

**Final Report**

**Programme 6: NE *Nephrops***

**6a: *Nephrops* Survey**

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## Summary

- This report describes the results of FSP Programme 6a, a trawl survey of the Farn Deep *Nephrops* ground undertaken in November and December 2004. The aims of the survey were to describe the composition of the *Nephrops* population in the vicinity of CEFAS underwater camera survey stations, and to describe the variability of commercial catch rates of *Nephrops* and by-catch species according to location, vessel and time.
- Four vessels from the Farn Deep trawler fleet participated in the programme: FVs Kristenborg, Star Divine, Gallant Venture and Quo Vadis. Each vessel undertook five one-day fishing trips, fishing an average of four stations per day. Standard commercial prawn trawls were used, with a cod end mesh size of 80 mm.
- The survey grid consisted of 45 stations. Each station was trawled up to four times, no more than once by each vessel, with a total of 79 trawls completed during the programme. The pattern of overlapping survey effort between the four vessels allowed catch rates to be contrasted between vessels, days and times of day.
- The average catch rate for *Nephrops* was 39 kg/hour, which is comparable with catch rates achieved under commercial conditions. Considerable variation in catch rates was apparent, even at a small spatial scale.
- In addition to *Nephrops*, 27 commercial fish species were taken in the catches. The main species were whiting, plaice, haddock, lemon sole and cod.
- The average size of *Nephrops* in the catch was 31.4 mm carapace length. There was some variation between vessels, and the largest *Nephrops* tended to occur further offshore.
- The contributions of location, vessel, day, time and tidal factors to variations in catch rates of *Nephrops* and the main by-catch species were determined by statistical analysis. Location, day of fishing and the state of the tide were the most important factors for *Nephrops*, while various other combinations of effects were identified as important for the other main commercial species. Catch rates of all species appear to be inherently very variable, even after accounting for the systematic effects of external factors.
- Catch rates of *Nephrops* appear to be determined by many other factors than abundance of *Nephrops* on the ground. It is concluded that variations in catchability owing to seasonal, diurnal and tidal patterns of emergence behaviour make trawl surveys an unsuitable method for monitoring trends in the abundance of *Nephrops*.
- Catch rates of cod and plaice were relatively small (6 – 8% of the total catch by weight, on average). However, they were highest when *Nephrops* catch rates were low, and vice versa. There was no association between catch rates of *Nephrops* and catch rates of haddock, whiting and lemon sole. This indicates that commercial fishing effort targeted at *Nephrops* is likely to take smaller by-catches of cod and plaice than were observed during this survey. Effective targeting for *Nephrops* is likely to include fishing at the right times (day and times of day) and under the right conditions (e.g. state of tide).
- Trawl surveys of *Nephrops* are useful firstly as a source of biological information to supplement the fishery independent underwater camera survey data, and secondly to provide insight into the factors determining catch rates of *Nephrops* and other species. This information could potentially be used in simulation models examining the assessment and management of *Nephrops* fisheries.

## Introduction

A Fisheries Science Partnership (FSP) was established between Defra<sup>1</sup>, CEFAS<sup>2</sup> and NFFO<sup>3</sup> for the duration of financial year 2003/04 with funding from Defra. A second programme was established in 2004/05. The objectives of the FSP are to enable the fishing industry, in collaboration with CEFAS, to provide independent and verifiable data on fish stocks, fishery catches and gear selectivity in a number of priority fishing areas. Fishing vessels were chartered to fish commercially to obtain new data on the distribution, catch rate and size distribution of target species, and in some cases by-catch species. Nine primary projects were scheduled for 2004/05. The charter of suitable fishing vessels was arranged by the NFFO, and work plans were developed between NFFO, CEFAS and the vessel skippers. CEFAS deployed sea-going staff to record raw data that were subsequently returned to the laboratory at Lowestoft for input and analysis.

This report is the first of two presenting the results of FSP Programme 6, carried out on the *Nephrops* fishery on the Farn Deep off the NE coast of England during autumn 2004. The second report (Programme 6b) compares catch rates and catch composition between conventional *Nephrops* trawls and a new design of gear with cut-away headline. Programme 6a, reported here, was designed for providing information useful for interpreting the results of the CEFAS camera survey of the *Nephrops* grounds (RV CEFAS Endeavour cruise 13/04; 12-18 October 2004), as well as providing information on variation and structure of commercial *Nephrops* catches on the Farn Deep. The programme used the commercial *Nephrops* trawlers FV Kristenborg and FV Star Divine for five days between 7 and 13 November, and FV Gallant Venture and FV Quo Vadis for five days between 14 November and 2 December. The work plan involved trawling under dispensation from the quota regulations. The vessels fished in the same area as in the equivalent FSP trips in 2003, but addressed different objectives. Cruise reports prepared by CEFAS observers are reproduced in Appendix 2.

1. Department of Environment, Food and Rural Affairs
2. Centre for Environment, Fisheries and Aquaculture Science
3. National Federation of Fishermen's Organisations

## Objectives

The provisional operational aims of Programme 6, as proposed by NFFO based on the 2003/04 FSP Programme were to:

- (a) Provide information on indicative catch rates
- (b) Stock monitoring
- (c) Create and contribute to time series data
- (d) Pursue effective technical measures
- (e) Create catch data comparisons with other ICES and CEFAS data

Aim (d) is addressed in the separate report on gear selectivity trials (Programme 6b). Due to the substantial change in the timing of the surveys (the 2003/04 FSP work was carried out in Spring 2004), and in the vessels used, the ability of the FSP to provide time-series data on abundance of *Nephrops* is limited. Catch rates of *Nephrops* in trawls are highly dependent upon factors such as season and tide, which is why trawl survey data are not generally used by ICES for monitoring the stocks. Methods such as counting of burrows using underwater cameras are considered to provide a more reliable indication of stock trends, and a survey of

this nature is carried out annually by CEFAS on the Farn Deeps. It was therefore agreed with NFFO that the survey component of Programme 6 should focus on spatial patterns in *Nephrops* population structure to provide data useful for interpreting the camera surveys. In addition, the use of standard *Nephrops* trawl gear, without the 20 mm liner used in last year's FSP trips, was considered more useful in providing data on catch compositions more comparable with the commercial fishery during autumn.

The original aims (a)-(c) and (e) were therefore restructured into two consolidated aims which are addressed in the present report:

- (1) To describe the commercial catch-rates and size composition of *Nephrops* in the vicinity of underwater camera tows
- (2) To describe the variation in commercial catch rates of *Nephrops* and by-catch species according to location, vessel and time of day.

## Methods

### **Objective 1: To describe the commercial catch-rates and size composition of *Nephrops* in the vicinity of underwater camera tows**

#### *Vessels and gear*

Four vessels were used during the programme. The two larger vessels were the wooden hulled trawlers FV Kristenborg (GY199, registered length 16.34 m, gross tonnage 70, engine 294 kW) and FV Star Divine (LH230, registered length 11.43 m, gross tonnage 16, engine 193 kW), with home ports of North Shields and Amble respectively. Each of these vessels made five day trips between 8 and 12 November 2004, fishing standard 180 ft prawn trawls with 80 mm mesh cod-ends. The two smaller vessels were the steel-hulled trawlers FV Gallant Venture (SN1, registered length 10.95 m, gross tonnage 23, engine 90 kW) and FV Quo Vadis (SN3, registered length 8.98 m, gross tonnage 9, engine 80 kW), both from the home port of North Shields. Each fished five one-day trips during the periods 15-16 November and 29 November - 1 December, again fishing standard prawn trawls with 80 mm mesh cod-ends.

#### *Catch sampling*

Trawl tows for the FSP Programme were undertaken according to normal commercial practice, except that tow duration was limited to 0.5 hours to allow as many as possible of the CEFAS camera survey stations to be sampled. The catch from each haul was separated by the fishing crew into *Nephrops*, commercial fish species and 'trash' fish. The individual species within each portion were quantified either by volume (baskets) or by counting of individuals, depending on the quantity of catch. Where appropriate, the *Nephrops* were separated by the fishing crew into two or three size grades. All species present were recorded, and lengths were measured in volumetric samples taken from the retained and discarded portions of the *Nephrops* and commercial fish catch.

Appendix 3 gives details of the on-board sampling protocol. Since it was not possible to deploy two scientific staff on every vessel on each occasion, a full and a reduced sampling protocol were defined, for two- and one-man operation respectively. Station priorities for full and reduced protocols were defined for each vessel, designed to give as complete spatial

coverage as possible with the full protocol. In the event, it proved possible effectively to deploy the full sampling protocol at all stations, owing in large part to the co-operation of the fishing crew.

### ***RV CEFAS Endeavour camera survey***

The RV CEFAS Endeavour (cruise 13/04) undertook an underwater TV survey of the Farn Deeps *Nephrops* grounds during 12-18 October 2004. At a total of 104 survey stations, a sledge-mounted underwater TV camera was towed over the ground to record at least 10 minutes of clear video footage covering approximately 400 m<sup>2</sup> of sea bed. Processing of video recordings takes place after the cruise, and was not completed by the time of the present report. The video recordings are replayed whilst experienced observers count the number of visible *Nephrops* burrow systems to arrive at an estimate of burrow density. When combined across survey stations, the burrow densities will be used to generate an estimate of *Nephrops* abundance across the area of suitable sediments within the Farn Deeps ground.

The camera survey stations are shown in Figure 1, alongside the trawl survey stations used during the FSP Programme. The FSP stations are a subset of the camera stations, but provide good coverage across the whole of the survey area. The 45 trawl stations were previously surveyed in March 2004 (2003/04 FSP programme, Cotter *et al.*, 2004) and during 1992-96. Previous surveys used a 20 mm mesh liner in the net to retain small *Nephrops*, whereas the current survey used unmodified commercial gear.

### ***Data analysis***

Numbers at size of male and female *Nephrops* taken in the catch at each survey station were estimated by raising the measured sample to the volume of the catch. Catch weights were calculated by using standard length-weight relationships. These data were used to calculate mean sizes and the catch rate in numbers or kg per hour at each station.

### **Objective 2: To describe the variation in commercial catch rates of *Nephrops* and by-catch species according to location, vessel and time of day**

### ***Data analysis***

Numbers at size of commercial fish species taken in the catch at each survey station were estimated in the same way as for *Nephrops*, and weights calculated using standard weight-length relationships. The catch rates (kg/hour) of the main commercial species were analysed statistically, using a method that identified how much of the variation was due to differences between locations (stations), vessels, days (seasonal effects), time of day (diurnal effects) and states of the tide (tide height and flowing or slack water). Correlations of catch rates between the main species were also examined.

## **Results**

### **Objective 1: To describe the commercial catch-rates and size composition of *Nephrops* in the vicinity of underwater camera tows**

### ***Stations fished***

Trip codes, dates, haul numbers, gear configurations, and average towing hours are summarised below in Table 1. Each vessel fished an average of four stations per day,

resulting in 79 stations fished during the Programme. All of the 45 defined stations (Figure 1) were fished at least once, with 30 stations fished by more than one vessel, one station fished by three vessels and one station fished by all four vessels. The positions, dates, and times of the hauls by each vessel, along with numbers caught for *Nephrops* and the five main commercial fish species, are shown in Appendix 1.

