Southern IFCA Whelk Population Survey- 2024

This report has been produced by Southern Inshore Fisheries and Conservation Authority.
Reported by IFCO Celie Mullen

A copy of the report is available on our website at www.southern-ifca.gov.uk or from Southern IFCA Office at:

Unit 3, Holes Bay Park, Sterte Road West, Poole, Dorset, BH152AA

Tel: 01202721773, email: enquiries@southern-ifca.gov.uk

1. Introduction

This paper describes the 2024 Southern IFCA Whelk Population Survey. The survey is conducted annually as part of the Southern IFCA Monitoring Programme to generate a timeseries dataset, monitor whelk stocks across the Southern IFCA District (the District) and inform evidence-based management.

In 2024, the second annual survey was undertaken, aimed at collecting whelk data from four regions within the District: The Solent, Poole Bay, Weymouth Bay, and Lyme Bay. The findings from this research, in conjunction with the Whelk Catch Per Unit Effort (CPUE) Pilot Project, which is due to commence in late 2024, will contribute to the Southern IFCA Whelk Monitoring Programme. This programme is designed to enhance our understanding of whelk stocks across Dorset, Hampshire, and the Isle of Wight, and to provide evidence on the effectiveness of management measures, for example under the proposed Pot Fishing Byelaw, which is currently undergoing Quality Assurance (QA) with the Marine Management Organisation (MMO). The time series data from the District aims to help contribute to national research efforts and datasets and support the post-publication phase of the Whelk Fisheries Management Plan (FMP).

1.1 The Fishery

UK landings of whelk reached 14.3 000 tonnes in 2022 and while demersal and pelagic species landings decreased in this year, shellfish landings increased over 260% (Marine Management Organisation, 2022). Low start-up costs and near-year-round availability have made whelks an attractive alternative fishing option in substitute of other fisheries. Similarly, whelk fishing complements or replaces other fisheries such as crab and lobster in the off-season (Haig *et al.,* 2015; McIntyre *et al*., 2014; McIntyre *et al.,* 2015). Within the Southern IFCA District, the fishery is generally active from March to July, with some fishing as early as December. Landings reach their highest during May, however, weather conditions, market value and demand contribute to the length of the season. Data on stocks is limited at a national scale, and the potential for regional differences emphasises the importance of local and regional data collection. There is a need to understand the relationship between whelk fishing effort and stocks in order to ensure sustainable management.

1.2 Whelk Pots

The whelk potting fishery uses a pot specifically built for collecting whelk (Figure 1) or uses recycled plastic containers (Seafish, 2024). To ensure the pot remains stable at the seabed, the bottom of the pot is lined with a cement block. Small drainage holes surrounding the pot assist in hauling methods. The top section of the pot is removed and replaced with a mesh net with a hole that allows easy entrance but almost impossible exit for whelk species. In contradiction, the bycatch from whelk potting is negligible due to escape gaps providing easy escape of fish species

Figure 1. An example of a typical whelk pot used.

before hauling. Bycatch that is commonly found consists of crab species and dogwhelk. Multiple pots are baited and attached to a single string, which is soaked from 6-48 hours before retrieval. Marker buoys as well as marker points on GIS systems are used to identify the geographical location of strings.

1.3 Common Whelk (*Buccinum undatum)*

Buccinum undatum known as the common whelk is a marine gastropod growing up to ~150mm in length. The organism features a pale-colour body, frequently adorned with black flecks, encased within a spiral shell characterised by prominent ribs and lines (Figure 2A). The posterior part of the whelk foot carries the operculum, commonly known as the shell door, a structure used to seal the shell's aperture, providing protection against potential threats (Figure 2B).

Figure 2A and 2B. Photographs of *Buccinum undatum*. The whelk shell door can be seen in Figure 2B (Alchetron, n.d.; The Wildlife Trusts, n.d.)

