# 2023 Wash intertidal cockle survey report

The 2023 Wash intertidal cockle surveys were conducted between March 21st and April 23rd, consistent with previous surveys. During the course of the surveys 1,059 stations were sampled from a total of 24 survey areas. Figure 1 shows the extent of the stations surveyed.

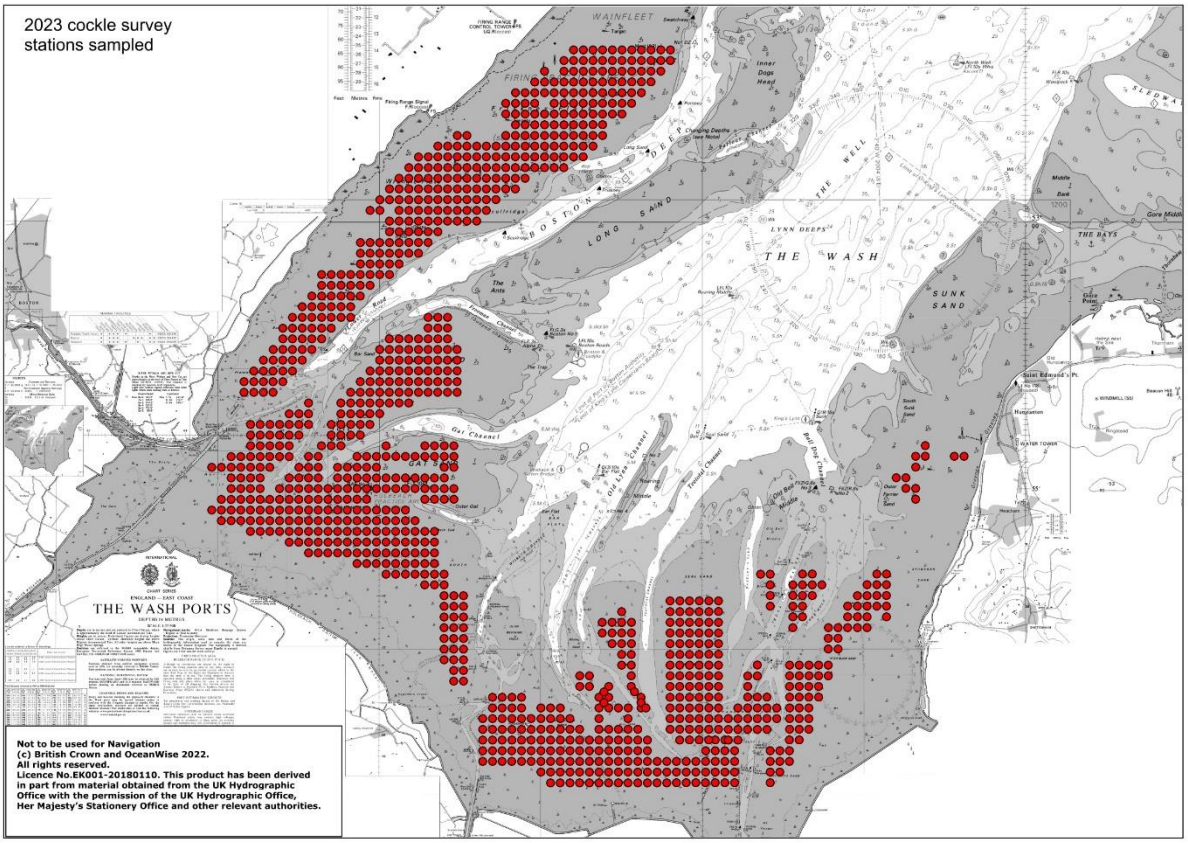


**Figure 1 – Chart showing stations sampled during the 2023 Wash cockle surveys**

## Summary of 2023 cockle stocks

| | |
|---|---|
| **Total Adult Stock** (≥14mm width) | 3,457 tonnes |
| **Total Juvenile Stock** (<14mm width) | 14,163 tonnes |
| **Total Stock** (all sizes) | 17,620 tonnes |

At the time of the 2022 survey, approximately half of the total cockle stock biomass, and almost all of the adult stock biomass came from 2018 and 2019 year-class cohorts (see figure 2). As the cockles from both of these cohorts were of a size vulnerable to atypical mortality and the 2020 cohort was too small to replace them, it was anticipated that the adult biomass would decline. The figures from the 2023 survey show that prediction was correct, and that the adult biomass had declined from 8,226 tonnes to 3,457 tonnes.

On a more positive note, the surveys found there had been good survival of the 2021 year-class cohort. In terms of cockle numbers, this had been the dominant cohort last

year, but their small size meant they only contributed to about 26% of the overall biomass. Although few of this cohort had reached 14mm width by the time of the survey, their growth meant they now represented 58% of the overall biomass. Together with juveniles from a 2022 settlement, these helped the juvenile cockle biomass increase from 5,485 tonnes to 14,163 tonnes. As the 2021 cohort is the one most likely to be targeted by the 2023 fishery, fishable stocks should be more abundant than last year.

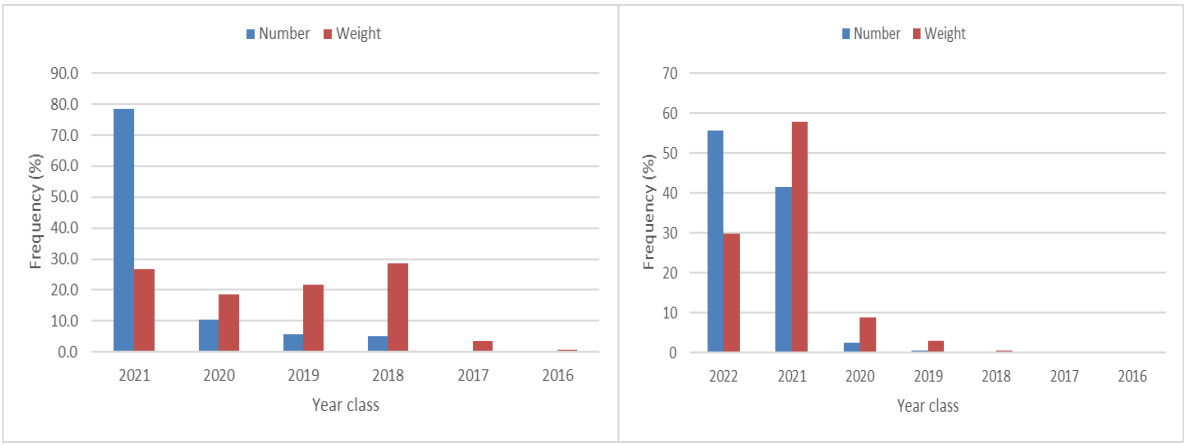


**Figure 2 – Changes to the cockle population structure between 2022 (left) and 2023 (right). Graphs show the proportionate sizes of each year-class cohort in terms of numbers (blue) and weight (red)**

Figure 3 compares this year's cockle stock with previous years. While there has been some recovery from last year, the total stock is still below average. The adult biomass is particularly low, which will impact the size of the TAC available for the fishery.

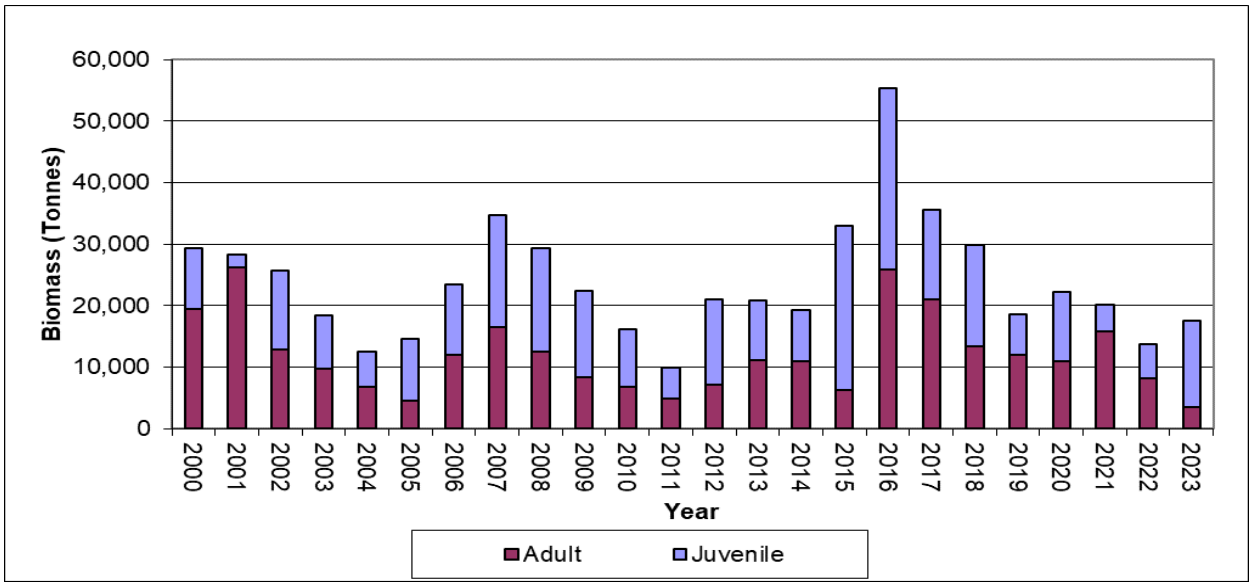


**Figure 3 - Adult and juvenile cockle stock biomass between 2000 and 2023 on the regulated beds**

The table 1 and charts 4-9, below, provide details about the stocks found on each bed and their distribution on the sands.

**Table 1 - Summary of cockle stocks on the Wash intertidal beds – April 2023**

| | Adult (≥14mm) | | | | Juvenile (<14mm) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| SAND | Area (ha) | Mean Density (no/m2) | Mean Weight (t/ha) | Biomass (t) | Area (ha) | Mean Density (no/m2) | Mean Weight (t/ha) | Biomass (t) | Total Biomass (t) | % Adult |
| **Black Buoy** | 75 | 13.33 | 0.54 | 40 | 187 | 675.33 | 7.45 | 1389 | 1430 | 3 |
| **Blackguard** | 37 | 10.00 | 0.69 | 26 | 12 | 60.00 | 0.36 | 5 | 30 | 85 |
| **Breast** | 560 | 32.89 | 1.26 | 704 | 1020 | 414.51 | 3.78 | 3855 | 4558 | 15 |
| **Butterwick** | 75 | 15.00 | 0.57 | 43 | 224 | 355.56 | 2.63 | 589 | 632 | 7 |
| **Butterwick EXT** | 75 | 18.33 | 0.78 | 58 | 249 | 306.50 | 2.18 | 543 | 601 | 10 |
| **Daseley's** | 162 | 16.92 | 0.70 | 113 | 709 | 195.44 | 1.24 | 882 | 996 | 11 |
| **Friskney** | 261 | 12.86 | 0.65 | 171 | 684 | 49.45 | 0.51 | 349 | 520 | 33 |
| **Friskney EXT** | 100 | 11.25 | 0.66 | 66 | 411 | 21.21 | 0.33 | 137 | 202 | 32 |
| **Gat** | 137 | 60.91 | 3.02 | 414 | 62 | 102.00 | 1.17 | 73 | 487 | 85 |
| **Herring Hill** | 37 | 10.00 | 0.36 | 13 | 261 | 108.10 | 1.07 | 278 | 292 | 5 |
| **Holbeach** | 411 | 24.55 | 0.97 | 398 | 709 | 138.77 | 1.06 | 750 | 1148 | 35 |
| **Hook Hill** | 50 | 25.00 | 1.00 | 50 | 25 | 65.00 | 1.39 | 35 | 84 | 59 |
| **IWMK** | 137 | 42.73 | 1.64 | 225 | 311 | 476.00 | 5.11 | 1589 | 1814 | 12 |
| **Mare Tail** | 236 | 36.32 | 1.19 | 282 | 336 | 436.67 | 4.16 | 1396 | 1678 | 17 |
| **Outer Ferrier** | 12 | 10.00 | 0.38 | 5 | 12 | 10.00 | 0.24 | 3 | 8 | 62 |
| **Pandora** | 12 | 10.00 | 0.32 | 4 | 100 | 107.50 | 0.40 | 39 | 43 | 9 |
| **Peter Black** | 25 | 10.00 | 0.36 | 9 | 124 | 69.00 | 0.31 | 39 | 48 | 19 |
| **Roger** | 236 | 17.89 | 0.98 | 231 | 174 | 300.00 | 1.93 | 336 | 566 | 41 |
| **South Ferrier** | 87 | 22.86 | 0.75 | 65 | 137 | 236.36 | 1.88 | 257 | 323 | 20 |
| **Styleman's** | 62 | 18.00 | 0.78 | 49 | 50 | 52.50 | 0.56 | 28 | 77 | 64 |
| **Thief** | 174 | 43.57 | 1.69 | 295 | 199 | 603.13 | 4.65 | 926 | 1221 | 24 |
| **Whiting Shoal** | 25 | 25.00 | 1.16 | 29 | 87 | 35.71 | 0.51 | 45 | 74 | 39 |
| **Wrangle** | 211 | 16.47 | 0.76 | 160 | 485 | 269.49 | 1.23 | 597 | 757 | 21 |
| **Wrangle EXT** | 12 | 10.00 | 0.70 | 9 | 124 | 18.00 | 0.19 | 23 | 32 | 27 |
| **Total** | **3210** | | | **3457** | **6693** | | | **14163** | **17620** | **20** |