**Table 1.** NE *Nephrops* surveys, 2004: details of fishing activities.

Cruise code	Vessel	Dates in 2004	No. hauls	Fishing gear	Average tow hrs.
KRSBCR104	Kristenborg	8-12/11/04	20	<i>Nephrops</i> trawl, 80 mm cod-end	0.5
STARDIV104	Star Divine	8-12/11/04	20		0.5
GALLVENT104	Gallant Venture	15-16/11/04 & 29/11-1/12/04	19		0.5
QUOVAD 1/04	Quo Vadis	15-16/11/04 & 29/11-1/12/04	20		0.5

### *Distribution patterns*

Catch rates of *Nephrops* averaged 39 kg/hour (1,600 *Nephrops*/hour), but varied considerably between stations and vessels in the range 0 to 180 kg/hour (0-12,000 *Nephrops*/hour) (Figure 2). Highest catch rates were observed in the central and northern parts of the survey area, but there was considerable variation even at very small spatial scales. Comparable burrow density estimates are not yet available from the October 2004 camera survey, but preliminary comparisons indicate that *Nephrops* density is not the primary source of variation in catch rates within the main commercial grounds.

### *Size compositions*

The size composition of the *Nephrops* catches by each vessel are summarised in Figure 3. The overall average size taken was 31.4 mm carapace length (CL), but the two larger vessels, Kristenborg and Star Divine, took a larger average size (32.8 mm CL) than the two smaller vessels, Gallant Venture and Quo Vadis (30.6 mm CL). Most of the catch by each vessel was above the minimum legal size (MLS) of 25 mm CL.

Average sizes in the catch varied considerably between stations, in the range 26.0-42.6 mm CL in males and 24.3-38.0 mm CL in females. The largest individuals of both sexes were found furthest offshore, particularly in the north-easterly part of the survey area (Figure 4).

## **Objective 2: To describe the variation in commercial catch rates of *Nephrops* and by-catch species according to location, vessel and time of day**

### *Catch rates of *Nephrops* and by-catch species*

In addition to *Nephrops* (total weight caught 1,577 kg), 27 commercial fish species were caught during the survey. Five species were caught in significant quantities, namely whiting (1,020 kg in total), plaice (336 kg), haddock (303 kg), lemon sole (261 kg) and cod (237 kg). The remaining species made a combined total of 271 kg. Catch distributions for the main species are shown in Figures 5-9.

The results of statistical analysis allow us to describe how much of the variation in catch rates was due to locations fished (stations), the particular vessel fishing, the day of fishing and the

time of day and state of tide at the time of fishing (Figure 10). In the case of haddock, only 6% of the variation in catch rates is explicable in terms of these systematic factors, and the state of the tide (tide height) is the only factor identified as important. Systematic variation in catch rate is most apparent in cod (68% of variation explained), for which the most important factors are vessel and state of tide. Tidal state (tide height and/or slack/flowing water) appears to be at least moderately important for all of the main species except plaice. Large amounts of variation (32-94%) remained unexplained by systematic effects, demonstrating that individual catch rates are inherently variable.

Only 25% of the variation in *Nephrops* catch rates was explained by the five variables examined, with day of fishing and tidal effects appearing to dominate. Location (station) was the third most important factor in explaining *Nephrops* catch rates (i.e. some areas tended, on average, to have higher catch rates than others). Since *Nephrops* burrow density estimates for autumn 2004 are not yet available, it is not yet possible to determine how much of the variation in *Nephrops* catch rates was due to differences in abundance as opposed to other factors that may be related to station position. However, given the low overall proportion of variation explained by the variables examined, and the greater influence of day and tidal state, differences in abundance of *Nephrops* between stations are probably not the main determinant of catch rates across the commercial grounds.

### ***Relationships between catch rates of Nephrops and by-catch species***

Catch rates of the main species of fish were also very variable between stations and there was no straightforward relationship with *Nephrops* catch rates. However, in the five species examined there was a tendency for high catch rates to occur when *Nephrops* catch rates were low (Figure 11). Conversely, highest catch rates of *Nephrops* tended to occur when catch rates of other species were low. This pattern of relationship was most apparent for cod and plaice.

Figure 12 shows a graphical representation of the main features of the correlations in catch rates between *Nephrops* and the by-catch species, based on a statistical procedure known as Principal Components Analysis. It shows that the catches fall into three categories: (i) those dominated by *Nephrops*; (ii) those dominated by haddock, whiting and lemon sole; and (iii) those dominated by cod and plaice. Type (i) and (iii) catches show opposing directions of variation – in other words, catches high in *Nephrops* are unlikely to be high in cod and plaice, and vice versa. Type (ii) catches appear unrelated to types (i) and (iii) – in other words, catches high in haddock, whiting and lemon sole appear to occur independently from catches high in *Nephrops* or cod and plaice.

### ***Size composition of by-catch***

The size compositions for the total catches of whiting, plaice and lemon sole show a single mode (Figure 13). In whiting and plaice, the mode is centred at about the MLS (27 cm in both species) so that roughly half (in numbers) of the catch was of landable size. Most haddock taken were above the MLS of 30 cm, but there appears also to have been a strong cohort of undersized fish in the catch. The size composition of cod showed small catches of fish below 20cm (most likely 0-group fish) with the bulk of the catch comprising fish of around 30 – 50cm, most likely a mixture of 1-group and 2-group cod. More than half of the cod were above the MLS of 35 cm. The overall catch of cod was relatively small – only 237 kg from 79 hauls (3 kg per haul, on average), representing 6% of the total catch of all species during the programme.

## Discussion and Recommendations

The surveys confirm the conclusion that, within commercial *Nephrops* grounds, *Nephrops* catch rates in individual hauls are determined by many other factors than the local abundance of *Nephrops*. Vessels differ in their catching power, and there are seasonal, diurnal and tidal differences in catch rates. These patterns are expected given that the availability of *Nephrops* to trawl gear depends heavily on patterns of burrow emergence behaviour. Large short- and long-term variations in availability to the gear are the main reason why trawl surveys are not considered an effective means of measuring trends in the abundance of *Nephrops*. The circumstances under which trawl surveys could be used to monitor *Nephrops* abundance are very demanding:

1. Strict control of conditions under which survey trawls are undertaken – time of day, state of tide, vessel and gear specification and probably several other factors;
2. A detailed, quantitative understanding of the effects of external variables on *Nephrops* availability and gear performance, that would allow rigorous statistical isolation of the contribution of abundance to the observed catch rate.

The first condition is unlikely ever to be satisfied within a meaningful time scale, even if resources were available to attempt such a survey. The second is more feasible, and the results of this FSP Programme could contribute towards an improved understanding of the factors determining catch rates. However, a longer series of survey data, with some continuity of vessels and gear specifications between years, would need to be built up before trawl surveys could potentially become a useful source of information on stock trends. Furthermore, the inherent variability of catch rates, for reasons that are beyond experimental control, means that any index of abundance based on trawl surveys is likely to be of very low precision.

These conclusions about the effectiveness of trawl surveys should not be extended to the interpretation of data on catch-rates in the normal commercial fishery. Commercial catch and landings per unit effort data are, and are likely to remain, an important source of information on the status of *Nephrops* stocks. This is effective because catch rates are aggregated across the targeting fleet and across many occasions, thus averaging out the effects of vessels, time, tide, etc. Interpretation of commercial catch-rate data still requires an awareness of possible changes in gear efficiency, the effects of spatial targeting of effort, changes in fleet composition and changes in the seasonal pattern of effort. This awareness is a prerequisite for all proper fisheries monitoring, and interpretation of commercial catch-rate data will certainly continue to be an important strand of *Nephrops* stock assessment in its widest sense.

Analysis of data from this FSP Programme will contribute to the better understanding of commercial catch-rate data. Once *Nephrops* density estimates are available from the autumn 2004 camera survey of the Farn Deeps grounds, a rigorous statistical analysis will be carried out to allow the effects of abundance on catch rates to be isolated from the effects of vessel and seasonal, time and tidal variables. Two further, specific, applications should be noted:

1. Data on the size composition of the *Nephrops* population, and its variation across the grounds, can be combined with the camera survey abundance estimates to arrive at an estimate of stock biomass. Camera surveys are likely to form an increasingly important source of information on *Nephrops* stock status in the Farn Deeps and other grounds, and increased biological data will improve the utility of the estimates.

2. Data on catch-rate variation and its sources can be used in simulation models of *Nephrops* stocks and fisheries to explore consequences for stock assessment and scenarios for future management. This could include the effects of *Nephrops* fisheries on other species.

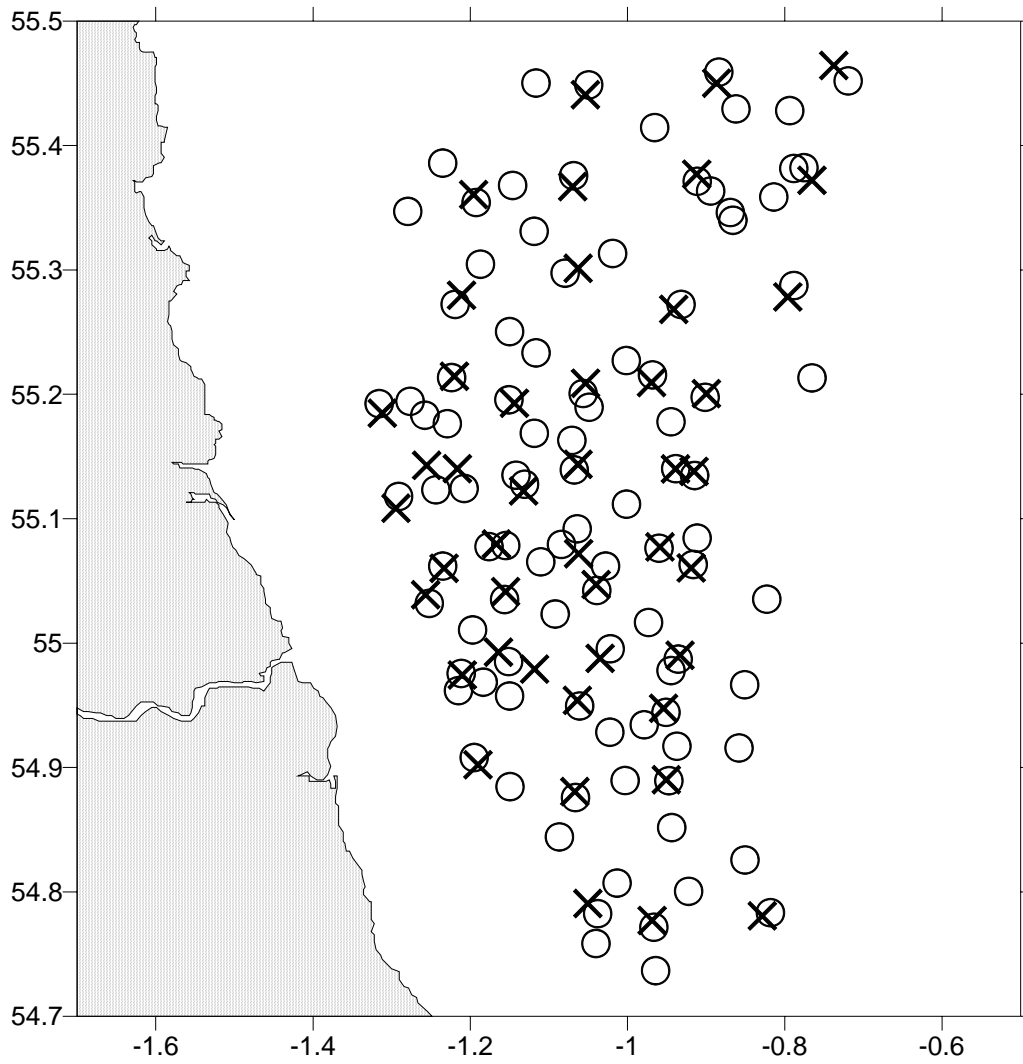
Although roughly 60% by weight of the catch of commercial species during this FSP Programme was of species other than *Nephrops*, this may not reflect the species composition under normal fishing conditions. The stations were spread out over the fishing grounds and there was no specific targeting of areas and times with high catch-rates of *Nephrops*. Comparison of catch rates between *Nephrops* and by-catch species during the FSP survey shows that catch rates of cod and plaice were highest when *Nephrops* catch rates were low and vice versa. This could be related to factors such as effects of tides on *Nephrops* emergence and availability of cod to the low-headline *Nephrops* trawls. This indicates that commercial targeting of *Nephrops* is likely to generate smaller by-catches of cod and plaice than were observed during this survey. Information of the type collected during the FSP surveys could potentially contribute to development of local management schemes aimed at further reducing the by-catch of depleted stocks such as cod and plaice.