Whelks are ubiquitously distributed along the UK coastline, ranging from the intertidal zone to depths of approximately 1200 meters. They inhabit diverse benthic substrates, including sand, mud, and gravel (Ager, 2008; Haig et al., 2015; Hollyman, 2017). Due to their sedentary nature and lack of a planktonic larval phase, whelk populations can form localised stocklets, leading to differentiation in population characteristics over short geographical distances (Weetman et al., 2006; Shelmerdine et al., 2007; BLUE, 2022). Within these areas, whelks utilise highly developed chemosensory systems to locate food sources. They are opportunistic feeders, actively preying on bivalves, molluscs, crabs, and polychaete worms, while also scavenging carrion (Scolding et al., 2007).

Sexual maturity in whelks is reached after several years and varies with geographical location. Mating is triggered in UK waters when temperatures fall below at least 12°C, although mating has previously been displayed at 9°C in the Solent (Kideys et al., 1993; Hollyman, 2017). Post-mating, females deposit up to 2000 egg capsules, each containing approximately 1000 eggs. While the majority of these eggs do not survive, they provide a crucial food source for the few that do (Naylor, 2011).

1.4 Southern IFCA Management

Whelks are exempt from EU Total Allowable Catch (TAC) limits as they are classified as a non-quota species (BLUE, 2022). Within the Southern IFCA District, current management practices include the national Minimum Conservation Reference Size (MCRS) of 45 mm in shell length (Defra, 2018), which is applied across the supply chain and to both commercial and recreational fishers under the Southern IFCA MCRS Byelaw[1]. Given the commercial significance of this species, it is crucial to assess the District's whelk populations to provide data that will inform sustainable management strategies. The evidence collected during the Whelk Population Survey will be integrated with other research initiatives, such as the Whelk CPUE Pilot Project, to form part of the Southern IFCA Whelk Monitoring Programme.

Research outputs will contribute to building an evidence base for informing and assessing future management, including the proposed Southern IFCA Pot Fishing Byelaw, which is currently undergoing Quality Assurance with the MMO. This research will establish a baseline for understanding whelk stocks in the District and therefore evaluating the effectiveness of future management measures proposed under the byelaw. Additionally, the survey will support the gathering of evidence to support the implementation of the Whelk Fisheries Management Plan (FMP). The management measures proposed under the FMP (published in December 2023) for consideration initially over a 6-year period include pot limits, reviews of MCRS, permit schemes, catch limits, and seasonal closures (Seafish, 2023). Obtaining data at a local and regional level will aim to contribute to the evidence gaps identified by the FMP at a national level.

2. Methodology

Survey areas were selected to encompass four primary fishing regions within the Southern IFCA District, aiming to identify any variations within the whelk population across the District. These fishing areas were chosen in collaboration with local fishers, leveraging their knowledge and experience of commonly utilised fishing grounds (Figure 3). The selected areas for sampling included the Solent, Poole Bay, Weymouth Bay, and Lyme Bay, areas which have been maintained through the 2023 and 2024 surveys. Although the survey aimed to collect samples at the start of the fishing season, adverse weather conditions necessitated sampling from March to June 2024. Please note that samples could not be collected from the Lyme Bay region during the 2024 survey due to unforseen circumstances.

The methodology involved local fishers conducting their usual fishing practices, utilising their own site-specific whelk pots, which are typically adjusted in height based on sea conditions, tidal ranges, and water flow. This approach ensured a more representative sample of the typical catch in each area, making the data relevant to local fishing practices. It is acknowledged that data analysis will need to account for variations in pot setup. Fishers either conducted their fishing activities independently or with Southern IFCA officers present on board during sampling.

