NIFCA Burrow Count Survey 2024

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Contents

Figures

Tables

Annex

Abstract

This report provides the results of the first Nephrops burrow count survey within the Northumberland Inshore Fisheries and Conservation Authority (NIFCA) district, using an underwater sledge camera tow. A total of six stations were successfully surveyed, and a density map was created to display the results. The average burrow density per station was 0.35 burrows/m², which was higher than most of the average burrow densities recorded in the same Functional Unit (FU6) further offshore at the Farne Deeps since 2007. For analysis of burrow count variations over a larger spatial coverage within the district, and for analysis of burrow density changes over time, annual burrow count surveys and a higher number of survey stations is recommended.

Primary Objective

To conduct a standard underwater camera survey of Nephrops burrow densities within the inshore region and to evaluate Nephrops abundance within the NIFCA district.

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.

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).

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 harvest rates are used to create advice on the TAC. For example, the ICES TAC advice for FU6 was 1607 tonnes in 2024, to ensure stock is exploited sustainably (ICES, 2023).

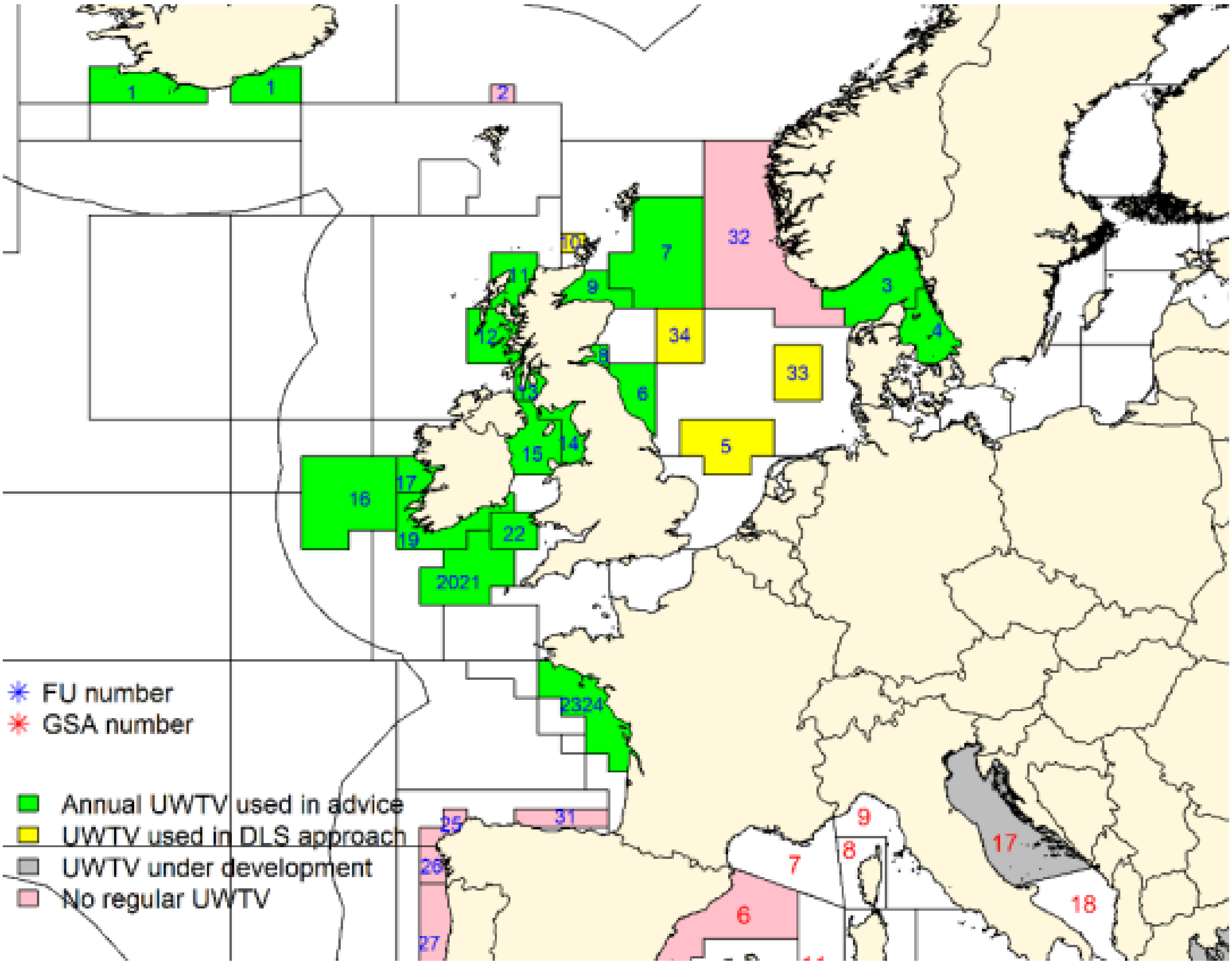


Figure 1 | Nephrops UWTV survey areas and functional units (FUs) in ICES areas (numbers in blue) and geographical subareas (GSAs) in the Mediterranean (numbers in red) (Dobby *et al*., 2021).

At the end of 2023, following the intense storm Babet, fishermen reported a significant decline in Nephrop catches on traditional fishing grounds within NIFCA's inshore region. Fishermen provided NIFCA the location of these fishing grounds, and initial surveys in the beginning of 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 by Envision, which found no significant changes in the habitat (hardness) and identified Nephrop burrows present in the video footage. Due to the opportunistic nature of using the 2023 multibeam bathymetric data, the report recommended a more targeted approach for future monitoring.

The stations surveyed by Cefas in FU6 fall outside of the NIFCA district, and the purpose of this trial is to initiate a Nephrop monitoring programme to gain information of the abundances within the NIFCA district. The aim of this survey is to identify and count the number of burrow entrances within a fixed field of view along a transect of known length, to be able to estimate the potential number of burrow systems. Burrow system counts are then converted into burrow density at each station, and hence hotspots and abundance of the Nephrops within the district can be estimated.

2. Methodology

The Nephrops burrow count survey took place onboard NIFCA Fisheries Patrol Vessel St Aidan on 13th August 2024, using a towed sledge camera comprising a Bowtech Surveyor-HD camera with three LED lights and two Z-bolt green point dive lasers (Figure 2). The survey was designed based on current fishing activity locations, and the creation of a randomised fixed grid of 44 ID stations. A total of six stations were surveyed. At each station, the sledge camera was deployed and transects were recorded over a clear 10-minute tow. Vessel location was recorded from the vessel GPS system, which was fed into HYPACK software to calculate the layback for the sledge camera position to give the camera location. Tow speed was kept between 0.5 and 1 knots.