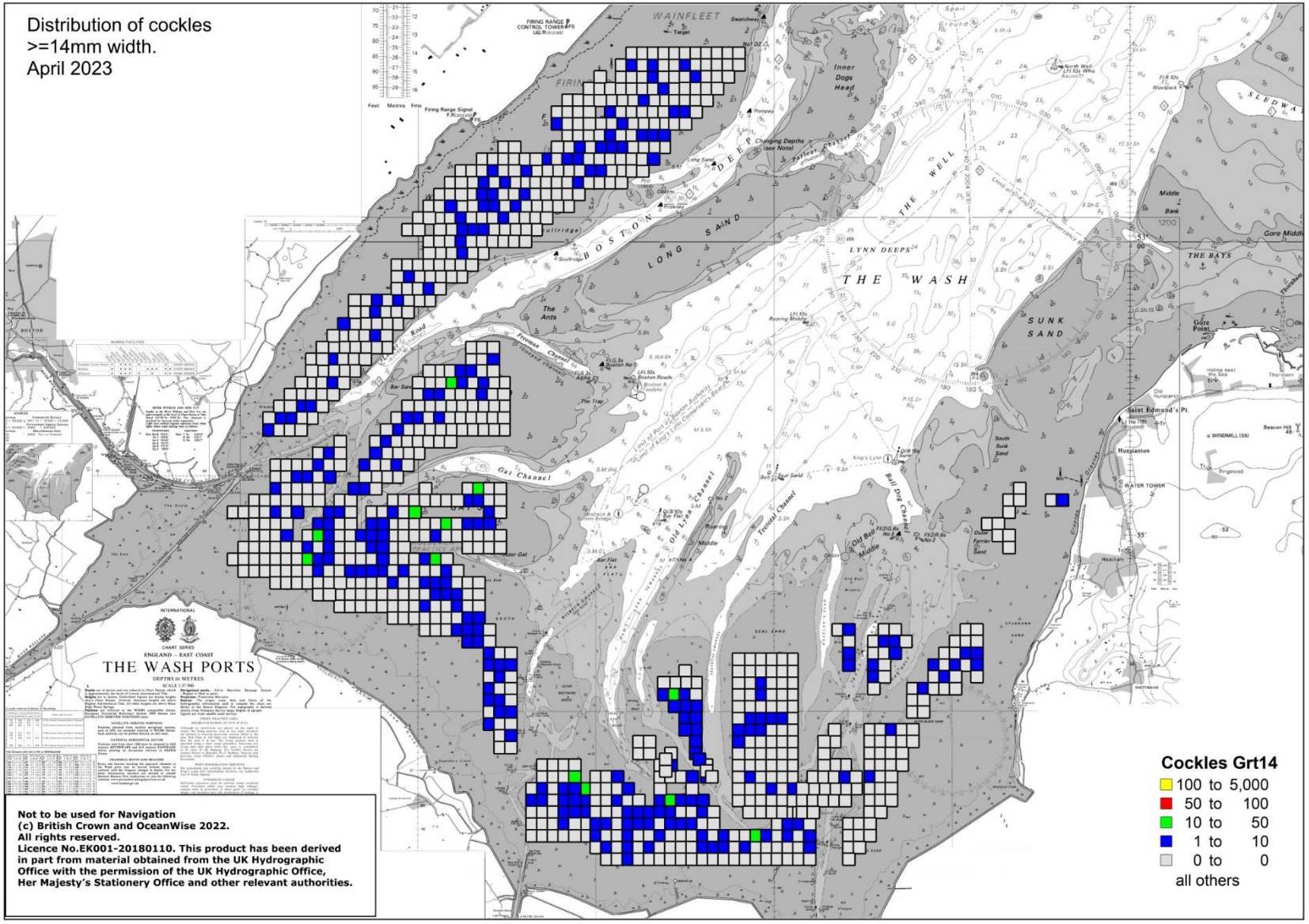


**Figure 4 – Chart showing the distribution of adult cockles (≥14mm width) at the time of the 2023 spring surveys**

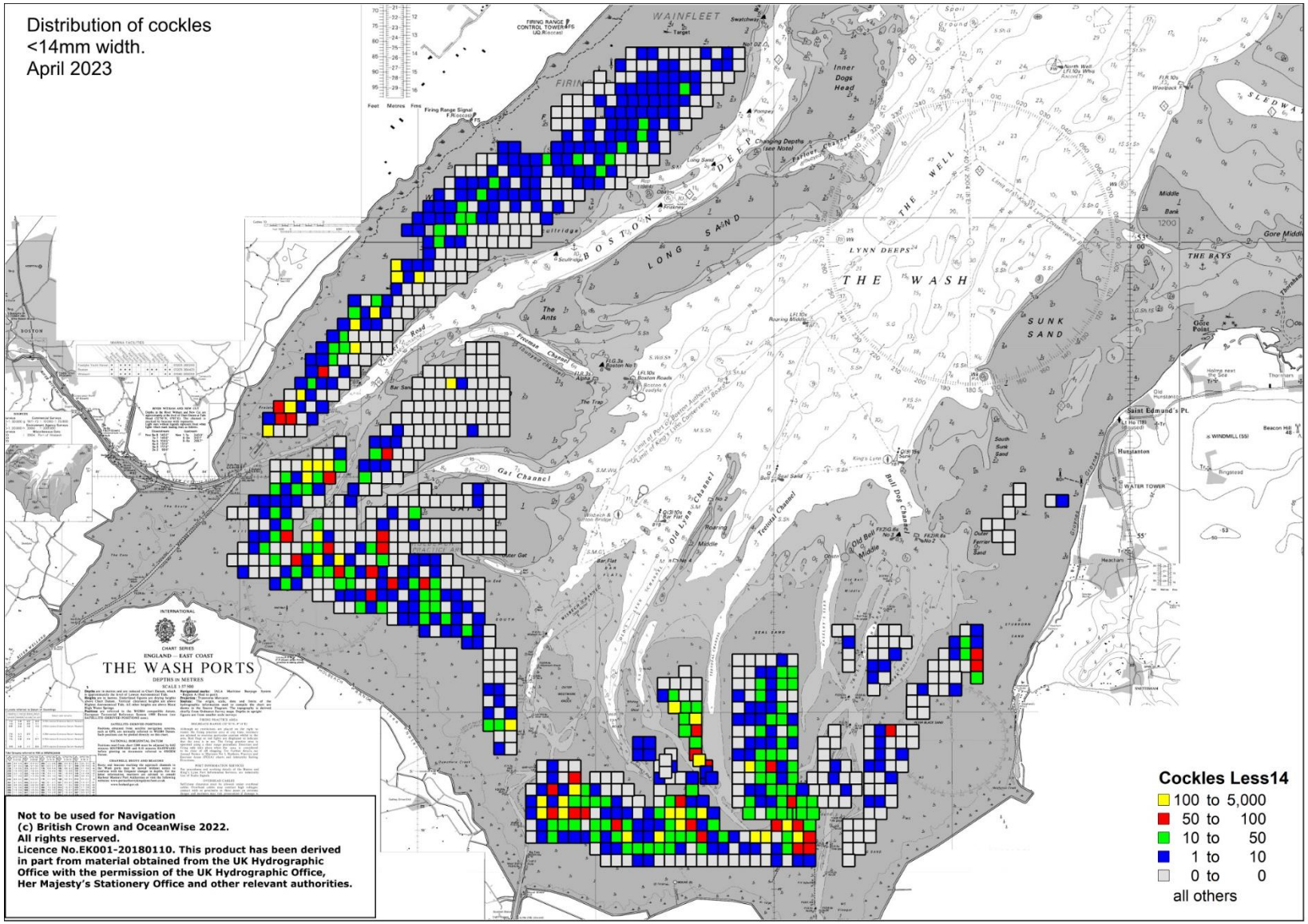


**Figure 5 – Chart showing the distribution of juvenile cockles (<14mm width) at the time of the 2023 spring surveys**

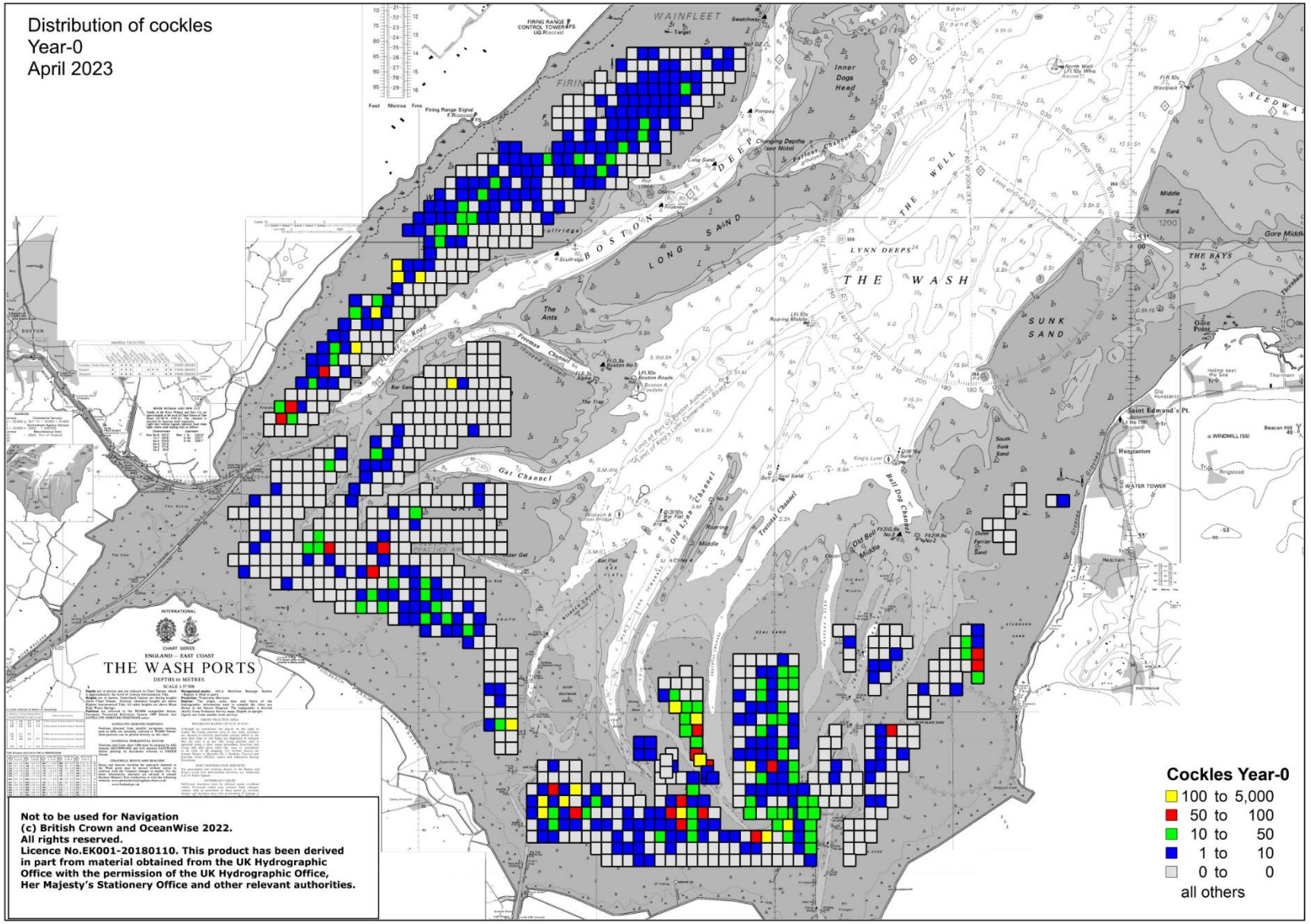


**Figure 6 – Chart showing the distribution of Year-0 (2022 year-class) cockles at the time of the 2023 spring surveys**

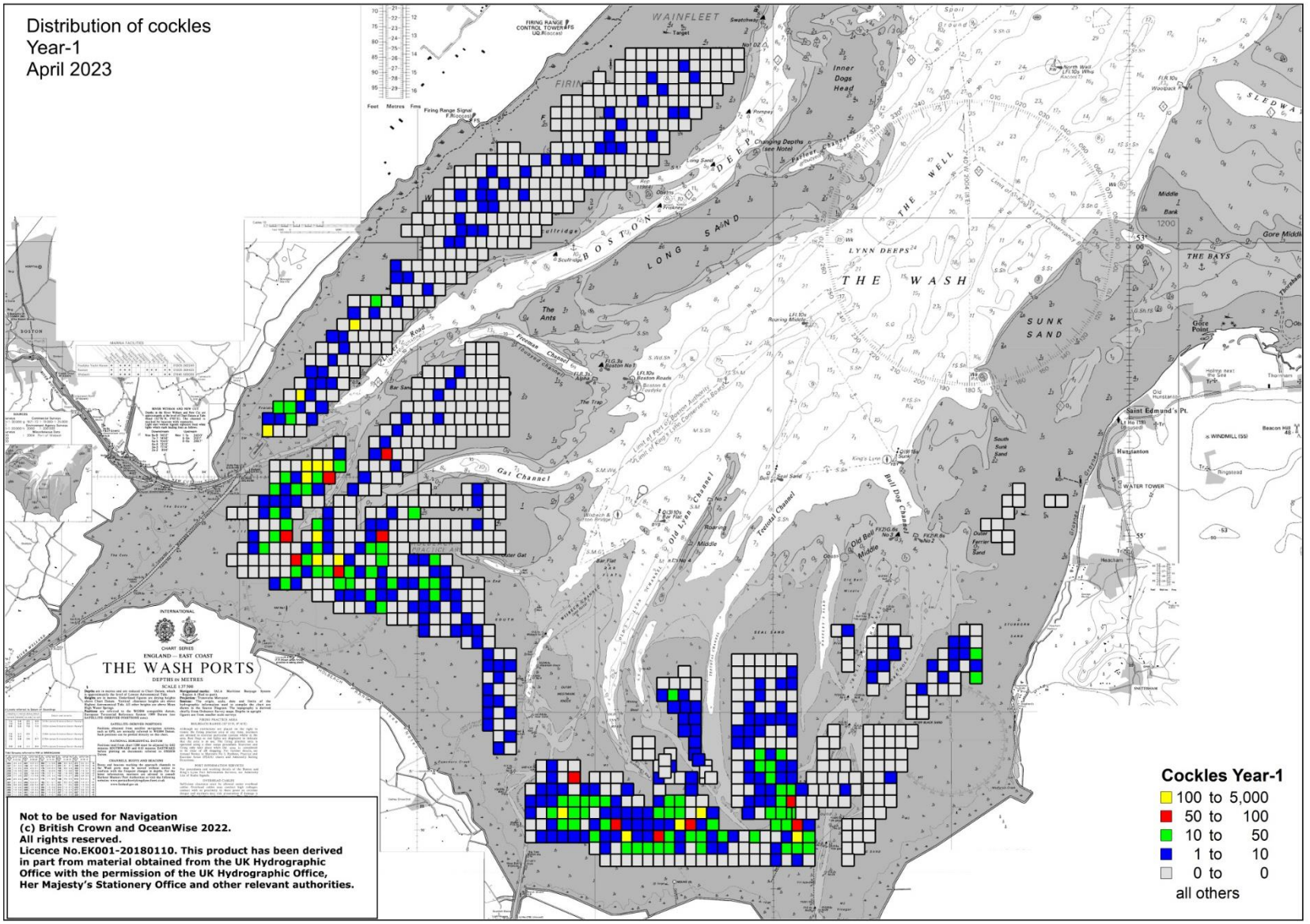


**Figure 7 – Chart showing the distribution of Year-1 (2021 year-class) cockles at the time of the 2023 spring surveys**

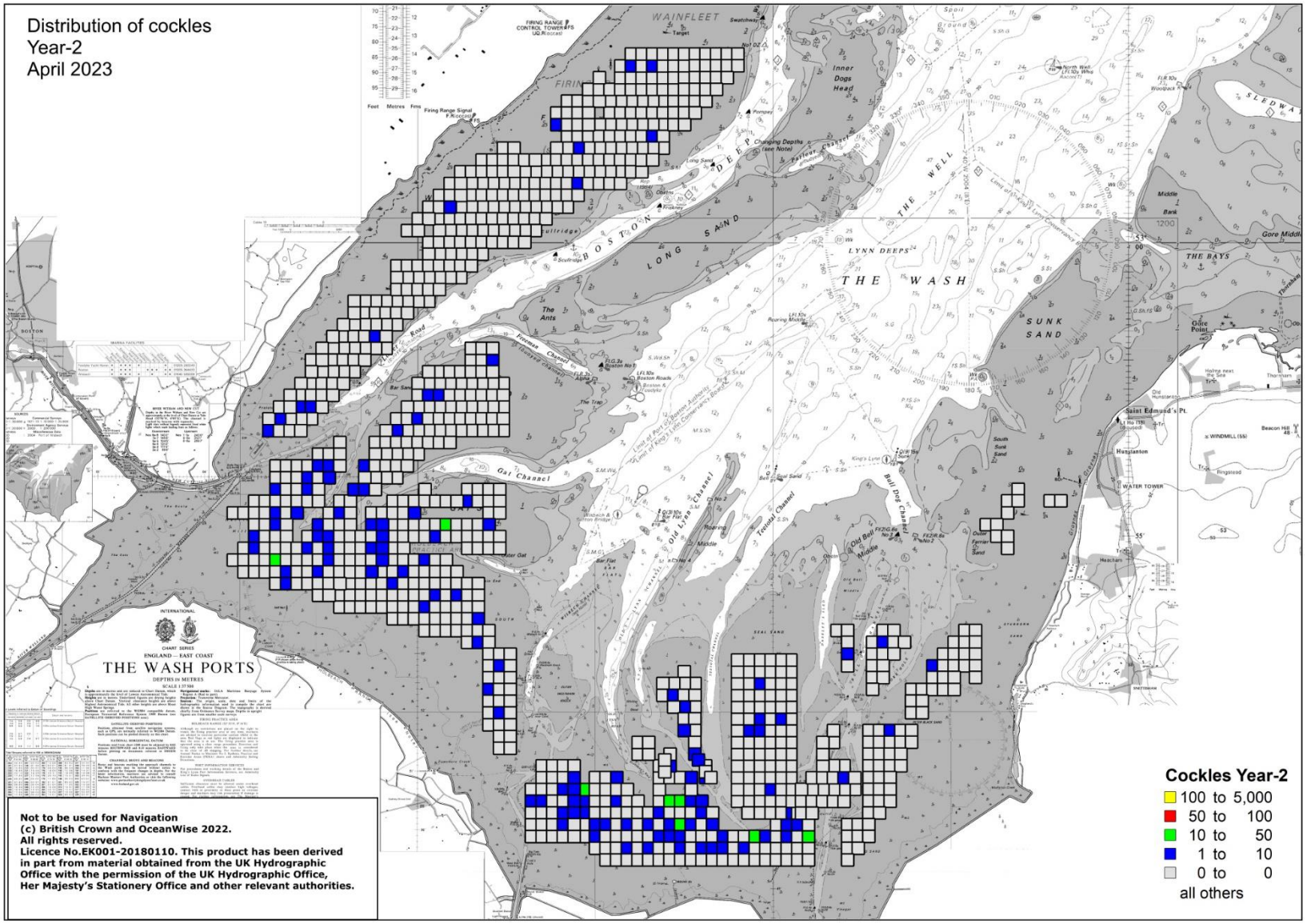