[1] SIFCA-MCRS-Byelaw.pdf (toolkitfiles.co.uk)

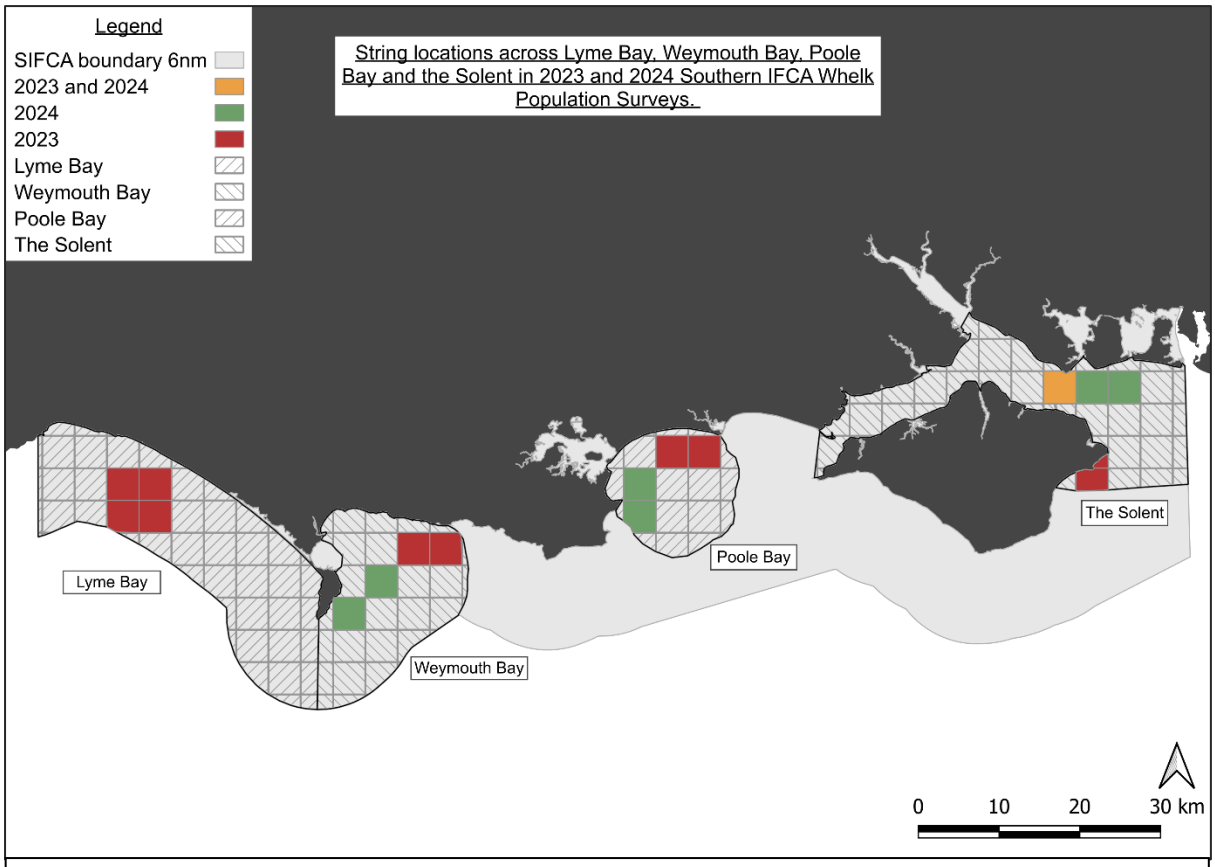

Figure 3. The Southern IFCA District. The 4 regions which samples were taken, Lyme Bay, Weymouth Bay, Poole Bay and The Solent are labelled. Fishing locations within each region are highlighted within a 4km grid system. Sampled areas from the 2023 data collection are highlighted in red, whereas areas sample during 2024 are highlighted in green. Areas that include samples from both 2023 and 2024 are shaded in orange.

Collection

Date of fishing trip, gear type, bait type, soak time and location (latitude and longitude) were collected on the day of retrieval. Five whelk pots from 3 strings were selected, providing 15 samples from each area. The methodology included:

- 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 and last pot.
- The pots were recovered in-board and all whelks from each chosen pot emptied directly into sample bags and labelled according to area, string number and pot number.