Video analysis took place in a controlled environment, to assess the potential number of burrow systems. 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.

Figure 2 | Survey equipment set-up. Sledge camera unit (top left), comprising a Bowtech Surveyor-HD camera with three LED lights and two Z-bolt green point dive lasers (top right), contacted to the A-frame onboard St. Aidan (bottom left), and indoor monitor set up for camera analysis of live footage (bottom right).

2.1. 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). 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).

2.2. Counting Procedure:

Multiple burrow entrances in close proximity which appeared to be part of a single system were counted as one burrow system. Where the field of view becomes obstructed by sediment, or the camera is '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 one-minute block, that minute was disregarded and only the useable minutes were analysed.

Each video transect was reviewed by two observers, independently, who identified and counted Nephrops burrow in minute blocks. The 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.

Counts of burrow systems were converted into burrow densities at each station, using the width of camera view (0.53m), the length of the tow (m) and the total burrow counts adjusted for associated biases. There are several components which are believed to contribute to bias in observer burrow counting. These were discussed at the 2018 WKNEPH[1] and bias estimates based on simulation models, preliminary experimentation and expert opinion were formed for each Functional Unit. For FU6, the Farne Deeps the cumulative bias is estimated to be 1.2, so the total burrow counts were adjusted by 20% in calculating the burrow densities at each station (Bell *et al.* 2018). Sledge camera coordinates (extracted from HYPACK data) were plotted in ArcGIS. The coordinates of the disregarded minutes within the tow were removed from the attribute table, to leave only the transect length with usable minutes which was analysed (Doyle *et al*., 2023). Each minute tow length was measured in ArcGIS Pro using the Calculate Geometry Attribute tool, to give only the total distance of useable minutes of the tow (Figure 3).

[1] ICES Workshop on Nephrops Stocks

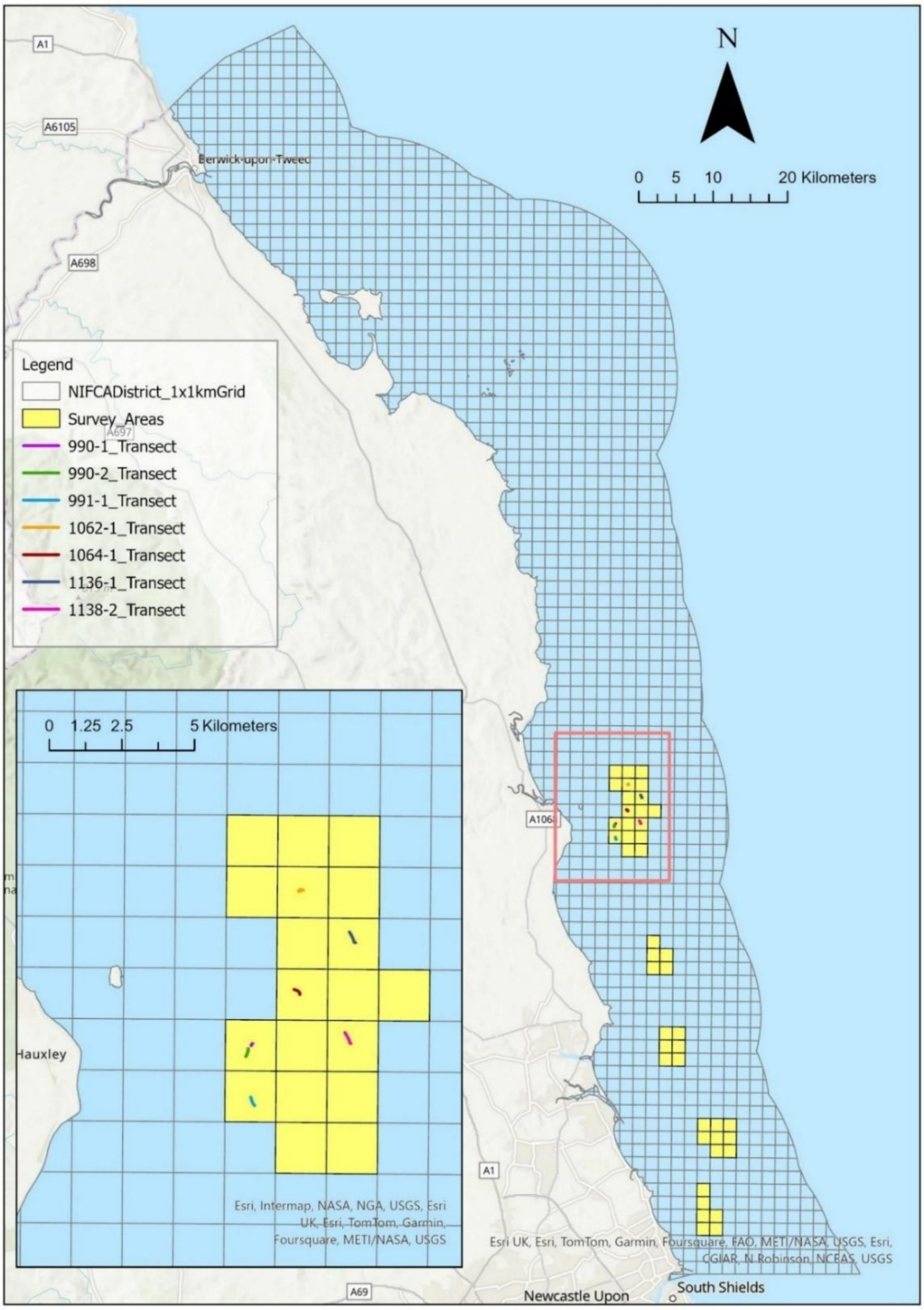


Figure 3 | 1km x1km grid covering the NIFCA district with the survey areas are highlighted yellow. Insert shows seven transects successfully completed in six of the grid stations.

3. Results

In August 2024, six out of 44 stations of the 1km x 1km NIFCA survey grid (Figure 3) were surveyed in the inshore area, using the sledge camera. Eight transects were completed however two stations were repeated due to a sediment cloud affecting the water quality in one transect, and issues with the camera positioning on the seabed for the other. An initial review of the footage during analysis for the transect useable minutes showed that only the transect with issues for the camera positioning was unusable, therefore seven transects in six stations were successfully completed (Table 1). The total of useable time varied from seven to 10 minutes across each transect (Table 2).

The overall visibility was ‘moderate’, however there was a moderate sea swell during the survey, which proved challenging to ensure a smooth camera tow along the seabed. The habitat type was ubiquitous across all survey stations, where a sandy/ mud substrate was present. Starfish, hermit crabs, brown crabs, flatfish, and dragonets were observed throughout the stations, and an urchin and lion’s mane sea jelly were present at one of the stations. No visible Nephrops were seen throughout the survey.

