

# NIFCA Nephrops Burrow Count Survey 2025

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Report prepared by Andrew Boon

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## Abstract

This report covers the results of the 2025 Nephrops burrow count survey, building upon the trial survey in 2024. This survey focusses on the inshore Nephrops fishery within the Northumberland Inshore Fisheries and Conservation Authority (NIFCA) district, utilising an underwater towed sledge camera. A total of 50 stations were surveyed in 2025, with density estimates derived from burrows counted from the video footage. Median burrow density increased in 2025 to 0.52 burrows/m<sup>2</sup>, from 0.34 burrows/m<sup>2</sup> in 2024 and remained higher than burrow densities recorded in the same Functional Unit (Farne Deep functional unit 6 (FU6)) further offshore. The 2025 survey included significantly more survey stations over a greater spatial scale, allowing for more accurate density estimates for the fishery area and increased confidence in the results. The 2025 survey will act as a baseline for future surveys, in 2026 there is a planned increase in spatial coverage of the survey and changes to survey equipment to best align with member institutes on the International Council for the Exploration of the Seas (ICES) Working Group on Nephrops Surveys (WGNEPS).

## 1. Introduction

Nephrops are a slim, pale orange coloured lobster that can grow up to 25cm, feeding on active prey, such as worms and fish. Nephrops are a commercially important species within the NIFCA district. In the last 10-15 years (2012-2023) Northumberland's trawl fishery has become more reliant on the local prawn (Nephrops) fishery, which is now a principal fishery in the NIFCA district. The local fishery takes place between 3-25 miles offshore, with the best catches seen during the autumn and winter months, also attracting many visiting trawlers from Scotland, Northern Ireland and other English ports during this time. There is also a small, seasonal Nephrops pot fishery, although fishing effort is limited. Both the pot and trawl fisheries are managed through a NIFCA permit scheme, with vessel size restrictions applying to each. The Nephrops pot fishery represents only a very small component of the wider crab and lobster pot fishery, which operates under an overall limit of 800 pots within the NIFCA district.

Nephrops occur in geographically distinct sandy and muddy habitats, where sediment is suitable for them to construct their burrows, in which they spend the majority of time (Doyle *et al.*, 2023 & Aldis, 2024). Nephrops prefer burrowing in finer sediments (i.e. muddier) as these sediments provide more stability in the construction of their burrows (Campbell *et al.* 2008). Time of year, light intensity, and tidal strength all influence the emergence behaviour of Nephrops (ICES, 2009 & 2012), as a predation avoidance strategy (Sbragaglia *et al.* 2017). This means that inhabited burrows (not collapsed) are used as a proxy to determine the presence and abundance of Nephrops.

The International Council for the Exploration of the Seas (ICES) are an advisor to Defra, who set total allowable catch (TAC) limits based on ICES scientific advice. In the last 20 years, underwater television (UWTV) surveys have played a significant and increasing role in gathering data for use within the ICES stock assessment process. The lack of age structured data and uncertain historic commercial catch data makes underwater burrow count camera surveys a more reliable, widespread technique to evidence stock assessments, independent to the fishery. This technique is used in many countries, such as Ireland, England, Denmark and Sweden, and widely used in the North Sea, Celtic Sea, Irish Sea, East Atlantic, and the Mediterranean (Firmin *et al.*, 2019). Nephrops stocks are managed in functional units and geographical subareas (Figure 1) and the results of the UWTV surveys in these functional units, directly influence the management advice on Nephrops stocks. With several countries now undertaking such surveys, standardised approaches and technologies have been agreed and adopted as best as practically possible (Leocádio *et al.*, 2018). Since 2024, NIFCA has been a Chair-invited Member of the ICES Working Group on Nephrops Surveys (WGNEPS), which focusses on the use of UWTV surveys to monitor Nephrops populations.

The Nephrops fishery in the NIFCA district falls within the Farne Deeps functional unit 6 (FU6), which is surveyed by Cefas annually. The results of which feed into the ICES management advice, where the maximum sustainable yield and

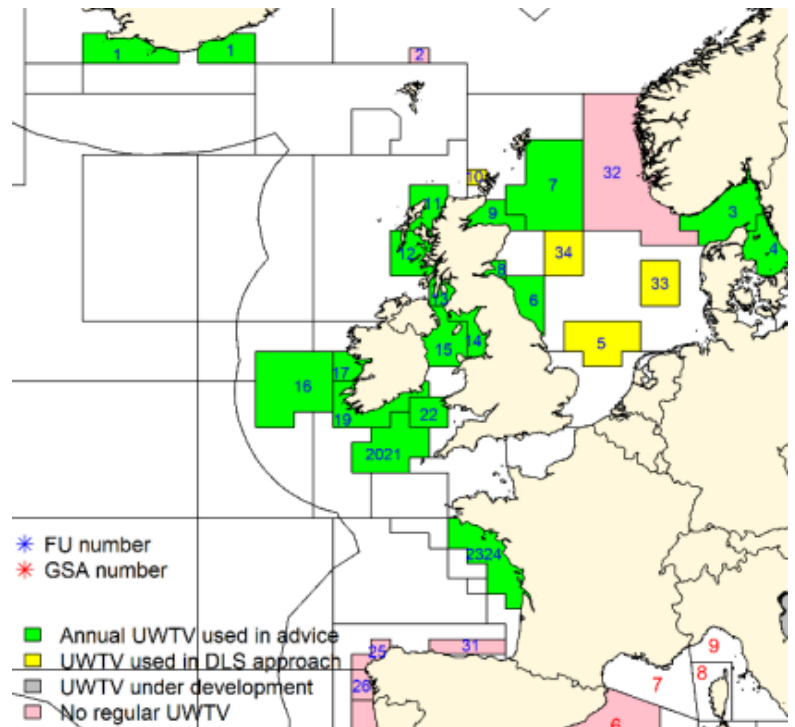


Figure 1: Nephrops UWTV survey areas and functional units (FUs) in ICES areas (numbers in blue) and geographical subareas (GSAs) in the Mediterranean (numbers in red) (Dobby *et al.*, 2021).

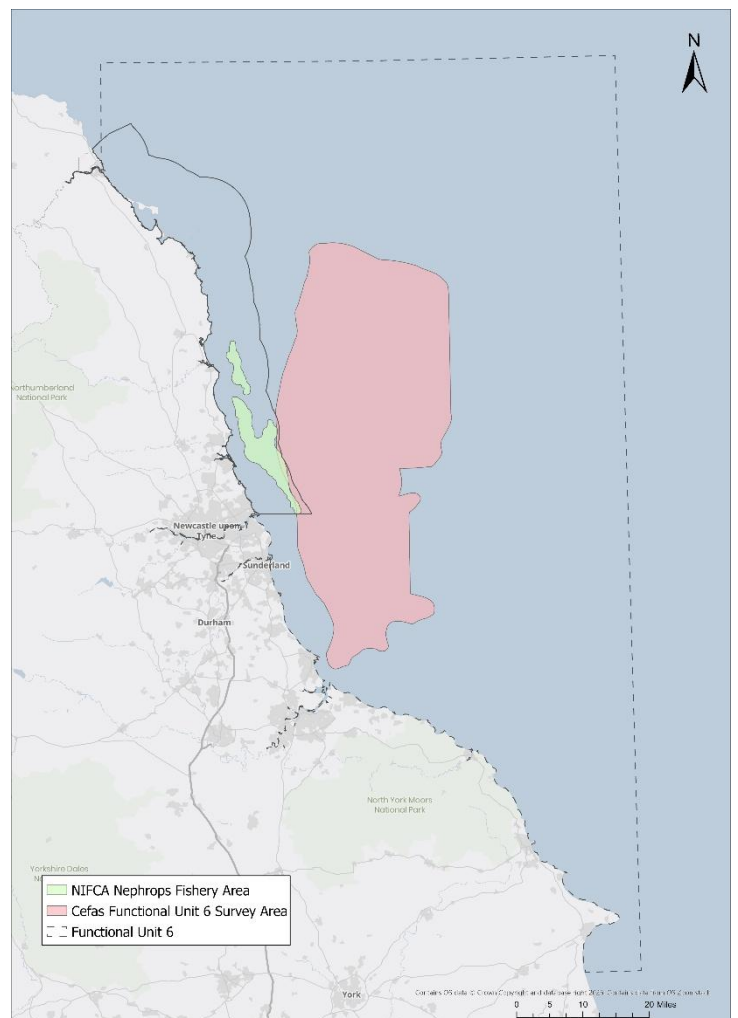


Figure 2: Nephrops FU6, the Cefas survey area for FU6 and NIFCA Nephrops fishery area.

harvest rates are used to create advice on the TAC. The ICES TAC advice for FU6 was 1,230 tonnes in 2025 to ensure stock is exploited sustainably (ICES, 2024). Currently, the Cefas survey area for FU6 does not significantly extend into the NIFCA district and no survey stations fall within the district. It is hoped that the development of NIFCA's UWTV capability will address this gap and contribute to the Cefas assessments of the functional unit.

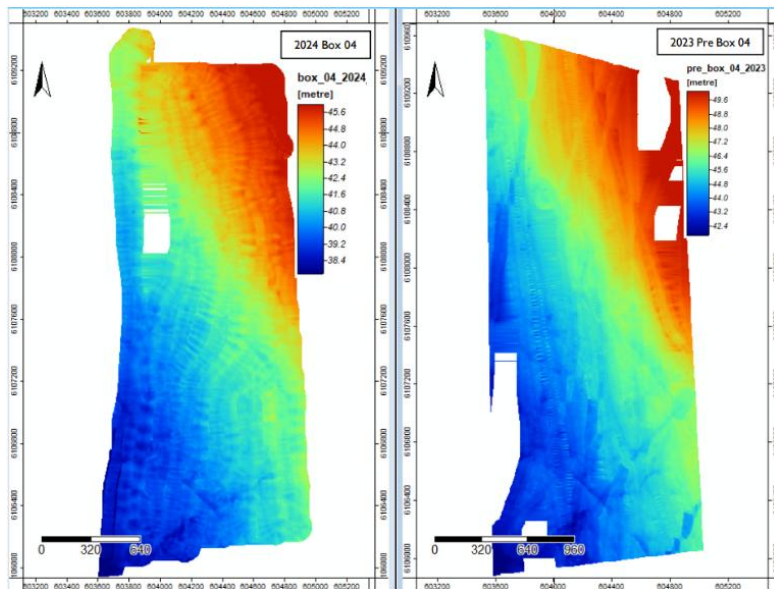


Figure 3: Multibeam bathymetry data from areas where declines in Nephrops were reported showing no significant change in the seabed hardness in the surveyed area.

At the end of 2023, following the intense storm Babet, fishermen reported a significant decline in Nephrops catches on traditional fishing grounds within NIFCA's inshore region. Fishermen provided NIFCA the location of these fishing grounds, and initial surveys in early 2024 assessed for any changes in the seabed habitat in these areas. Data was collected onboard the NIFCA patrol vessel St. Aidan for backscatter multibeam bathymetry to evaluate seabed hardness, and ROV video footage for ground truthing. This data along with multibeam bathymetry data collected before the storm was analysed with no significant changes in the habitat (hardness) found (Figure 3) and Nephrops burrows present in the video footage. The footage was also shared with affected local fishers for their input. Due to the opportunistic nature of using the 2023 multibeam bathymetric data, the report recommended a more targeted approach for future monitoring. The trial in 2024, and subsequent expanded survey in 2025 was intended to develop and establish an UWTV monitoring programme for Nephrops abundance within the NIFCA district. The aim of this survey is to estimate the burrow density and therefore the abundance of Nephrops within this inshore fishery.