**Figure 8 – Chart showing the distribution of Year-2 (2020 year-class) cockles at the time of the 2023 spring surveys**

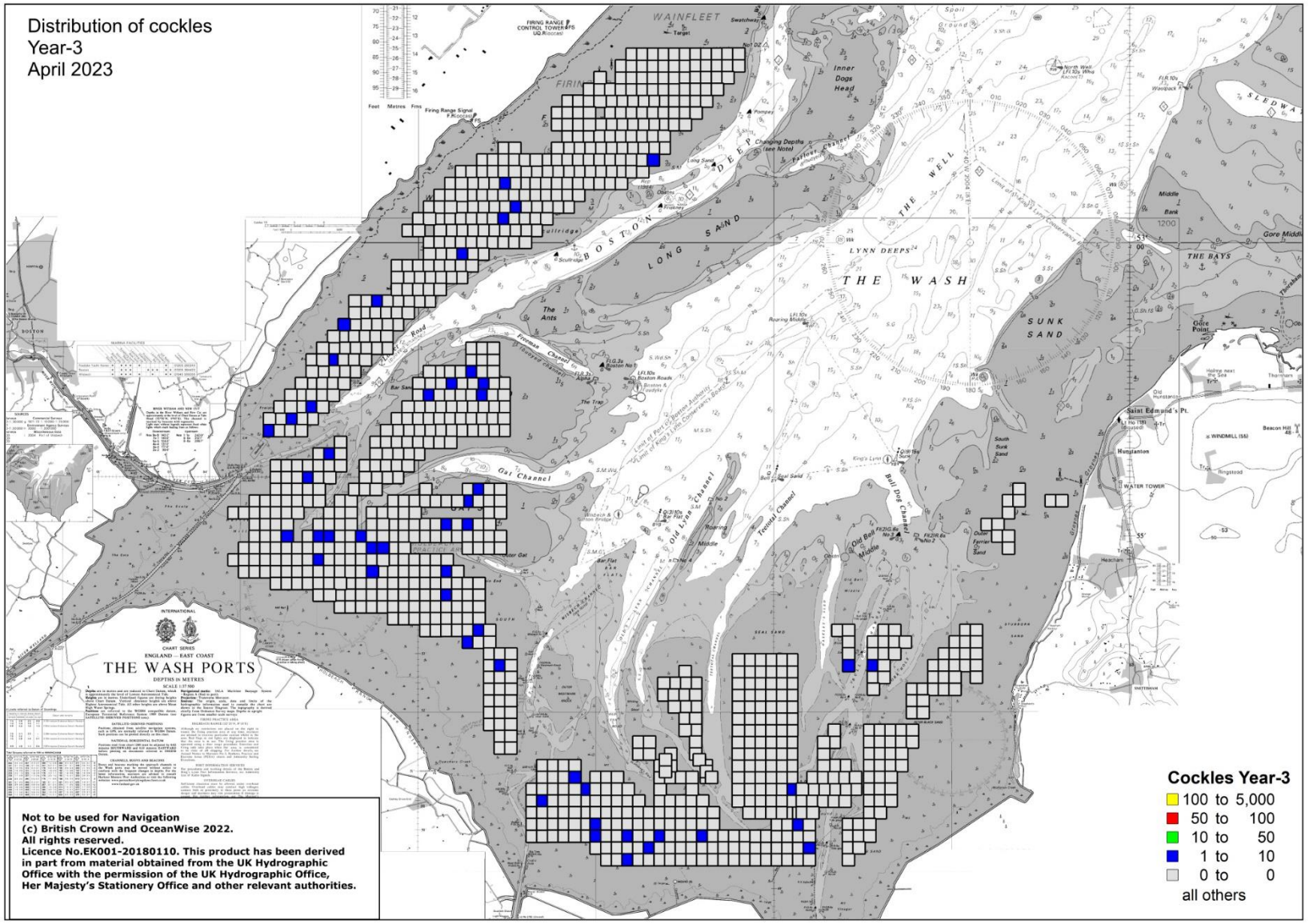


**Figure 9 – Chart showing the distribution of Year-3 (2019 year-class) cockles at the time of the 2023 spring surveys**

## Cockle distribution

Figure 4 shows the stock of adult (≥14mm width) cockles are thinly distributed over a wide area, presenting no pockets dense enough to support a fishery without the inclusion of smaller cockles. These larger cockles are predominantly survivors from the 2020 and 2019 year-class cohorts, shown in figures 8 and 9. Prior to 2008, the industry almost exclusively targeted cockles of this size or larger, but high annual losses from atypical mortality has forced the industry to target smaller cockles.