Table 1 | Transect metadata. Depth of water, tow direction, and camera start and end coordinates of tow for all survey transects.

Station Ref	Water Depth (m)	Tow Direction	Start Lat	Start Long	End Lat	End Long
991.1	40.5	NW	55.3127680	-1.4964597	55.3137660	-1.4969721
990.1	41	NE	55.3227983	-1.4968006	55.3232072	-1.4963570
990.2	40.5	SW	55.3223260	-1.4978035	55.3209107	-1.4985321
1064.1	44.5	NW	55.3318104	-1.4818003	55.3327014	-1.4836255
1062.1	44.3	NW	55.3501495	-1.4807504	55.3499756	-1.4822383
1136.1	45.3	NNW	55.3409173	-1.4645598	55.3427848	-1.4665220
1138.1	44.6	SE	55.3237565	-1.4659847	55.3243981	-1.4665835
1138.2	44.1	NNW	55.3231930	-1.4660543	55.3251310	-1.4678681

The transect videos were uploaded and saved to a shared google drive as a ‘.mov’ file and were reviewed on a computer monitor through google drive (Annex I). Each transect video was randomly assigned two observers from a group of three to review the footage independently. Observers agreed to all watch the footage at the slower speed of x0.7. The first usable minute for the transect was used as a ‘lead-in’ minute for the observer, with all subsequent useable minute’s burrow counts recorded. The Lin CCC validation of the observer pairing counts per minute for each transect showed the counts from five transects were concordant (>0.5) and two were not (991.1 and 1136.1). These two transects required an additional count by a third observer, followed by recalculation of the Lin’s CCC validation against the original counts, which results were subsequently above the concordant threshold (Annex II).

Burrow densities were calculated across the total length and per minute of the transect (Annex III). Total transect densities varied from 0.22 burrows/m^2 at station 1138.2, to 0.57 burrows/m^2 at station 1062.1 (Figure 5). For station 990 which had two transects completed in the grid, an average was taken to calculate the overall density (Table 2). The overall average density of all the stations surveyed was 0.35 burrows/m^2. Figure 6 shows the locations and densities of the six stations with no apparent geographic pattern exhibited in the distribution of the burrow densities.

Table 2 | Calculations for mean density of burrows within the six stations. Width of view for all transects was 0.53m

STN Ref	Total Video Length	Total Tow Length (m)	Useable Mins	Analysed Tow Length (m)	# Burrows (Av)	20% Bias	Area of Tow (m²)	Mean Density (burrows/m²)
991.1	19:13	184.58	10	112.46	29.5	23.6	59.60	0.40
990.1	15:00	69.29	9	50.39	12.0	9.6	26.71	0.36
990.2	15:20	166.68	7	73.50	11.0	8.8	38.96	0.23
1064.1	14:36	165.84	8	124.02	44.0	35.2	65.73	0.54
1062.1	15:40	144.23	7	31.74	12.0	9.6	16.82	0.57
1136.1	15:55	254.58	10	193.26	17.5	14.0	102.43	0.14
1138.1	09:51	n/a	n/a	n/a	n/a	n/a	n/a	n/a
1138.2	16:10	249.95	8	173.20	25.5	20.4	91.80	0.22

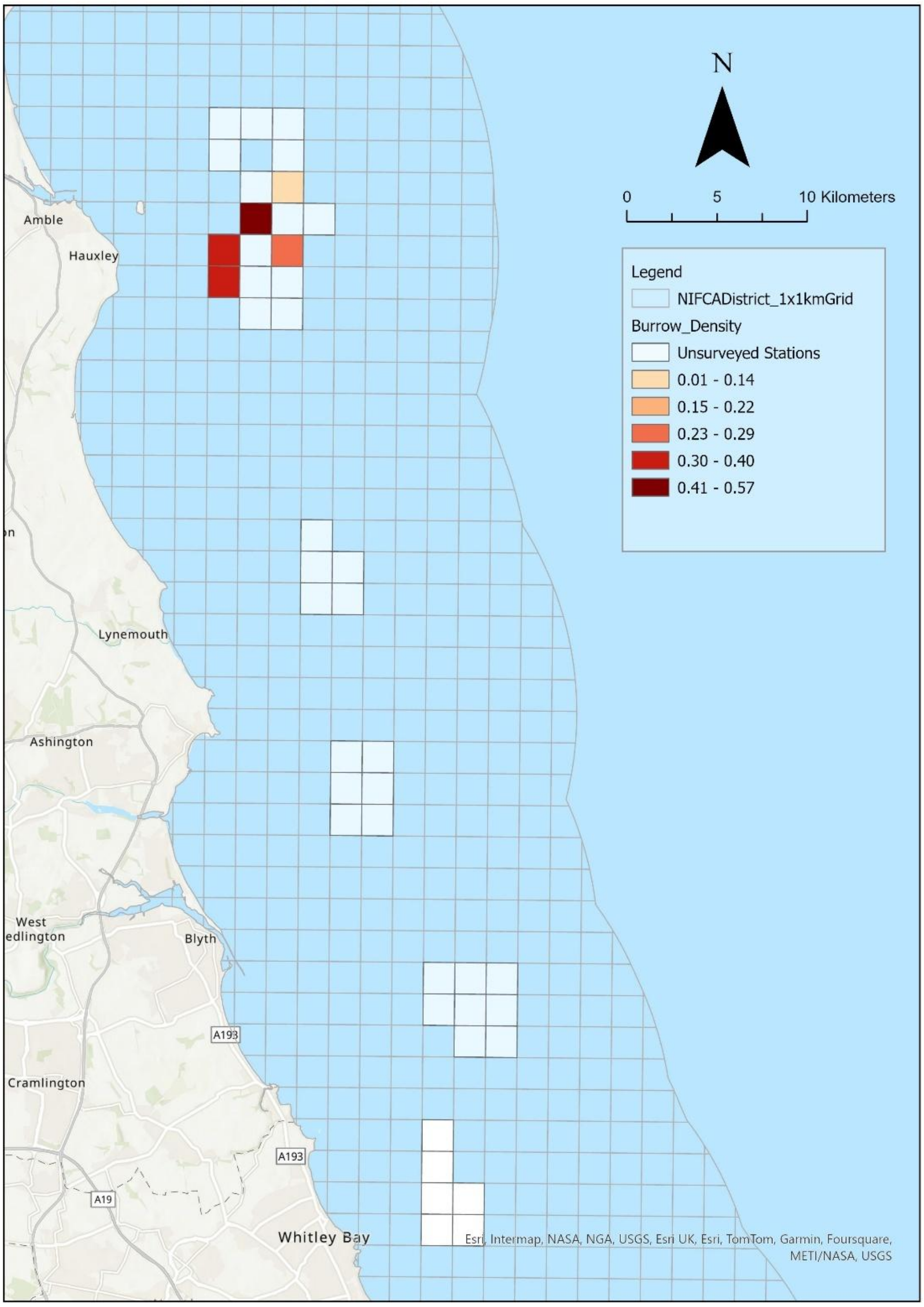


Figure 4 | Nephrops burrow density map per grid station surveyed. White grids represent stations not surveyed.