Measurement

- The retained whelks were measured for total shell length (TSL) and widest shell width (WSW) for the first 50 individuals, measurements in mm were made using Vernier callipers (Figure 4). Individuals were categorised as either above or below the MCRS of

45 mm, and the weight of each group (> or < MCRS) (in kg) was recorded.

- During the sorting of whelk samples, other bycatch species, such as the netted dogwhelk (*Tritia reticulata*), were also present. These bycatch species were excluded from any CPUE, WSW, and TSL values.

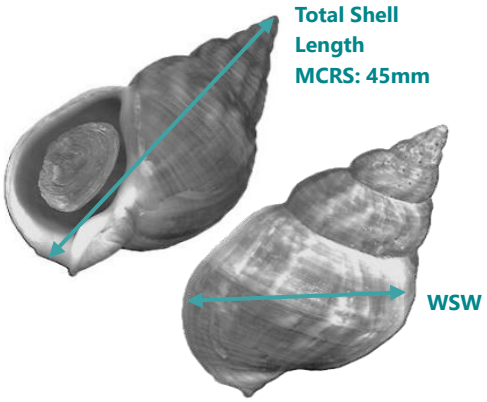

Figure 4. Diagrams of the common whelk showing the total shell length (TSL) and widest shell width (WSW).

3. Results

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). Please note potting methods used to obtain data for this survey are size selective due to the escape holes for drainage, which also minimise 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 Catch Per Unit Effort

3.1.1 Analysis of 2024 data

- In the 2024 survey, Weymouth Bay recorded the highest collected weight of whelk at 39.99 kg, while Poole Bay and The Solent reported total catches of 37.46 kg and 23.15 kg, respectively (Figure 5).
- Weymouth Bay exhibited the highest total Catch Per Unit Effort (CPUE) with an average of 2.67 kg per pot. Additionally, this site had the lowest CPUE of whelk under the MCRS, at an average of 0.073 kg per pot (Figure 5).
- The Solent demonstrated the lowest total CPUE, at an average of 1.54 kg per pot.
- The Poole Bay sample showed the highest CPUE of under MCRS whelks, at an average of 0.504 kg per pot.
- Statistical analysis of the sites revealed that the total CPUE in Weymouth Bay was significantly higher than in The Solent ($p<0.01$). This trend was also observed when comparing the CPUE of whelks above MCRS.
- The CPUE of whelk under MCRS in Weymouth Bay was significantly lower than in Poole Bay ($p<0.01$).

3.1.2 Comparison to 2023 dataset: All data combined

- A paired t-test was undertaken to compare the two datasets against each other. Please note that no data was collected in Lyme Bay in the 2024 survey due to unforeseen circumstances, although the 2023 dataset has been included in graphs for reference. Figure 5 shows the comparison of sites between years.
- The total weight of whelk collected across the three sites in the 2024 survey was 100.6 kg, which is slightly lower than the 114.2 kg recorded in the 2023 dataset for the same sites.
- Statistical analysis indicated no significant difference in the total weight of whelk collected in 2024 compared to 2023 ($p>0.05$). Similarly, there was no significant difference in the weight of whelk above or below the MCRS collected across all sites in 2024 compared to 2023 ($p>0.05$).