Figure 5 shows the distribution of juvenile (<14mm width) cockles. These are predominantly from the 2021 and 2022 year-class cohorts, the individual distributions of which can be seen in figures 6 and 7. Because the 2021 cohort will be the main focus of the coming fishery, but the 2022 year-class will need to be protected, it is better to look at their individual distributions than as a whole when considering management options. Figure 7 shows the Butterwick, Dills, Mare Tail, Hook Hill, IWMK and Breast sands all support high-density patches of 2021 year-class cockles that exceed 500 cockles/$m^2$ and will present good fishing opportunities. There are also smaller pockets of this cohort on the Tofts and Daseley's. From figure 6 it can be seen that the Butterwick (and where it borders Wrangle), IWMK, Thief, Breast and Daseley's sands, plus a small pocket on the Roger, have all attracted good settlements of 2022 year-class spat exceeding 1,000 cockles/$m^2$. Having only settled last summer, this Year-0 cohort are currently only 5-9 mm in width and won't spawn until 2024 at the earliest. Where their densities exceed 1,000/$m^2$ (areas coloured yellow in figure 6) it is policy in the Wash Cockle Fishery Management Plan to protect them with spatial closures[1]. As some of the sands have benefited from good settlements in 2021 and 2022, spatial closures to protect the 2022 cohort could result in good fishing opportunities being lost. However, enabling the fishery to target the older cockles in such areas could threaten the sustainability of future fisheries. When considering management options, therefore, these areas must be studied closely in order to maximise fishing opportunities without threatening sustainability.

Due to the tendency for cockle numbers to be biased in favour of younger/smaller individuals, density charts showing cockle numbers (as seen in figures 4-9) do not always reflect the better fishing opportunities. Generally, cockle densities based on biomass are better indicators of where the best fishing opportunities are situated. Figure 10 shows the cockle distribution in terms of biomass of total stock (excluding Year-0's). The areas coloured yellow and red on this chart present the best fishing opportunities.

[1] It should be noted that while the Management Plan only specifies protecting Year-0 cockles in areas exceeding 1,000 cockles/$m^2$, even outside of these areas, Year-0 cockles should not be deliberately targeted by the fishery.

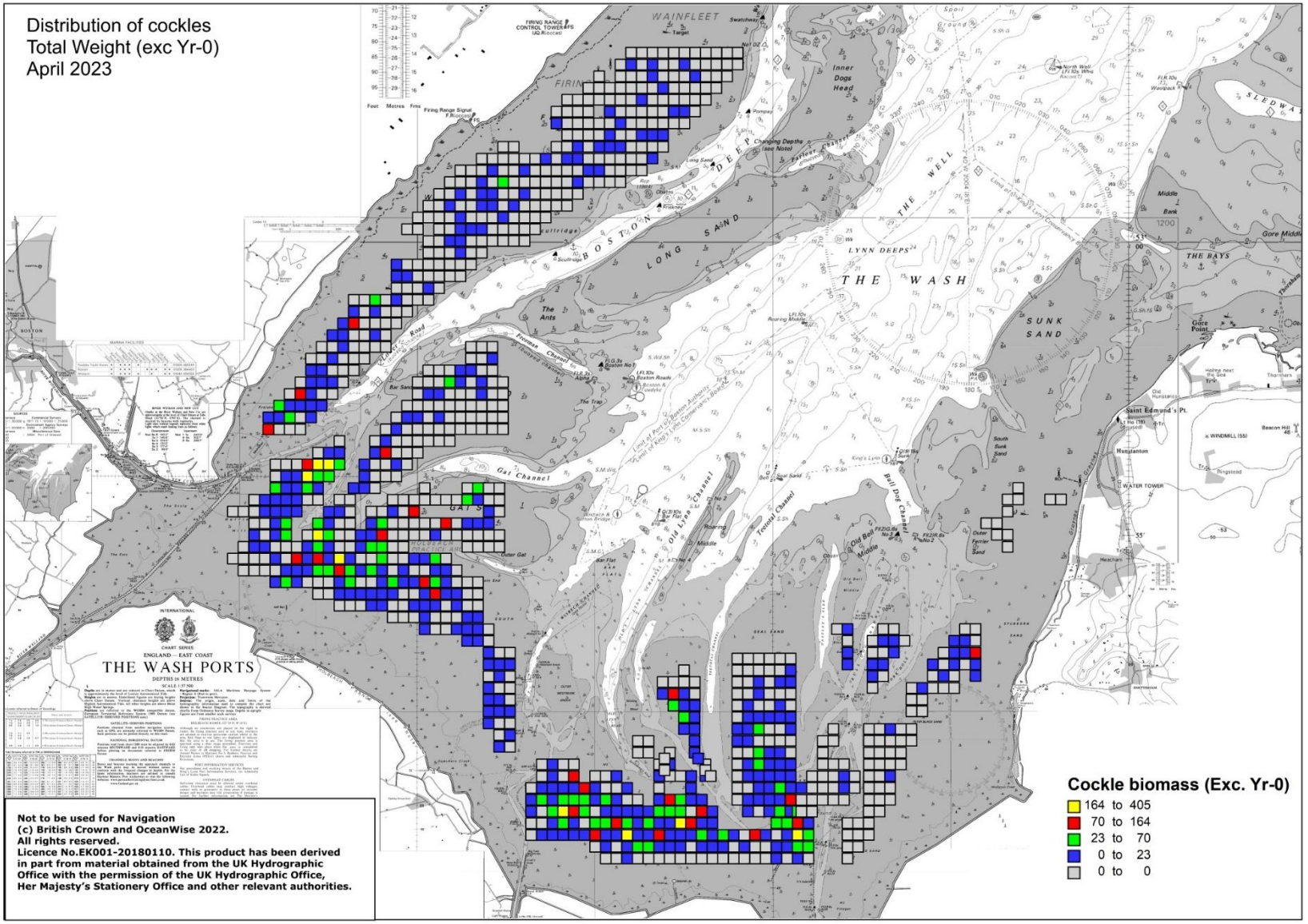


**Figure 10 – Total biomass (g/0.1m$^2$) of cockles at each station (excluding Year-0s) at the time of the 2023 spring survey**

## Effectiveness of the 2022 spatial closures

Spatial closures are management tools that have been used effectively in numerous fisheries to protect vulnerable features and species, including juvenile stocks to support sustainability. Such closures have traditionally been employed in The Wash to protect juvenile cockle stocks to good effect and prior to the introduction of the TAC and the suite of measures introduced in the 2008 Wash Shellfish Policies, was one of the core management tools alongside daily quotas for protecting stocks. The 2008 policies, and the updated 2018 Wash Cockle Fishery Management Plan, formally introduced the requirement for spatial closures in areas that Year-0 cockles exceed densities of 1,000 cockles/$m^2$.

While such closures help to safeguard the sustainability of future fisheries, they are often unpopular with the industry, particularly if they deny access to older cockles that are also present. When small and large cockles are present in high-densities together, ridging-out will often occur. In such instances, it is usually the larger cockles that are pushed out and die first. It is important, therefore, when implementing closures to protect juvenile stocks, that their full impact on the fishery is understood. Where possible, pragmatism is used to find an appropriate balance between protecting the juvenile stocks and facilitating the current fishery. Such decisions, however, need to take into consideration several factors including the abundance of juvenile and fishable stocks outside of the closed areas. Further, as opening such areas would breach the management policies that were agreed with Natural England, such decisions would delay the HRA process while their impacts were considered, thus delaying the start of the fishery.

Despite the poor prospects for the 2022 fishery, industry representatives suggested and supported extensive spatial closures last year that greatly exceeded those areas that would have otherwise been required through the policies. These closures, and the low stock densities beyond them, made the 2022 fishery particularly difficult, resulting in many fishermen struggling to achieve their daily quotas and the Total Allowable Catch not being fully achieved. Understandably, fishermen have, therefore, questioned how successful these closures have been at protecting the juvenile stocks. Because cockles grow rapidly in their first years, when looking at the effectiveness of closures, it is better to compare the biomass of the stocks rather than purely numbers of individuals. Therefore, figures 11 and 12, below, compare the biomass of the 2021 year-class cohort at the time of the 2022 and 2023 surveys.

.

