Southern IFCA District - Whelk Survey 2023

This report has been produced by the Southern Inshore Fisheries and Conservation Authority.

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1. Introduction

This is the first report on a new survey, first carried out in 2023, to assess the population of the common whelk (*Buccinum undatum*) across the Southern IFCA District, sampling; Lyme Bay, Weymouth Bay, Poole Bay and The Solent, UK. The survey was carried out during early April 2023 using local commercial fishermen from each area and their site-specific whelk pots. The aim is to repeat this survey annually to create a dataset on the stocks of whelk, as a commercially important species, and to monitor trends in abundance and density between different areas and over time. This survey forms part of the Southern IFCA Whelk Monitoring Programme (see S1.3) and outcomes from this survey will provide data on the whelk population which can be used as a baseline on which to monitor future changes and trends, and how these relate to current and proposed management measures for the whelk fishery. The results from this survey program will be reviewed in conjunction with other available evidence as part of future management reviews, a review of MCRS by Southern IFCA and/or the introduction of a national Whelk Fisheries Management Plan under The Fisheries Act 2020. This work will be used along-side further studies within the area; such as the collaboration with the University of Southampton that is investigating size of maturities (SOM) for whelks across the District.

1.1 The Fishery

Over the past two decades, whelks have rapidly become one of the UK's most economically important fisheries, sitting as the fourth most valued species landed in England by UK vessels (Blue Marine Foundation, 2022). Landings into English ports, by UK vessels, increased six-fold from 3,500 tonnes in 1998 (UK Sea Fisheries Annual Statistics, 1998) to 22,100 tonnes in 2020 (MMO, 2021). Over the same period, the value of whelk landings rose from ~£400 per ton (UK sea fisheries annual statistics 1998) to £1,235 per tonne (MMO, 2020) with the fishery total UK landings valued at a high of £27 million in 2020 (£19.8m in England) (BLUE, 2022). Now, post disruptions from the pandemic, the total UK landings value is similar to 2018 at £22 million (MMO 2018, 2020, 2021).

The species is of considerable importance to vessels of ≤10 metres in length that make up a large part of the UK's inshore fishing fleet (MMO, 2018). Vessels in this size category predominantly work the 0-12 nautical mile inshore zone where whelk populations are found in high abundances between depths of 5 and 100m (Nielson, 1974; Morel & Bossy 2004). In 2018, whelks made up nearly a quarter of all shellfish landed by ≤10 metre vessels (MMO, 2018), providing an important source of local income to coastal communities. The whelk fishery typically takes place from March to July, with landings peaking in May (BLUE, 2022). However, some fishermen do fish as early as December, depending on demand, sale price and weather conditions.

2021 UK Whelk landings value

£22 million

Currently, the UK whelk fishery is managed under a minimal number of regulations. Whelks are not subject to EU total allowable catch (TAC) as they are a non-quota species (BLUE, 2022) and in England, national measures currently only include a Minimum Conservation Reference Size (MCRS) of 45mm. In addition, an increase in demand from abroad, near year-round availability of stock, low start-up costs and the decline in alternative fisheries have made it a popular displacement fishery (Haig et al., 2015; McIntyre et al., 2014). Whelk also provide a valuable alternative to fishers on off-seasons for crab and lobsters. As a result, the industry has expanded rapidly and raised concerns that whelk populations are at risk of unsustainable exploitation.

The whelk potting fishery uses a specific type of pot designed for capturing whelk (Figure 1.1), often using discarded 25 litre plastic containers. One side of the container is removed and replaced with a section of netting with a hole in the centre to act as an entrance. This entrance forms the top of the trap. This allows the whelks an easy entry to the pot, but then it is almost impossible to get out. The bottom of the pot is weighted with a block of cement to ensure that the pot lands upright on the seabed and remains

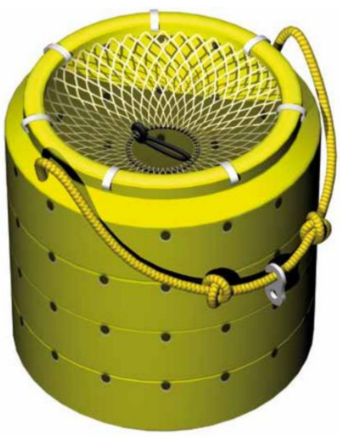

Figure 1.1 – Typical whelk pot (Seafish, 2015).

this way when it's fishing. Inside, there will be some method of fixing the bait and numerous holes are made around the pot to allow the water to drain from it as the pot is hauled. Multiple whelk pots are attached to a string with each end being indicated by surface buoys. Pots are left for anywhere between 6 – 48 hrs to 'soak' before being retrieved. By-catch is negligible, due to the design of the pots, most other fish and shellfish can easily escape before the gear is hauled. Any unwanted by-catch is typically returned to the sea alive. Within the district bycatch commonly includes dog whelk and crabs.