## 2. Methodology

### 2.1 Survey Planning

The 2024 survey was a trial to assess the effectiveness of UWTV surveys to monitor Nephrops populations. This survey was designed following input from local fishers and habitat maps, with a total of six stations surveyed. In 2025, the extent of the survey area and the number of survey stations increased. For this, the NIFCA Nephrops fishery area was defined using Inshore Vessel Monitoring System (I-VMS) data for trawlers within the NIFCA district. This data was filtered by vessel speed to infer fishing activity and determine the extent of the fished area, defined as an area of 163km<sup>2</sup> (Figure 4a).

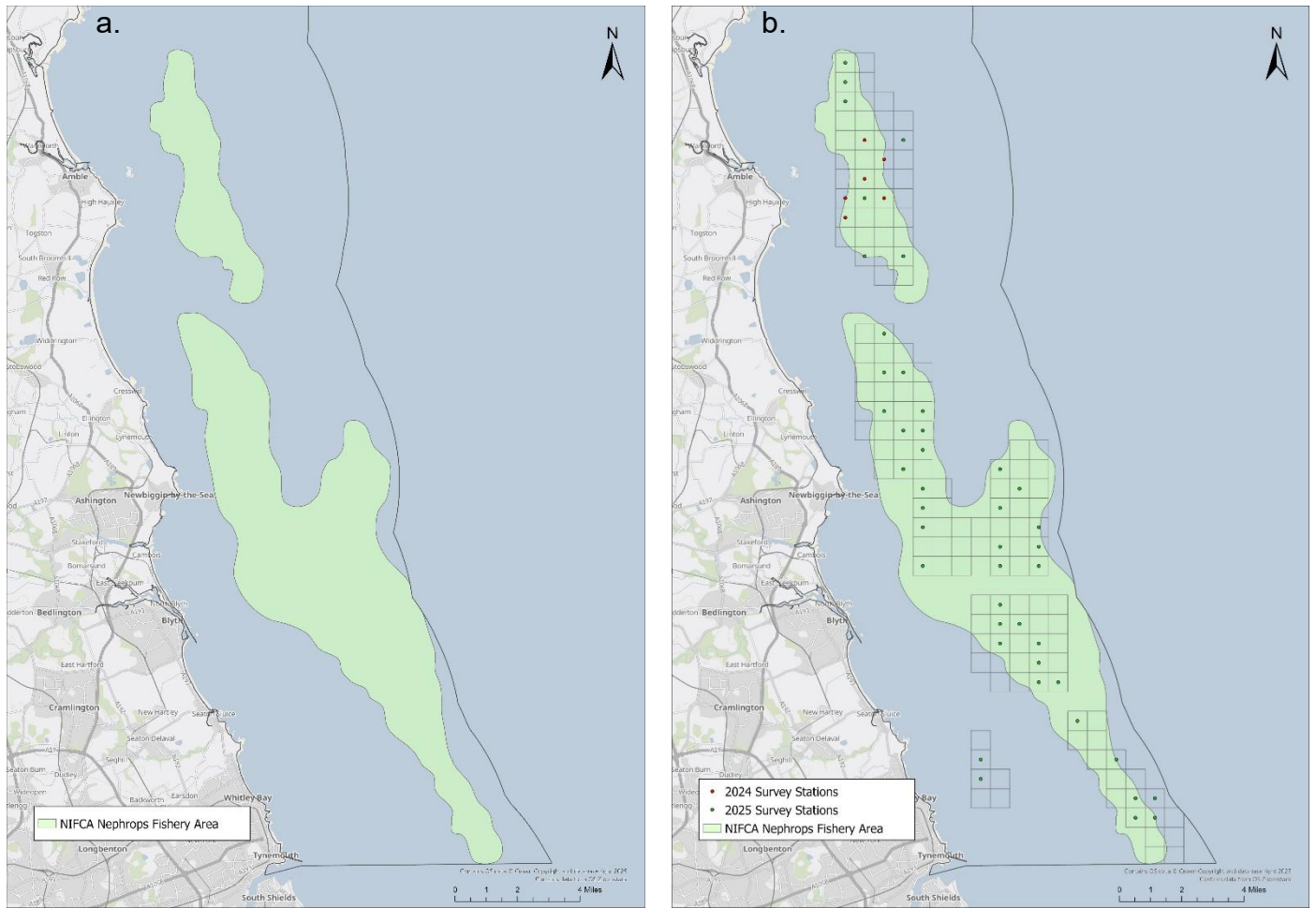


Figure 4a: NIFCA Nephrops fishery area.

Figure 5b: NIFCA Nephrops fishery area and 1km<sup>2</sup> with the stations surveyed in 2025, with those stations surveyed in 2024 also shown.

Following this, a 1km<sup>2</sup> grid was overlaid across the fished area, as well as over areas where mud habitat was found but no fishing activity identified from the I-VMS data (Figure 4b), identifying a total of 150 stations. To compare with the 2024 trial, the six stations surveyed in 2024 were repeated in 2025, with a further 44 randomly selected, totalling 50 stations. Of the 50 stations surveyed in 2025, 46 fell within the fishery area.

## 2.2 Survey Equipment and Methodology

A towed sledge comprising a Bowtech Surveyor-HD camera with three LED lights and two Z-bolt green point dive lasers was used (Table 1 & Figure 6).

Table 1: Camera frame and equipment specifications used in the 2024 and 2025 surveys.

<b>Camera System</b>	Bowtech Surveyor-HD
<b>Video</b>	30fps .mkv file
<b>Resolution</b>	1920 x 1080
<b>Lasers</b>	2 point lasers
<b>Source of Distance over Ground</b>	Layback calculated from HYPACK and ship's position
<b>Positioning System</b>	Layback calculated from HYPACK and ship's position from hemisphere GPS (accurate to 8-10cm)
<b>Data Transmission</b>	Non-load-bearing camera cable
<b>Lighting</b>	3 LED spotlights
<b>Camera Height</b>	30cm
<b>Camera Angle</b>	65°
<b>FOV</b>	52cm

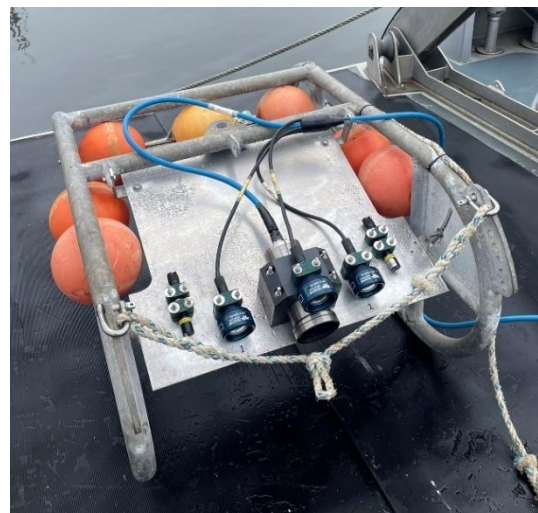


Figure 6: Camera frame setup used in the 2024 and 2025 surveys.

The 2025 survey was completed over seven days between 23<sup>rd</sup> June and 10<sup>th</sup> July onboard NIFCA Fisheries Patrol Vessel St Aidan. At each station, the sledge was towed for 12 minutes, with seven minutes of useable footage required for individual station analysis. Vessel location was recorded from the vessel GPS system, which was fed into HYPACK software, with camera location calculated based on the layback estimate from the length of cable deployed during each tow. Tow speed was kept between 0.5 and 1 knots where possible and distance over ground calculated post-survey for each minute used in the analysis.

For quality control of navigation data, the sledge camera tracks were validated by plotting the sledge position data against the vessel position data on ArcGIS, to ensure the tracks of the vessel and sledge camera were similar.

### 2.3 Burrow Identification

Nephrops burrows typically have multiple entrances, with burrow complexes with two or three functional openings are the most common on the inshore grounds (Leocádio *et al.*, 2018). The main features which define a Nephrops burrow system are at least one crescent-shaped entrance, a delta of excavated material (known as the driveway), and (where visible) a shallow angle of descent (a tunnel). Occasionally liner tracks can be seen by the entrance, created by the Nephrops as it enters and emerges from the burrow (Leocádio *et al.*, 2018) (Figure 7). Entrance apexes either face each other in a simple U-shaped burrow system or converge on one central point in a more developed system, where several entrances form a T-shaped system (Dobby *et al.*, 2021). Each burrow system is assumed to represent one adult Nephrops (Firmin *et al.*, 2018). Training on burrow identification

and counting procedures was provided by Cefas staff experienced in UWTV surveys and Nephrops analysis in early 2025.

## 2.4 Counting Procedure

Analysis of the footage was done by four internal counters and was completed independently in a controlled environment. Each video was reviewed by a counter prior to analysis and where the field of view became obstructed by sediment, or the camera was 'flying' and the seabed cannot be seen when the camera is moving, the seconds obscured were recorded. If more than 20 seconds were obscured from any individual minute block, that minute was disregarded and only the useable minutes were analysed. For each of the 50 stations surveyed in 2025, each station had a minimum of seven minutes of useable footage, in line with the ICES recommendation (Dobby *et al.*, 2021).



Figure 7: Nephrops emerging from a burrow taken from footage captured in the 2025 survey.

Following an initial review of obscured seconds, each station was randomly allocated to two counters, who independently reviewed, identified and counted Nephrops burrows in minute blocks. The first usable minute for the transect was used as a 'lead-in' minute for the observer, with the seven subsequent useable minute's burrow counts recorded. Following this first round of counting, a Lin's concordance correlation coefficient (CCC) test was performed to statistically check the concordance of the observer's results, where 1 represents complete agreement and -1 complete disagreement. In line with Cefas's methodology, the threshold 0.5 was used to determine concordance, with any scoring below requiring a third observer to review the footage and statically compare their results to the previous observers. If, following the inclusion of a third counter, the Lin's CCC threshold of 0.5 was not met, then counts were averaged across all recorders for each minute. For each station, the presence or absence of Gadoid species, flatfish, other fish species, sea pens, crustacea and trawl marks were recorded by the first and second counters, as well as any additional comments regarding the footage.

## 2.5 Burrow Density Estimates

Counts of burrow systems were converted into burrow densities at each station, using the width of camera view (0.52m), the length of the tow (m) and the total burrow counts adjusted for associated biases. There are several components which can contribute to bias in observer burrow counting. These bias correction factors have been formed for each functional unit, with Cefas estimating the cumulative bias is 1.2 for FU6, so the total burrow counts at each station were adjusted by 20% (Bell

*et al.* 2018). Sledge camera coordinates (extracted from HYPACK data) were plotted in ArcGIS, additional minutes beyond the required seven for analysis, and disregarded minutes were removed, leaving only the minutes used in the analysis. (Doyle *et al.*, 2023). Each minute tow length was measured in ArcGIS Pro using the Calculate Geometry Attribute tool, to give the total distance of useable minutes per tow.

Kriged estimates of density for areas between surveyed stations were calculated. Kriging is a geostatistical method of predicting values for unknown locations between known densities for specific stations. This utilises a grid design to provide abundance estimates and calculates uncertainties of these estimates of Nephrops populations (Dobby *et al.*, 2021). Through bootstrapping of the data, it is possible to calculate a coefficient of variation (CV) value. For this, kriged estimates are repeated 1,000 times to generate the CV value, which provides confidence intervals of absolute Nephrops abundance. To generate quality-assured estimates of Nephrops absolute abundance within defined areas, a coefficient of variation (CV) or relative standard error of less than 20% is recommended by ICES (ICES, 2012).