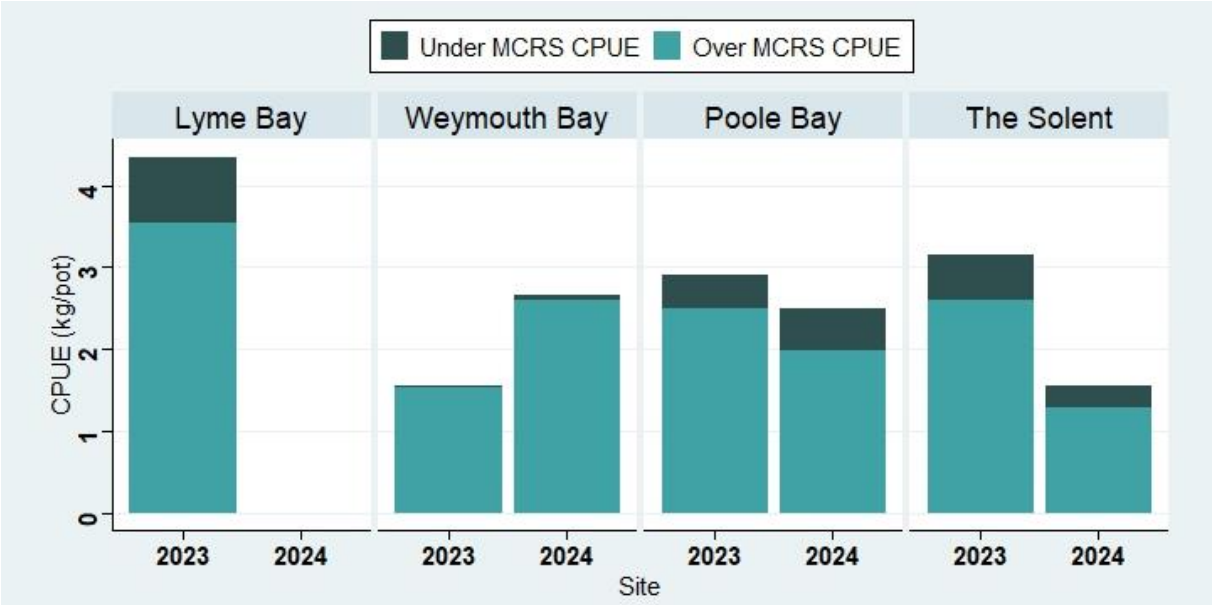

Figure 5. A comparison of Catch Per Unit Effort (CPUE) of sites surveyed within the whelk survey 2023 and 2024. Please note Lyme Bay was not surveyed in 2024. Above MCRS CPUE (above 45mm) is represented by light blue and under MCRS CPUE is represented by dark blue.

Weymouth Bay

- There was a significant increase in the total CPUE collected in the 2024 survey, at an average of 2.7 kg per pot, compared to the 2023 survey, which was 1.55 kg per pot ($p<0.01$).
- There was a significant increase in the average CPUE of whelks above the Minimum Conservation Reference Size (MCRS) in the 2024 survey, at 2.6 kg per pot, compared to 1.53 kg per pot in the 2023 survey ($p<0.01$).
- Additionally, a significantly larger CPUE of undersized whelks was observed in 2024, at 0.1 kg per pot, compared to 0.013 kg per pot in 2023 ($p<0.01$).

Poole Bay

- The total CPUE in 2024 was lower than in 2023, at 2.49 kg/pot compared to 2.94 kg/pot, although the difference was not statistically significant ($p>0.05$).

- The CPUE of whelks above the Minimum Conservation Reference Size (MCRS) was also lower in the 2024 survey compared to 2023, at 1.99 kg/pot and 2.49 kg/pot, respectively, but this difference was not significant ($p>0.05$).
- The average CPUE of whelks under MCRS was higher in 2024 than in 2023, at 0.5 kg/pot and 0.42 kg/pot, respectively, although this difference was not significant ($p>0.05$).

The Solent

- The total CPUE of whelks was significantly lower in 2024, at 1.53 kg/pot, compared to 3.15 kg/pot in 2023 ($p<0.01$).
- The CPUE of whelks above MCRS was lower in 2024, at 1.28 kg/pot, compared to 2.59 kg/pot in 2023. Similarly, the CPUE of whelks under MCRS was lower in 2024, at 0.27 kg/pot, compared to 0.56 kg/pot in 2023.
- The CPUE for both above MCRS and under MCRS whelks were statistically different between the years (both $p<0.01$).

3.2 Length Data

3.2.1 Analysis of 2024 dataset

- Statistical comparison of the 2024 dataset showed statistical differences in length of whelk across the 3 survey regions ($p<0.01$) (Figure 6).
- The average length of whelk was highest in Weymouth Bay at 63.6mm, compared to Poole Bay (50.4mm) and The Solent (48.9mm).