## **Acknowledgements**

This work was carried out in co-operation with the skippers and crew of the FVs Kristenborg (skipper Kevin Caffrey), Star Divine (skipper Sean Robinson), Gallant Venture (skipper Peter Dixon) and Quo Vadis (skipper Peter Hammerberg) and CEFAS thanks them for their valued contribution. NFFO and Defra are acknowledged for facilitating this work, and all staff at CEFAS who contributed to this programme are thanked for their help.

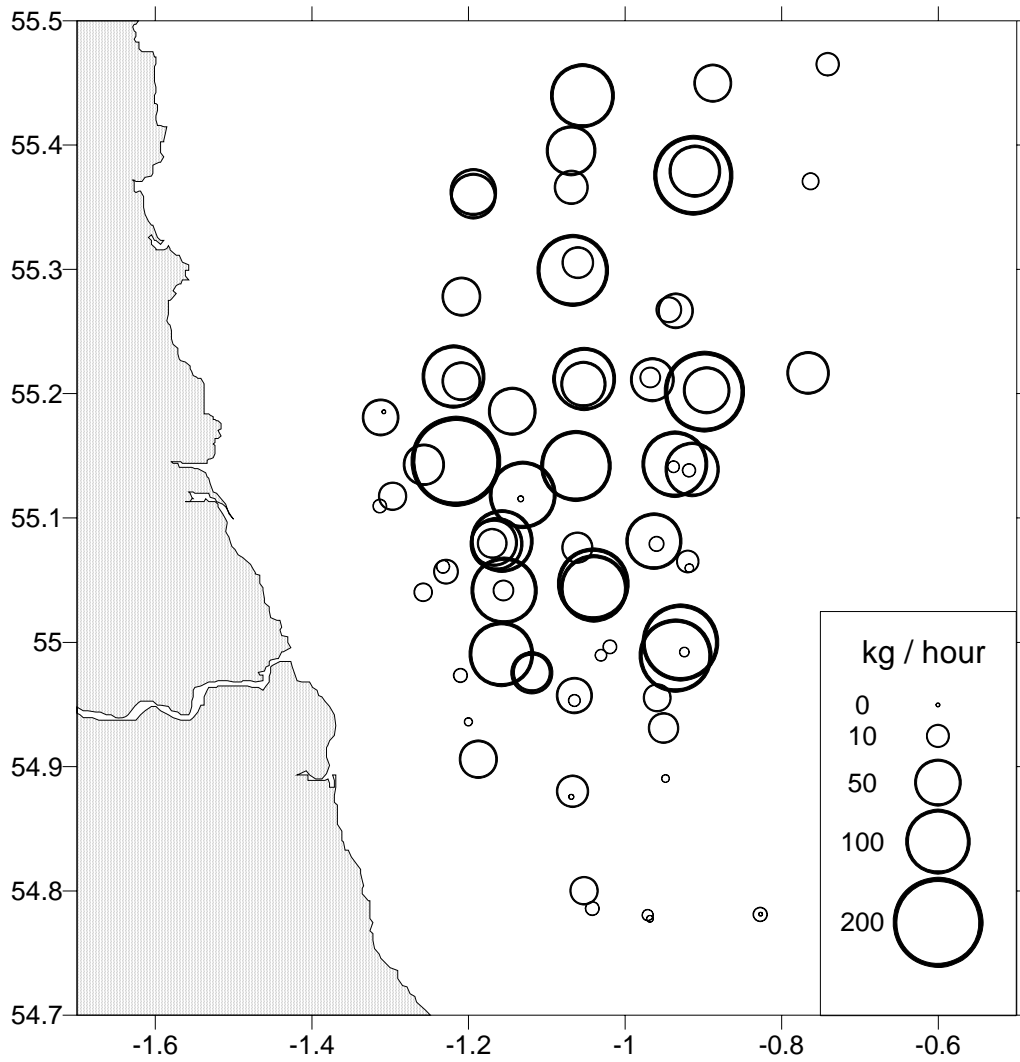
## **References**

- Cotter, J., Elson, J., Lovewell, S., Lawler, A. and Boon, T. 2004. Report on catches of *Nephrops*, cod, and other species on the Farn Deeps ground by FV Luc and FV Still Waters in spring 2004. CEFAS/NFFO Fisheries Science Partnership 2003/04. Final Report.

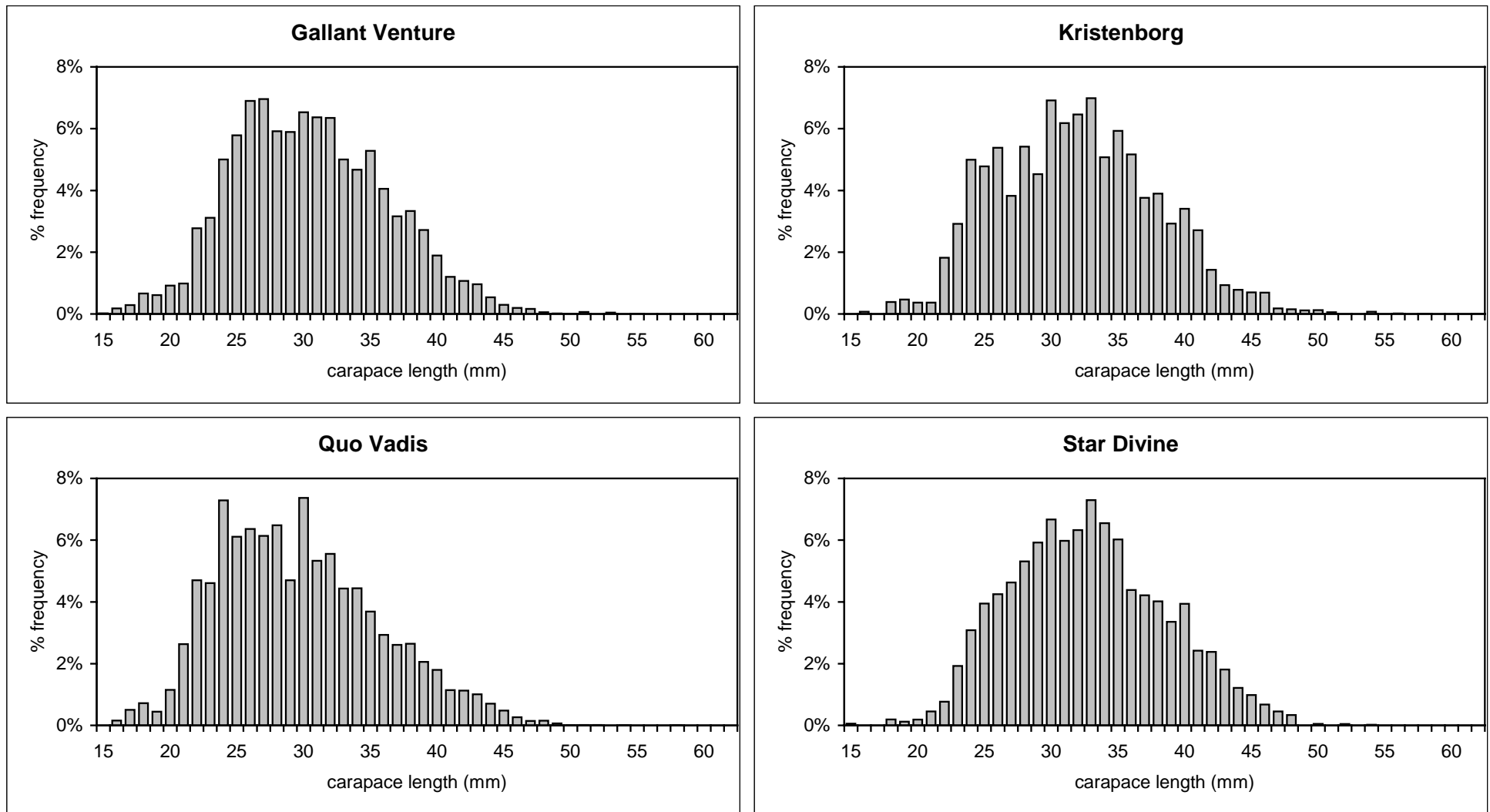


**Figure 1.** Positions of the camera stations used in the underwater TV survey of the Farn Deeps *Nephrops* grounds by RV CEFAS Endeavour in October 2004 (circles), shown alongside the trawl stations defined for the 2004 FSP Programme 6a (crosses).