### 3. Results

In total, 57 camera deployments took place at 50 stations in the 2025 survey. Six stations required multiple deployments due to poor visibility, obstructions and equipment failures. Six further stations were relocated due to obstructions and unsuitable habitat type at the station. Of the 50 stations surveyed, 46 fell within the NIFCA Nephrops fishery area. One of the stations had anomalous GPS data which resulted in significantly elevated density estimates therefore this was removed from the analysis. Therefore 45 stations were used in the analysis.

#### 3.1 Burrow Counts

Counts per minute were highly variable between stations, ranging from 0-22, but averaging at 5.87 burrows per minute. Final counts that passed the Lin's CCC test are shown in Figure 8, highlighting the difference between stations and variance between minutes counted at the same station.

### Counts per Minute by Station

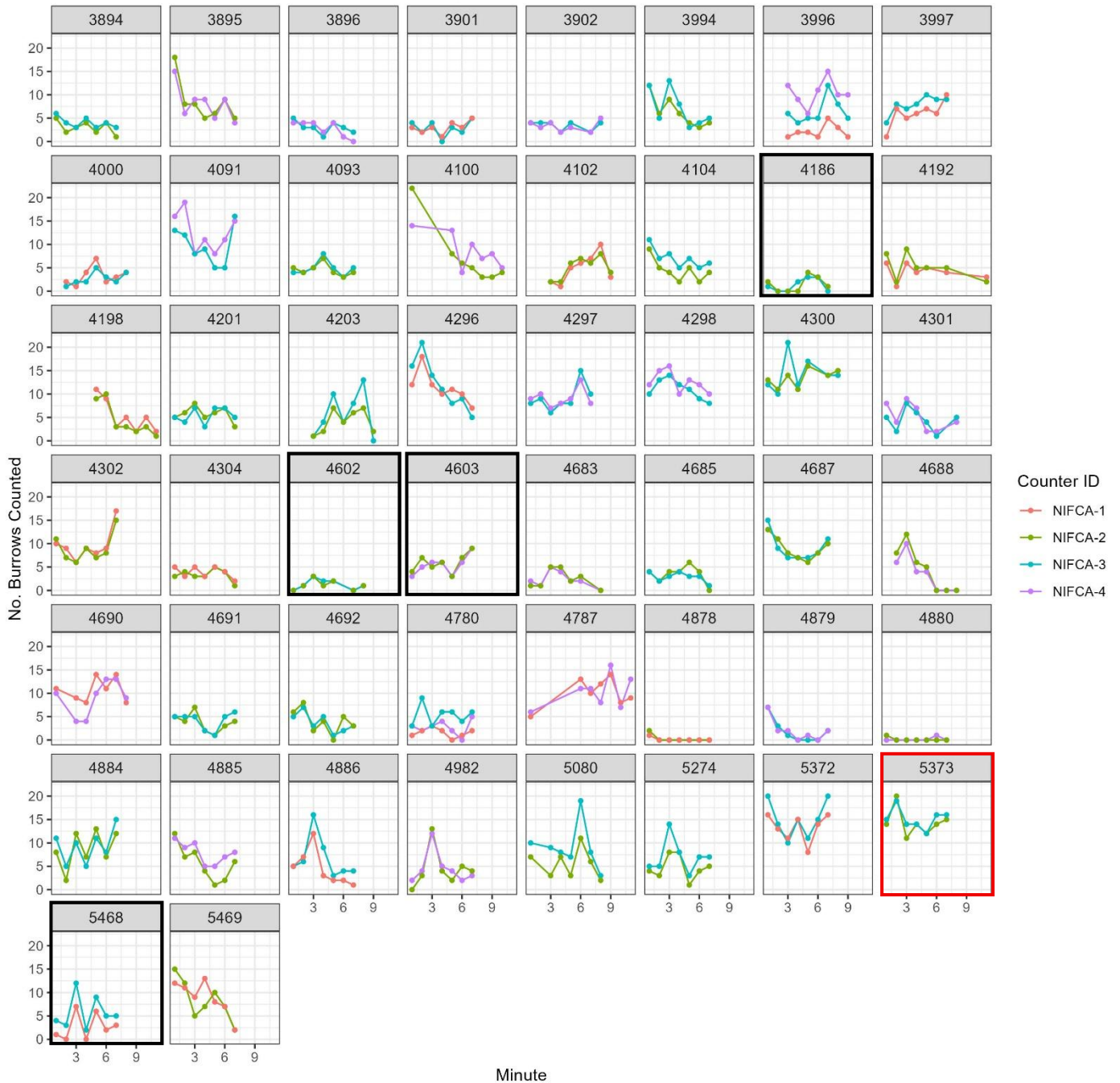


Figure 8: Burrow counts per minute for each individual counter per station. Stations 4186, 4602, 4603 and 5468 (black boxes) were located outside of the fishery area. Station 5373 (red box) was removed from the density analysis due to a positional data error.

### 3.2 Lin's Concordance Correlation Coefficient

Of the stations surveyed, 25 passed the Lin's CCC test following an initial round of counting by their assigned first and second counters. Two stations 4878 and 4880 (Figure 8) had counts that were too low for the Lin's CCC test to be completed. A further 21 stations met the Lin's CCC threshold following a third counter, with only two stations counts averaged due to not achieving sufficient concordance. Despite this, there was minimal variance between counters and therefore the counts were deemed suitable for use. Concordance between counters varied from 0.5-0.96 across all stations, with an average concordance of 0.73.

### 3.3 Distance over Ground

There was no significant change in the distance over ground covered at individual survey stations between the 2024 and 2025 survey. Tows were kept between 0.5 and 1 knot to prevent the sled from becoming stationary and also lifting up and losing sight of the seabed. The mean distance covered across all sites in 2025 was 119m, compared to 108m in 2024. The median distances were 111m and 112m respectively.

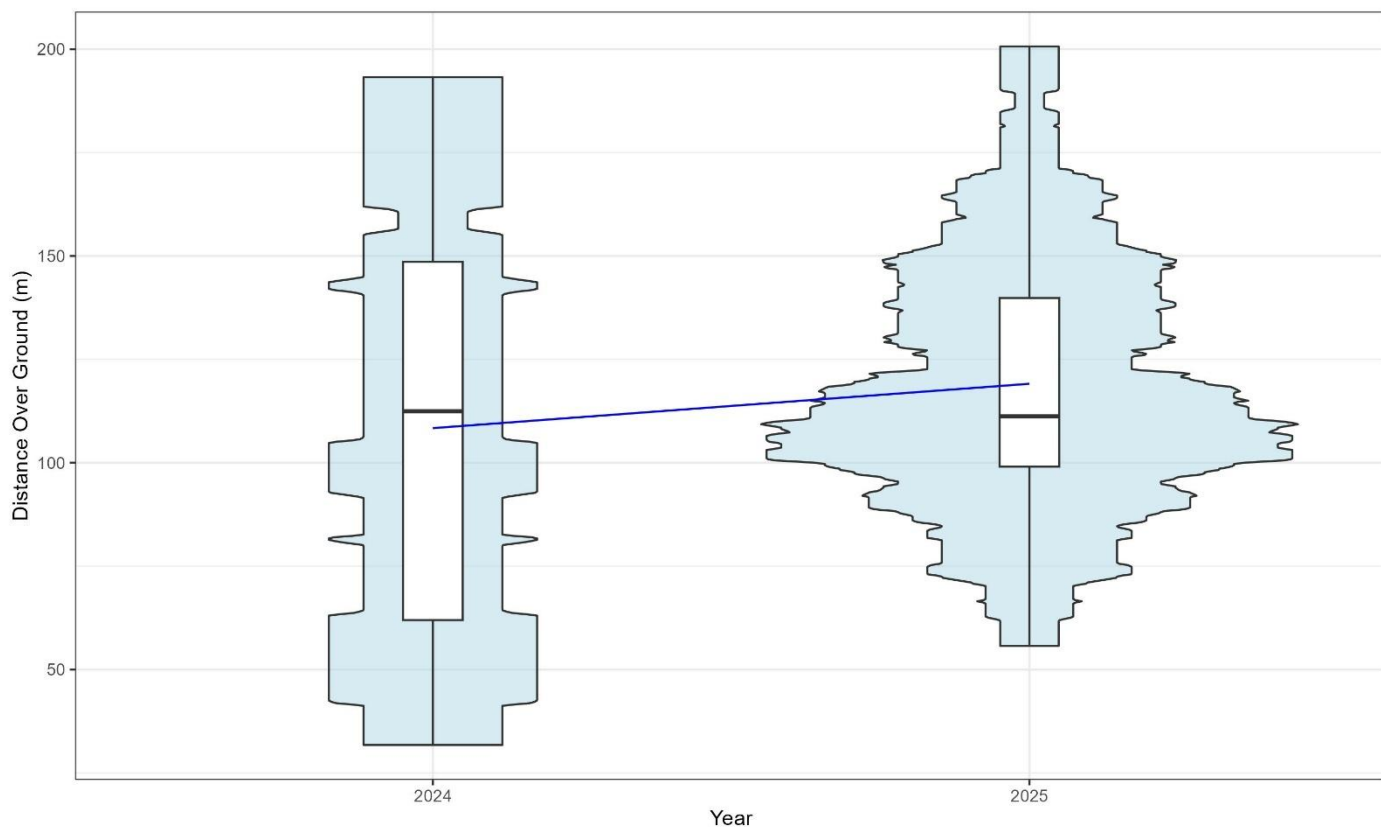


Figure 9: Violin and box plot of distance over ground covered at individual stations. The blue line indicates the mean density over time. The horizontal black lines represent medians, white boxes the inter quartile ranges, the black vertical lines the range and any outliers are displayed as black dots.

### 3.4 Burrow Density

#### 3.4.1 Overall Burrow Density

Given the low number of stations surveyed in 2024 and the increased distribution of survey stations in 2025, it is difficult to compare the two datasets and therefore the comparative results presented should be read with caution. Median station density increased from 0.34 burrows/m<sup>2</sup> in 2024, to 0.52 burrows/m<sup>2</sup>. Mean burrow density increased from 0.53 to 0.59 burrows/m<sup>2</sup> (Figure 10). The mean density in 2024 is likely skewed by the outlier in the data that may be masking the real increase. Without this outlier, mean burrow density in 2024 was 0.33 burrows/m<sup>2</sup>. In 2025, no outliers were observed in the data, excluding the station with erroneous GPS data which was removed from the analysis. The remaining data displayed a typical distribution in burrow density that has been observed across other UWTV surveys.