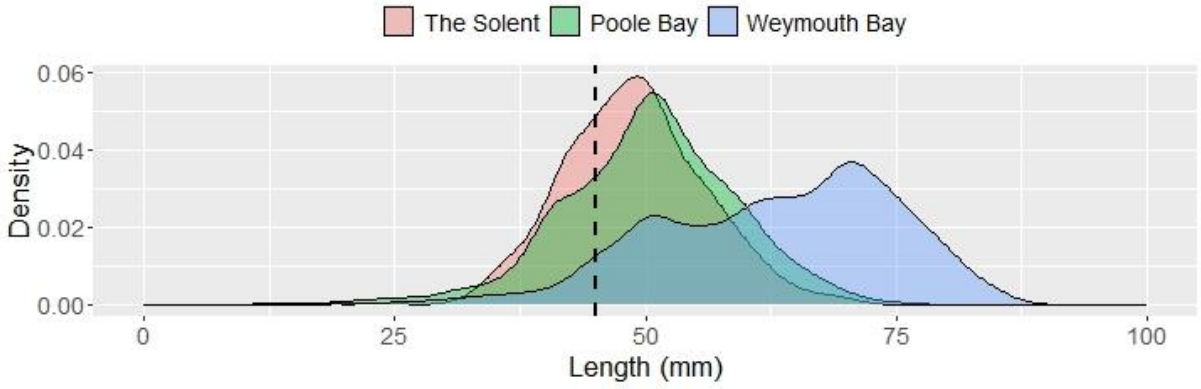

Figure 6. The length distribution of the 2024 dataset. Weymouth Bay is represented in blue, Poole Bay in green and The Solent in red. The minimum conservation reference size of 45mm is represent by a vertical dashed black line.

3.2.2 Comparison to 2023 survey

Weymouth Bay

- The average length of whelk found in Weymouth Bay was significantly higher in 2024 (63.6mm) compared to 2023 (61.1mm) ($p<0.01$).

Poole Bay

- The average length of whelk was similar between the two surveyed years ($p > 0.05$). The average length in 2024 was 50.4mm compared to 51mm in 2023.

The Solent

- Average length of whelk was statistically different between the 2023 and 2024 datasets ($p < 0.01$). The average length of whelk in 2024 (48.9mm) was lower than in 2023 (51.9mm).

3.3 Width Data

3.3.1 Analysis of 2024 dataset

- Statistical analysis of the width of whelk showed variation across the 3 surveyed sites in 2024 ($p < 0.01$), suggesting that all sites were statistically different to each other (Figure 7).
- Weymouth Bay had the largest width whelks found at 38.3mm, compared to Poole Bay (30.6mm) and The Solent (28.6mm).
- Statistical analysis of width data showed in both Weymouth Bay and The Solent, all strings showed significantly different width sizes (all p values < 0.01).

Figure 7. The width distribution of the 2024 dataset. Weymouth Bay is represented in blue, Poole Bay in green and The Solent in red.

3.3.2 Comparison to 2023 survey

Weymouth Bay

- The width of whelk in Weymouth Bay was significantly larger in 2024 compared to 2023 ($p < 0.01$).
- The average width in 2024 was 38.3mm compared to 33.7mm in 2023.

Poole Bay

- While the length of whelk in Poole Bay was similar between years the width showed significant differences ($p < 0.01$).
- The width in the 2024 was larger compared to 2023 (30.6mm compared to 29mm, respectively).

The Solent

- The width of whelk in the Solent was significantly lower in 2024 than in the 2023 survey ($p<0.01$).
- The average width in 2024 was 28.6mm compared to 30.5mm in 2023.