4. Discussion

This survey concludes the first burrow count survey within the NIFCA district of the Amble inshore region to give abundance estimates of Nephrops. The primary objective of the survey was successfully met, completing seven camera tows in six stations within the burrow count survey, used to calculate burrow densities.

Mean burrow density calculated within the Amble inshore region of the NIFCA district was 0.35 burrows/m^2. This is higher than the density found in the FU6 2024 summer survey where mean density was 0.24 burrows/m^2 (Table 3), calculated from a survey of 110 stations (Figure 5). The highest density recorded in FU6 over an 18-year period (2007 – 2024) was 0.37 burrows/m^2 in 2019 (Firmin *et al*., 2019). Density identified in the Amble inshore region was also higher than the 2023 mean burrow density found in the Celtic Sea 'Smalls' ground (FU22) which was 0.27 burrows/m^2 (Doyle *et al.*, 2023). In the Amble inshore area, the highest burrow density was found in the most northern station, at 0.57 burrows/m^2, which is significantly higher than any of the average burrow densities found in the Farne Deeps since 1997 (Firmin *et al*., 2019).

The Cefas 2024 burrow density estimate for FU6 continues a declining trend recorded since its 18-year record high of 0.37 burrows/m^2 in 2019 (Firmin *et al.*, 2019). In comparison mean burrow densities in the Celtic Sea FU22 have fluctuated much more over an 18-year period (2006 – 2023), with the highest density 0.55 recorded in 2017 and the lowest 0.27 in 2020 and 2023 (Doyle *et al.*, 2023). Without previous years of survey data in the NIFCA district, changes in abundance over time cannot be analysed. Therefore, annual burrow count surveys within the NIFCA district would be recommended to assess comparisons between years.

Limited stations were surveyed in the time available, surveying more stations in future burrow count surveys within the NIFCA district will allow for a larger spatial coverage to identify burrow hotspots and areas of higher Nephrops abundance, across areas of varying fishing pressure. Cefas found the highest abundance area is distributed in the central west side of FU6, shown in the Nephrops density distribution map in Figure 5 (Firmin *et al.*, 2019). Geostatistical analysis to estimate spatial structure of Nephrops densities over the whole NIFCA district rather than just at designated stations was not carried out due to a low number of surveyed stations. Precision improves as the number of stations is increased (Dobby *et al.*,2021), so this additional analysis step can be carried out in future years with more surveyed stations.

Table 3 | Cefas geostatistical model results from UWTV-FU 6 Nephrops survey in 2007–2024 (Firmin *et al.,* 2019, ICES WGNeps Update 2024)

Year	Stations	Mean density (burrows/m^2)	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	1163	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

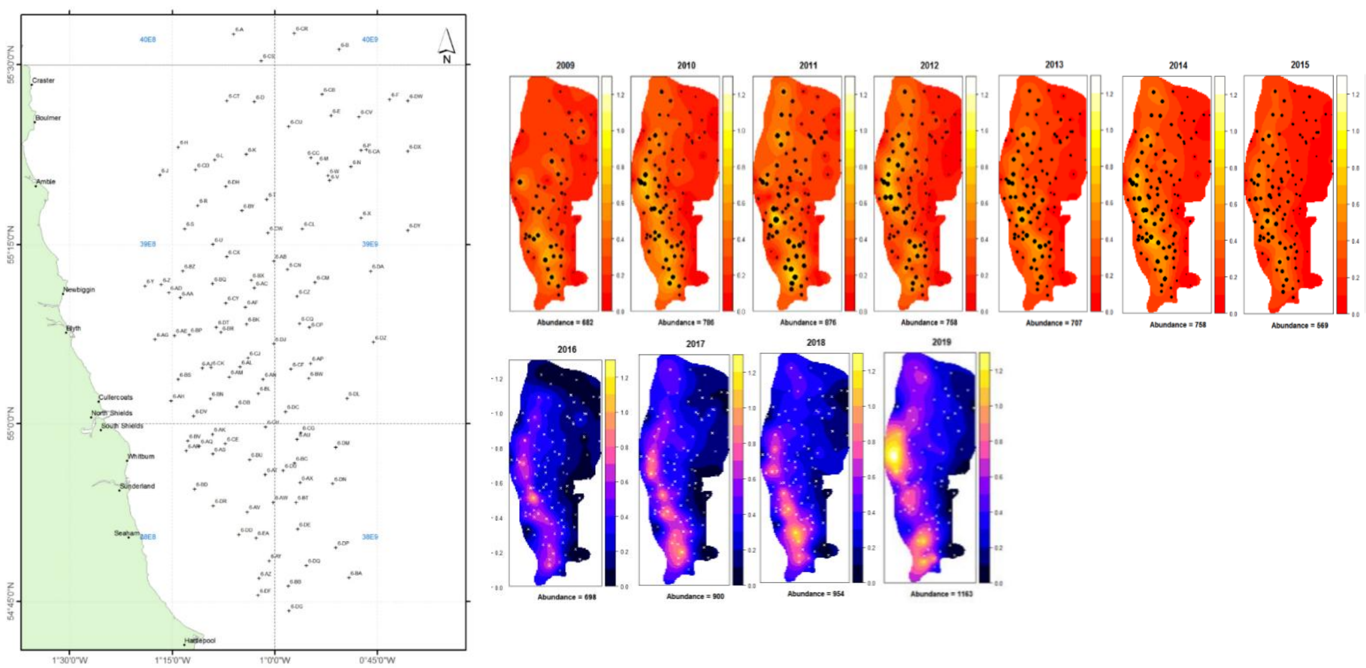


Figure 5 | Cefas FU6 Nephrops stations (left, Firmin 2024) and density distribution from geostatistical outputs from 2009 – 2019 (right, Firmin et al, 2019).