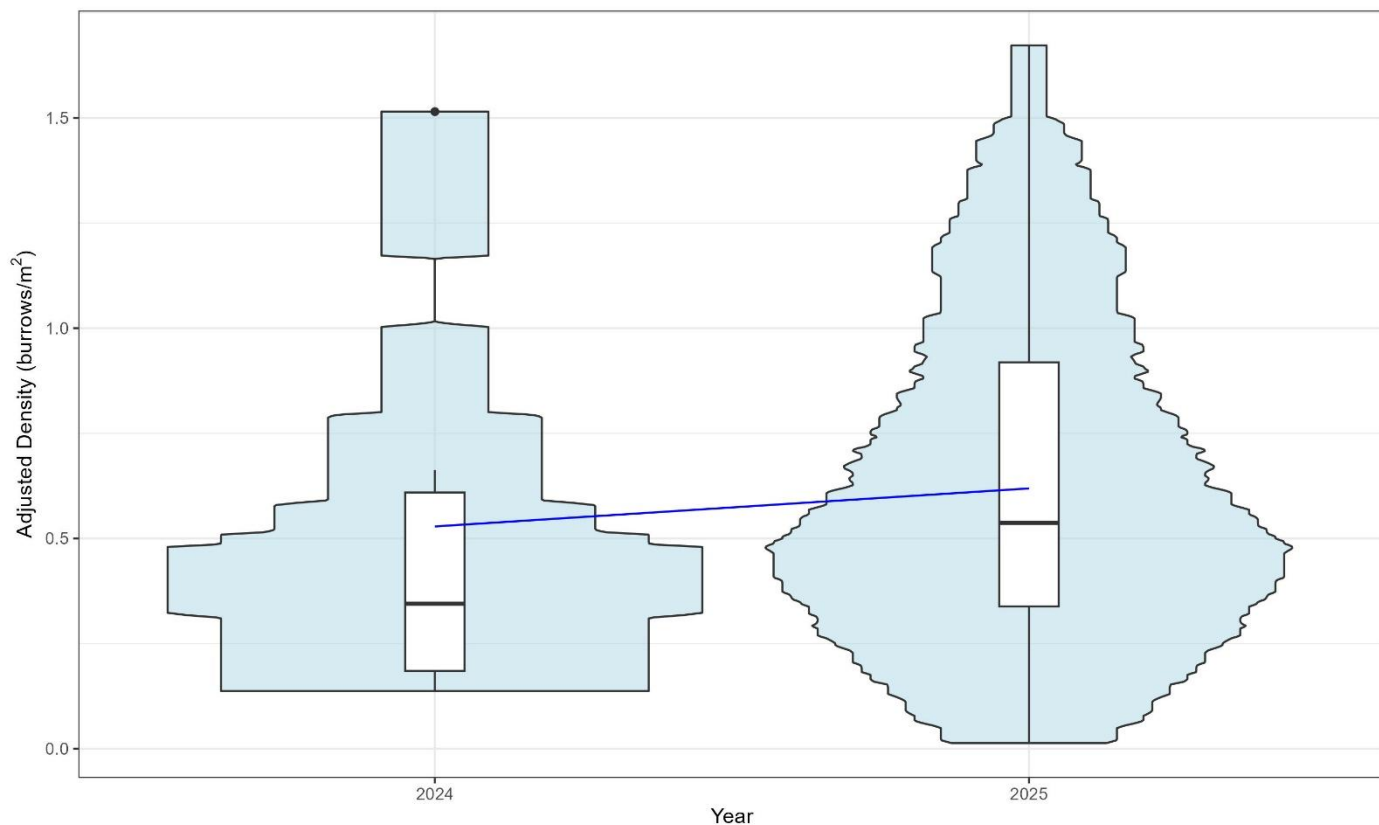


Figure 10: Violin and box plot of adjusted burrow density. The blue line indicates the mean density over time. The horizontal black lines represent medians, white boxes the inter quartile ranges, the black vertical lines the range and any outliers are displayed as black dots.

### 3.4.2 Kriged Density Estimates

Mean kriged density estimates for the fishery area in 2025 increased to 0.62 burrows/m<sup>2</sup> compared to 0.56 burrows/m<sup>2</sup> in 2024. The spatial distribution of the 2024 survey stations clearly biases the kriged density estimates, with a significant “halo effect” north of 55.35°N (Figure 4). Haloing occurs where data points are limited, and extreme high or low points have a significant effect on neighbouring density estimates. In this case, the high densities in the northernmost extent of the fishery area are impacted by the high densities recorded at the nearest survey stations. This area of high density in 2024 did not carry through into 2025, further highlighting that this was not biologically driven, and instead a consequence of the halo effect.

The increased coverage of the fishery area in 2025 has provided significantly more confidence in density estimates when compared to the outputs from the 2024 survey. There was no clear indication of any haloing, areas of high density continued across multiple stations, indicating consistency across surrounding areas rather than being influenced by fewer stations. Both kriged and station density is highest around 55.20°N, with relatively consistent distributions of both kriged and station density across the remainder of the fishery area. Lowest station and kriged density were found towards the east of the fishery area, potentially highlighting and confirming the extent of the fishery area.

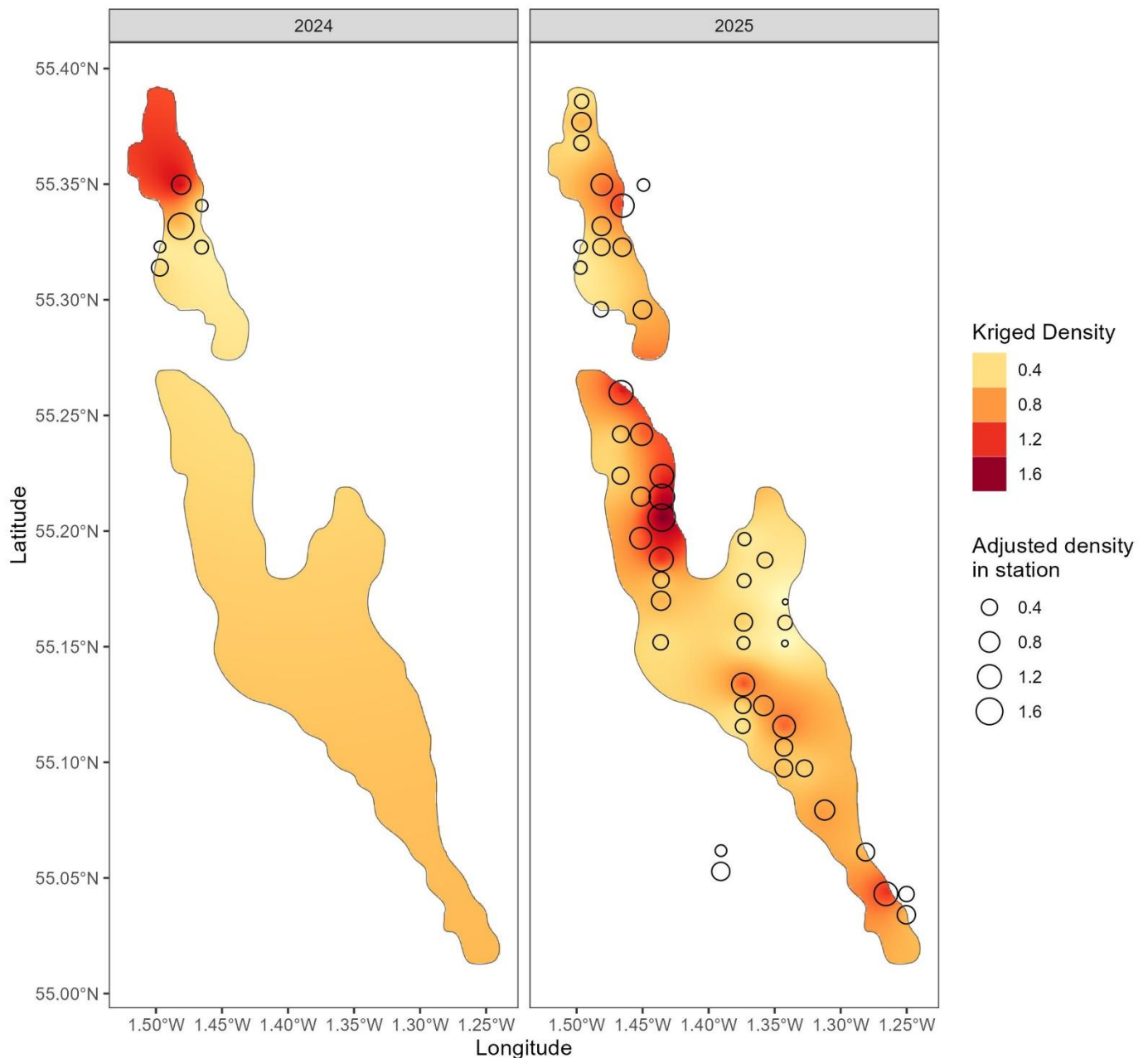


Figure 11: Contour plot of adjusted density (burrows/m<sup>2</sup>) by station for each year and kriged density estimates (burrows/m<sup>2</sup>) for the fishery area.

### 3.4.3 Burrow Density Inside vs. Outside Fishery Area

The stations outside of the fishery area will act as “control” stations and help identify any difference between fished and unfished areas. Both median and mean burrow densities were lower outside of the fishery area, although given the number of stations surveyed outside of the fishery area (4) there is a lower confidence in these densities. Mean density in the fishery area was 0.62 burrows/m<sup>2</sup>, compared to 0.3 burrows/m<sup>2</sup> outside of the area (Figure 12). There was significantly lower variation in burrow density outside of the fishery area compared to within the fishery area, leading to smaller interquartile ranges. This would suggest that the stations outside of the fishery, whilst widely distributed (Figure 11), are broadly similar in their densities and may mean that whilst the number of stations are low, the densities are representative of areas outside of the fishery area, but in areas of *Nephrops* habitat.

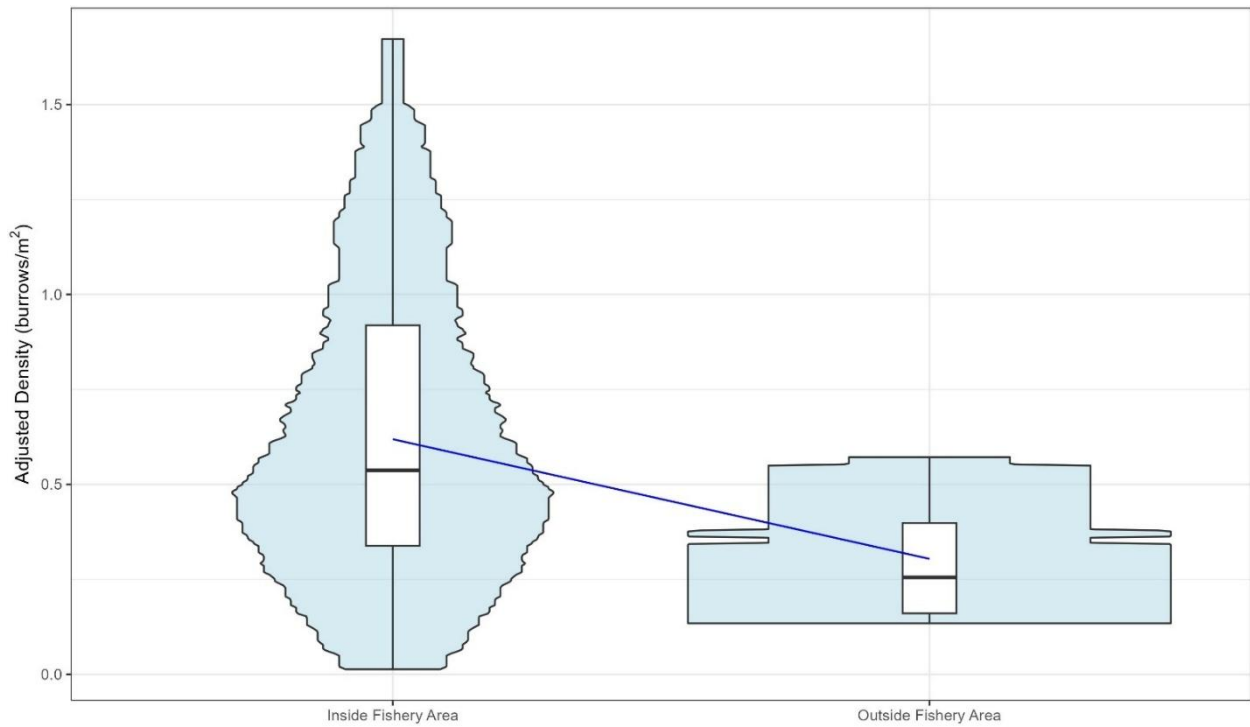


Figure 12: Violin and box plot of adjusted burrow density from the 2025 survey for stations inside and outside of the NIFCA Nephrops fishery area. The blue line indicates the mean density over time. The horizontal black lines represent medians, white boxes the inter quartile ranges, the black vertical lines the range and any outliers are displayed as black dots.