3.4 Size category proportion

- All sample sites exhibited at least 74% of individuals above MCRS. Notably, in Weymouth Bay, 93% of the whelk population was above the MCRS (Figure 8).
- 48% individuals caught in Weymouth Bay exceed 65mm, whereas these figures were 4% and 2% in Poole Bay and The Solent respectively.
- The 2024 dataset size category proportions were compared against the 2023 dataset. Weymouth Bay displayed similar length category distributions in 2023 and 2024. The percentage of whelk above 65m in 2024 increased from 42% found in 2023.
- Poole Bay also displayed consistent distributions of length in 2023 and 2024.
- While the percentages of whelk under and over MCRS remained similar in the Solent between 2023 and 2024, a larger proportion of the sample population occurred within smaller size categories in 2024.

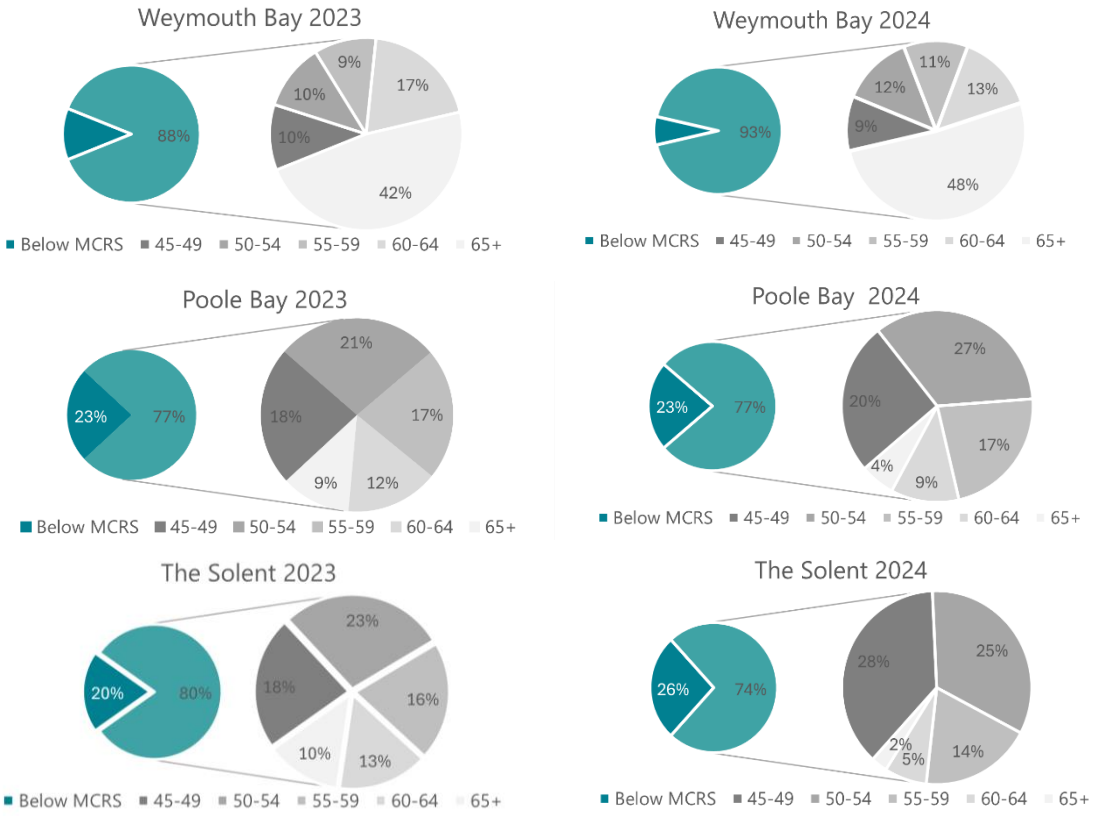

Figure 8. Pie charts representing the length distribution of whelks at each location surveyed in 2024, categorised by size and compared against the same criteria in the 2023 survey. The left pie chart for each figure represents the percentage of whelk below MCRS (dark blue) and above MCRS (light blue). The right pie charts categorise the above MCRS subsample into its representative size categories: 46-50mm, 51-55m, 56-6mm. 61-65mm >65mm. The colour varies through a gradient from dark grey to represent the smaller whelks to light grey, the bigger the whelk.