5. Recommendations

Lessons learnt from carrying out this survey and feedback from Cefas and other Nephrops experts, in developing a Nephrops monitoring plan for the NIFCA district the following is recommended to improve data collection, analysis and survey design:

- Carrying out annual burrow count surveys to assess any variations between years and to gain a higher temporal coverage of Nephrops stock assessment.
- Increasing the number of stations surveyed to give a higher spatial coverage of Nephrops densities within the district. This could include having randomly selected stations, fixed stations or a mixture of the two. In determining the stations, targeting areas of different fishing pressure should also be incorporated.
- Including complementary data for recording a classification of sediment type of the seabed, as this will influence Nephrops' ability to construct burrow complexes and hence the number of burrows present at a station. Furthermore, this will provide a temporal dataset for monitoring the suitability of the habitat and identify any potential changes.
- The timing of the surveys during the year. Favourable conditions would be a calm day with little to no swell. This would allow for a more efficient survey with a smooth tow and save time as (potentially) fewer stations will need to be revisited due to poor water quality and sediment kick up. Surveys should aim to align with Cefas surveys which take place in May/June.
- Alter the equipment set-up of the sledge camera. In reviewing other organisations' footage, the analysis of the imagery would be improved by raising the camera higher off the seabed and positioned at a steeper incline. This will improve the angle of the imagery to enable easier identification of burrows and reduce visible barriers such as the topography of the seabed.
- Replace the point lasers with line lasers which extend to the bottom of the imagery to remove discrepancies in whether a burrow falls within or is outside the FOV.
- In line with the WGNEPS analysis and continually annual monitoring include a Volin Plot graph in the report. This will provide a visual comparison tool to show the temporal changes of the distribution of the mean densities recorded across the sampled grid stations.
- To estimate the spatial structure of Nephrops densities over the whole NIFCA district rather than just at designated stations, geostatistical analysis could be carried out. Total survey abundance, variance and confidence limits could also be calculated from this analysis (Cefas Methods). Geostatistical analysis methods to carry out the abundance estimates, estimation uncertainties, sampling effort, and minimum number of stations required to achieve a particular relative error, can be found in Section 5, Survey Data Analysis of 'ICES Survey Protocols – Manual for Nephrops Underwater TV Surveys, coordinated under ICES Working Group on Nephrops Surveys (WGNEPS)' (Dobby *et al*., 2021).

References

Aldis, C., 2024. MBES Data Interpretation – Box 04. Envision. Technical Report. 2024-124.

Bell E., Clements A., Dobby H., Doyle J., Feekings., Leocádio A., Lordan C., Weetman & Wieland. 2018 Using underwater television surveys to assess and advise on *Nephrops* stocks.ICES Cooperative Research Report No. 340. 49pp. https://doi.org/10.17895/ices.pub.4370

Campbell N., Allan L., Weetman A. & Dobby H. 2008. Investigating the link between *Nephrops norvegicus* burrow density and sediment composition in Scottish waters. ICES Journal of Marine Science 66:9, 2052-2059.

Dobby, H., Doyle, J., Jónasson, J., Jonsson, P., Leocádio, A., Lordan, C., Weetman, A., and Wieland, K. 2021. ICES Survey Protocols – Manual for Nephrops underwater TV surveys, coordinated under ICES Working Group on Nephrops Surveys (WGNEPS). ICES Techniques in Marine Environmental Sciences Vol. 65. 44 pp. https://doi.org/10.17895/ices.pub.8014

Doyle, J., Bentley, K., Sullivan, M., Opanowski, A., Sugrue, S., Farrell, E., Domingos, M., Hehir, I., Ní Chonchúir, G., and McCorriston, P. 2023. The "Smalls" Nephrops Grounds (FU22) 2023 UWTV Survey Report and catch scenarios for 2024. Marine Institute UWTV Survey report

Firmin, C., Ouréns, R., Vanstaen, K., Lawler, A., Elson, J., Veneziano, A., Clarke, D., Whybrow, M., Howat, A. 2018. CEnd 10/18 Nephrops TV Survey Final Report – 2018

Firmin, C., Lawler, A., Vanstaen, K., Reeve, C., Palmer, D., Laptikhovsky, V., Shuff, L., Brash, R., Goodsir-Thompson, B. 2019. Research Vessel Survey Report. Survey: C END 09-2019.

Firmin C. 2024. Survey summary for FU6 and FU14 [owerpoint presentation]. Cefas, Working Group on Nephrops Surveys (WGNEPS)

ICES. 2009. Report of the Benchmark Workshop on Nephrops assessment (WKNEPH). ICES CM: 2009/ACOM:33.

ICES. 2012. Report of the Study Group on Nephrops Surveys (SGNEPS). ICES CM 2012/SSGESST: 19. Ref: SCICOM, ACOM.

ICES. 2023. Norway lobster (Nephrops norvegicus) in Division 4.b, Functional Unit 6 (central North Sea, Farn Deeps). In Report of the ICES Advisory Committee, 2023. ICES Advice 2023, nep.fu.6. https://doi.org/10.17895/ices.advice.21975188

Leocádio, A., Weetman, A., and Wieland, K. (Eds). 2018. Using UWTV surveys to assess and advise on Nephrops stocks. ICES Cooperative Research Report No. 340. 49 pp. https://doi.org/10.17895/ices.pub.4370

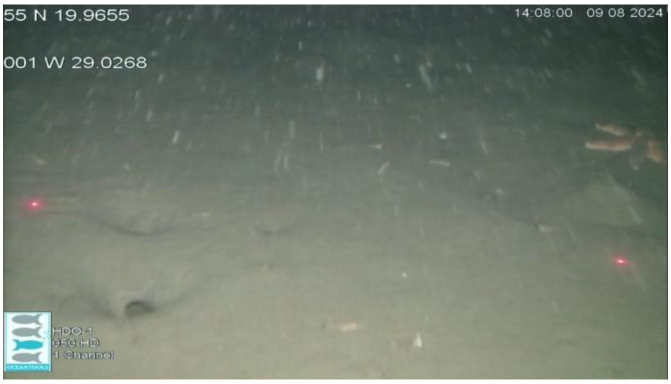
Sbragaglia V., Leiva D., Arias A., García J.A., Aguzzi J. & Breithaupt T. 2017. Fighting over burrows: the emergence of dominance hierarchies in the Norway lobster (*Nephrops norvegicus*). Journal of Experimental Biology 200, 4624-4633.