#### 3.4.4 Burrow Density Fixed Station Comparisons

Of the six stations surveyed in 2024, all six were revisited during the 2025 survey, allowing for direct station-by-station comparisons to be made. Burrow density at four of these stations increased in 2025, with the most significant change occurring at station 4091 where density increased from 0.17 to 1.10 burrows/m<sup>2</sup> (Figure 13). A significant decline was observed at station 3996, where burrow density fell by 0.89 burrows/m<sup>2</sup> to 0.62 burrows/m<sup>2</sup> in 2025. Overall, across all stations there was a mean increase from 0.52 burrows/m<sup>2</sup> to 0.61 burrows/m<sup>2</sup>.

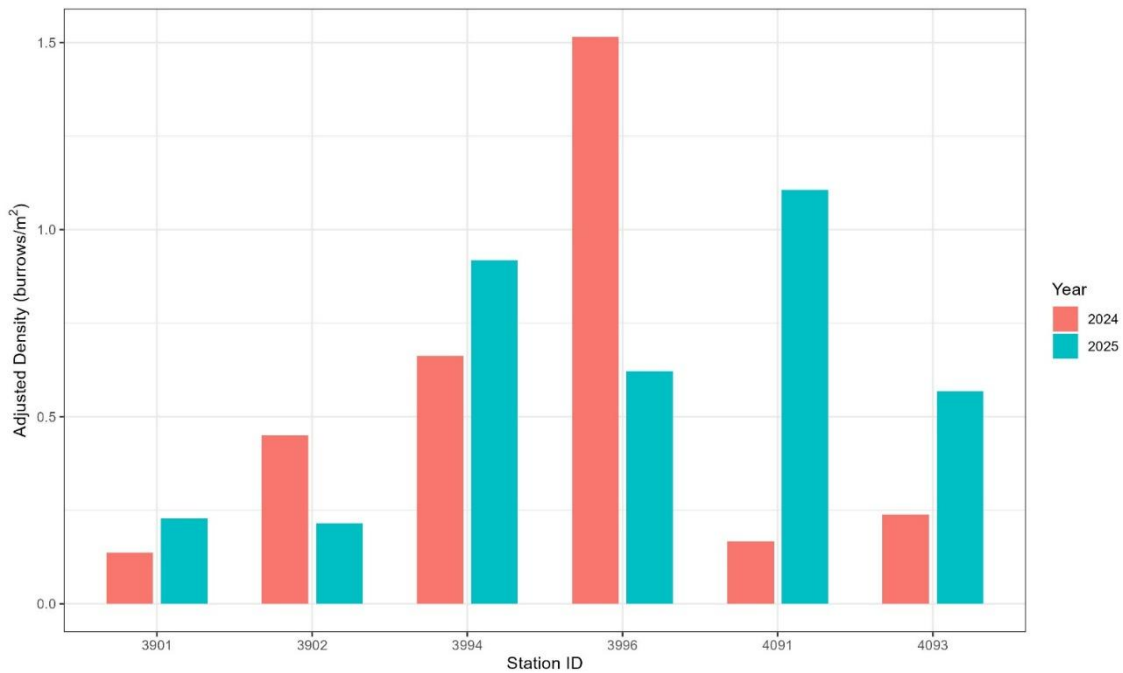


Figure 13: Burrow density for stations surveyed in 2024 and 2025.

### 3.5 Nephrops Abundance

Nephrops abundance calculated from kriged density estimates increased in 2025 to 101.1 million, with a CV value of 14.4% (Figure 14). This was a 11.96% increase from the abundance estimate for 2024 of 90.3 million (Figure 15). The CV value for the 2024 abundance estimates was 31.9%, likely as a result of the low number of stations and discrete spatial distribution. This CV highlights the uncertainty of 2024 results, with the CV estimate above the 20% limit in the ICES guidance.

ICES guidance suggests that if a greater than 40% change in abundance is observed when compared to the previous year, then a review of 20% of footage from the year the change was observed is required (if resources allow). If, following this review, there is a difference of greater than 20% between the original and the reviewed counts, then a full review and recount of the survey is required. Given the changes between 2024 and 2025, a further review was not required. Given the levels of confidence in abundance estimates from the 2024 survey, had the change in 2025 triggered these review thresholds, no further review would have been undertaken.

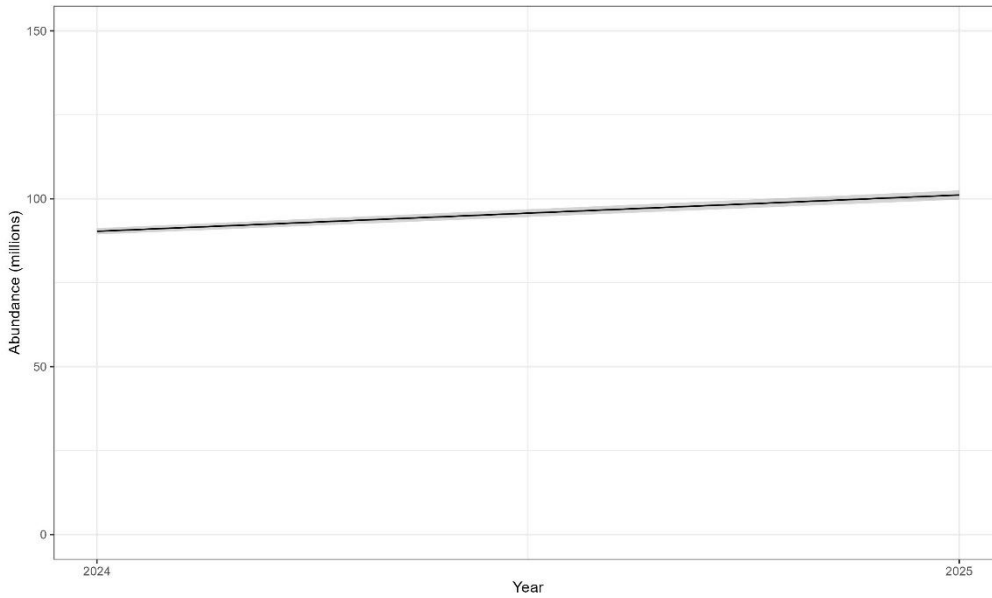


Figure 14: Time series of total Nephrops abundance in the NIFCA Nephrops fishery area with shaded 95% confidence intervals.



Figure 15: Time series of total Nephrops abundance change in the NIFCA Nephrops fishery area with the additional review triggers of  $\pm 40\%$  (green) and  $50\%$  (red).

### 3.6 Additional Species and Observations

Across all 50 stations surveyed, the presence or absence of several species were noted, as well as the presence or absence of evidence of fishing activity in the form of trawl marks. Flatfish and other fish species were the most commonly observed when reviewing the footage, both of which were seen in 94% (47) of stations (Figure 16 and Table 2). Crustacea species were reported in 78% (39) of stations, with sea pens observed in 62% (31) of stations. Gadoids were the lowest observed, only seen in 20% (10) of stations. Trawl marks were seen in 20% (10) of stations within the fishery area, and in 25% (1) of stations outside of the fishery area.

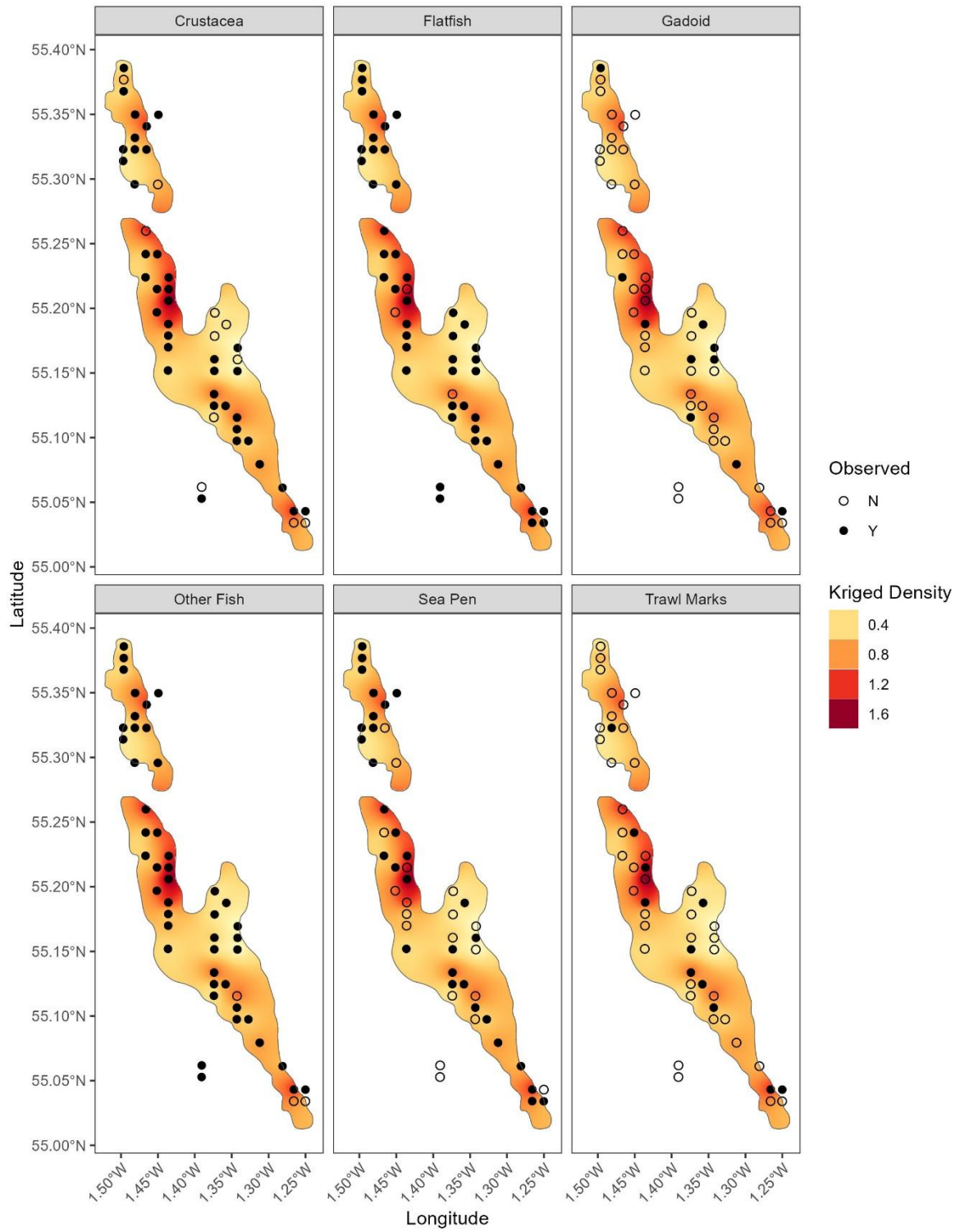


Figure 16: Spatial distribution of recorded presence or absence of crustacea, flatfish species, Gadoid species, other fish species, sea pen species and trawl marks from the UWTV survey in 2025 alongside kriged Nephrops burrow densities/m<sup>2</sup> for 2025.