1.2 The Common Whelk

The common whelk (*Buccinum undatum*) is a boreal, neogastropod mollusc native to the subtidal waters of the UK and north Atlantic continental shelf (Golikov, 1968), typically preferring sandy bottom areas. Whelks are opportunistic feeders, scavenging on carrion (Nasution et al., 2004), polychaetes, molluscs, echinoderms and a variety of smaller crustaceans (Nielsen, 1975; Taylor, 1978; Hamel and Himmelman, 1993). Individual whelk can grow up to 150mm in length.

Studies indicate Whelk populations in Europe are autumnal and winter breeders (Fretter and Graham, 1984; Kideys et al., 1993) with egg deposits thought to occur in winter and on into early spring (Thorson, 1946; Fretter and Graham, 1962).

Whelks have several life-history characteristics that make them vulnerable to fishing pressure (Shrives et al., 2015). The species lack a planktonic larval phase and are relatively sedentary as adults, limiting their dispersal potential and gene flow, resulting in local variations and adaptations (Weetman et al., 2006; Shelmerdine et al., 2007; BLUE, 2022). Subsequently, they are known to form discrete sub-populations named stocklets and demonstrate significant variation in the size-at-maturity, even over small spatial scales (Haig et al., 2015). Sexual maturity is not reached for several years and is dependent on geographical location. Up to 2,700 eggs may be laid in one mass with only 1% of eggs hatching, as individuals who hatch first typically eat the remaining unhatched eggs (BLUE, 2022).

1.3 The District and Current Management

The Southern Inshore Fisheries and Conservation Authority (SIFCA) are responsible for the management of the commercial whelk fishery within the 0-6 nautical miles of coastal waters in the Southern District.

The whelk fishery in England is dominated by fisheries along the south coast, with large volumes of whelk being removed from the SIFCA district each year. The weight of whelk landings in English ports from 2009-2019 are highlighted in an AIFCA/NEFC report, 2022 (Figure 1.3). Given the commercial importance of this species, it is important that the District's whelk populations are assessed in order to provide data that will help inform sustainable management approaches.

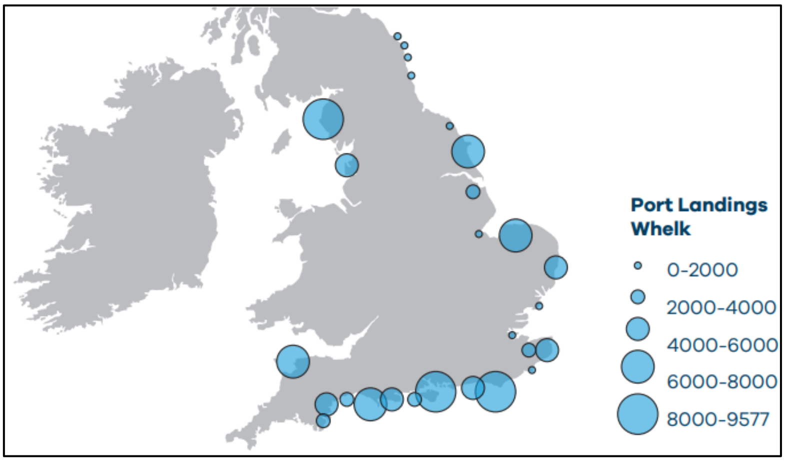

Figure 1.3 - English port landings of whelk from 2009-2019.

Southern IFCA currently have a proposed Pot Fishing Byelaw, which includes a permitting element and associated conditions. For commercial whelk fisheries, fishers would be required to hold a permit, to have all pots marked with tags issued by Southern IFCA and for strings of pots to be marked clearly using marker buoys at each end. In developing this management approach, SIFCA committed to implementing a Whelk Monitoring Program.

2. Materials and Methodology

Areas for the survey were chosen to sample all four main fishing areas within the SIFCA district, to aim identify any variation within the whelk population. Current fishing areas were selected in conjunction with fishers, using their knowledge and experience of the areas commonly used by the fishery (Figure 2.1). The areas sampled were: the Solent, Poole Bay, Weymouth Bay and Lyme Bay.

Data was collected in early April around the start of the fishing season, currently suggested at March to July (BLUE, 2022), with some fishers targeting whelk as early as January. Local fishers were requested to undertake their normal fishing practice, using their own site-specific whelk pots; as the height of whelk