4.0 Discussion

- Although the survey is relatively novel, being only the second of its kind, it has significantly contributed to the development of a comprehensive data series for monitoring whelk populations as part of the Whelk Monitoring Programme within the Southern IFCA District. The objective is to conduct annual surveys to build a robust dataset that establishes characteristics of the whelk populations along the Hampshire, Dorset, and Isle of Wight coastlines. This dataset will help identify trends and patterns in whelk stock abundance across different sampled areas and over multiple years. While the 2024 dataset can be compared to the previous year's data, the ongoing survey efforts will enable the analysis of long-term trends to inform an evidence base for this species.

- It is recognised that the method of sampling is inherently size selective due to methods employed by fishers to reduce the quantity of whelk below MCRS which is retained in pots and thus the level of post-capture sorting required. There is likely to be an element of variation introduced by using subtly different pots in each location. However, this risk was weighed up against the need to use pots which are adapted to the conditions of each site and have been optimised by the fisher in each case to maximise capture potential in line with specific environmental considerations

- The analysis revealed variations in whelk populations across the district, indicating that there is the potential for subpopulations with differing characteristics. For instance, whelks in Weymouth were generally larger, with higher catch levels, than those in Poole Bay and in turn Poole Bay showed larger whelks and higher catch levels than in the Solent. This supports observations of varying whelk sizes across the UK (McIntyre *et al.,* 2015), even over relatively small spatial areas. 48% of individuals collected in Weymouth Bay exceeded 65mm in length compared to 2% of those collected in the Solent.

- While Weymouth Bay exhibited the lowest CPUE of whelks above the MCRS in the 2023 survey, at 1.53 kg/pot, this figure significantly increased to 2.59 kg/pot in the 2024 survey. Consequently, Weymouth Bay demonstrated the highest CPUE from a harvesting perspective compared to other areas. In contrast, the CPUE, as well as the length and width of whelks caught in the Solent, significantly decreased between years and displayed the lowest levels when compared to other sites. Variations in CPUE and whelk size may be attributed to several factors, including fishing pressure, genetic variation, ecological and environmental conditions such as depth, predation pressure, and availability of food resources. This variation can be monitored through the annual time-series dataset, as the time-series dataset is developed further analysis can be made of patterns in the population and potential influencing factors.

- The Southern IFCA survey highlights the variability that can be displayed in whelk allometry across the District, potentially influenced by a range of environmental and anthropogenic factors such as freshwater inputs and physical barriers like bay and temperature fluctuations. Consequently, small subpopulations with distinct characteristics may exist over short distances. For instance, whelks in Weymouth tend to be larger and wider, whereas those in the Solent are generally smaller and thinner, with a spiral point towards the base. Additionally, whelks in Weymouth Bay have been observed with barnacle colonies covering their shells, which were not present in other sampled areas (Figure 9).

Figure 9. Images of whelks collected from Weymouth Bay in the 2024 survey, displaying barnacle colonies across the shells.

- The notable differences observed between areas highlights the complexity surrounding effective whelk management and supports continued evidence gathering over a time series to effectively understand whelk populations and support a robust evidence base to inform appropriate management strategies which support the sustainability of whelk stocks and fisheries.

5.0 Summary

- The data collected during the 2024 Whelk Population Survey builds upon the baseline dataset established in 2023, with the goal of enhancing the understanding of whelk populations within the Southern IFCA District.
- The findings indicate that features of whelk populations vary across different geographical regions and exhibit small subpopulation variations over short distances.
- This evidence, combined with data from the Whelk CPUE Pilot Project, will contribute to the Whelk Monitoring Programme.
- This programme seeks to establish a robust evidence base to evaluate the effectiveness of future management strategies within the Southern IFCA District and contribute to national data collection programs.

6.0 References

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