Fish species (Gadoids, flatfish and others) were seen ubiquitously across the survey stations, with no apparent trends in presence or absence in relation to Nephrops burrow density and inferred abundance. Crustacea were typically seen throughout the fishery area, but primarily in areas of higher Nephrops burrow density. Sea pens were seen across the spectrum of burrow densities, most commonly found north of 55.20°N. The distribution of reported trawl marks was spread across the fishery area but was more commonly seen in areas of higher Nephrops burrow density. The station outside of the fishery area with the reported trawl mark was in close proximity to the fishery area and could be from activity not detected during the analysis of the fishery and may indicate that fishing activity extends beyond the current boundary of the fishery area.

Amongst the additional station observations, only sea pen presence demonstrated a significant difference between stations inside and outside of the fishery area. No other variables showed any substantial differences between inside and outside of the fishery area (Table 2).

Table 2: Percentages of stations where presence of crustacea, flatfish species, Gadoid species, other fish species, sea pen species and trawl marks was noted from the UWTV survey in 2025 for inside and outside of the Nephrops fishery area.

	Gadoid	Flatfish	Other Fish	Sea Pens	Crustacea	Trawl Marks
Inside Fishery Area	20%	93%	93%	65%	78%	22%
Outside Fishery Area	25%	100%	100%	25%	75%	25%

## 4. Discussion

Whilst the 2025 survey is the second year that NIFCA has undertaken an UWTV Nephrops burrow count survey, given the increases in the number of stations covered and associated confidence in the data, the 2025 survey will act as a baseline for future years.

### 4.1 Burrow Counts

Training from Cefas in early 2025 strengthened the in-house capacity of NIFCA for Nephrops UWTV survey analysis. Individuals involved in the counting process reviewed footage from the 2024 survey where counts had been agreed and all four NIFCA counters were required to pass a Lin's CCC test prior to reviewing the 2025 footage. Increasing the robustness of the survey methodology and burrow counting process in 2025 was key to the success of the survey and has allowed for significant confidence in the burrow counts and associated density and abundance estimates derived from the counts. Having only 4% of stations failing to achieve concordance following a Lin's CCC test highlights the consistency across the counters involved. Prior to the 2026 survey, counters will repeat the same process of reviewing footage of known counts prior to any analysis of the 2026 survey, as suggested by the ICES best practice guidance for UWTV surveys.

## 4.2 Burrow Density

Mean adjusted burrow density from the NIFCA UWTV survey in 2025 remained higher (0.59 burrows/m<sup>2</sup>) than that of the wider Cefas survey, where a mean density of 0.36 burrows/m<sup>2</sup> was reported (Table 3). Over the period of 2007-2025, the 2025 Cefas survey recorded the second-highest burrow density, only exceeded in 2019, and appears to have marked the end of a declining trend in the Nephrops abundance since the 2019 peak. Given the fluctuation across the survey years from the Cefas data for FU6, the increases seen in the wider ICES community and the increased number of stations in the 2025 NIFCA survey, the variation in burrow density between 2024 and 2025 appears normal and it is too early in the monitoring process to identify any long-lasting trends for the NIFCA Nephrops fishery.

Table 3: Cefas geostatistical model results from UWTV-FU 6 Nephrops survey in 2007–2025 (Firmin, 2025).

Year	Stations	Mean density (burrows/m <sup>2</sup> )	Absolute Abundance (millions)	95% confidence interval (millions)
2007	105	0.28	858	23
2008	95	0.31	987	39
2009	76	0.22	682	38
2010	95	0.25	785	21
2011	97	0.28	878	17
2012	97	0.24	758	13
2013	110	0.23	706	18
2014	110	0.24	755	18
2015	110	0.18	568	13
2016	110	0.24	697	19
2017	110	0.29	909	21
2018	109	0.31	950	23
2019	91	0.37	1,163	26
2020	110	0.35	1102	24
2021	110	0.31	982	22
2022	109	0.28	878	20
2023	109	0.29	899	17
2024	110	0.24	760	20
2025	81	0.36	1,115	26

Given the increased spatial coverage of the sample stations across the fishery area, the 2025 survey was the first year where it was possible to use Kriged burrow density estimates to confidently visualise the distribution of Nephrops burrow density from the NIFCA survey. It was not possible to determine with any confidence whether the density of Nephrops had shifted within the fishery area, however future surveys will be compared against this 2025 baseline.

Burrow density inside of the fishery area compared to outside of the fishery area in the 2025 survey was as expected, with significantly lower densities outside of the fishery area. This was expected as fishing vessels do not target these areas; however, habitat type is similar to that of the fishing area, so burrows were expected. Given the stations outside of the fishing area display expected patterns of burrow density, it is reasonable to assume that they are representative of similar, but less productive, Nephrops habitat. For robustness, increasing the number of stations outside of the fishery area, as well as continued surveying of these areas for future years will identify trends over time and potential new areas for the fishery to expand to is recommended.

Direct comparisons between the 2024 and 2025 surveys indicate an overall increase in estimated Nephrops burrow density. Given that each station is located within a 1 km<sup>2</sup> grid and the tow track varies within that grid rather than following a fixed point, some degree of intrastation variability is expected. This spatial variability likely accounts for the substantial year-to-year differences observed at stations 3996 and 4091. Although such variation cannot be eliminated, increasing the total number of stations reduces its influence on overall density estimates, as reflected in the more stable kriged outputs for 2025. Consequently, while the broader trend suggests increasing Nephrops density across the survey area, interpreting station-specific temporal changes remains challenging because the exact same section of seabed cannot be surveyed consistently across years.

### **4.3 Nephrops Abundance**

With the significant increase in survey stations in 2025, direct comparisons with 2024 are difficult. The increased spatial coverage of the NIFCA Nephrops fishery area from the 2025 survey stations has significantly increased the accuracy of the density and abundance estimates. The 2025 survey provides a more robust baseline assessment of Nephrops populations within the NIFCA Nephrops fishery area. The stations were selected randomly and are therefore not evenly distributed across the fishery area, resulting in clustering in some areas and larger gaps in others. The density for these areas is estimated through the kriging process but there is lower confidence in burrow density and Nephrops abundance for some areas of the site. Precision improves as the number and distribution of stations is improved (Dobby *et al.*, 2021), and so confidence in this analysis will improve in future years, with stations more evenly distributed in an isometric grid.

Whilst confidence in the 2024 abundance estimate is low, shown by the elevated CV value, there was a significant increase in Nephrops abundance in the NIFCA survey in 2025. Such increases have also been observed across the wider ICES community. Across the 20 surveys of functional units by members of the ICES WGNeps in 2025, 75% (15) of functional units saw an increase in Nephrops abundance in 2025, with 40% of functional units (8) seeing increases beyond the 40% change trigger point for additional reviews. Cefas have reported a 47% increase in abundance in FU6 (ICES WGNeps, unpublished), triggering a partial review of the 2025 survey in line with

Nephrops UWTV Survey Series Protocols (Dobby et al., 2021). The review confirmed the abundance increase in FU6 and the ICES TAC advice for FU6 in 2026 was increased to 2,176 tonnes, from 1,230 in 2025 (ICES, 2025a).

## 5. Recommendations and Next Steps

### 5.1 ICES WGNeps Contribution

As a member of WGNeps, NIFCA will now contribute to the annual WGNeps report. This report summarises the national contributions on the results of the surveys conducted in the relevant year, together with time series covering all survey years, problems encountered, data quality checks and technological improvements (ICES, 2025b). For this, NIFCA has provided a brief summary of the 2025 survey that can be seen in the Appendix of this report.

### 5.2 Development of a NIFCA Reference Set

Prior to the 2025 survey, NIFCA staff reviewed a selection of stations from the 2024 survey. Consensus counts were determined for these selected stations and then individual counts by each of the counters were completed. All counters passed a Lin's CCC test against these consensus counts. With more footage available and to better align with ICES guidance, NIFCA aims to develop a region-specific reference set developed in line with the ICES process outlined in **Error! Reference source not found.** and with members of the WGNeps.

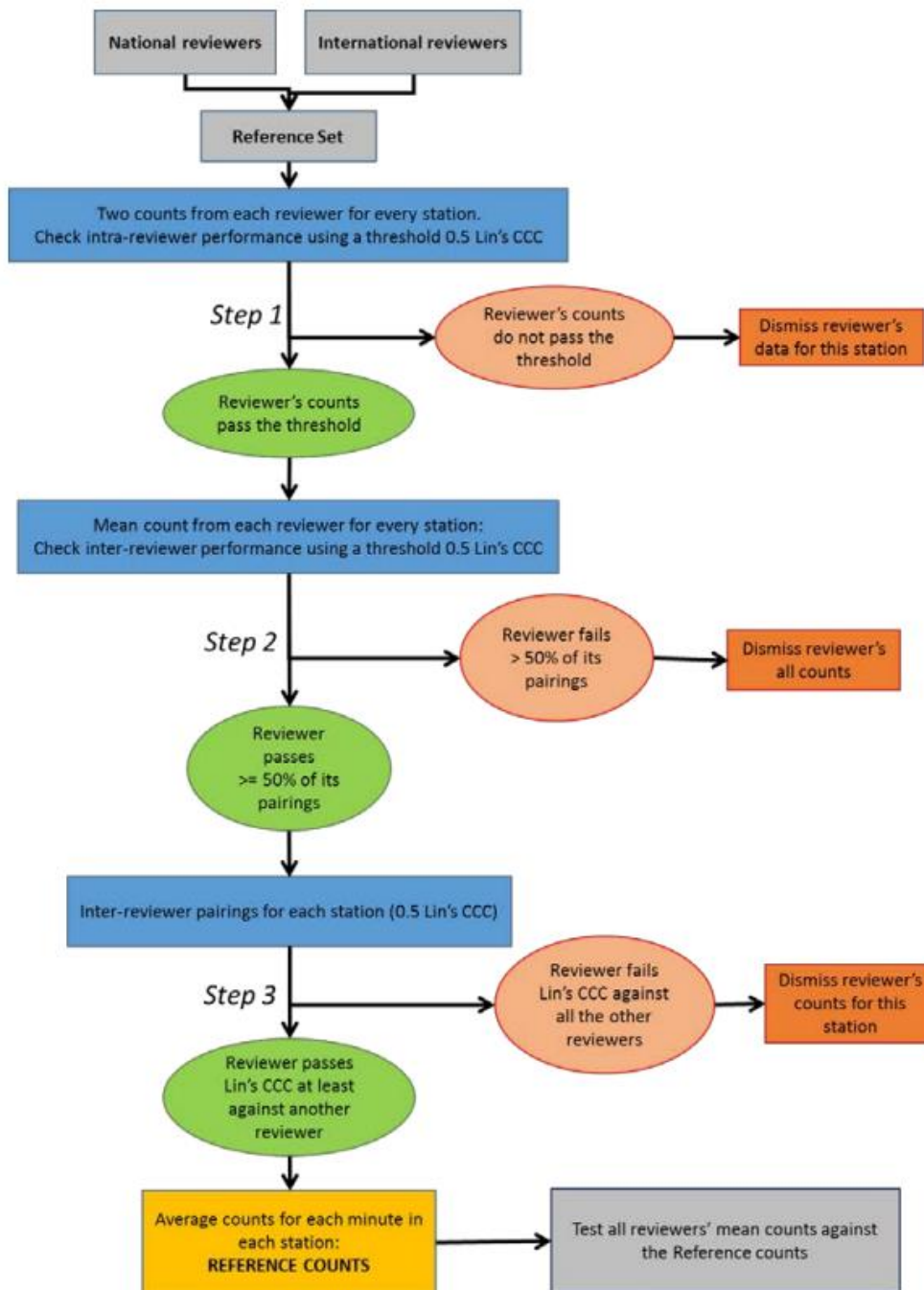


Figure 17: Decision tree in using Lin's CCC statistics to screen the reference count data for intra-reviewer (step1) and inter-review consistency (step 2) and robustness of reference counts (step 3) (ICES, 2018).