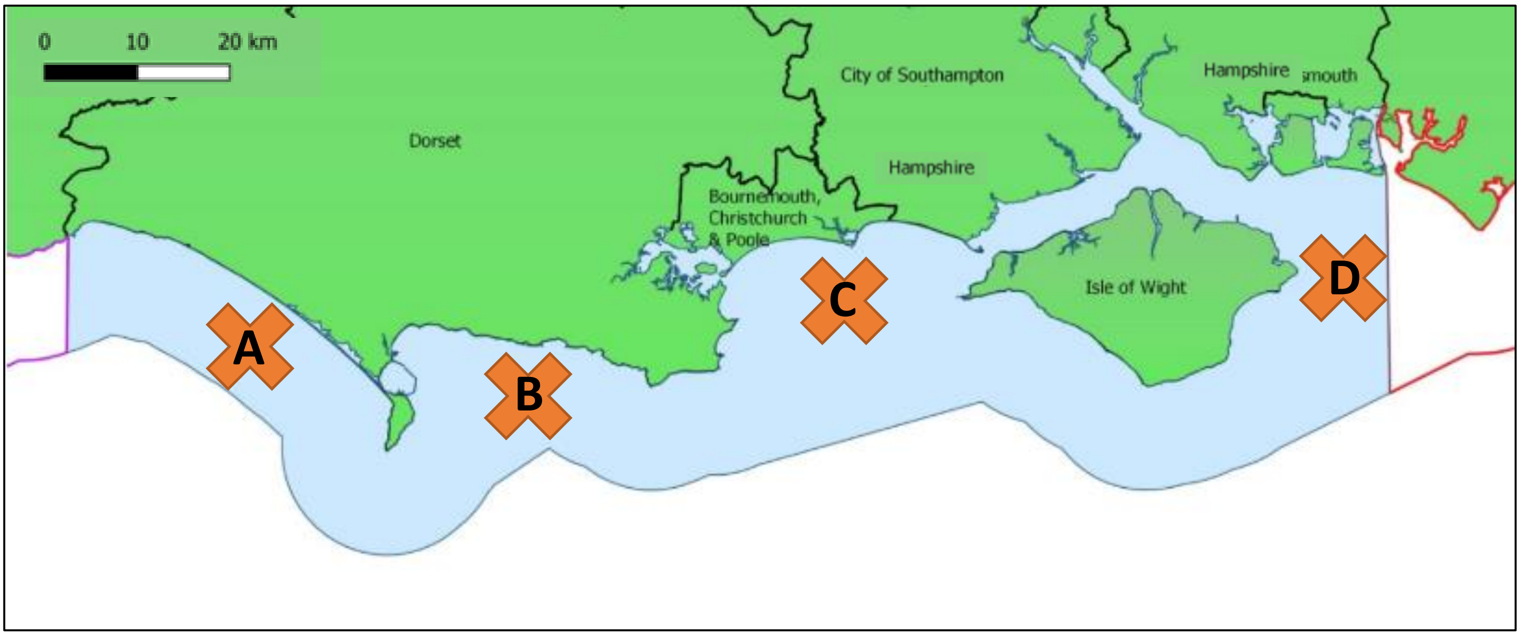

Figure 2.1 – Southern IFCA district, with orange crosses indicating the different survey areas. A as Lyme Bay, B as Weymouth Bay, C as Poole Bay and D as The Solent

pots are typically altered due to sea conditions, tidal ranges and water flow. This allowed for a more representative sample of what would normally be caught in each area allowing data to be relevant to fishing practice in each area, it is recognised that data analysis will need to be considered in light of this variation in pot set up.

Date, gear type, bait type, soak time and location (latitude and longitude) were collected on the day of retrieval. Three strings with five whelk pots were used at each site according to the following methodology:

- Whelk pots were baited and deployed between 12 and 48 hours before retrieval, dependant on weather windows.
- The GPS position, using the vessel GPS system, were recorded upon retrieval of the first pot.
- A waypoint was created at the position of the pot once out of the water using the GPS and the waypoint number recorded
- The pots were recovered in-board and all whelks from each pot emptied directly into sample bags and labelled according to area, string number and pot number.

The whelks retained were measured for the total length and widest width of the first 50 individuals, total length being from the base of the aperture to the tip of the whorl (mm), using Vernier callipers (Figure 2.2).

Individuals were separated into above or below the minimum size of 45mm and the weight (kg) of each size class was recorded (<45, 45-50, 50-55, 60-65, >65).

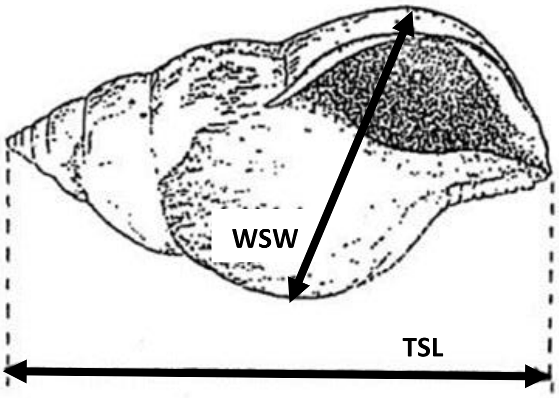

Figure 2.2 – The Total Shell Length (TSL) and the Widest Shell Width (WSW) of a whelk is determined as above. (Eastern IFCA website).

Other bycatch species were present whilst sorting whelk samples; such as the netted dogwhelk (*Tritia reticulata*). These were removed from any CPUE and TSL values. The image below shows the visual

identification between the two species (Figure 2.3).