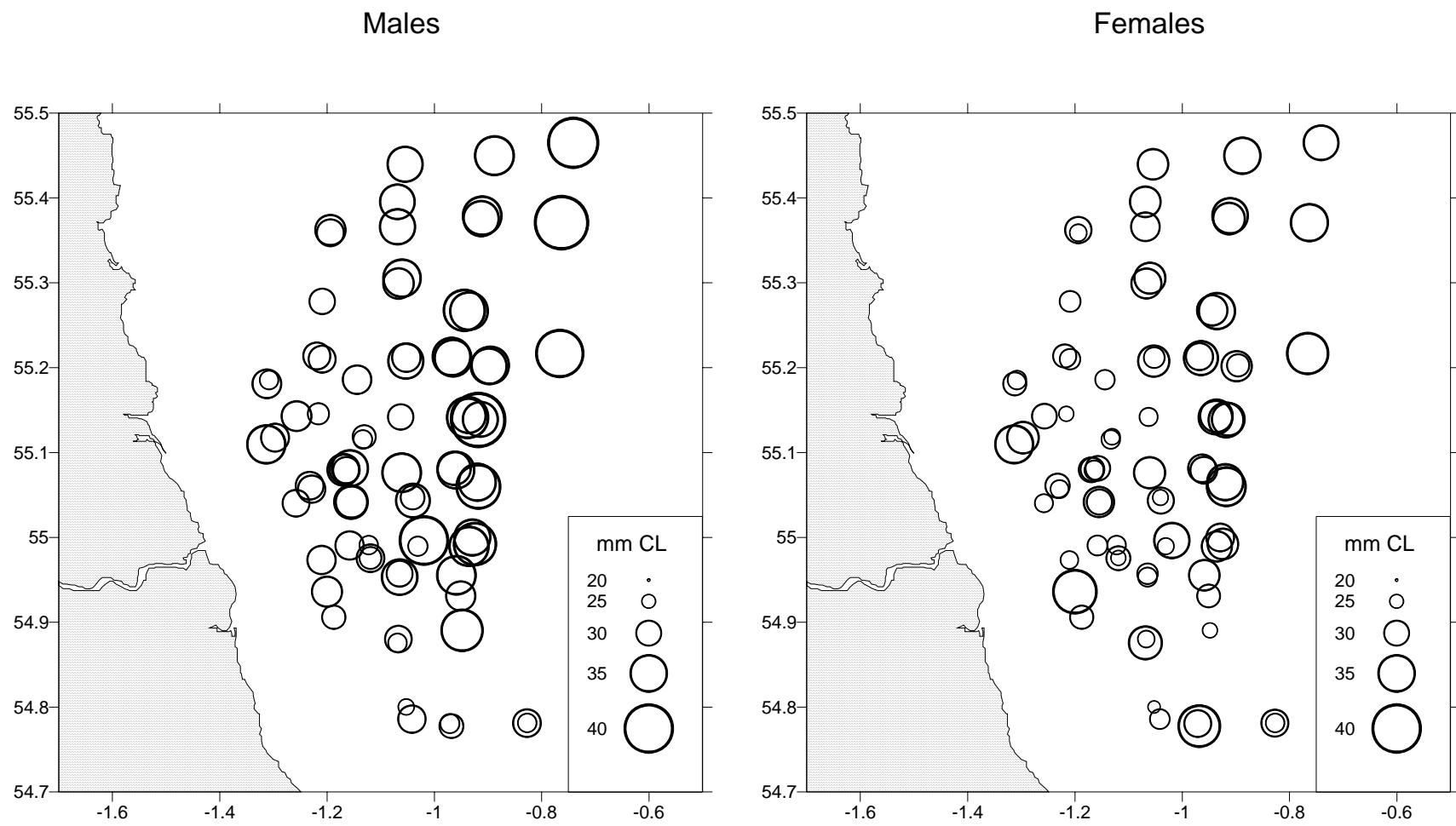
## Nephrops catches



**Figure 2.** Catch rates of *Nephrops* observed during 2004 FSP Programme 6a on the Farn Deeps *Nephrops* grounds.

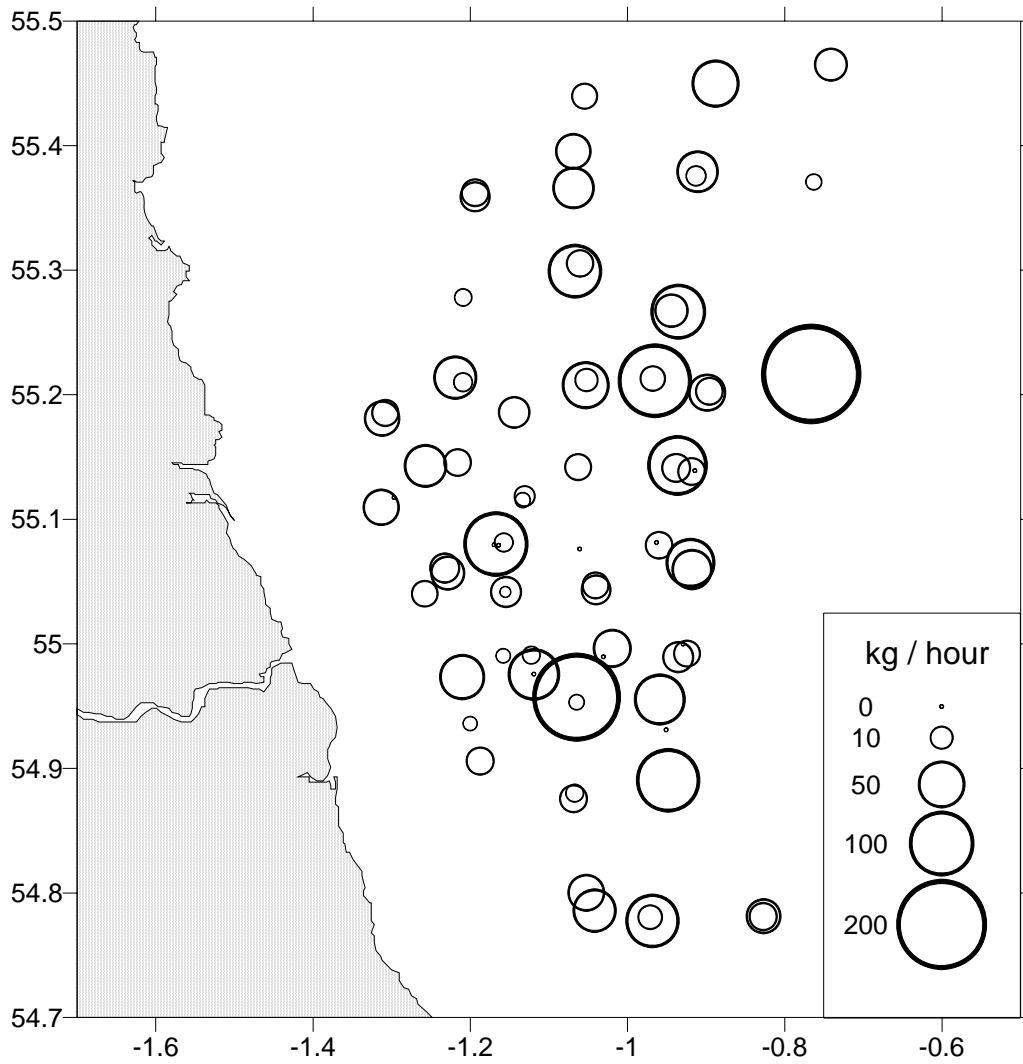


**Figure 3.** Size distributions of *Nephrops* in the catches by each vessel during 2004 FSP Programme 6a.



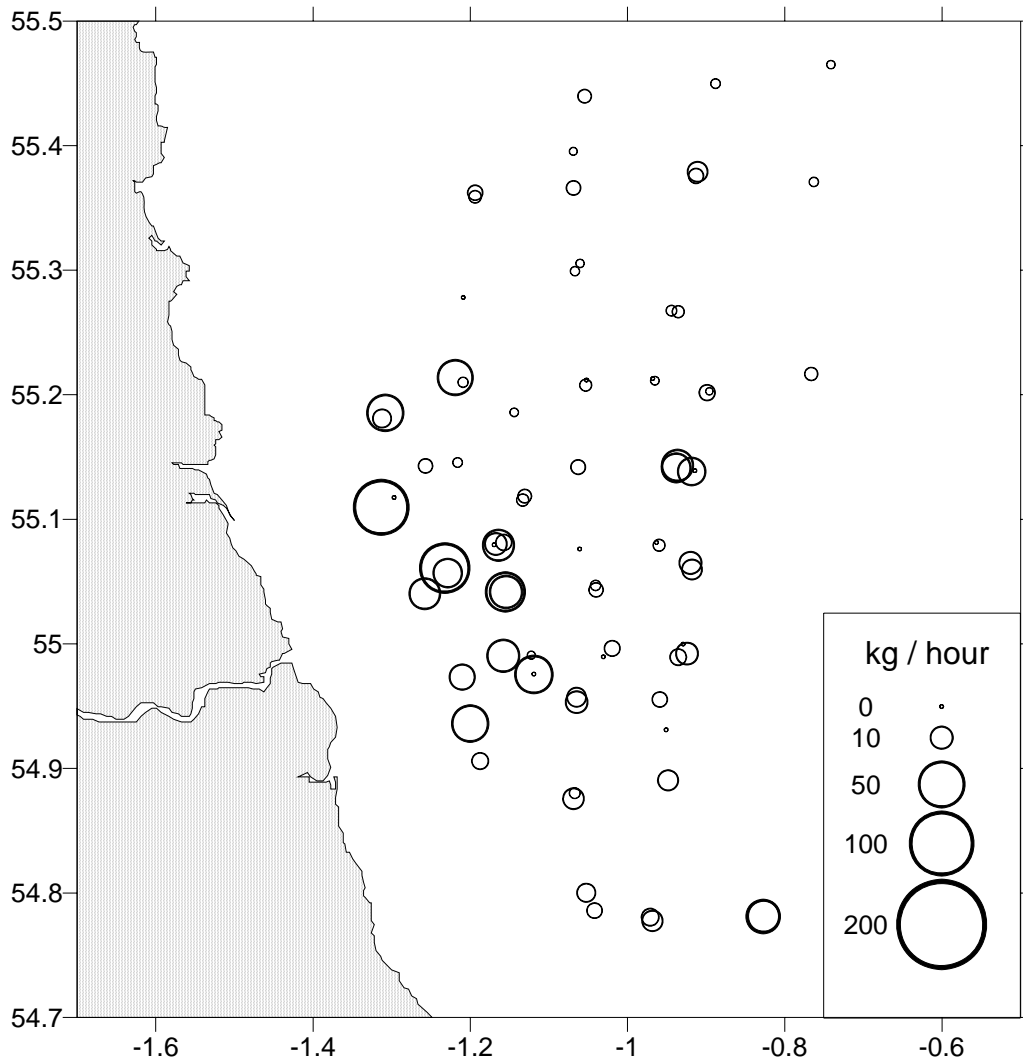
**Figure 4.** Mean sizes (mm carapace length) of male and female *Nephrops* in catches across the Farn Deeps grounds observed during the 2004 FSP Programme 6a.