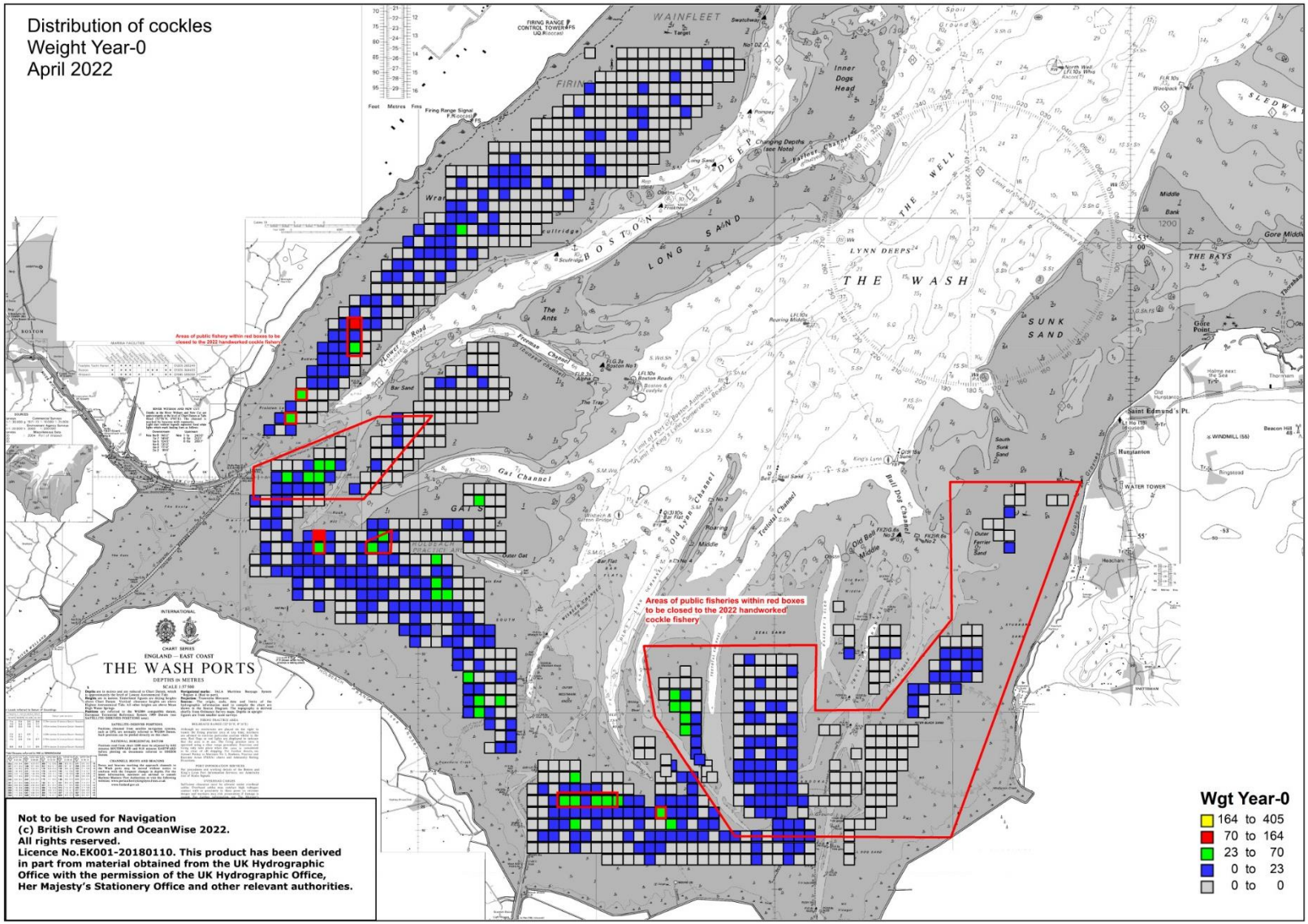


**Figure 11 – Biomass of 2021 year-class cockles at time of 2022 survey. Areas within red boxes closed to 2022 fishery**

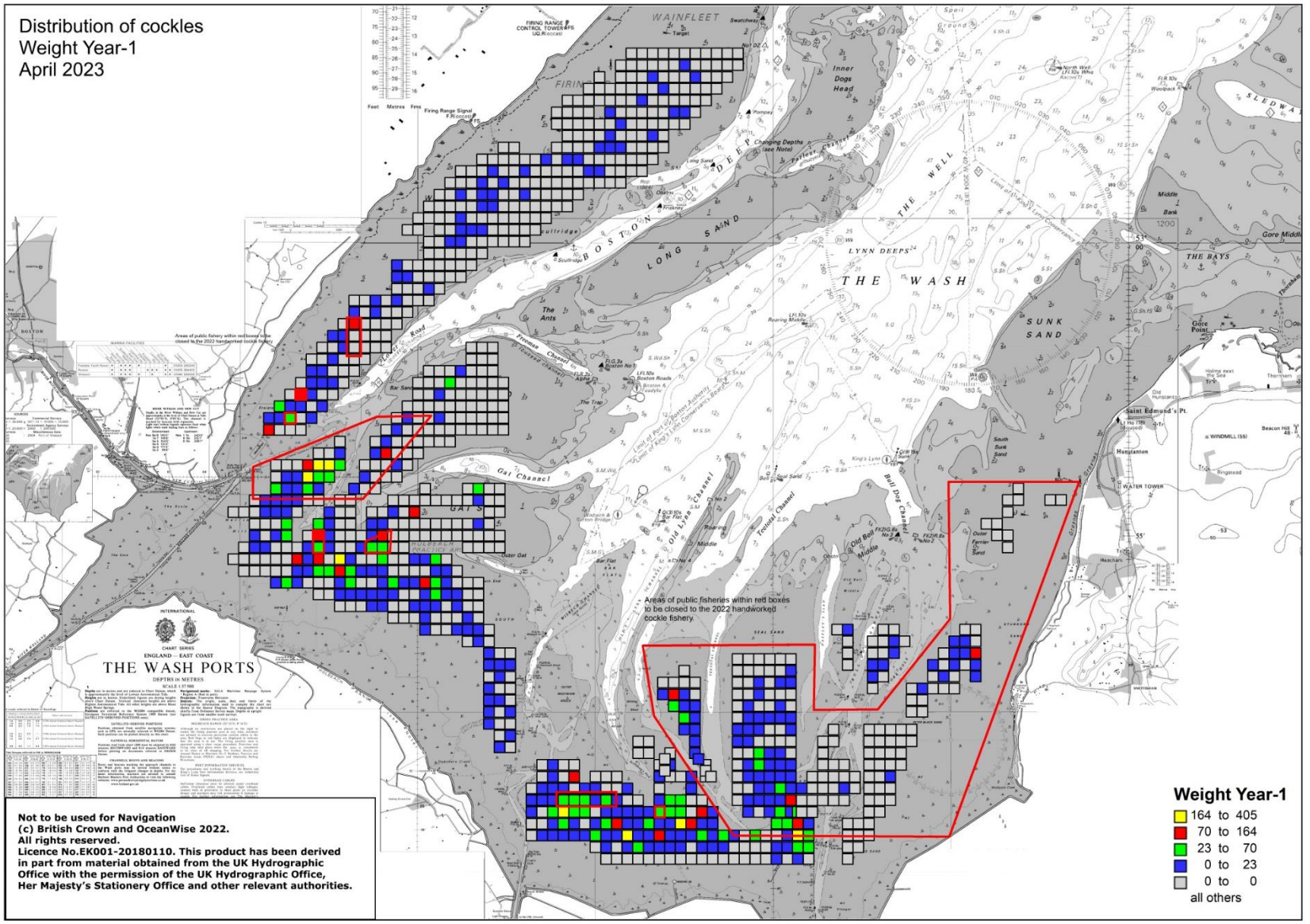


**Figure 12 – Biomass of 2021 year-class cockles at time of 2023 survey. Areas within red boxes closed to 2022 fishery**

Comparison of the charts above show that at most of the survey stations, the biomass of the 2021 year-class cohort had increased between the two stations. Overall, the total biomass of this cohort had shown a 122% increase, from 3,680 tonnes in 2022 to 8,177 tonnes in in 2023. These included approximately 150-200% increases in biomass on Butterwick, Friskney, Mare Tail and IWMK; 200-250% increases on the Dills, Daseley's and Gat; a 300% increase on South Ferrier and a 400% increase on the Breast. Other beds increased biomass by even larger margins, but as these supported few cockles to begin with, the margin for error would be larger. Overall, the 122% increase is slightly lower than the 138% increase predicted from the cockle survival study conducted in 2020, which looked at 20 years of previous survey data to estimate cohort survival and mortality trends. However, each of the beds listed above fared better than the 2020 study predicted they would have. The only beds in which this cohort declined in biomass between the two surveys were Wrangle, which showed a 28% decline and the Thief, which declined by 1%.

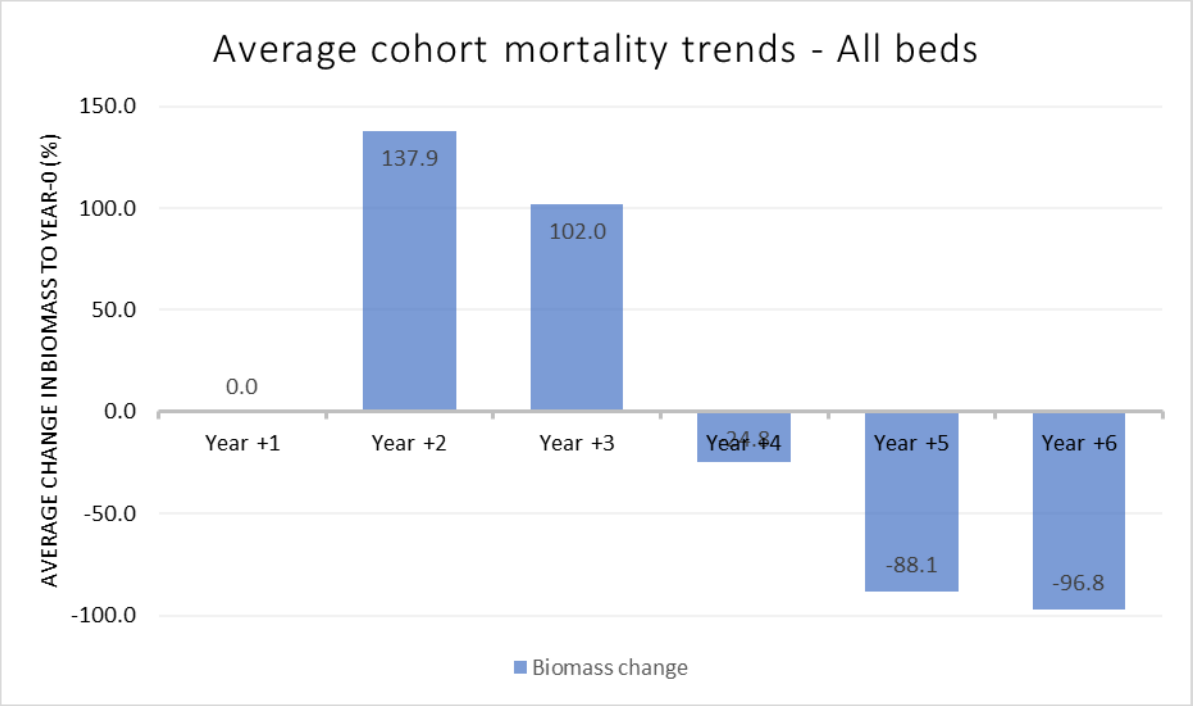


**Figure 13 – Predicted changes in cockle cohort biomass over time compared to base values seen during cohort's first survey (e.g. values compared to Year-0 biomass)**

The increases in biomass of the 2021 cohort, and the findings from the 2020 cockle survival study seen in figure 13, demonstrate the importance of protecting Year-0 stocks for their first year. Barring on some of the slow-growing beds where the peak biomass is a year later, the survival study predicts that on the majority of the beds, the 2021 cohort will be at its peak biomass this year. Thereafter, mortality rates will begin to exceed growth rates and the biomass will decline.

# Proposed Management Measures for 2023 fishery

## Total Allowable Catch

Since its introduction in 1998, the Total Allowable Catch (TAC) for the fishery has been calculated as a third of the adult cockle stock (cockles ≥14mm width). Based on the current adult stock of 3,457, the **TAC for the 2023 fishery should be 1,152 tonnes**.

The size of the TAC this year is one of the smallest since its introduction and does not represent well the abundance of fishable stocks[2] available to be harvested. This disparity between the size of the TAC and available stocks has been broadening in recent years, driven by atypical mortalities killing disproportionate numbers of larger cockles on which the TAC is based, and the industry needing to target smaller cockles in response to the die-offs. As the industry are no longer purely targeting the cockles that contribute to the TAC, the allocated TAC is often either too high or too low for the available stocks. This leads to difficulties achieving the TAC when it is too high and good fishing opportunities being wasted when it is too low. Officers have, therefore, been reviewing the way the TAC is calculated to determine whether there is a more appropriate approach that could be adopted, that would be more representative of the fishable stocks available, whilst maintaining overall stock sustainability. The review recommended a change in the way the TAC is calculated from 1/3$^{rd}$ adult cockles to 1/6$^{th}$ total stock. Over the past 23 years this change would not have greatly altered the overall amount of cockles that had been harvested, but in recent years would have provided greater parity between the size of the TAC and the available stocks. Additional minimum stock thresholds that have been introduced subsequent to the introduction of the TAC would continue to safeguard stock sustainability and food availability for the overwintering bird populations, should we change the way the TAC is calculated.

Using a calculation of 1/6$^{th}$ total stocks, the **TAC of the fishery this year would be 2,937 tonnes**.

A report detailing the rationale for changing the way in which the TAC is calculated has been submitted to Natural England for consideration and will be forwarded to the industry for consultation.

<u>Additional minimum stock thresholds</u>

Subsequent to the introduction of the TAC in 1998, further minimum stock thresholds were formally introduced into the Shellfish Management Policies in 2008 to ensure the SSSI Conservation Objective targets were met. These include:

- Maintaining a total cockle stock biomass above 11,000 tonnes
- Maintaining a minimum spawning stock biomass (cockles ≥14mm width) above 3,000 tonnes

[2] "Fishable stocks" is a term used frequently in this report. These are cockles which may or may not have reached a size of 14mm width at the time of the spring surveys, but which will have reached a size by which they will have spawned prior to the fishery. These are generally 13+mm width when harvested in summer.

- Maintaining sufficient cockle and mussel stocks to feed 24,000 oystercatchers (as determined by the Bird Food Model)

Even applying the worse-case scenario of the larger, 2,937 tonne TAC being used, the fishery would not reduce the total cockle stock of 17,620 tonnes below 11,000 tonnes. There are also sufficient cockle and mussel stocks to satisfy the bird food model, assuming a cockle fishery of 2,937 tonnes and a maximum mussel relaying fishery of 1,147 tonnes[3]. At the time of the spring survey, the stocks of cockles ≥14mm width were just 3,457 tonnes, which could restrict the fishery to a TAC of just 457 tonnes if it was thought this population could not recover. The reason why this group is currently so low is due to the poor recruitment seen in 2019 and 2020, which are the cohorts that would comprise this group. By contrast, the 2021 cohort was much more successful. While too small at the time of the surveys to support this group, many of their 8,177 tonnes will recruit into this population over the summer, maintaining an adult biomass exceeding the threshold. As the size of the cohort recruiting into this population exceeds the proposed 2,937 tonnes TAC, it is highly unlikely that the fishery would prevent this threshold from being achieved.

**Protection of Year-0 juvenile cockles**

At the time of the surveys, there was estimated to be 5,236 tonnes of Year-0 cockles from the 2022 cohort, the spatial distribution of which can be seen in figure 6. Figure 14 shows how this compares to previous year's spatfalls.

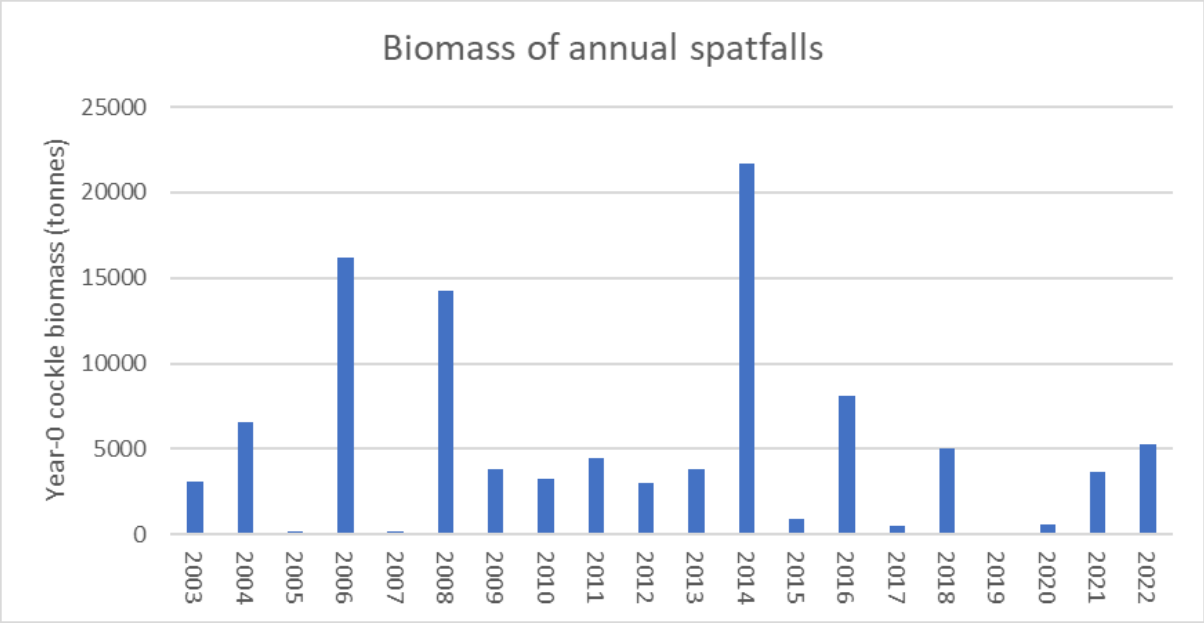


**Figure 14 – Size of annual cockle settlements between 2003-2022**

While not as exceptional as those that occurred in 2006, 2008 and 2014, this cohort is nevertheless on par with other successful settlements that grew on to produce good fisheries. Following directly after a successful settlement in 2021, it provides optimism

[3] In all likelihood, the mussel fishery will actually be limited to 500 tonnes.

for the coming fisheries. For reasons described in the section above, however, it is important that these young cockles are afforded adequate protection this year if they are to develop into good fisheries in 2024 and 2025. This will require spatial closures where their densities exceed 1,000/$m^2$.