Figure 2.3 – Four netted dogwhelk (*Tritia reticulata*) to the left and four common whelk (*Buccinum undatum*) to the right.

3. Results

3.1 Catch Per Unit Effort (CPUE)

The weight data collected was analysed to provide a value for Catch Per Unit Effort (CPUE), defined as kilograms of whelk per pot (kgs/pot). CPUE was calculated for total kg of whelk, kg of whelk over the MCRS and kg of whelk under the MCRS (MCRS = 45mm). The caveat of CPUE under MCRS is that the potting method used to obtain data for this survey is size selective due to the escape holes for drainage, which also minimize catches of whelk under the MCRS.

On this basis the data for CPUE under MCRS will not be representative of this size class as it cannot be guaranteed that all whelk under MCRS have been sampled. However, comparisons can be made between sites and over time to look for changes, in the knowledge that the sampling method is consistent.

3.1.1 Total CPUE

The site with the greatest mean average total CPUE was Lyme Bay at 4.33kgs/pot, whereas Weymouth Bay had the lowest average total CPUE at 1.54kgs/pot. The mean average for the Solent and Poole Bay were 3.12kg/pot and 2.91kg/pot, respectively.

All Shapiro-Wilks tests ($\alpha = 0.05$) indicated that the CPUE data was not normally distributed ($p < 0.05$). Therefore, non-parametric analysis of the median values were used (Figure 3.1).

A Kruskal-Wallis test showed a significant difference in the median CPUE of pots in different areas ($x^2 = 32.951$; df = 3; $p = 0.001$). The median CPUE in Weymouth Bay was 1.65kg/pot, Lyme Bay was 4.20kg/pot, the Solent was 3.30kg/pot and Poole Bay was 2.70kg/pot.

A Kruskal-Wallis multiple comparison post-hoc Dunn test (1964)(p-values adjusted with the Bonferroni method) showed a significant difference in the median total CPUE between; Lyme Bay and Poole Bay ($p = 0.043$); Lyme Bay and Weymouth Bay ($p < 0.001$); Poole Bay and Weymouth Bay ($p = 0.016$); the Solent and Weymouth Bay ($p = 0.002$). No significant differences in total CPUE were seen between Poole Bay and the Solent ($p = 1.000$) and Lyme Bay and the Solent ($p = 0.180$).

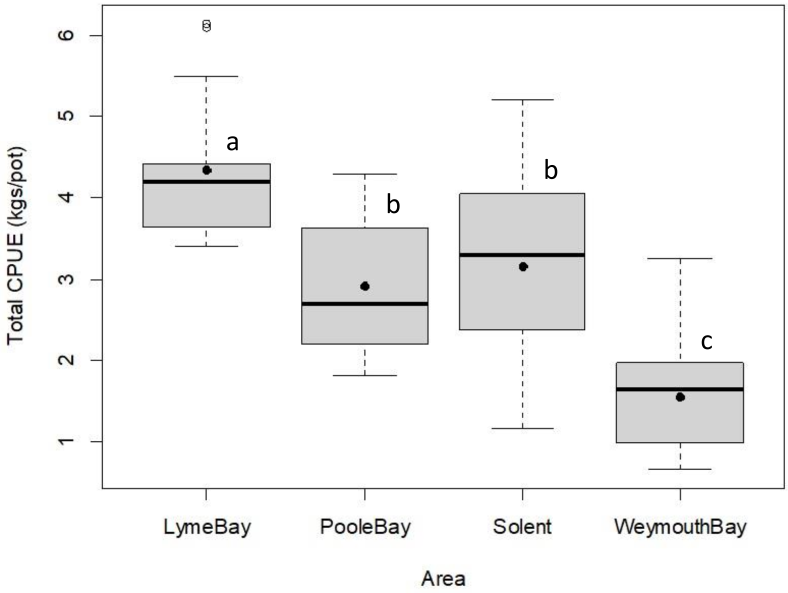

Figure 3.1 - Total Catch per Unit Effort (CPUE, kg/pot) box plots from the Survey. Stripe shows median value from samples (n=15) from each area, boxes show inter-quartiles, whiskers show range and black dots show mean.

3.1.2 Over MCRS CPUE

The site with the greatest mean average Over MCRS CPUE (O.MS.CE) was Lyme Bay (Figure 3.2) at 3.55kg/pot, whereas Weymouth Bay had the lowest average O.MS.CE at 1.53kg/pot.

All Shapiro-Wilks tests ($\alpha = 0.05$) indicated that the CPUE data was normally distributed ($p > 0.05$). A Levene's test ($\alpha = 0.05$) indicated that the data shows homogeneity of variance ($p = 0.438$).

A One-way ANOVA test ($\alpha = 0.05$) showed a significant difference in the mean O.MS.CE of pots in different areas ($F=13.07$; $p < 0.001$).