Annex i

Screenshot examples of Nephrops burrows recorded by observers

Station Ref: 991.1

Station Ref: 1062.1

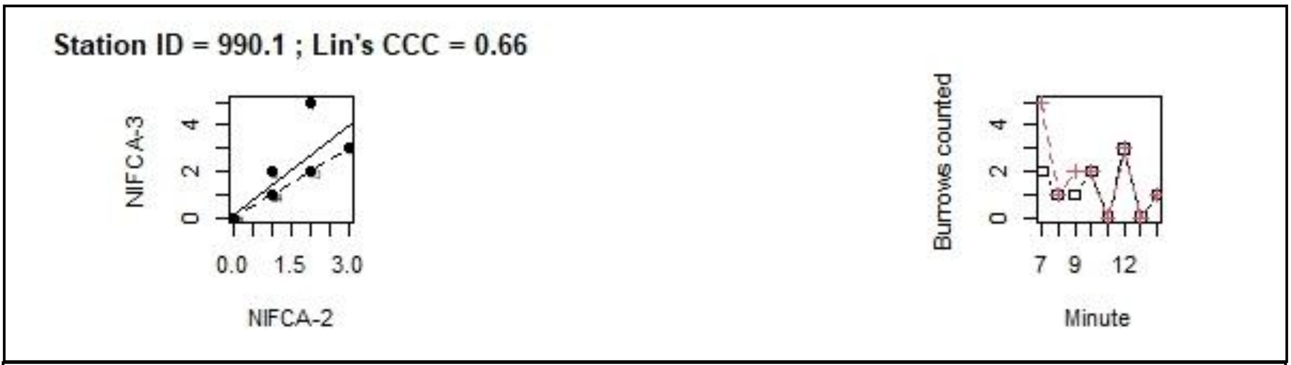


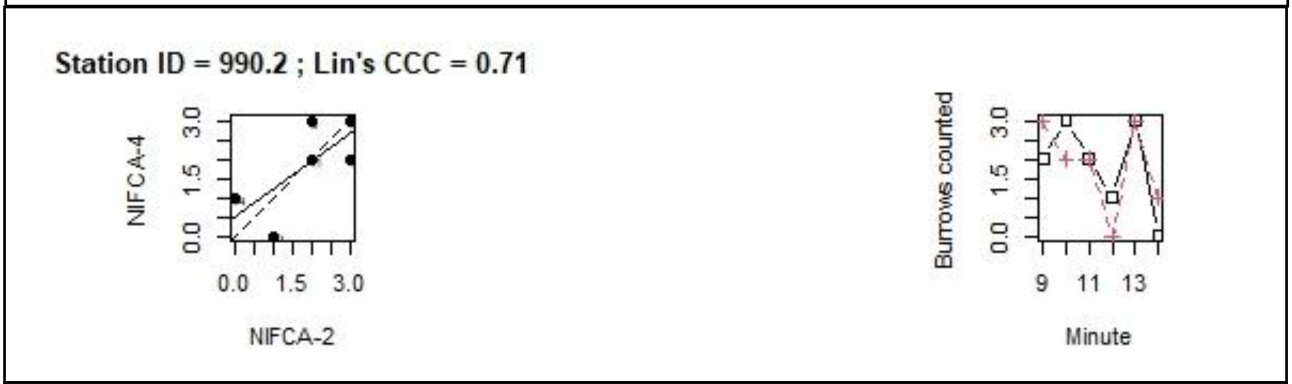
Station Ref: 990.1

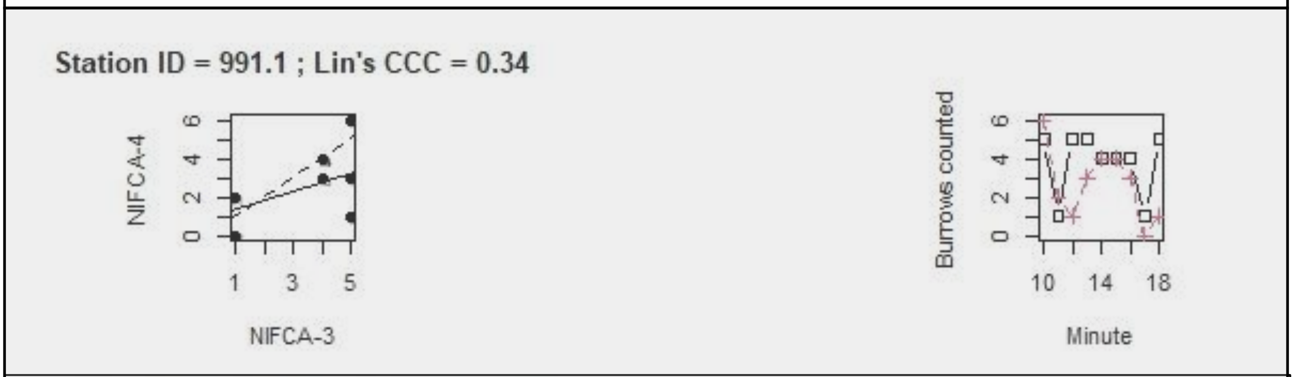
Station Ref: 1136.1

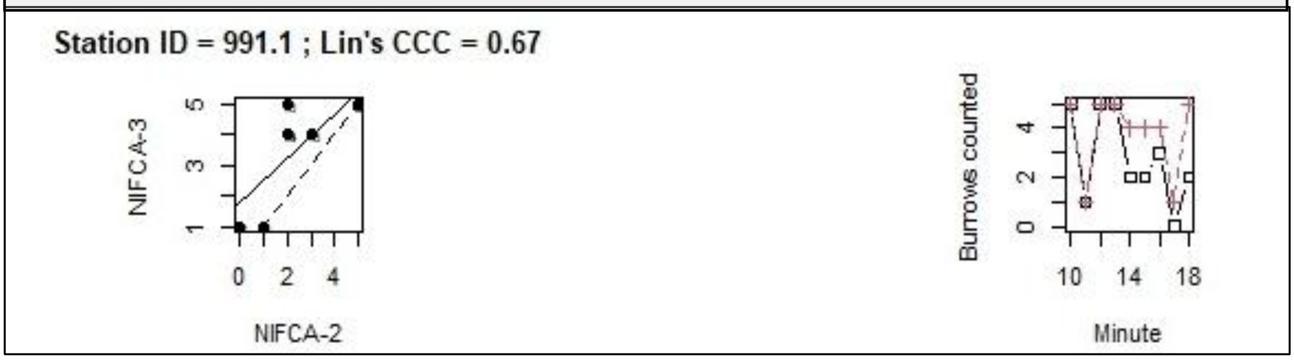
Annex ii

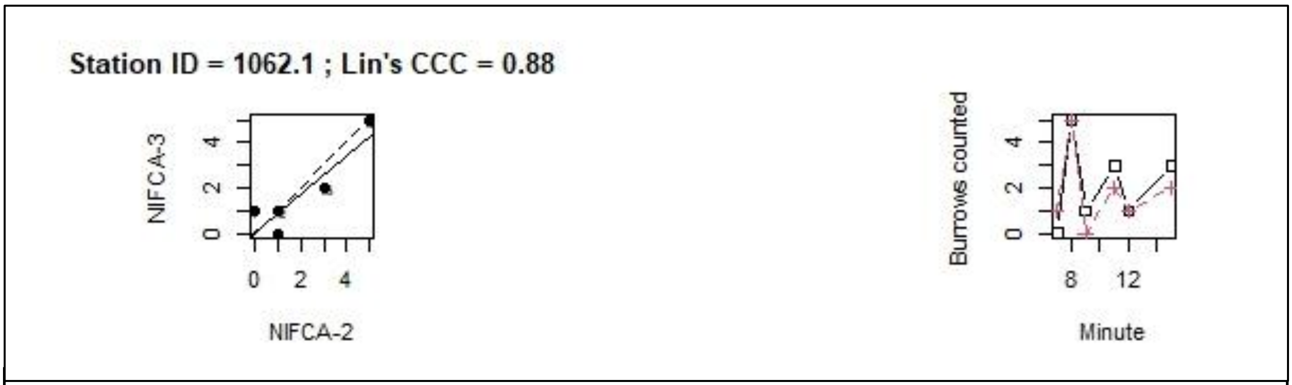
Lin's CCC RPlots outputs of Observer pairing counts for each transect. Grey plots represent non-concordant results (<0.5).