Figures 15 to 17 below show the distributions of Year-0 cockle densities (coloured squares) overlaid with biomass data for the stock excluding Year-0 cockles (coloured circles). Areas denoted by yellow squares represent patches of Year-0 cockles that should be closed to the fishery, while yellow and red circles represent the best fishing opportunities in terms of weight of cockles. For clarity, figures 18 to 20 show the positions of these proposed closures without the background details.

Figure 15 shows five squares on Butterwick and one on the Roger that should be closed. The data suggests that these squares only support low densities of fishable stocks. Figure 16 has only a single box on the southern side of Holbeach that would need closing. This area does not support fishable stocks. Figure 17 contains eleven squares that should be closed. Although none of these survey stations supported fishable densities of cockles in the samples, the two areas closest to the Trial Bank on Inner Westmark Knock are close to stations that do. These two areas have subsequently been re-assessed on foot in June to ensure the closures best fit the distribution of the juveniles they are protecting. The updated positions of these closures are shown in figure 18.

The Thief Sand also supports large areas of Year-0 cockles and smaller populations of larger cockles. Three different management options have been proposed for this sand, therefore. These include:

- Option 1 (figure 21)– Implement the minimum closures required to protect Year-0 juveniles in densities exceeding 1,000 cockles/$m^2$. This option will leave large areas of 500-999 Year-0 cockles/$m^2$ unprotected. Further, mapping out the boundaries to more accurately follow the actual cockle densities over such a wide area would be difficult.

- Option 2 (figure 22) – Implement a single, large closure that protects the majority of the high density Year-0 juveniles, but has a patch of larger cockles open at northern edge. This option offers much better protection of Year-0 juveniles than Option 1 but still leaves a patch of fishable stocks open. This border would also be easier to map accurately than those required for option 1.

- Option 3 (figure 23) – Complete closure of Thief Sand

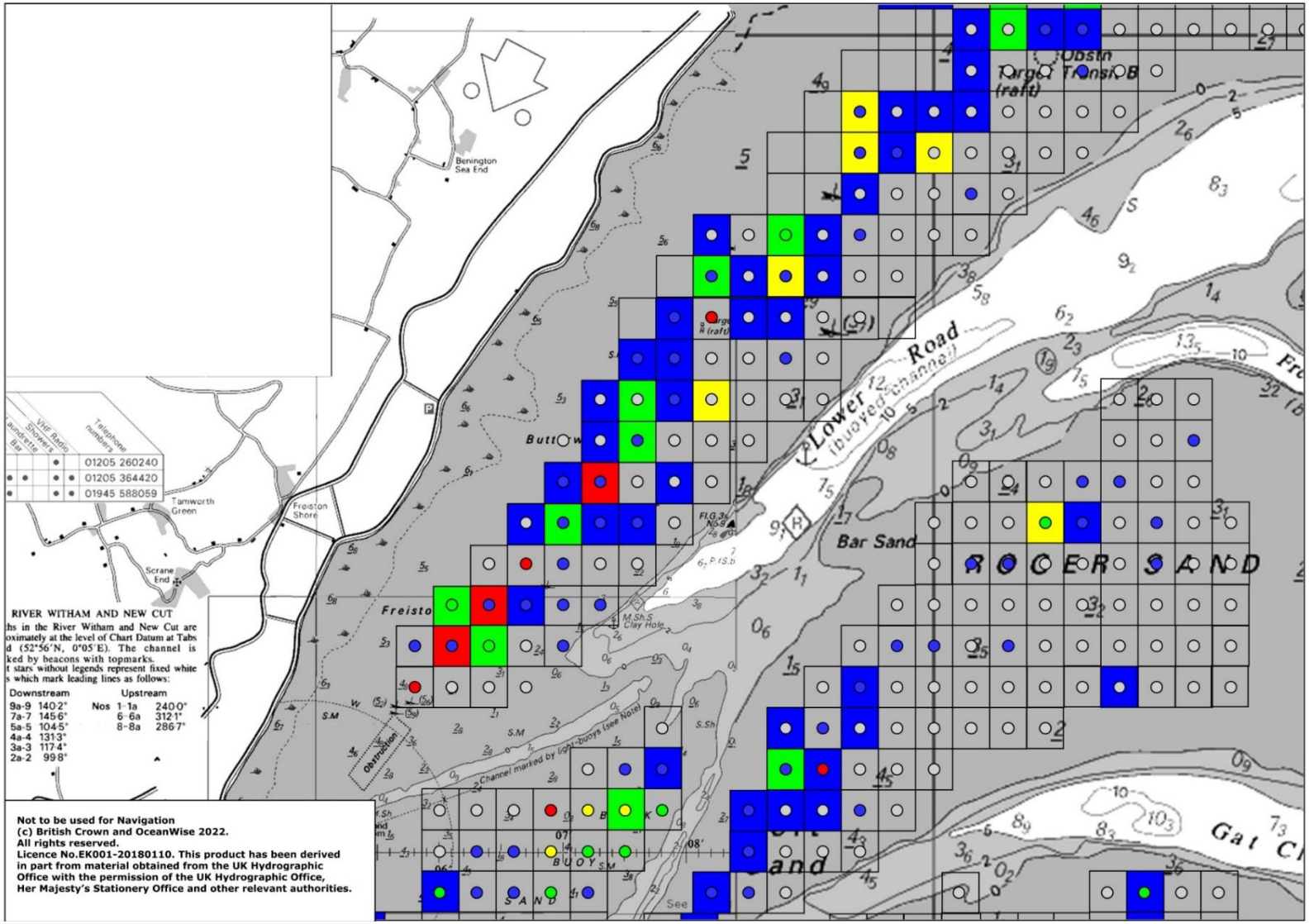


**Figure 15 – Distribution of Year-0 juveniles (coloured squares) and fishable stocks (coloured circles). Yellow squares require closures**

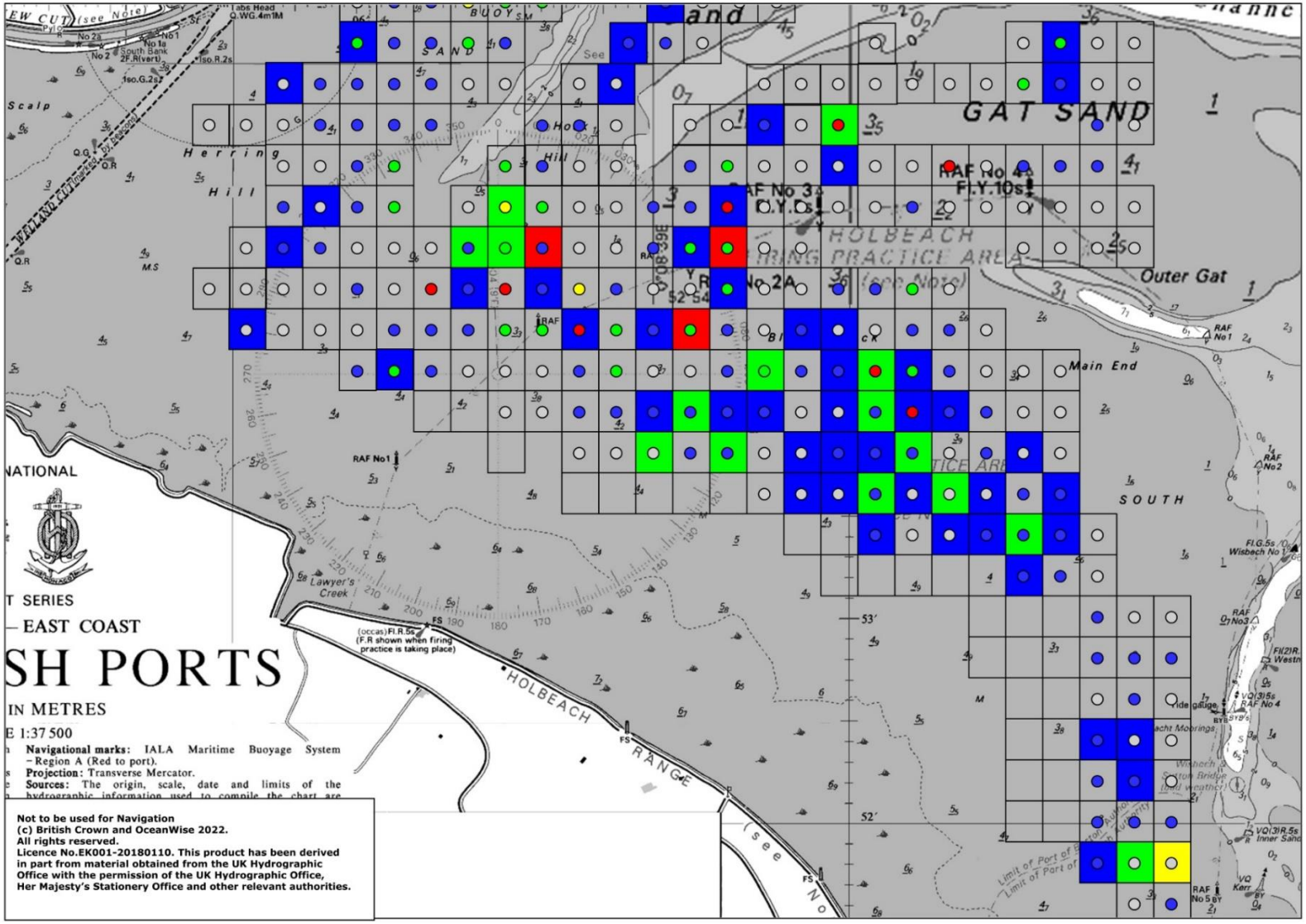


**Figure 16 – Distribution of Year-0 juveniles (coloured squares) and fishable stocks (coloured circles). Yellow squares require closures**