A Scheffe post-hoc test ($\alpha = 0.05$) indicated that O.MS.CE per pot from Lyme Bay (mean = 3.55kgs/pot), were significantly greater than all sites. The Solent and Poole Bay showed no significant differences between each other and had a similar mean O.MS.CE (2.59kgs/pot and 2.49kgs/pot, respectively). Weymouth Bay had a significantly smaller O.MS.CE than all sites, with a mean of 1.53 kgs/pot.

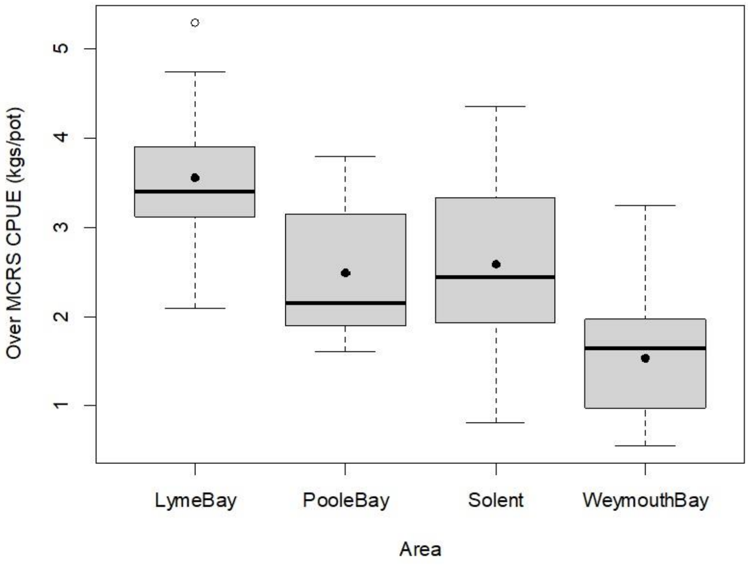

Figure 3.2 - **Bar chart with black dots showing mean Over Minimum Conservation Reference Size Catch Per Unit Effort (Over MS.CE) in kilos per pot (kg/pot) in each area (n=15). Stripe shows median, boxes show inter-quartiles, whiskers show range.**

3.1.3 Under MCRS CPUE

The site with the greatest average Under MCRS CPUE (U.MS.CE) was Lyme Bay (Figure 3.3) at 0.79kgs/pot, whereas Weymouth Bay had the lowest average U.MS.CE at 0.01kg/pot. The mean average for the Solent and Poole Bay were 0.56kg/pot and 0.42kg/pot, respectively

A Shapiro-Wilks tests (α = 0.05) indicated that the U.MS.CE data for Weymouth was not normally distributed ($p < 0.001$). The other sites (Solent, Lyme Bay and Poole Bay) were normally distributed ($p>0.05$). A log+1 transformation of the data did not alter the distribution. Therefore, non-parametric tests were used.

A Kruskal-Wallis test showed a significant difference in the median U.MS.CE of pots in different areas ($x^2 = 36.217$; df = 3; $p < 0.001$). The median U.MS.CE in Weymouth Bay was 0kgs/pot, Lyme Bay was 0.75kgs/pot, the Solent was 0.45kgs/pot and Poole Bay was 0.4kgs/pot.

A Kruskal-Wallis multiple comparison post-hoc Dunn test (1964) (p-values adjusted with the Bonferroni method) showed a significant difference in the median U.MS.CE between; Lyme Bay and Weymouth Bay ($p < 0.001$); Poole Bay and Weymouth Bay ($p = 0.004$) and finally the Solent and Weymouth Bay ($p < 0.001$). No significant differences in Under MCRS CPUE were seen between Lyme Bay and Poole Bay ($p = 0.088$); Lyme Bay and the Solent ($p = 0.507$) and Poole Bay and the Solent ($p = 1.000$).

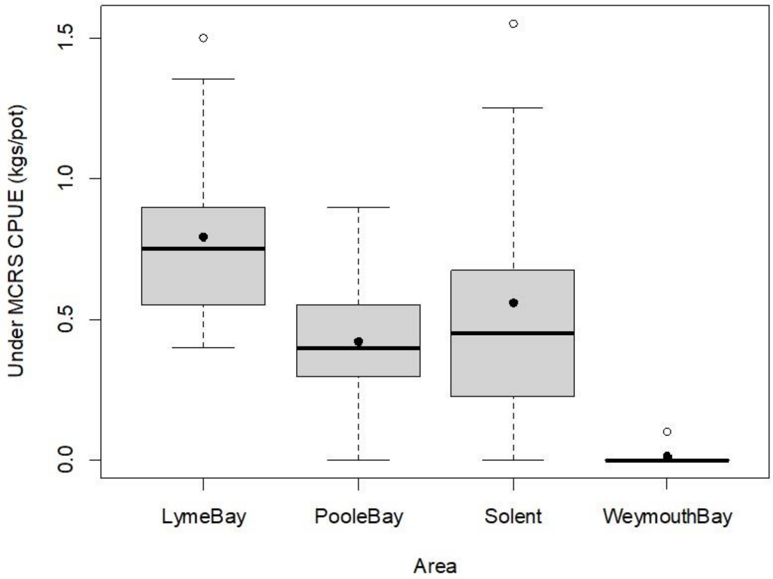

Figure 3.3 - **Under Minimum Conservation Reference Size Catch per Unit Effort (Under MS.CE, kg/pot) box plots from the Survey. Stripe shows median value from samples (n=15) from each area, boxes show inter-quartiles, whiskers show range and black dots show mean.**