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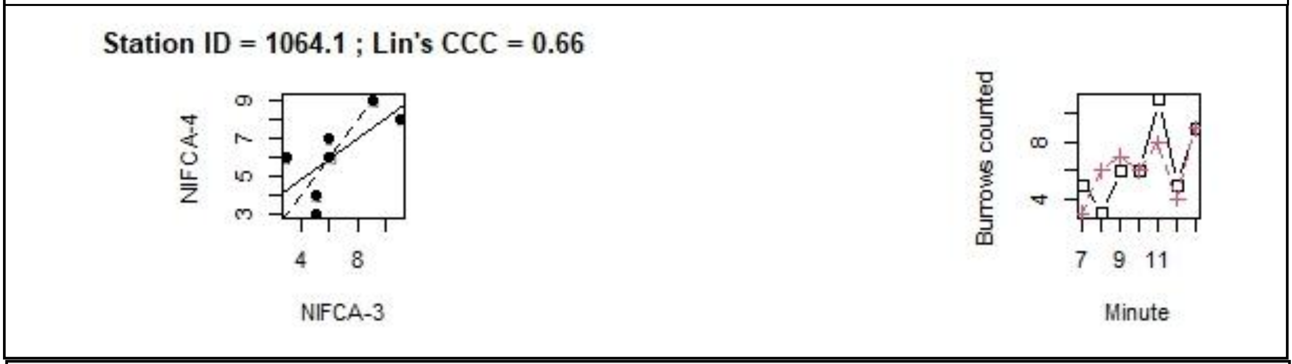
NIFCA-3
NIFCA-2
Burrows counted
Minute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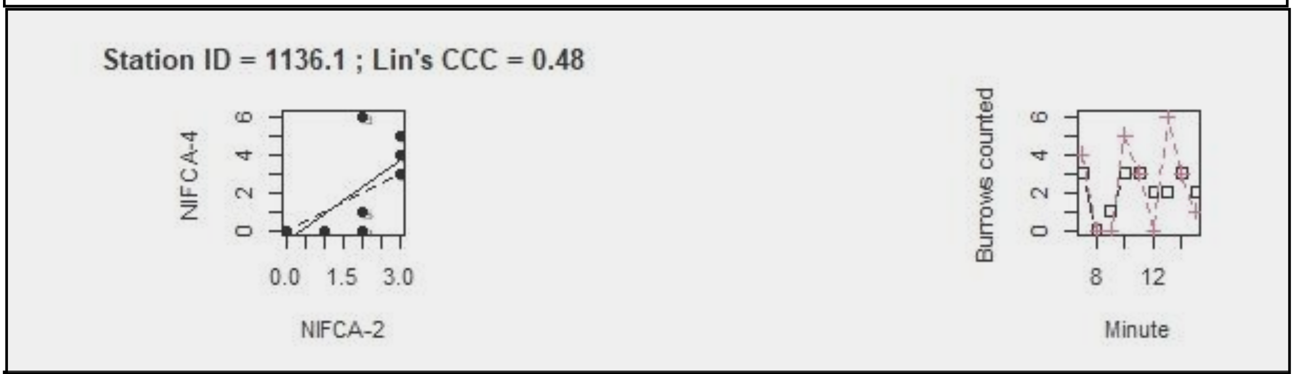
NIFCA-4
NIFCA-3
Burrows counted
Minute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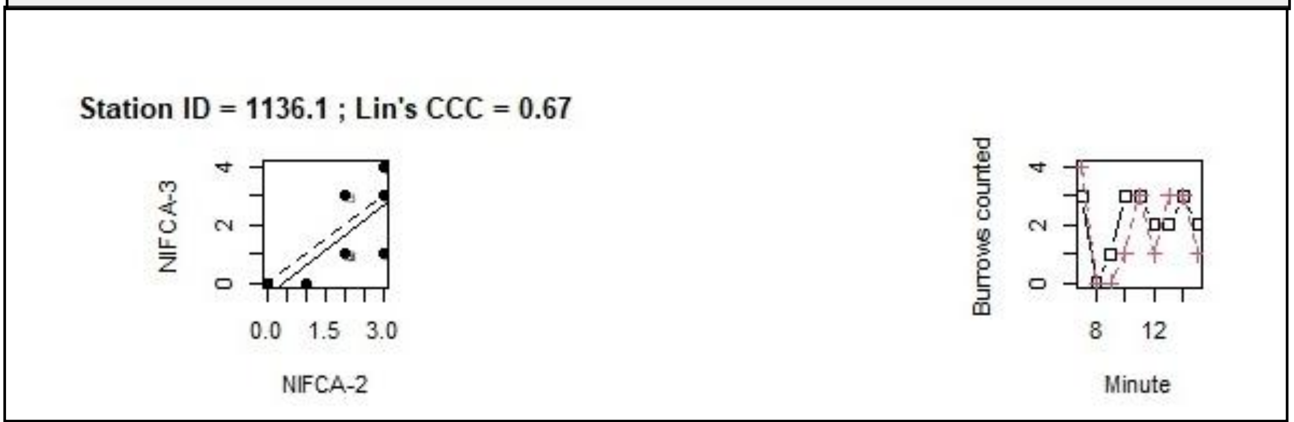
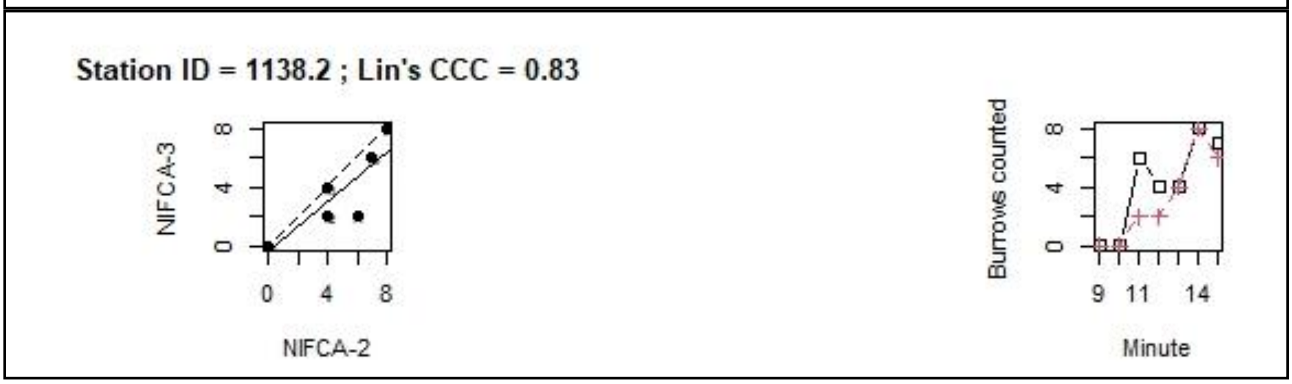
NIFCA-4
NIFCA-2
Burrows counted
Minute