## Whiting catches



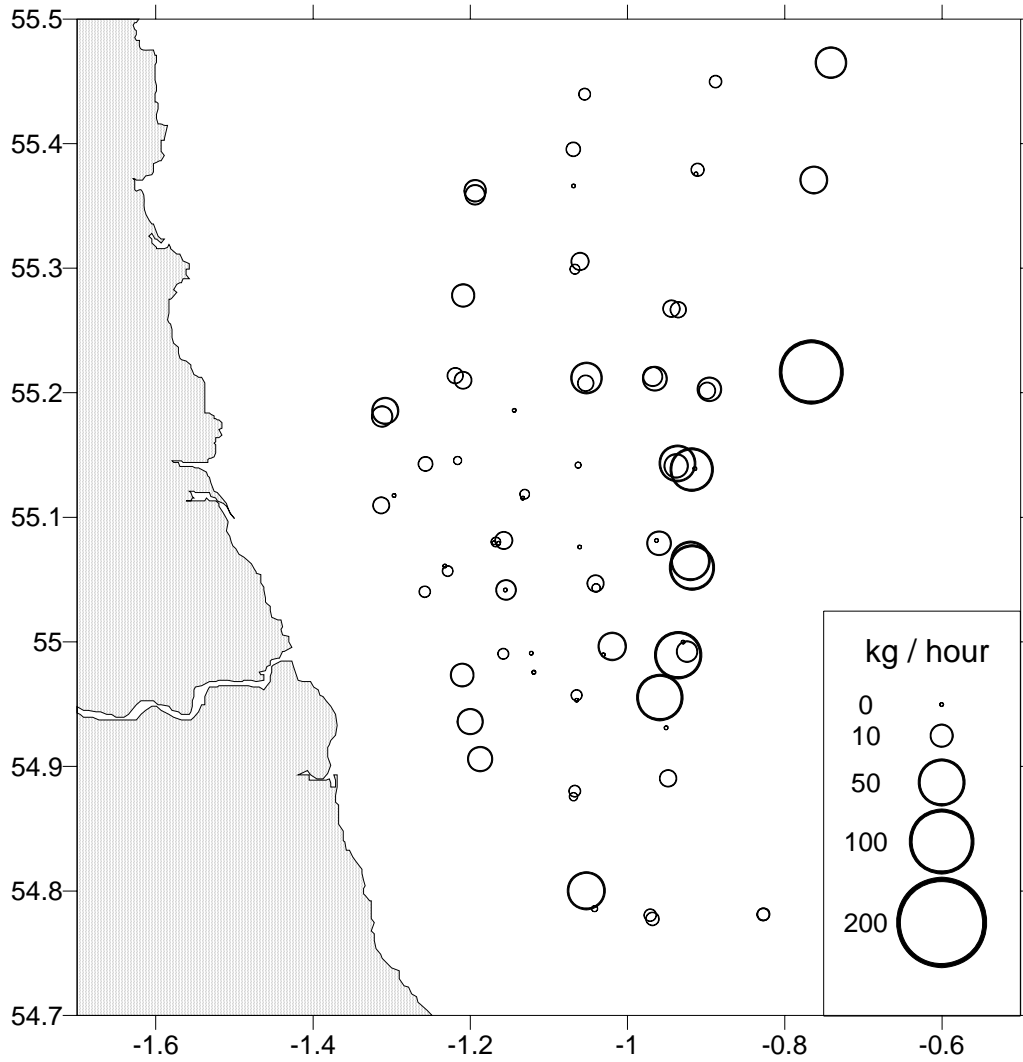
**Figure 5.** Catch rates of whiting observed during 2004 FSP Programme 6a on the Farn Deeps *Nephrops* grounds.

## Plaice catches



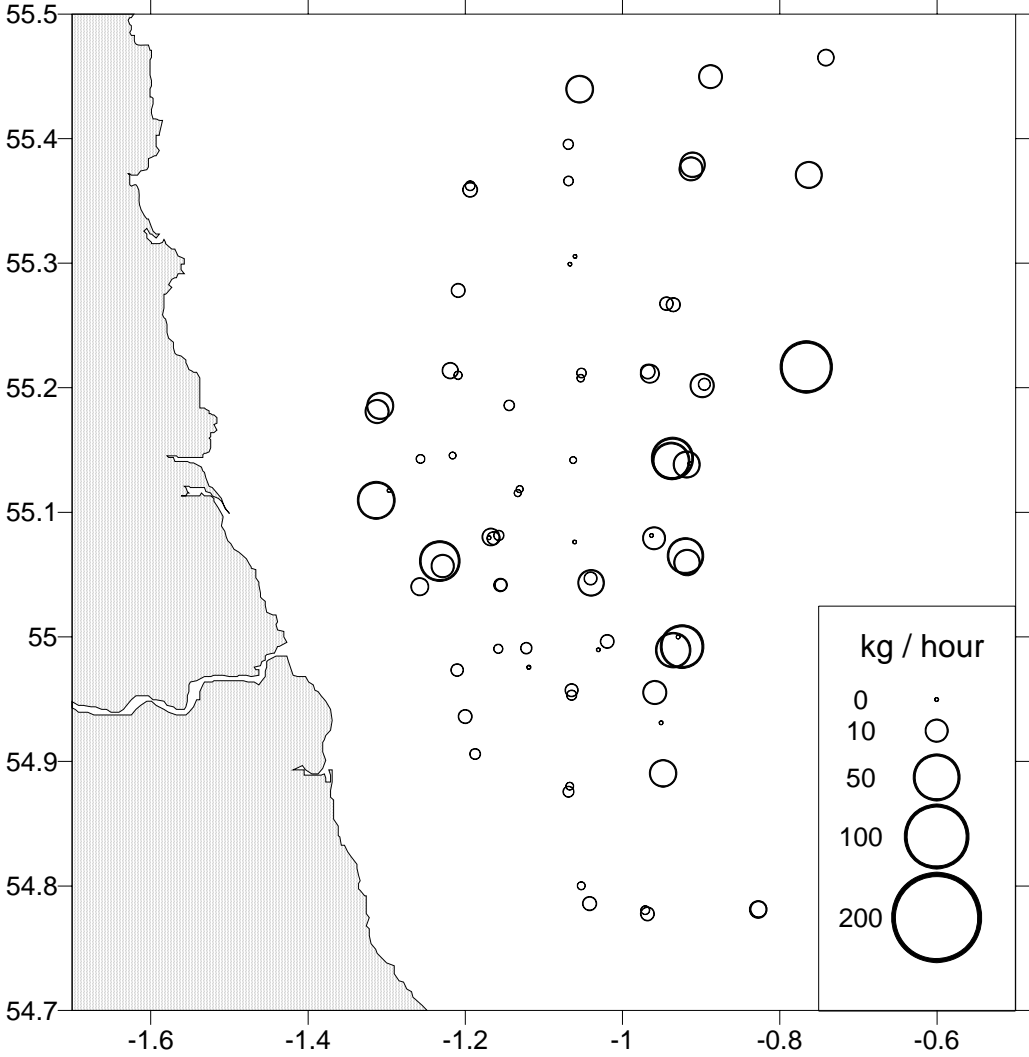
**Figure 6.** Catch rates of plaice observed during 2004 FSP Programme 6a on the Farn Deeps *Nephrops* grounds.

# Haddock catches



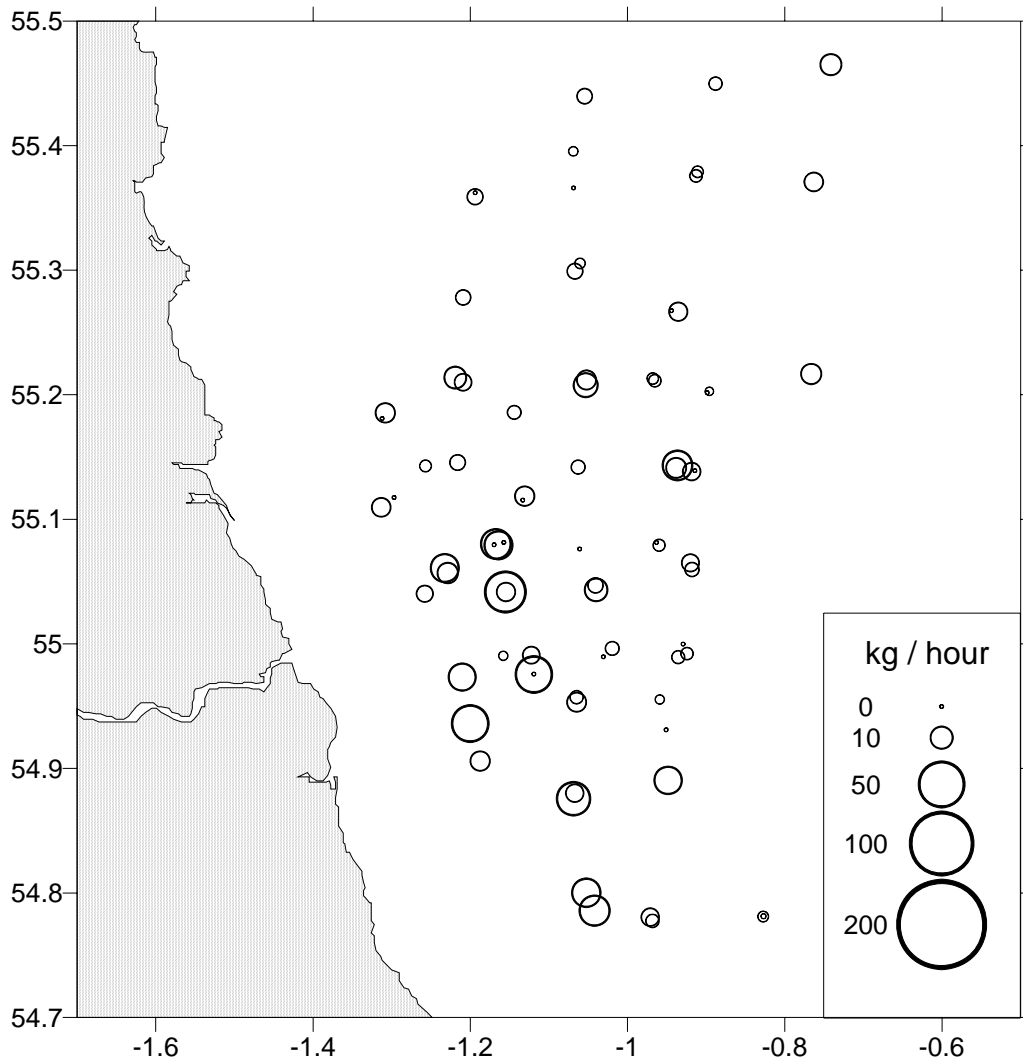
**Figure 7.** Catch rates of haddock observed during 2004 FSP Programme 6a on the Farn Deeps *Nephrops* grounds.