3.1.4 Total Catch by Weight descriptives

From looking at the average weight per pot, between 1 - 18% of the haul was under the MCRS (Figure 3.4). With the largest average percentage of undersize per haul located at Lyme Bay and the Solent (18%) and the smallest at Weymouth Bay (1%).

Figure 3.4 – Percentage weight of catch above and below the MCRS of 45mm across the different sites within the survey.

Poole Bay had a longer soak time than any of the other three sites with 48 hours compared to 24 and 20 hours seen at other sites (Table 1). However, this had no notable effect on the number of undersize whelk, with the number of undersize remaining lower than the Solent or Lyme Bay. Weymouth Bay had the shortest soak time and also had the lowest percentage of undersize whelk present.

Hole width varied between fishers from 13mm to 25mm. Drainage holes may affect the total number of undersize individuals within each pot due an increasing number of whelk being able to escape with an increase in the size of the drainage holes. Therefore, the drainage holes effectively act as an escape gap, a strategy used in other IFCAs (Eastern, Kent & Essex and Sussex).

Table 1 - Comparison of soak time and drainage-hole width across all areas.

	Lyme Bay	Poole Bay	Solent	Weymouth Bay
Soak Time (hrs)	24	48	24	20
Hole width (mm)	20-22	13	25	25

3.2 Total Shell Length Frequency data

A visual analysis of the total shell length (TSL) frequency data from all four areas showed that Weymouth Bay had a wider range of TSL data than any other area (Figure 3.5).

All Shapiro-Wilks tests ($\alpha = 0.05$) indicated that the TSL data is not normal ($p < 0.05$).

Comparing the median TSL of whelks (mm) (all strings combined) between each area (Poole Bay, Weymouth Bay, Lyme Bay and the Solent) using a Kruskal-Wallis test and post-hoc Dunn's Method showed that there was a significant effect of area on TSL ($x^2 = 253.63$; df = 3; $p = 0.001$).

The median TSL in Poole Bay was 52mm, Weymouth Bay was 63mm, Lyme Bay was 53mm and the Solent was 52mm.

"In all areas, the mean and median ***were greater than the MCRS*** *of 45mm"*

A Kruskal-Wallis multiple comparison post-hoc Dunn test (1964)(p-values adjusted with the Bonferroni method) showed a significant difference in the median TSL between; Lyme Bay and Poole Bay ($p < 0.001$); Lyme Bay and the Solent ($p = 0.012$); Lyme Bay and Weymouth Bay ($p < 0.001$); Poole Bay and Weymouth Bay ($p < 0.001$) and finally the Solent and Weymouth Bay ($p < 0.001$). No significant differences between TSL were seen between Poole Bay and the Solent ($p = 1.000$).

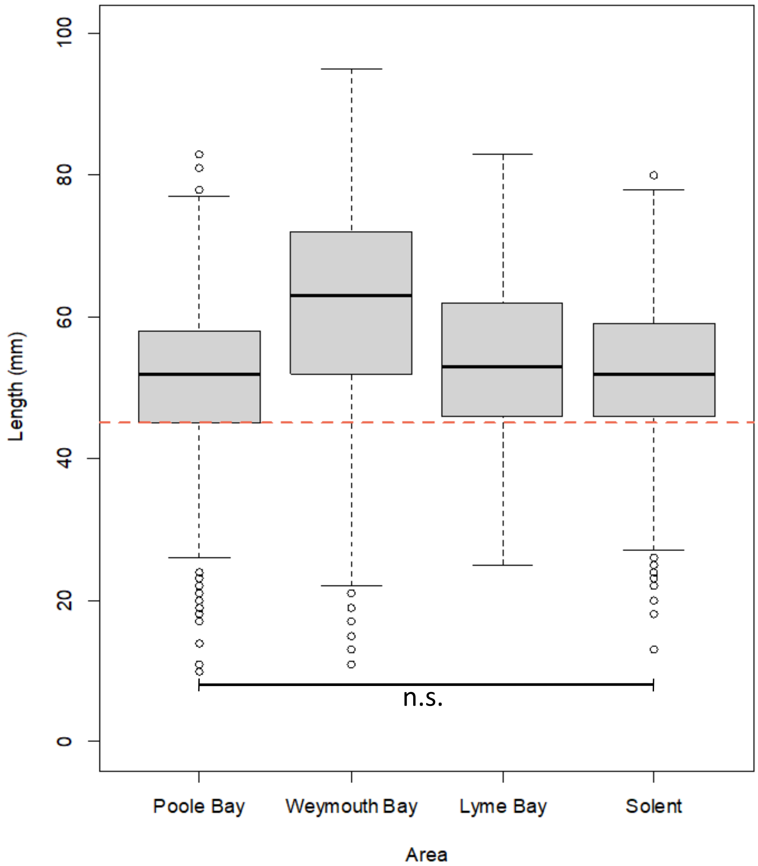

Figure 3.5 – Comparison of the TSL of whelks measured (mm). The thick black line shows the median TSL, the red dotted line represents the minimum conservation reference size of whelk of 45mm.