### 5.3 2026 Survey Design

To improve the spatial coverage of the survey across the fishery area in 2026, NIFCA will use a 4km<sup>2</sup> grid instead of a 1km<sup>2</sup> grid (Figure 18). This resolution, similar to that used by other ICES WGNEPS members, will still allow for accurate estimates of spatial variations of Nephrops densities across the fishery area, whilst reducing the potential for haloing through the Kriging process. Increase the coverage to the full fishery area at the 1km<sup>2</sup> grid resolution would result in around 170 stations, which would neither be feasible or proportionate. Further work on the design of the 2026 survey is planned and will be finalised in early 2026, prior to the survey window in June.

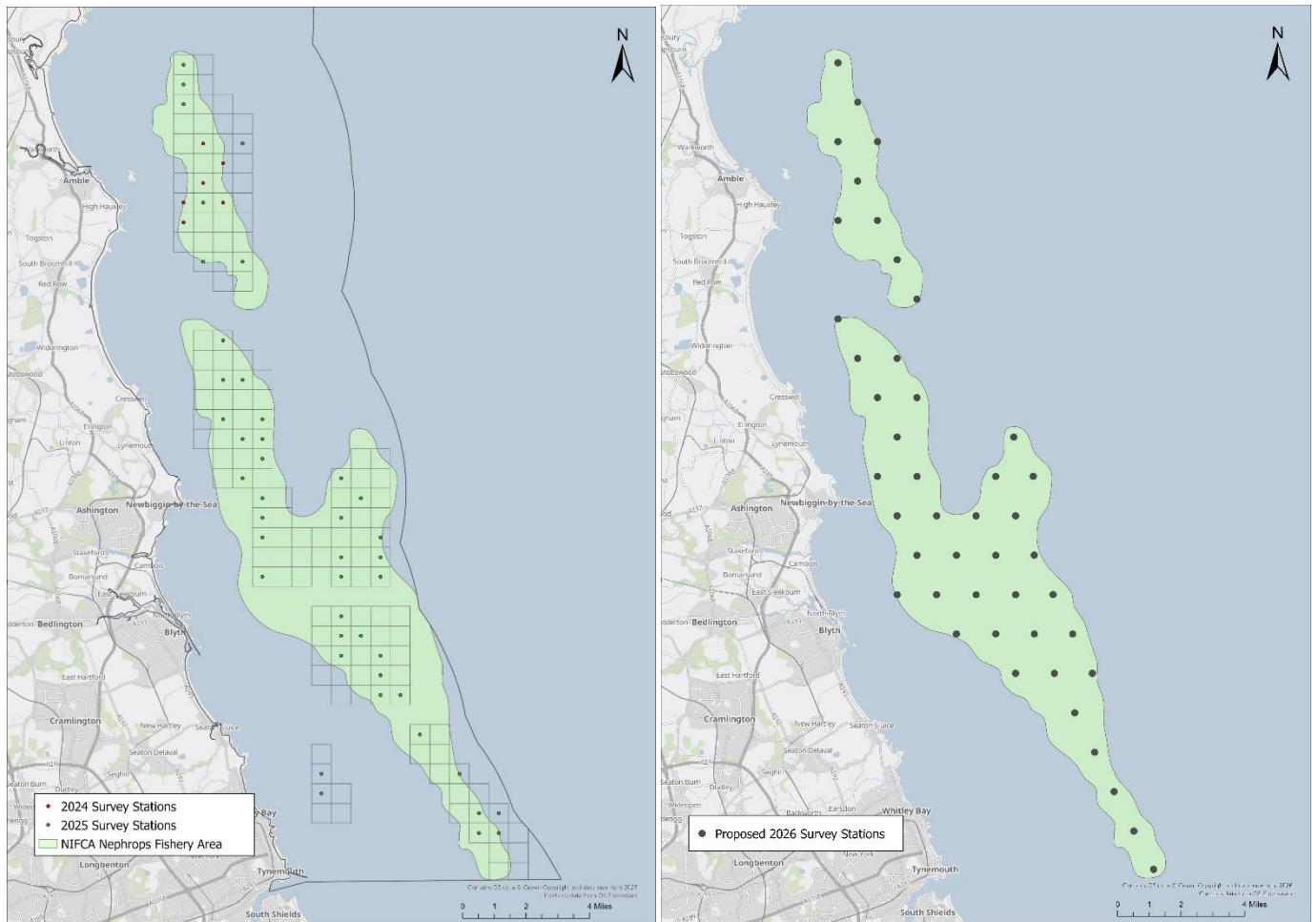


Figure 18: Proposed survey stations within the NIFCA Nephrops Fishery Area for 2026 compared to the stations surveyed in 2024 and 2025.

## 5.4 Equipment Development

With the success of the 2025 survey and planned monitoring surveys for 2026 and beyond, NIFCA has made the decision to better align its equipment with that used by WGNeps members and has designed and commissioned a new sledge to be used in future surveys (Figure 19). The existing frame differed significantly from other member specifications, with the setup at a shallower angle and significantly closer to the seabed, causing issues during analysis of the footage. The new sledge design allows for the camera mounting angle and camera height to align better with other member institutes and improve on our survey capabilities.



Figure 19: The new NIFCA camera frame designed to align with ICES WGNeps member institute specifications.

Table 4: Camera setup specifications from ICES WGNEPS member institutes, as well as the previous NIFCA setup and new sledge specifications.

ICES WGNEPS Institute	Camera mounting angle (°) relative to the seabed	Height centre camera lens to deck (cm)
Marine Directorate	37	90
MI-Ireland	40	75
AFBI-NI	45	75
DTU-AQUA	60	70
SLU	45	92
CEFAS	40	97
IFREMER	40	75
CNR-IRBIM	45	80
IEO	45	80
MFRI-Iceland	45	105
<b>Average</b>	<b>44.2</b>	<b>83.9</b>
<b>NIFCA Previous Sledge</b>	<b>65</b>	<b>30</b>
<b>NIFCA New Sledge</b>	<b>40</b>	<b>90</b>

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## 7. Appendix – ICES WGENEPS Summary Report of the 2025 NIFCA Survey

### Northumberland Inshore Fisheries and Conservation Authority (NIFCA), England: FU6 - Inshore

The NIFCA *Nephrops* fishery falls within FU6, which is assessed by Cefas. However, current UWTV stations for FU6 do not extend to within the NIFCA district and prior to 2024, there was limited understanding of *Nephrops* abundance within this area. NIFCA has developed surveys for the inshore area (within 6nm of land) of FU6 since 2024 following reports of significant declines in catches of *Nephrops*. The six stations surveyed in 2024 trialled the methodology and provided a baseline for burrow density and abundance over a relatively small proportion of the fishery area. The number of survey stations sampled increased from six in 2024 to 46 in 2025. This increase in number and coverage across the inshore fishing area allows for greater confidence in the analysis and results.

Functional Unit	6	Area name	Farn Deepes - NIFCA
Survey design	Partial fixed + randomised 1km grid	Previous surveys	2024 - present
Country (ies)	UK (E)	Vessel name (s)	NIFCA PV St Aidan
Survey code (s)	NIFCA_NephropUWTV_2025	Dates (start/end)	23/06/25 – 10/07/25
Number scientific staff	4	Staff exchanges	None
Number of stations (planned/completed/used in analysis)	46/46/45		
Deviations from the survey plan (e.g. coverage/weather related problems, technical problems, potential biases, etc.)	Of the 46 planned stations, all 46 were completed. 1 station removed from the analysis due to positional data issues. 6 stations were relocated to the closest stations due to ground type and obstructions present.		
Distance over ground source used	Layback from ships position	Average field of view (cm)	52cm
Adjusted mean density	0.62 burrows/m <sup>2</sup>	Adjusted abundance (millions), CV	101.2 ± 14.3 million, 14.13%
% Threshold trigger (Yes / No/ Decision Tree)	No		
Overall footage quality (poor, medium, good)	Good		
Reference footage for survey area generated	2024		
Quality control of station counts (Lin's CCC or consensus count) State Lin's CCC threshold	CCC (threshold >= 0.5) to 3rd counter then average		
Other survey activities (CTD, Trawl, sediment samples, sediment profile images, % stations with trawl marks recorded, presence/absence sea-pen distribution etc.)	No CTD, trawl, sediment samples or sediment profile images taken.		

	<p>Presence of gadoids, flatfish, other fish sp., sea pens, crustacea and trawl marks recorded for each station.</p> <p>Sea pens recorded in 64% (29) of stations.</p> <p>Trawl marks recorded in 22% (10) of stations.</p>	
<p>Data storage, level of analysis and dissemination (by data type)</p>	<p>Nephrops burrow counts</p>	<p>Footage stored as .mkv on HDD and network drive. Station, count and observation data on network drive as .xlsx and .csv files.</p> <p>Processing of station, count and nav file data in R and Excel with analysis in R.</p>
	<p>CTD</p>	<p>No</p>
	<p>Trawl</p>	<p>No</p>
	<p>Sediment</p>	<p>No</p>
	<p>Other</p>	<p>Nav files (GPS / depth) stored as .csv</p>