# Lemon sole catches

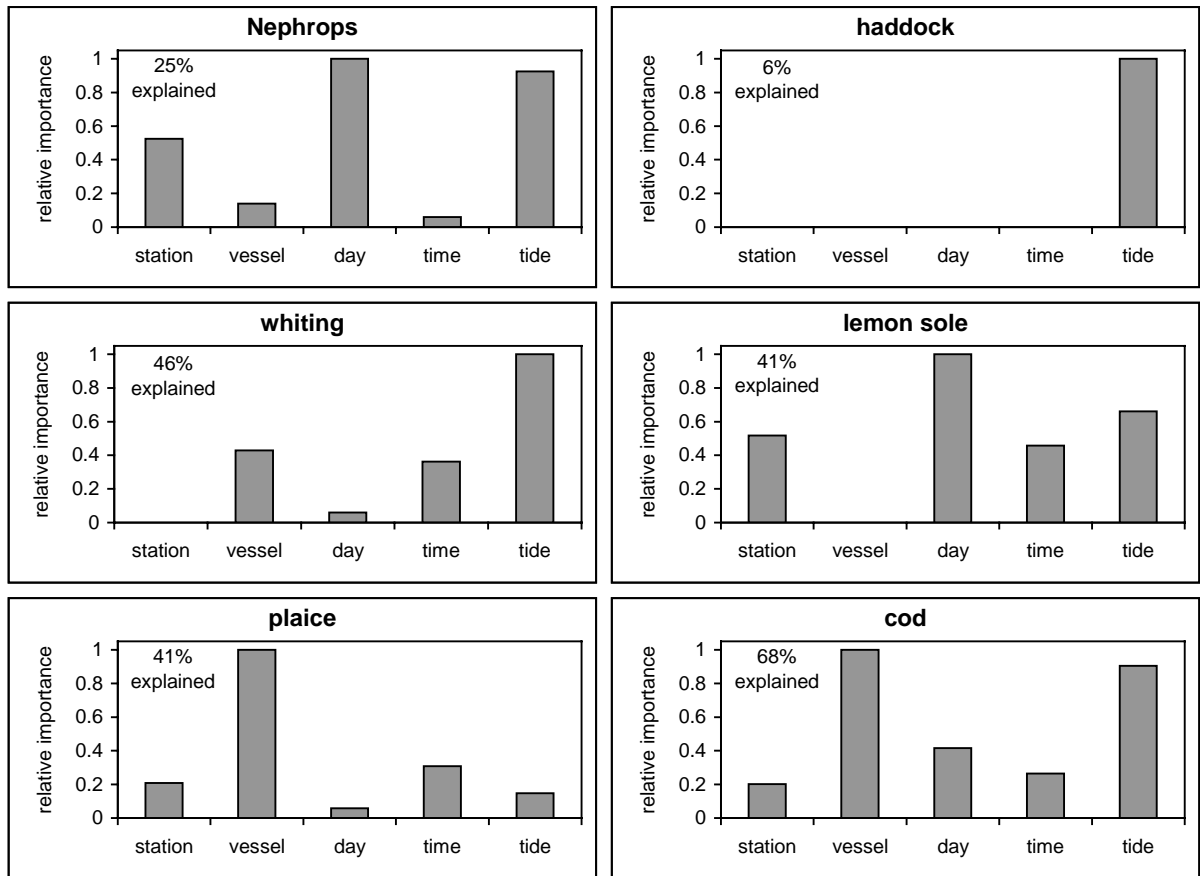


**Figure 8.** Catch rates of lemon sole observed during 2004 FSP Programme 6a on the Farn Deeps *Nephrops* grounds.

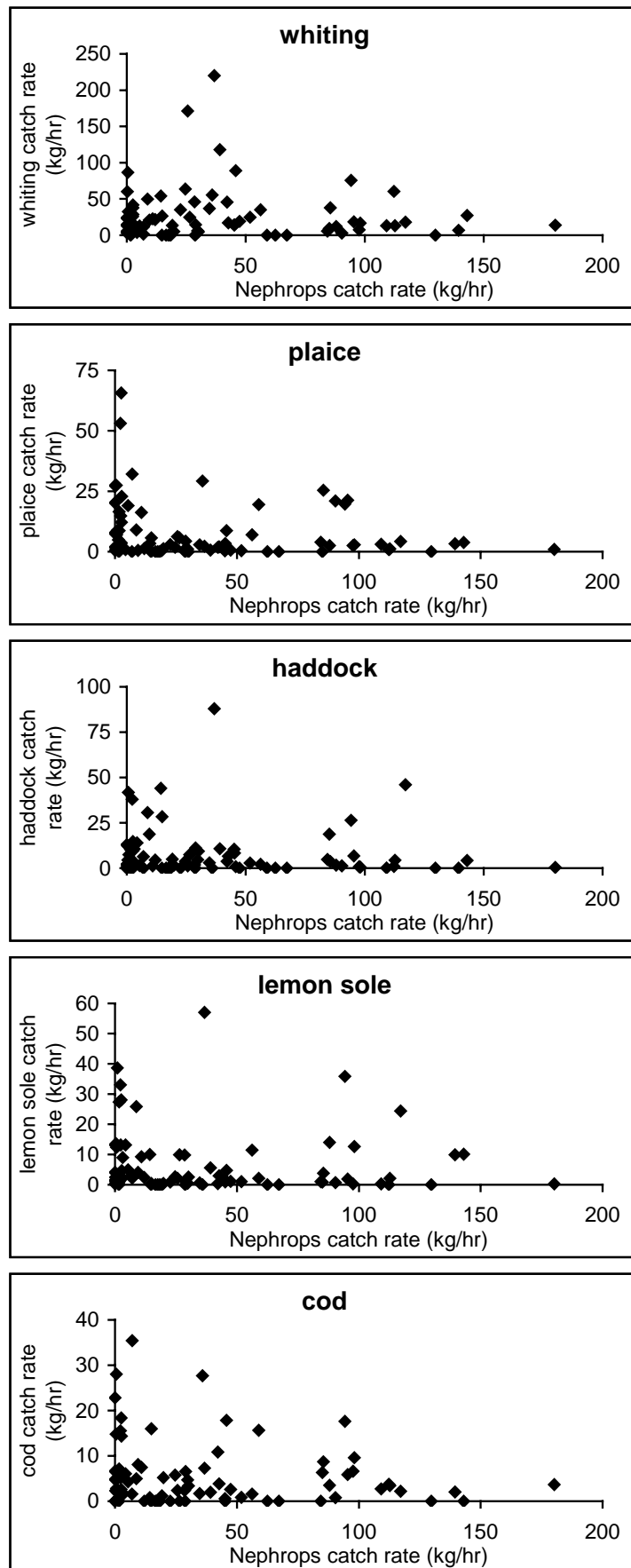
## Cod catches



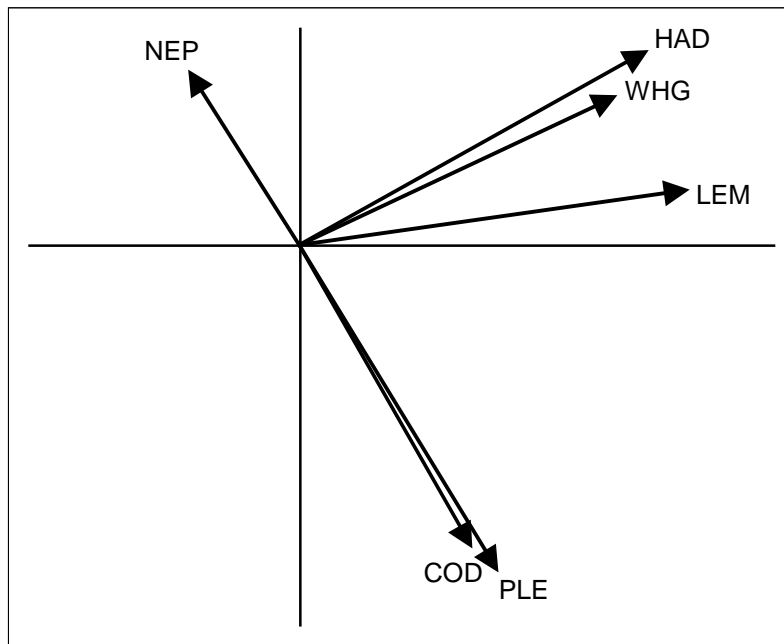
**Figure 9.** Catch rates of cod observed during 2004 FSP Programme 6a on the Farn Deeps *Nephrops* grounds.



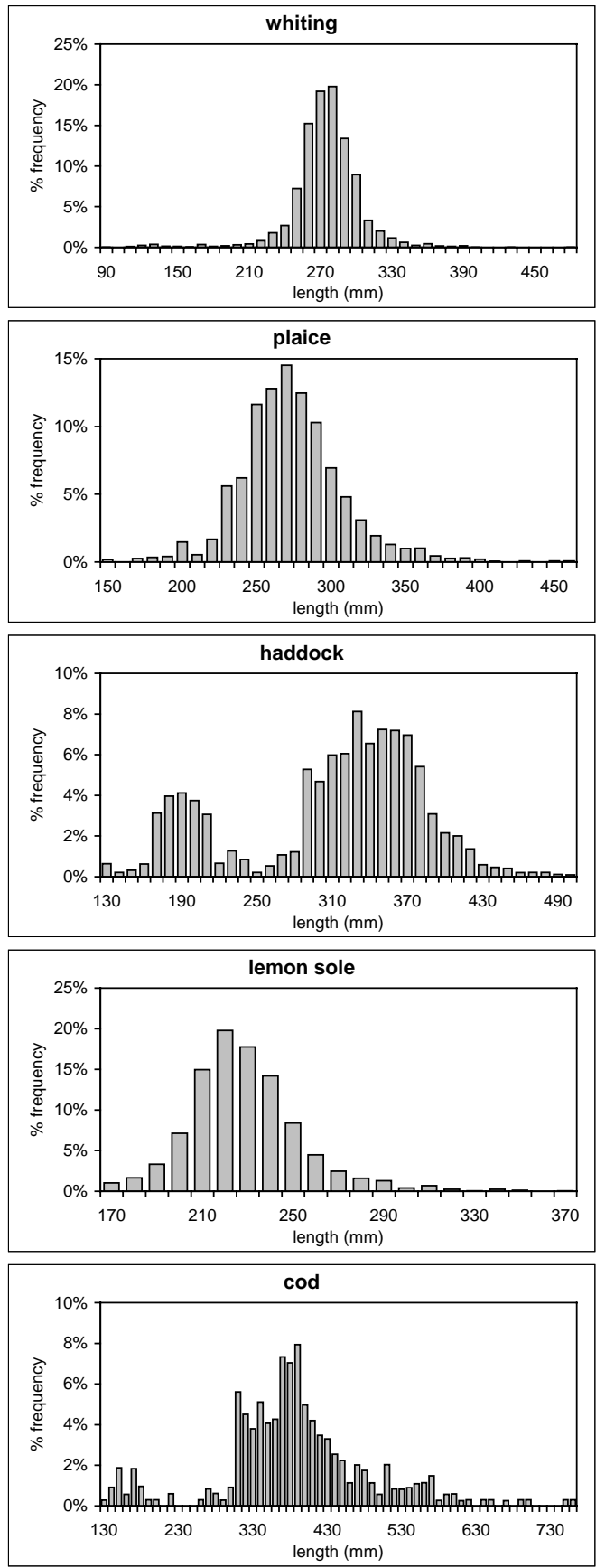
**Figure 10.** Relative importance of location (station), vessel identity, day, time and state of tide in accounting for variations in catch rate (kg/hour) of *Nephrops* and the main by-catch species observed during 2004 FSP Programme 6a on the Farn Deeps *Nephrops* grounds. % explained describes the proportion of the total variation in catch rates that can be accounted for in terms of these factors.



**Figure 11.** Catch rates of commercial by-catch species shown in relation to catch rates of *Nephrops* observed during 2004 FSP Programme 6a.



