore the change in average size is likely not to be directly related to fishing pressure. The increase in CPUE in this site both at or above and below MCRS may be resulting in a density influence on growth and therefore average length but this survey does not provide data which allows this to be tested.
- The average length of Manila clam in Southampton Water being at or slightly below the MCRS of 35mm is consistent between years and is possibly a reflection of higher levels of fishing effort in this area historically.
    - Historic levels of fishing effort cannot be quantified as the requirement for fishers to indicate hours fished has only recently been introduced, however as a timeseries dataset on fishing

effort is built, this will help indicate whether future patterns in average length can be related to fishing intensity.

In summary, the data from the autumn 2021 and spring 2022 surveys does not indicate that the Solent Dredge Permit Fishery is have a negative effect on the stock of the two main commercially harvested species studied in the annual bivalve survey, the Manila clam and the Common cockle. As the collection of catch and effort data continues under the new permit scheme, future survey work will be able to be analysed against these additional data sources to provide a quantified assessment of the impact of fishing intensity on stock levels.