Station ID = 1136.1 ; Lin's CCC = 0.67
NIFCA-3
NIFCA-2
Burrows counted
Minute


Station ID = 1138.2 ; Lin's CCC = 0.83
NIFCA-3
NIFCA-2
Burrows counted
Minute

Annex iii

Table listing the burrow counts and densities of each minute per transect. Green represents a usable minute, red a disregarded minute and amber the lead-in (first) minute of the survey counts.

STN Ref	Survey Min	Length of Tow (m)	Area of Tow (m^2)	Useable Minute	# of Burrows (Av)	20% Bias	Mean Density (burrows/m^2)
991.1	9	72.12		1st			
991.1	10	9.27	4.9131	Y	5	4	0.81415
991.1	11	5.76	3.0528	Y	1	0.8	0.26205
991.1	12	19.24	10.1972	Y	5	4	0.39226
991.1	13	8.68	4.6004	Y	5	4	0.86949
991.1	14	17.74	9.4022	Y	3	2.4	0.25526
991.1	15	15.49	8.2097	Y	3	2.4	0.29234
991.1	16	11.40	6.042	Y	3.5	2.8	0.46342
991.1	17	11.73	6.2169	Y	0.5	0.4	0.06434
991.1	18	13.15	6.9695	Y	3.5	2.8	0.40175
990.1	5	10.12	5.3636	N			
990.1	6	8.78	4.6534	1st			
990.1	7	13.36	7.0808	Y	3.5	2.8	0.39544
990.1	8	5.32	2.8196	Y	1.0	0.8	0.28373
990.1	9	7.00	3.71	Y	1.5	1.2	0.32345
990.1	10	5.04	2.6712	Y	2	1.6	0.59898
990.1	11	3.17	1.6801	Y	0	0	0.00000
990.1	12	9.18	4.8654	Y	3	2.4	0.49328
990.1	13	6.81	3.6093	Y	0	0	0.00000
990.1	14	0.51	0.2703	Y	1	0.8	2.95967
990.2	5	18.39	9.7467	N			
990.2	6	30.92	16.3876	N			
990.2	7	22.90	12.137	N			
990.2	8	16.24	8.6072	1st			
990.2	9	7.85	4.1605	Y	2.5	2	0.48071
990.2	10	14.53	7.7009	Y	2.5	2	0.25971
990.2	11	13.19	6.9907	Y	2	1.6	0.22888
990.2	12	12.22	6.4766	Y	0.5	0.4	0.06176
990.2	13	14.62	7.7486	Y	3	2.4	0.30973
990.2	14	11.09	5.8777	Y	0.5	0.4	0.06805
990.2	15	4.73	2.5069	N			
1064.1	5	18.39	9.7467	N			
1064.1	6	18.62	9.8686	1st			
1064.1	7	17.54	9.2962	Y	4.0	3.2	0.34423
1064.1	8	21.95	11.6335	Y	4.5	3.6	0.30945
1064.1	9	13.60	7.208	Y	6.5	5.2	0.72142
1064.1	10	19.90	10.547	Y	6.0	4.8	0.45511
1064.1	11	18.69	9.9057	Y	9.5	7.6	0.76724
1064.1	12	23.14	12.2642	Y	4.5	3.6	0.29354
1064.1	13	9.20	4.876	Y	9.0	7.2	1.47662
1064.1	14	4.81	2.5493	N			
1062.1	6	63.70	33.761	1st			
1062.1	7	7.33	3.8849	Y	0.5	0.4	0.10296
1062.1	8	1.57	0.8321	Y	5.0	4	4.80711

1062.1	9	2.01	1.0653	Y	0.5	0.4	0.37548
1062.1	10	12.32	6.5296	N			
1062.1	11	1.37	0.7261	Y	2.5	2	2.75444
1062.1	12	8.44	4.4732	Y	1.0	0.8	0.17884
1062.1	13	16.34	8.6602	N			
1062.1	14	20.13	10.6689	N			
1062.1	15	11.0	5.8406	Y	2.5	2	0.34243
1136.1	5	33.45	17.7285	N			
1136.1	6	27.87	14.7711	1st			
1136.1	7	11.13	5.8989	Y	3.5	2.8	0.47466
1136.1	8	17.43	9.2379	Y	0.0	0	0.00000
1136.1	9	16.04	8.5012	Y	0.5	0.4	0.04705
1136.1	10	25.41	13.4673	Y	2.0	1.6	0.11881
1136.1	11	35.67	18.9051	Y	3.0	2.4	0.12695
1136.1	12	27.85	14.7605	Y	1.5	1.2	0.08130
1136.1	13	27.58	14.6174	Y	2.5	2	0.13682
1136.1	14	22.07	11.6971	Y	3.0	2.4	0.20518
1136.1	15	10.08	5.3424	Y	1.5	1.2	0.22462
1138.2	6	24.14	12.7942	N			
1138.2	7	26.15	13.8595	N			
1138.2	8	22.77	12.0681	1st			
1138.2	9	26.06	13.8118	Y	0.0	0	0.00000
1138.2	10	26.47	14.0291	Y	0.0	0	0.00000
1138.2	11	24.69	13.0857	Y	4.0	3.2	0.24454
1138.2	12	21.70	11.501	Y	3.0	2.4	0.20868
1138.2	13	23.48	12.4444	Y	4.0	3.2	0.25714
1138.2	14	24.41	12.9373	Y	8.0	6.4	0.49469
1138.2	15	26.39	13.9867	Y	6.5	5.2	0.37178
1138.2	16	3.69	1.9557	N			