**Figure 12.** Graphical representation of the relationships between catch rates of *Nephrops* and commercial fish by-catch species observed during 2004 FSP Programme 6a (NEP = *Nephrops*, WHG = whiting, PLE = plaice, HAD = haddock, LEM = lemon sole, COD = cod). Arrows in the same direction signify positive correlations between species (e.g. COD and PLE); arrows in opposing directions signify negative correlations (e.g. NEP and COD); arrows more or less perpendicular to those of another species signify lack of correlation (e.g. NEP and HAD or COD and HAD).



**Figure 13.** Size distributions of the main commercial by-catch species in the catches observed during 2004 FSP Programme 6a.

**Appendix 1: NE *Nephrops* FSP Programme 6a, 2004: Station and catch (in numbers) details for *Nephrops* (NEP), whiting (WHG), plaice (PLE), haddock (HAD), lemon sole (LEM) and cod (COD).**

Cruise: KRISTENBORG 1/04

STN	Rect	Shot Lon	Shot Lat	Haul Lon	Haul Lat	Date	Time	Tow hrs	NEP_N	WHG_N	PLE_N	HAD_N	LEM_N	COD_N
1	39E8	-1.157	55.030	-1.153	55.053	08-Nov-04	13:15	0.50	127	3	58	0	5	13
3	39E8	-1.145	55.203	-1.143	55.168	09-Nov-04	13:20	0.50	1041	54	1	0	4	1
5	39E8	-1.227	55.047	-1.238	55.075	09-Nov-04	8:50	0.58	61	53	136	0	116	14
10	38E8	-1.060	54.944	-1.070	54.963	08-Nov-04	10:20	0.53	31	7	16	0	3	2
12	38E8	-1.200	54.962	-1.200	54.910	08-Nov-04	8:35	0.58	10	7	50	14	6	16
13	39E9	-0.920	55.046	-0.920	55.084	12-Nov-04	9:15	0.58	160	165	20	46	105	12
15	39E9	-0.935	55.162	-0.941	55.121	12-Nov-04	12:15	0.58	28	56	33	16	100	11
16	39E9	-0.877	55.208	-0.921	55.195	11-Nov-04	15:30	0.58	2819	84	11	8	36	0
18	39E9	-0.925	55.275	-0.963	55.260	11-Nov-04	13:55	0.58	202	62	2	6	9	0
22	39E8	-1.222	55.200	-1.217	55.227	09-Nov-04	12:00	0.58	2261	137	62	7	13	8
24	39E8	-1.295	55.096	-1.332	55.123	09-Nov-04	10:15	0.50	38	80	180	14	82	5
25	39E9	-0.752	55.362	-0.775	55.380	11-Nov-04	10:45	0.58	44	18	2	26	53	5
26	39E9	-0.756	55.477	-0.727	55.453	11-Nov-04	8:50	0.50	93	63	1	29	16	8
29	39E9	-0.910	55.392	-0.916	55.360	11-Nov-04	12:25	0.58	2869	21	8	0	35	2
33	39E8	-1.043	55.062	-1.037	55.025	09-Nov-04	15:20	0.58	2045	51	5	1	39	10
34	38E8	-1.122	54.989	-1.117	54.962	12-Nov-04	7:05	0.58	947	179	65	0	0	17
39	39E9	-0.919	55.127	-0.918	55.150	12-Nov-04	10:40	0.67	29	52	36	65	59	7
42	38E8	-1.048	54.983	-1.013	54.996	08-Nov-04	11:30	0.50	57	0	0	0	0	0
44	39E8	-1.137	55.075	-1.192	55.083	08-Nov-04	14:30	0.58	1713	0	39	0	6	10

[continued...]

**APPENDIX 1 (continued):**

Cruise: STAR DIVINE 1/04

STN	Rect	Shot Lon	Shot Lat	Haul Lon	Haul Lat	Date	Time	Tow hrs	NEP_N	WHG_N	PLE_N	HAD_N	LEM_N	COD_N
8	38E9	-0.934	54.886	-0.963	54.895	08-Nov-04	10:40	0.50	6	254	14	4	43	8
9	38E8	-1.065	54.890	-1.072	54.861	08-Nov-04	9:15	0.50	1	43	15	1	2	12
10	38E8	-1.060	54.949	-1.070	54.965	08-Nov-04	12:05	0.50	623	495	12	1	7	2
12	38E8	-1.202	54.965	-1.218	54.982	08-Nov-04	13:35	0.57	67	129	27	19	6	7
13	39E9	-0.918	55.051	-0.918	55.069	09-Nov-04	14:35	0.50	8	80	10	51	29	3
15	39E9	-0.942	55.133	-0.931	55.154	09-Nov-04	16:00	0.50	1615	218	37	32	122	25
18	39E9	-0.916	55.274	-0.955	55.259	12-Nov-04	9:20	0.50	370	167	3	5	6	2
19	39E8	-1.053	55.225	-1.054	55.190	12-Nov-04	12:30	0.50	713	123	4	6	1	4
20	39E8	-1.059	55.316	-1.074	55.282	12-Nov-04	11:12	0.50	2239	164	2	1	0	2
25	39E9	-0.753	55.047	-0.780	55.386	11-Nov-04	8:07	0.20	158	237	2	53	75	4
27	39E9	-0.887	55.437	-0.889	55.463	11-Nov-04	9:30	0.50	403	117	2	2	32	2
28	39E8	-1.049	55.452	-1.060	55.427	11-Nov-04	13:00	0.50	1489	31	5	2	48	3
29	39E9	-0.910	55.395	-0.912	55.363	11-Nov-04	10:58	0.50	828	92	12	3	37	2
30	39E8	-1.070	55.379	-1.068	55.353	11-Nov-04	15:50	0.50	382	91	6	0	3	0
31	39E8	-1.188	55.375	-1.200	55.343	11-Nov-04	14:30	0.50	1066	49	4	10	10	2
36	38E9	-0.964	54.768	-0.972	54.787	09-Nov-04	11:00	0.50	4	180	13	2	7	4
37	38E8	-1.056	54.796	-1.028	54.776	09-Nov-04	9:55	0.50	59	109	7	1	7	8
38	39E9	-0.969	55.198	-0.961	55.225	12-Nov-04	8:00	0.50	612	269	2	13	20	2
41	38E9	-0.937	54.984	-0.912	55.000	09-Nov-04	13:20	0.50	12	35	16	8	121	2
44	39E8	-1.145	55.077	-1.190	55.083	08-Nov-04	15:15	0.50	977	236	15	1	11	11

[continued...]

**APPENDIX 1 (continued):**

Cruise: GALLANT VENTURE 1/04

STN	Rect	Shot Lon	Shot Lat	Haul Lon	Haul Lat	Date	Time	Tow hrs	NEP_N	WHG_N	PLE_N	HAD_N	LEM_N	COD_N
4	39E8	-1.131	55.129	-1.131	55.108	01-Dec-04	12:43	0.50	3034	19	5	1	1	4
5	39E8	-1.233	55.068	-1.224	55.046	01-Dec-04	14:14	0.50	265	66	31	6	28	7
6	38E8	-1.170	54.996	-1.146	54.985	15-Nov-04	8:45	0.50	2008	9	33	2	2	1
8	38E9	-0.962	54.894	-0.940	54.968	16-Nov-04	10:40	0.50	383	0	0	0	0	0
20	39E8	-1.061	55.293	-1.060	55.318	29-Nov-04	9:22	0.50	285	35	1	4	0	1
21	39E8	-1.204	55.288	-1.214	55.268	29-Nov-04	13:47	0.50	773	13	0	14	4	4
22	39E8	-1.200	55.223	-1.218	55.197	29-Nov-04	15:07	0.50	684	16	2	5	1	4
23	39E8	-1.306	55.174	-1.310	55.196	01-Dec-04	9:23	0.50	0	38	70	95	40	6
30	39E8	-1.067	55.409	-1.071	55.381	29-Nov-04	10:33	0.50	883	69	1	3	1	1
31	39E8	-1.191	55.371	-1.197	55.353	29-Nov-04	12:15	0.50	905	42	9	12	2	0
32	39E8	-1.061	55.151	-1.064	55.132	01-Dec-04	11:29	0.50	2902	34	5	1	1	2
34	38E8	-1.120	54.985	-1.119	54.966	16-Nov-04	8:45	0.50	888	0	0	0	0	0
35	38E9	-0.817	54.786	-0.838	54.776	30-Nov-04	9:55	0.53	66	47	58	5	11	1
36	38E9	-0.967	54.770	-0.975	54.791	30-Nov-04	11:43	0.50	39	30	10	2	2	5
37	38E8	-1.044	54.797	-1.061	54.803	30-Nov-04	13:01	0.52	598	76	13	28	1	13
39	39E9	-0.916	55.130	-0.913	55.148	16-Nov-04	15:13	0.57	1231	0	0	0	0	0
40	39E9	-0.962	55.071	-0.965	55.092	16-Nov-04	13:50	0.50	1221	0	0	0	0	0
41	38E9	-0.939	54.997	-0.919	55.003	16-Nov-04	12:20	0.50	2148	0	0	0	0	0
42	38E8	-1.016	54.985	-1.023	55.008	15-Nov-04	10:38	0.50	26	71	6	17	6	2
44	39E8	-1.142	55.079	-1.173	55.084	15-Nov-04	12:47	0.50	1376	15	6	6	2	0

[continued...]

**APPENDIX 1 (continued):**

Cruise: QUO VADIS 1/04

STN	Rect	Shot Lon	Shot Lat	Haul Lon	Haul Lat	Date	Time	Tow hrs	NEP_N	WHG_N	PLE_N	HAD_N	LEM_N	COD_N
1	39E8	-1.156	55.033	-1.154	55.050	16-Nov-04	15:00	0.50	1841	51	42	8	5	4
2	39E8	-1.215	55.155	-1.217	55.136	01-Dec-04	12:44	0.53	6300	42	2	1	1	3
4	39E8	-1.133	55.114	-1.133	55.117	16-Nov-04	16:38	0.50	0	10	4	0	1	0
6	38E8	-1.070	54.985	-1.175	54.997	30-Nov-04	13:59	0.50	0	14	1	0	3	4
7	38E9	-0.959	54.955	-0.959	54.955	16-Nov-04	10:58	0.50	208	128	8	51	31	1
9	38E8	-1.066	54.887	-1.069	54.873	30-Nov-04	8:16	0.50	525	15	3	2	1	2
11	38E8	-1.188	54.897	-1.188	54.915	16-Nov-04	8:51	0.50	763	40	6	18	4	12
14	39E8	-1.265	55.050	-1.251	55.030	01-Dec-04	14:23	0.52	138	33	49	2	13	4
16	39E9	-0.910	55.197	-0.881	55.209	29-Nov-04	9:11	0.52	706	36	1	13	7	1
19	39E8	-1.051	55.221	-1.054	55.202	29-Nov-04	12:18	0.50	1995	23	0	21	1	1
23	39E8	-1.307	55.174	-1.318	55.188	29-Nov-04	14:36	0.50	579	70	8	32	31	0
24	39E8	-1.296	55.124	-1.298	55.111	15-Nov-04	8:50	0.53	331	0	0	0	0	0
33	39E8	-1.041	55.056	-1.040	55.038	01-Dec-04	9:00	0.52	3209	29	3	5	3	2
35	38E9	-0.818	54.788	-0.836	54.775	30-Nov-04	10:53	0.52	0	85	45	13	10	1
38	39E9	-0.967	55.221	-0.969	55.205	29-Nov-04	10:46	0.57	120	34	0	8	13	2
40	39E9	-0.961	55.067	-0.958	55.091	01-Dec-04	10:30	0.53	52	32	3	15	34	2
41	38E9	-0.925	54.997	-0.947	54.982	16-Nov-04	12:21	0.50	1667	51	8	61	86	3
43	39E8	-1.060	55.086	-1.062	55.067	15-Nov-04	11:54	0.50	269	0	0	0	0	0
44	39E8	-1.186	55.081	-1.154	55.078	15-Nov-04	10:28	0.50	320	0	0	0	0	0
45	39E8	-1.243	55.148	-1.271	55.138	29-Nov-04	15:59	0.50	718	102	6	5	3	2