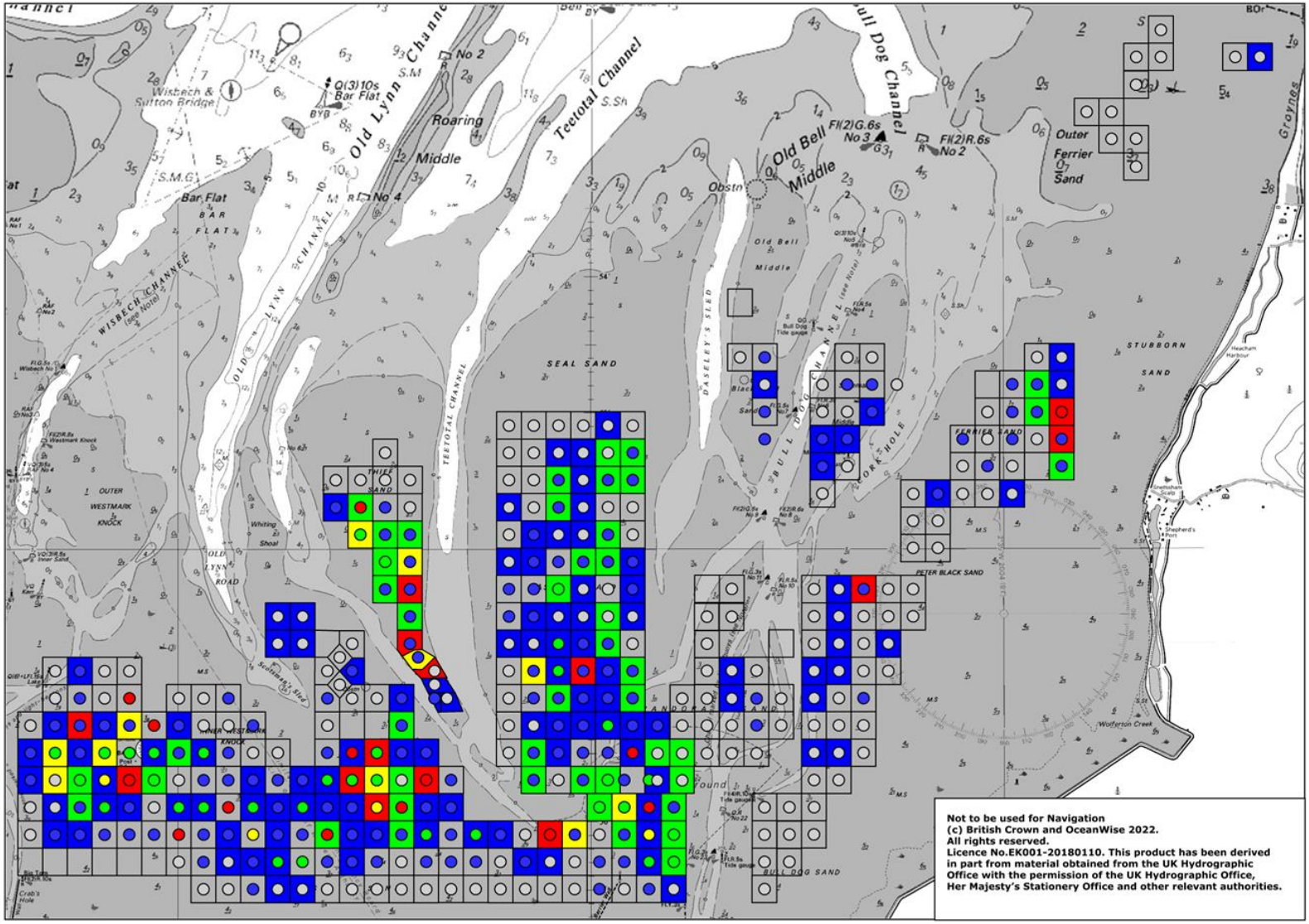


**Figure 17 – Distribution of Year-0 juveniles (coloured squares) and fishable stocks (coloured circles). Yellow squares require closures**