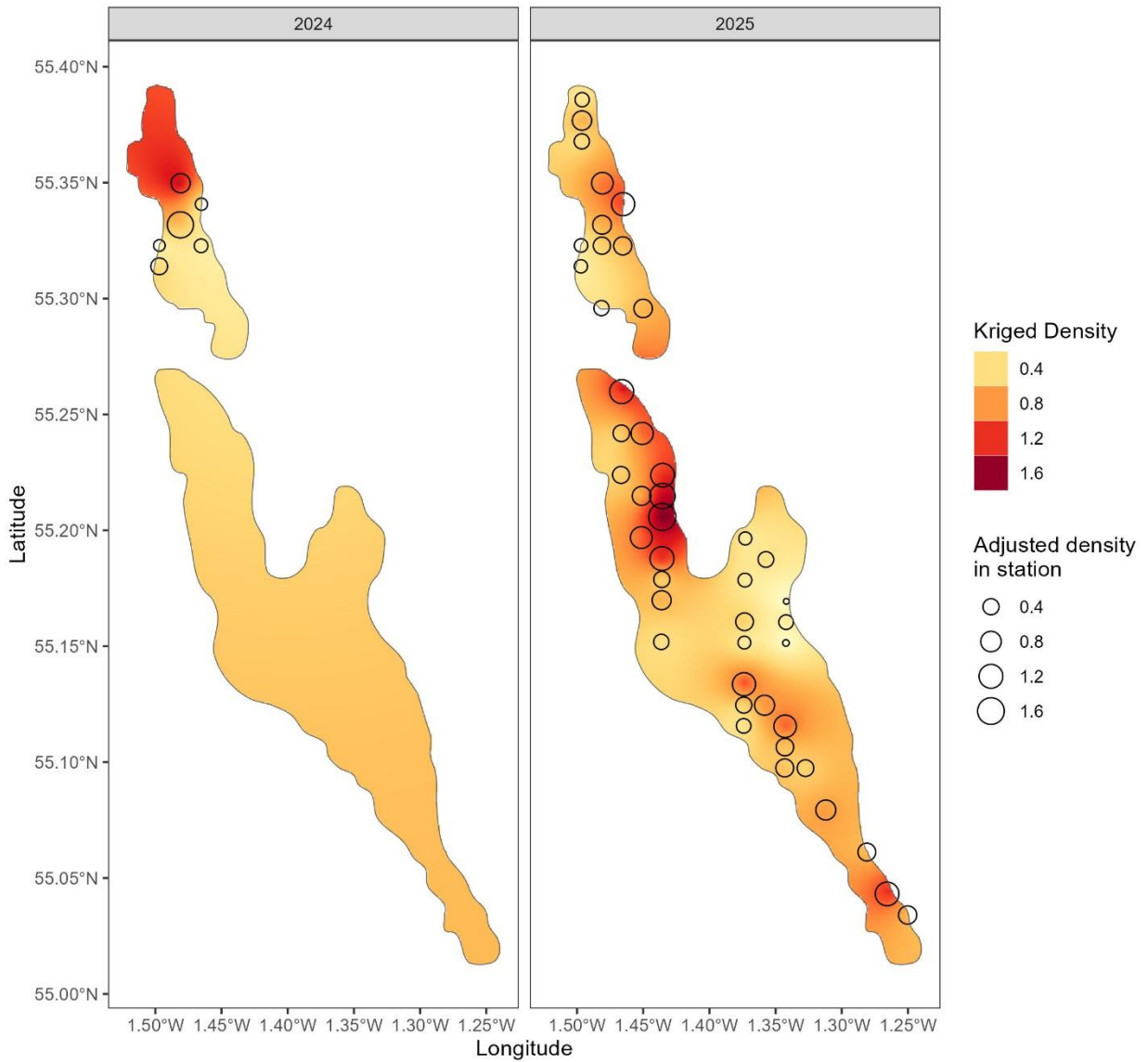


Fig. 1: Map of density (burrows/m<sup>2</sup>) by station for each year. \*Given the low number of stations surveyed in 2024, there is reduced confidence in kriged densities across the whole fishery area.

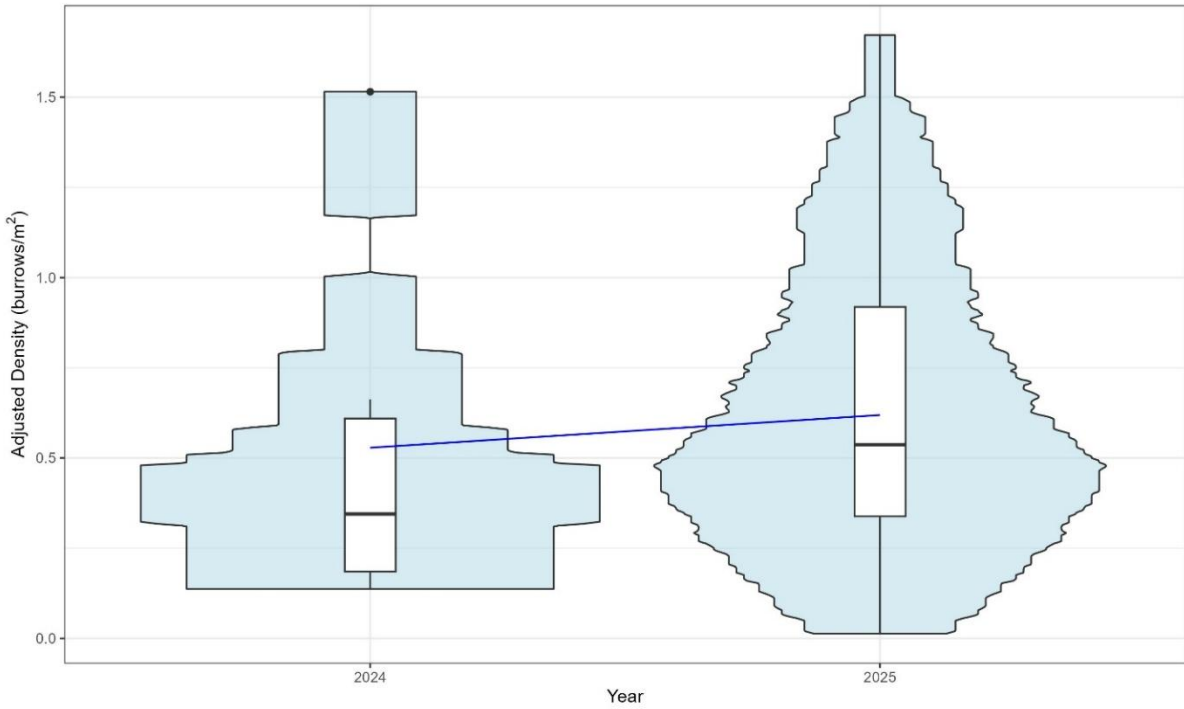


Fig. 2: Violin and box plot of adjusted burrow density. The blue line indicates the mean density over time. The horizontal black lines represent medians, white boxes the inter quartile ranges, the black vertical lines the range and the black dots are outliers.

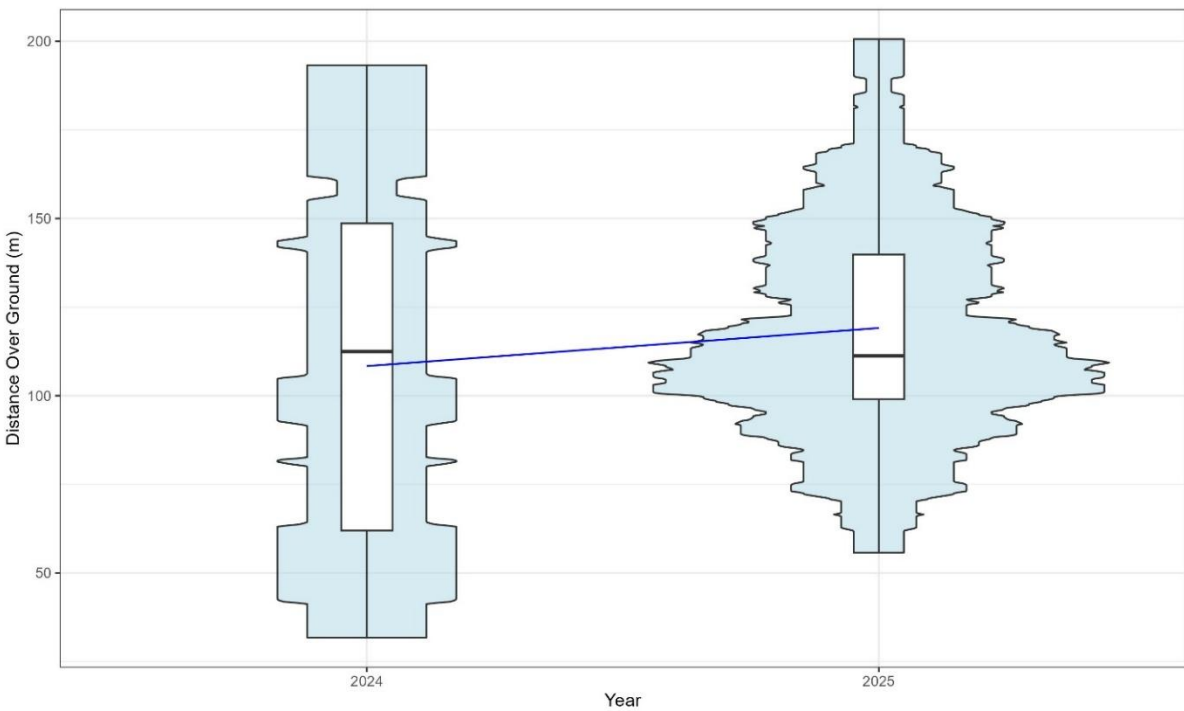


Fig. 3: Violin and box plot of distance over ground. The blue line indicates the mean over time. The horizontal black line represents the median; white box is the inter quartile range. The black vertical line is the range, and the black dots are outliers.

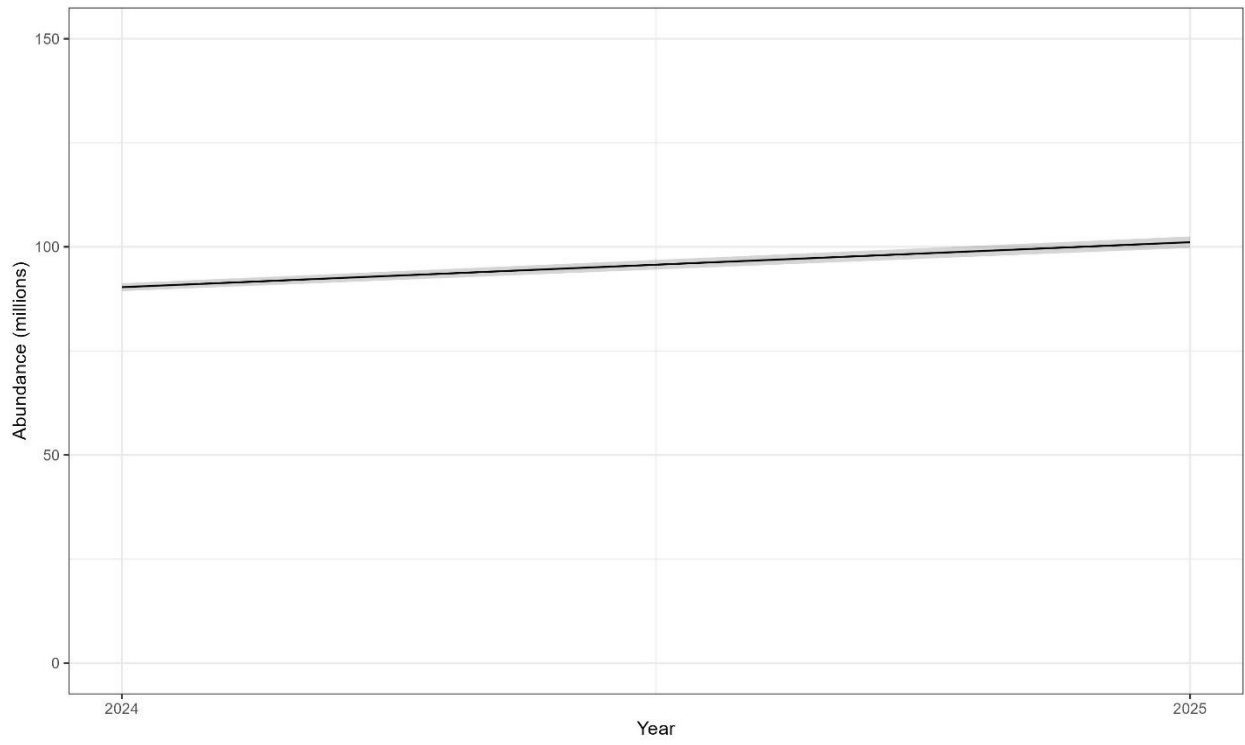


Fig. 4: Time series of total abundance (with 95% confidence intervals).