In all areas, the mean and median TSL were greater than the MCRS for the district of 45mm. In all areas the inter-quartiles were more than or equal to the MCRS.

The largest individual was found in Weymouth Bay at 95mm.

3.2.1 Poole Bay size distribution

The distribution follows a bell-shaped curve (Figure 3.6). The greatest number of whelk were seen in the 45-50mm class (n=157) with the next highest number in the 50-55mm size class (n=154). Of the number of individuals caught 74.7% were above the MCRS while the remaining 25.3% were undersize.

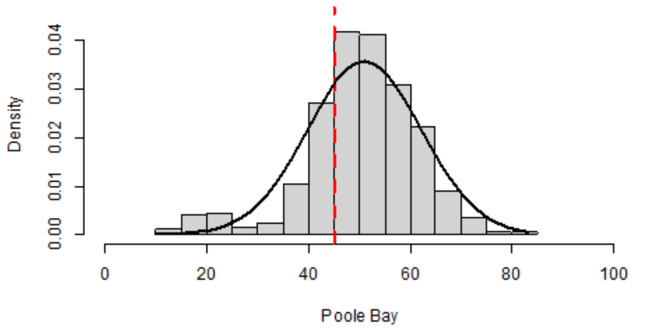

Figure 3.6 – Density of whelk caught in the Poole Bay in 5mm size classes.

3.2.2 Weymouth Bay size distribution

The distribution follows a bell-shaped curve (figure 3.7). The greatest number of whelk were seen in the 60-65mm class (n=100) with the next highest number in the 70-75mm size class (n=84). Of the number of individuals caught 86.8% were above the MCRS while the remaining 13.2% were undersize.

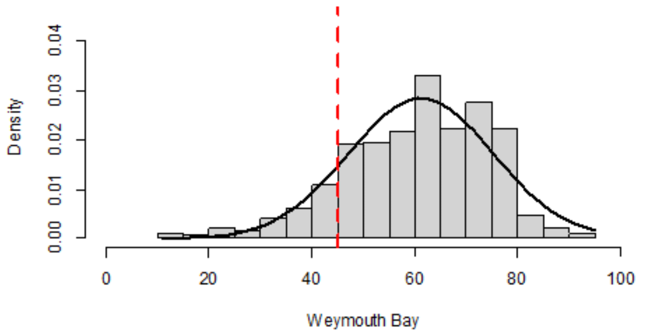

Figure 3.7 – Density of whelk caught in the Weymouth Bay in 5mm size classes.

3.2.3 Lyme Bay size distribution

The distribution follows a bell-shaped curve (Figure 3.8). The greatest number of whelk were seen in the 45-50mm class (n=130) closely followed by the next highest number in the 50-55mm size class (n=111). Of the number of individuals caught 76.9% were above the MCRS while the remaining 23.1% were undersize.

"the common whelk (Buccinum undatum) is abundant with the average size in all areas above the 45mm MCRS"

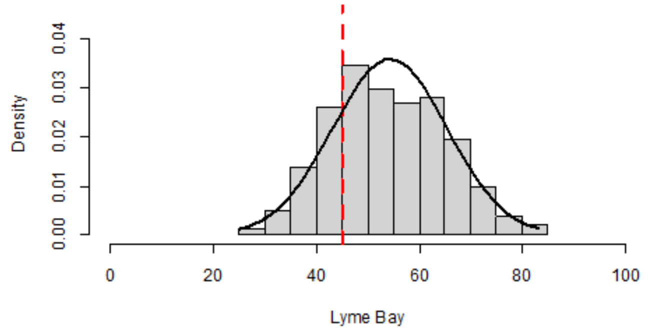

Figure 3.8 – Density of whelk caught in the Lyme Bay in 5mm size classes.

3.2.4 Solent size distribution

The distribution follows a bell-shaped curve (Figure 3.9). The greatest number of whelk were seen in the 55-55mm class (n=168) with the next highest number in the 45-50mm size class (n=139). Of the number of individuals caught 76.3% were above the MCRS while the remaining 23.7% were undersize.