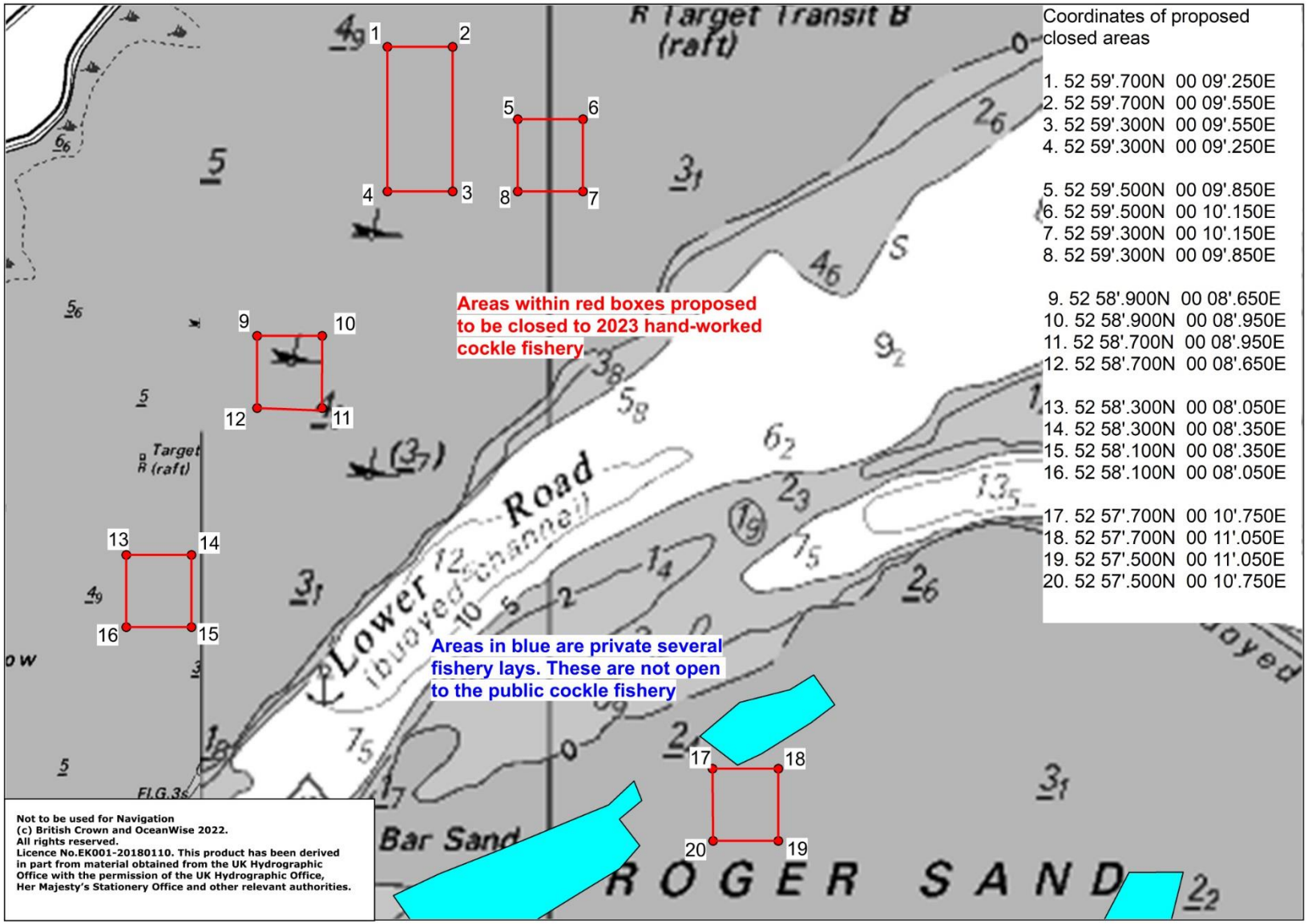


**Figure 18 – Positions of closures on Butterwick and Roger sands to protect Year-0 juvenile cockles**

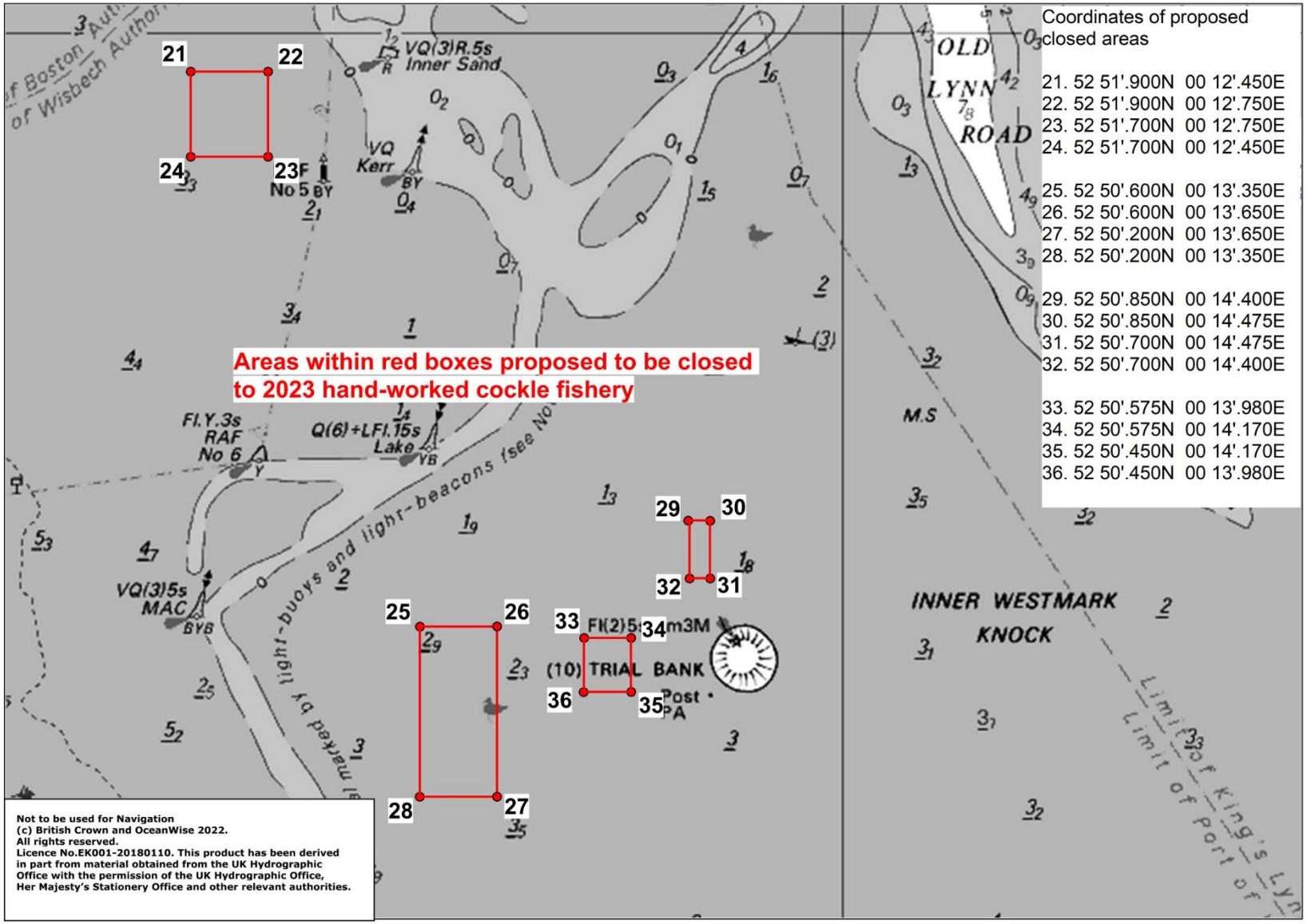


**Figure 19 – Positions of closures on Holbeach and IWMK sands to protect Year-0 juvenile cockles**

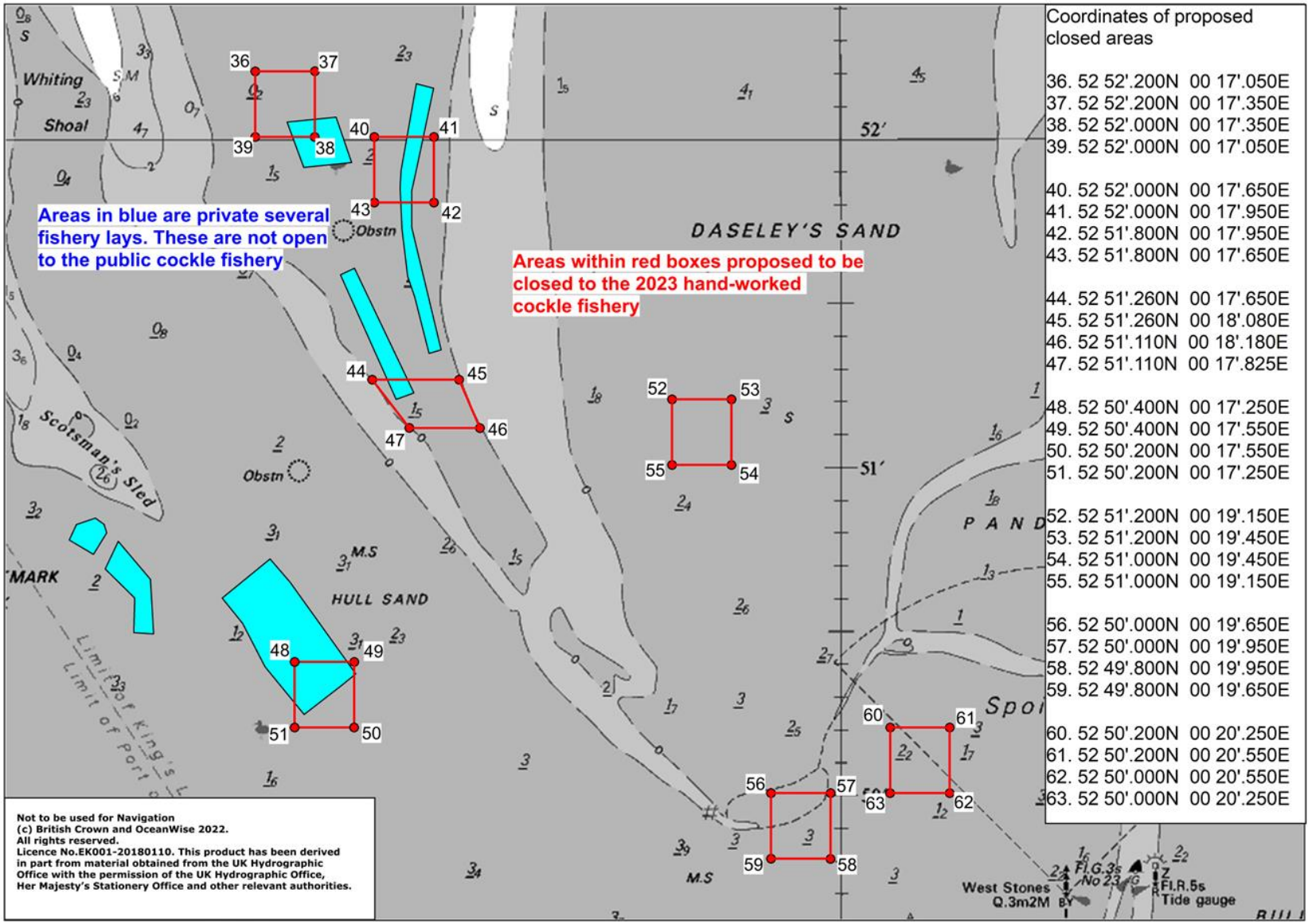


**Figure 20 – Positions of closures on Breast, Thief and Daseley's sands to protect Year-0 juvenile cockles**

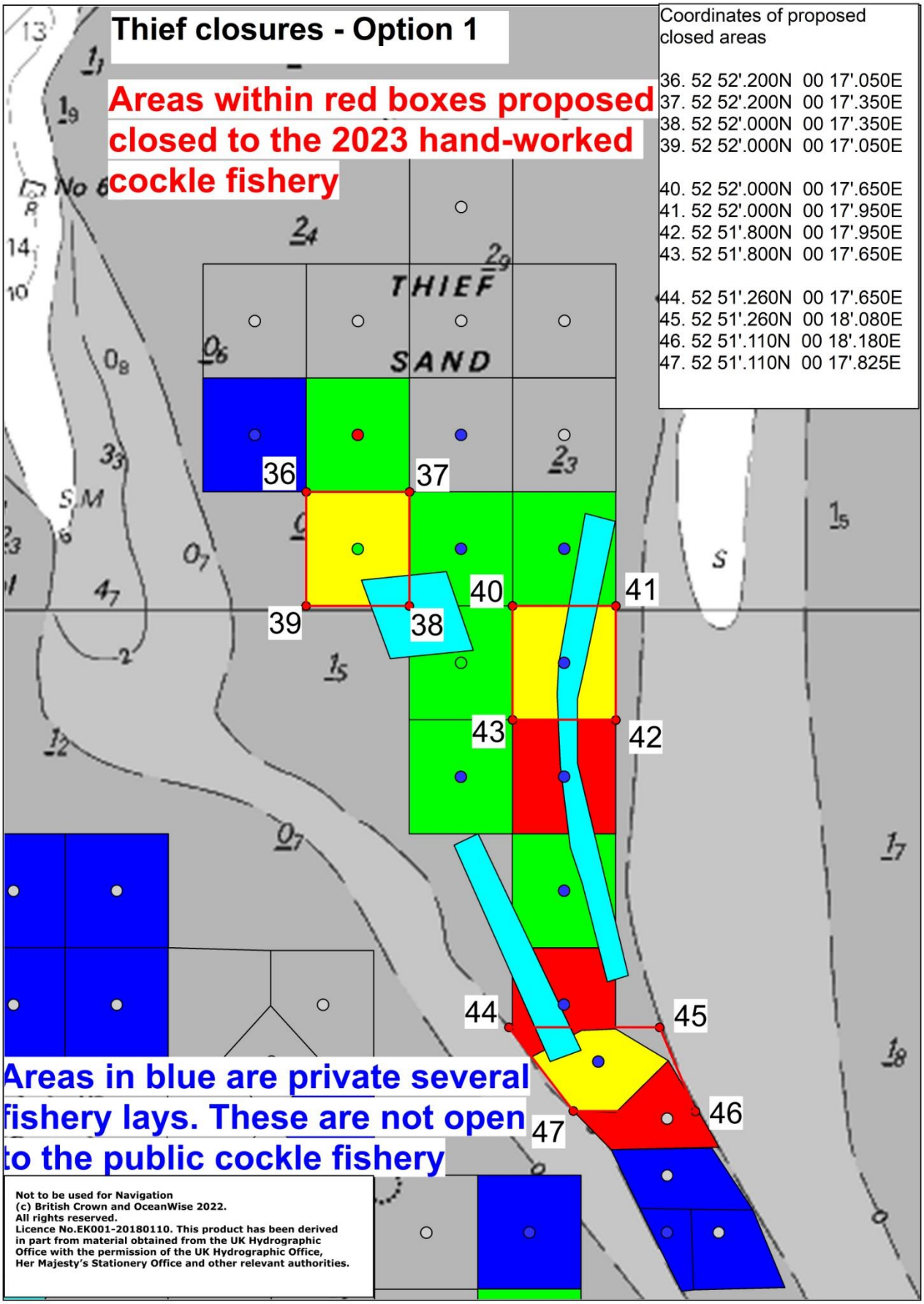


**Figure 21 – Option 1 – Minimal closures on the Thief Sand**

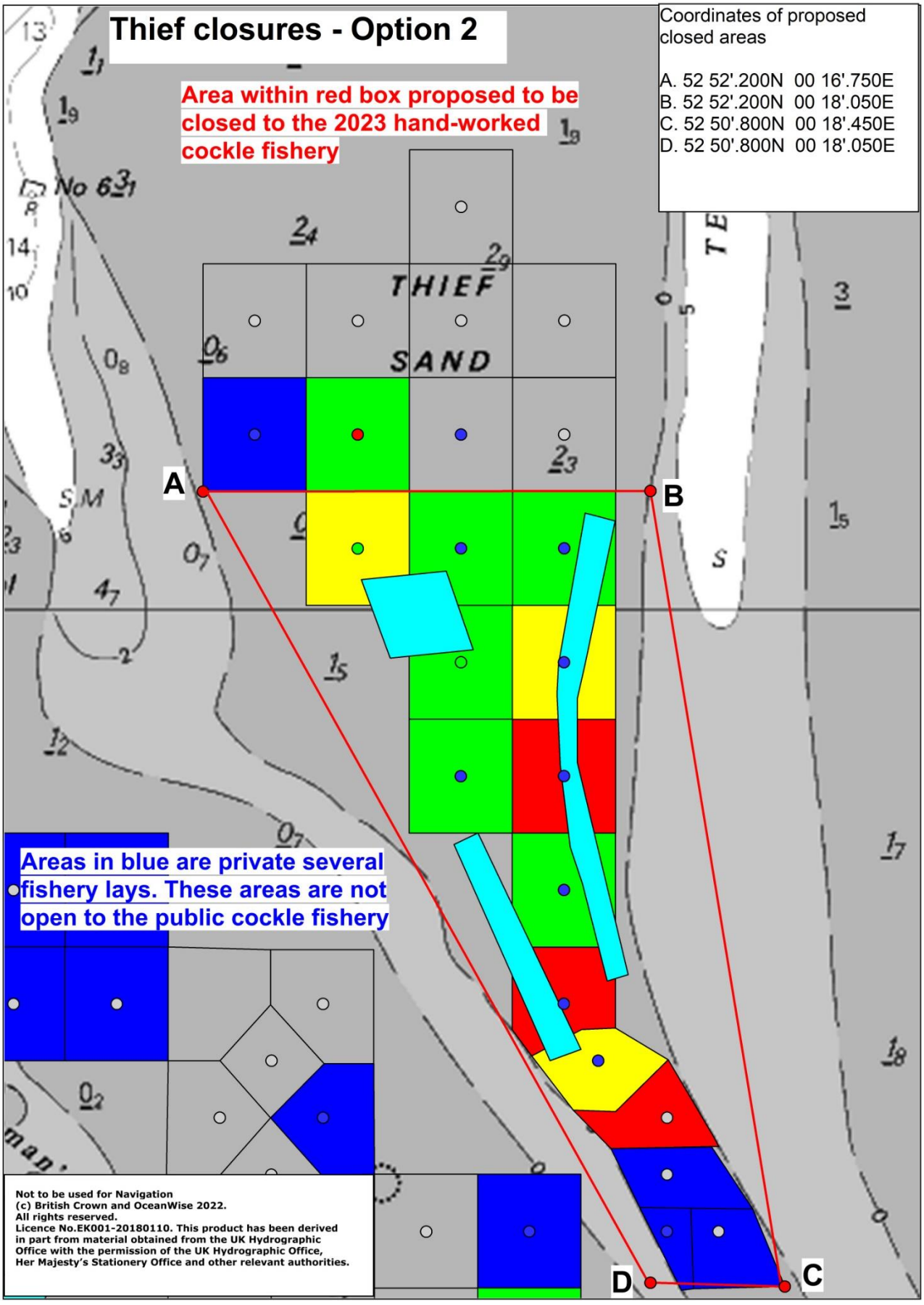


**Figure 22 – Option 2 – Single, large closure on the Thief Sand**

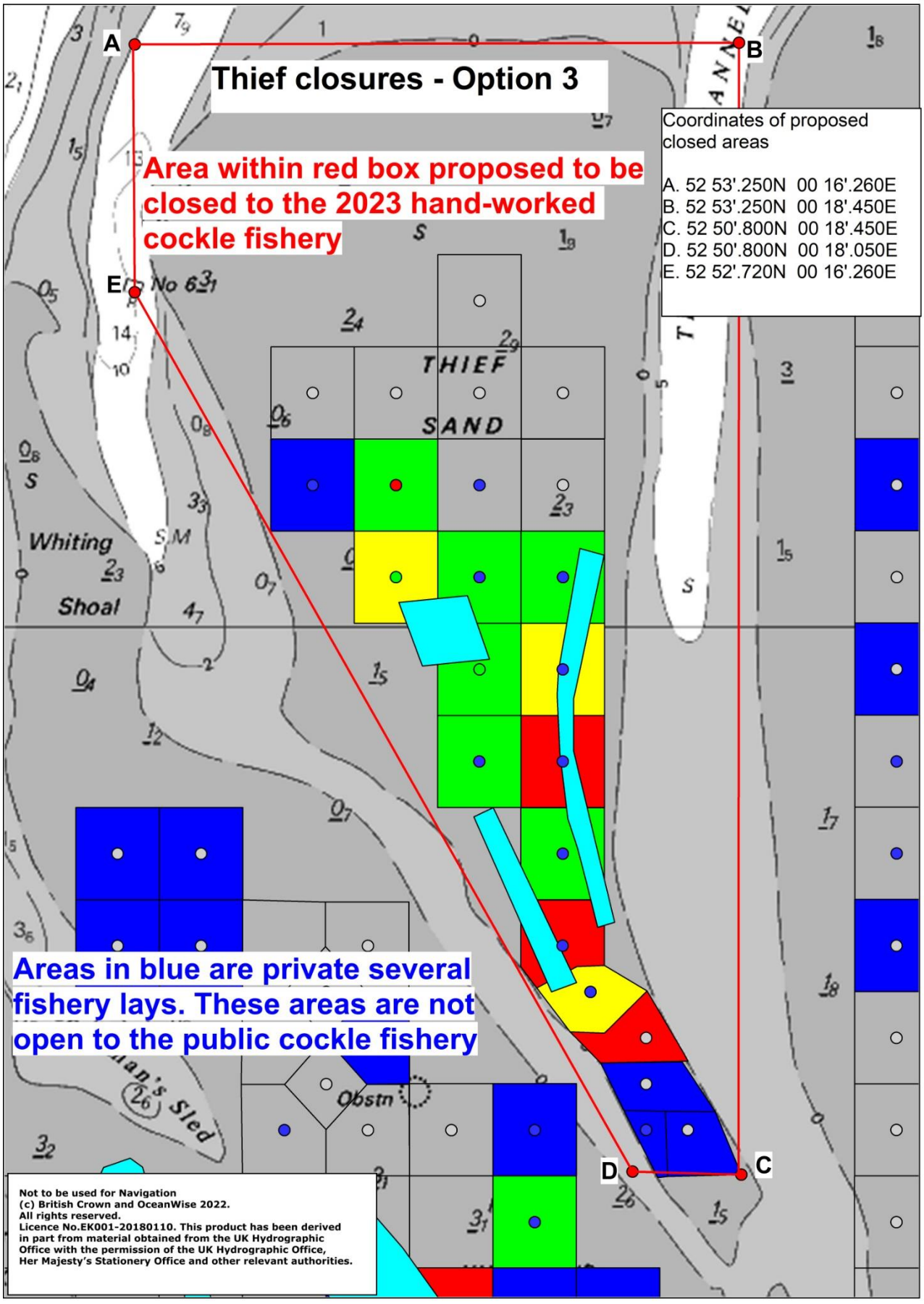


**Figure 23 – Option 3 – Total closure of the Thief Sand**