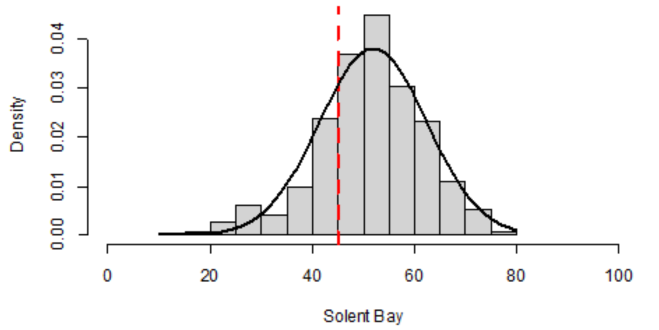

Figure 3.9 – Density of whelk caught in the Solent in 5mm size classes.

4. Discussion

This was the first survey of whelk populations carried out across the Southern IFCA district, as part of the Whelk Monitoring Programme, which has provided a baseline for population structure and catch rates that can be monitored through repeated survey work over time. The aim is to continue to repeat the methodology outlined in this report on an annual basis to build up a time series dataset on the populations of the whelk and to determine trends and patterns of abundance and density between the different areas sampled and between years. Site co-ordinates have been retained to ensure consistency and CPUE in particular will provide a useful metric for monitoring trends in whelk populations. With a single year of data, no conclusions can be drawn on the relationship between the whelk populations and potential influencing factors. As the time-series is developed the data will be able to be analysed in light of any changes in management measures to determine if any changes can be identified or, if trends in the data emerge, what external factors could be contributing to the patterns seen.

In general, the data from this survey shows that the common whelk (*Buccinum undatum*) is abundant with the average size in all areas above the 45mm MCRS. In all cases, the mean, median and both upper and lower interquartile rangers were greater than the current MCRS. At present 75% (and higher) of all catch are above the MCRS in all areas. The MCRS for whelk is subject to much debate with a view that the current national size of 45mm is not in line with biological data. This is supported by a recent University of Southampton study which suggested that 50% of the whelk population across the SIFCA district reaches sexual maturity at a size of 56mm (Hadley & Jensen, 2023). It is likely that discussions on MCRS, and other management for whelk, will be forthcoming at a national level with the Whelk FMP, one aim of this survey was to collect data that would help inform those discussions from a Southern IFCA District perspective and ensure that site-specific evidence was available as part of the wider evidence base.

When comparing Over MCRS CPUE across different sites within the district significant differences were seen. The weight of whelk caught in Lyme Bay (3.55kg/pot) were significantly higher than those caught in any other area; while the weight of whelk caught in Weymouth Bay (1.53kg/pot) were significantly lower than in any other area. This could be indicative of a number of factors, with known influences on whelk populations in other areas including fishing pressure or genetic variation and ecological and environmental conditions, such as: depth, predation pressure and availability of food sources (Olabarria and Thurston, 2003; Fahy *et al*. 2006; McIntyre *et al*., 2015). Although, Weymouth Bay had a significantly lower Over MCRS CPUE on average, the individual whelk from Weymouth Bay had a greater weight per individual. On average in Weymouth Bay each whelk weighed 33.4g compared to 18.1g in Lyme Bay, 17.8g in the Solent and 13.7g in Poole Bay. This is related to Weymouth Bay showing a greater number of larger individuals with fewer under MCRS (1% of total catch) than any other site.

The average length comparison showed that the only sites that weren't significantly different were between Poole Bay and the Solent. Three of the sites' medians and interquartile ranges only differed by small amounts (Poole Bay, Lyme Bay and Solent) with only 1mm difference between median values. Weymouth Bay had a noticeably larger range of TSL with the largest recorded reaching 95mm and the smallest at 6mm. The median and interquartile ranges were also increased at this site. However, it should be noted that the total number of organisms sampled in Weymouth Bay was not as high. This is because on average Weymouth Bay had only 46.2 individual whelk per pot, compared to 238.8 in Lyme Bay, 212.6 in Poole Bay and 177.2 in the Solent. It is noted that smaller sample sizes can skew results and decrease statistical power. This could explain the wider range and higher values on the box and whisker pot of TSL for the Weymouth Bay area.

5. Summary

In summary, the data presented provides a baseline for comparisons with future whelk studies. The methodology used has allowed the collection of data which, over time, will contribute to an evidence base that will help contribute to future reviews of management, with relevance to the proposed Pot Fishing Byelaw that is currently in draft with Southern IFCA and other reviews including MCRS and outcomes of the Whelk FMP.

Additional data collected over the years will be analysed against this baseline providing a quantified assessment on the population of whelks across the main commercial areas of the Southern IFCA District.

The survey demonstrates that there is a variable size range for whelk in the district, which also includes those yet to enter the fishery (<45m), although quantifying the smaller size classes is difficult as they would not have been sampled effectively by the fishing gear.

The number of whelk caught in size ranges >65mm decreased, however the results from Weymouth Bay indicated that large whelk are still present in the district and individually weigh more than those of a smaller size.

6. Acknowledgements

The successful completion of the survey was due to assistance provided by local members of the fishing community engaged in the fishery.

7. References

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