## Appendix 2: NE *Nephrops* FSP Programme 6a, 2004: Cruise reports

CENTRE FOR ENVIRONMENT, FISHERIES AND AQUACULTURE SCIENCE  
LOWESTOFT LABORATORY, LOWESTOFT, SUFFOLK NR33 0HT, ENGLAND

### 2004/05 FISHERIES SCIENCE PARTNERSHIP – FARN DEEPS *NEPHROPS* SURVEY

**REPORT:** FV Kristenborg GY199

**SKIPPER:** K Caffrey

**CEFAS STAFF:** A R Lawler  
S Cutchey (9-11/11)

**LOCATION:** North East coast - Farn Deeps

**DATES:** 7-13 November 2004

#### **AIMS:**

1. To describe commercial catch rates of *Nephrops* in the vicinity of underwater camera tows carried out on the Farn Deeps grounds in October 2004 by CEFAS.
2. To describe the size composition and mean size of *Nephrops* in the vicinity of underwater camera tows.
3. To describe the catch rates of fish by-catch species taken during trawling for *Nephrops* in different areas of the Farn Deeps grounds.
4. To describe the variation in commercial catch rates of *Nephrops* and by-catch species according to location, vessel and time of day.

#### **NARRATIVE:**

Staff travelled to North Shields on Sunday 7 November. The following morning CEFAS staff met the skipper and crew of FV Kristenborg at the North Shields fishing quay. Kristenborg sailed at 0715h after sampling equipment and gear had been loaded. Later the same day, Kristenborg returned to port and entered the Royal Quays dock that afforded greater protection and security. Kristenborg sailed daily from the Royal Quays dock and finally docked at 1830h on Friday 12 November when sampling equipment and gear was unloaded. CEFAS staff returned to Lowestoft the following day. A total of five daily fishing trips was made by the vessel FV Kristenborg over the dates 8-12 November 2004.

#### **RESULTS:**

Trawl stations had been assigned a priority of 1, 2 or 3 based on the availability of scientific staff on board, and time available (see Appendix 3). It was assumed that an average sampling rate of four stations per day would be possible. Thus it was expected that FV Kristenborg would sample around 20 stations over the course of five days. A total of 19 half-hour tows were successfully completed, comprising 8 and 11 priority 1 and 2 stations respectively (Figure 1). On the occasions when only one CEFAS staff member was available, the assistance of the crew enabled the full sampling protocol expected for priority 1 stations to be worked at all completed stations. Of all the priority 1 and 2 stations assigned to FV Kristenborg, only station 2 (priority 2) was not sampled owing to poor weather conditions.

At each station the volume of the whole catch was assessed. It was then sorted into a) commercial categories of mixed fish, whiting and large and small *Nephrops* and b) discard categories typically comprising mixed commercial species, whiting and non-commercial species. Each category was volumetrically assessed. Commercial fish were measured or sub-sampled and measured. Samples of *Nephrops* were sexed and measured. Discarded commercial species were measured or sub-sampled and measured. Discard non-commercial species were counted. When these data are analysed

together with the data from the other three vessels participating in the Farn Deeps *Nephrops* survey, it is expected that aims 1 to 4 will be accomplished in full.

#### **FISHERY CONSIDERATIONS:**

The skipper of FV Kristenborg made some valuable comments about gear efficiency and *Nephrops* catchability issues that will need to be taken into account when interpreting the results of the Farn Deeps survey:

1. It was suggested that the gear does not start to fish efficiently from the onset of towing, so that half-hour tows may not be fully representative of commercial catch rates.
2. The tidal cycle was approaching full springs towards the end of the survey. Catchability of *Nephrops* is thought to be reduced at times of large tides.
3. Highest catch rates of *Nephrops* are considered to occur during slack water. Constraints of survey coverage and timing dictate that stations are sampled at varying states of the tide which are not necessarily optimal for the highest catch rates of *Nephrops*.

A R Lawler  
15 November 2004

**PRAWN SAMPLING STATIONS  
FV KRISTENBORG - 8-12/11/04**

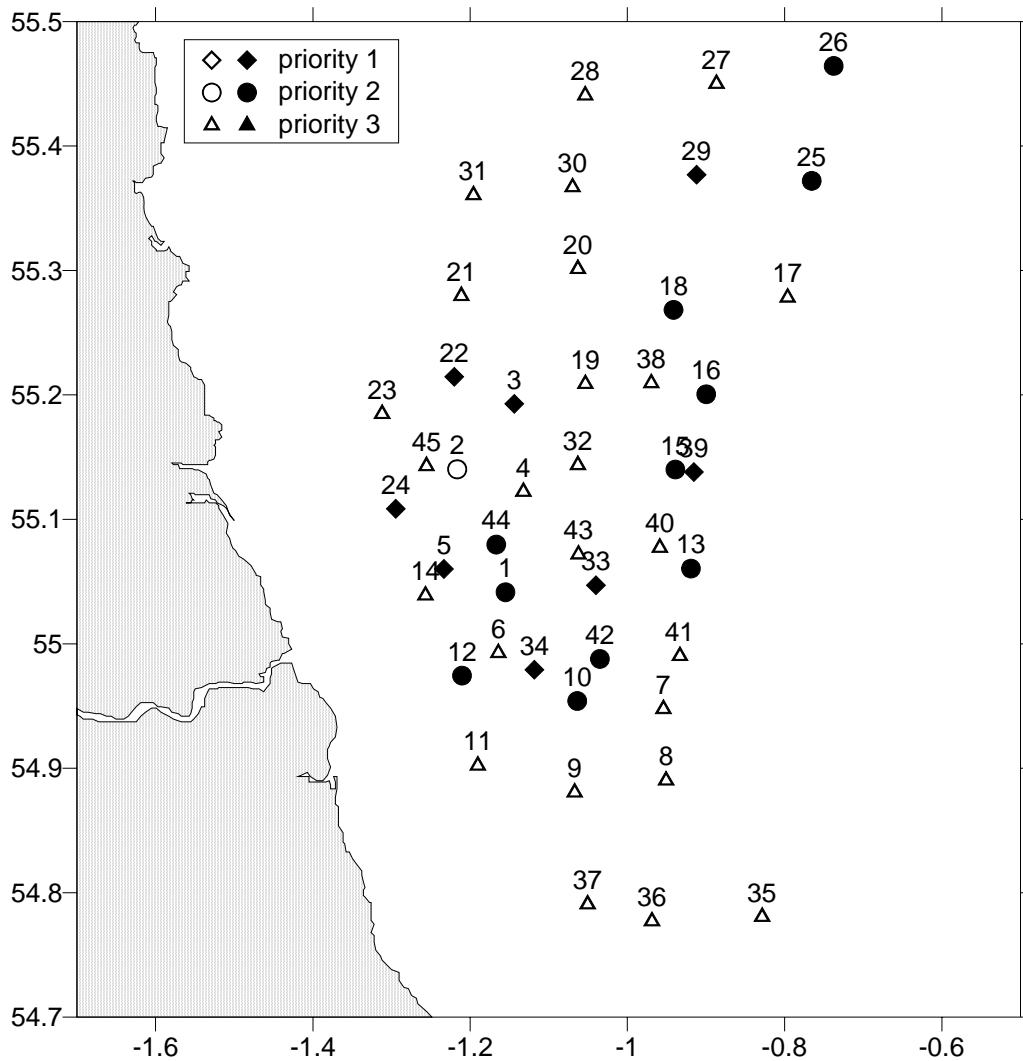


FIGURE 1. Trawl stations for the Farn Deeps *Nephrops* survey. Symbols show sampling priorities for FV Kristenborg: priority 1, full sampling; priority 2, reduced sampling; priority 3, additional. Filled symbols show sampled stations 8-12/11/04 – all completed stations were sampled according to the full priority 1 sampling protocol.

## APPENDIX 2 contd.: Cruise reports

CENTRE FOR ENVIRONMENT, FISHERIES AND AQUACULTURE SCIENCE  
LOWESTOFT LABORATORY, LOWESTOFT, SUFFOLK NR33 0HT, ENGLAND

### 2004/05 FISHERIES SCIENCE PARTNERSHIP – FARN DEEPS *NEPHROPS* SURVEY

**REPORT:** FV Star Divine LH230

**SKIPPER:** S Robinson

**CEFAS STAFF:** S R Lovewell  
S Cutchey (8/11)

**LOCATION:** North East coast - Farn Deeps

**DATES:** 7-13 November 2004

#### AIMS:

1. To describe commercial catch rates of *Nephrops* in the vicinity of underwater camera tows carried out on the Farn Deeps grounds in October 2004 by CEFAS.
2. To describe the size composition and mean size of *Nephrops* in the vicinity of underwater camera tows.
3. To describe the catch rates of fish by-catch species taken during trawling for *Nephrops* in different areas of the Farn Deeps grounds.
4. To describe the variation in commercial catch rates of *Nephrops* and by-catch species according to location, vessel and time of day.

#### NARRATIVE:

Staff travelled to North Shields on Sunday 7 November. The following morning CEFAS staff met the skipper and crew of FV Star Divine at the North Shields fishing quay. Star Divine sailed at 0715h after sampling equipment and gear had been loaded. Later the same day, Star Divine returned to port and entered the Royal Quays dock that afforded greater protection and security. Star Divine sailed daily from the Royal Quays dock and finally docked at 1830h on Friday 12 November when sampling equipment and gear was unloaded. CEFAS staff returned to Lowestoft the following day. A total of five daily fishing trips was made by the vessel FV Star Divine over the dates 8-12 November 2004.

#### RESULTS:

Trawl stations had been assigned a priority of 1, 2 or 3 based on the availability of scientific staff on board, and time available (see Appendix 3). It was assumed that an average sampling rate of four stations per day would be possible. Thus it was expected that FV Star Divine would sample around 20 stations over the course of five days. A total of 20 half-hour tows were successfully completed, comprising 11, 7 and 2 priority 1, 2 and 3 stations respectively (Figure 1). Owing to the unstinting effort and assistance of the crew, all stations were worked up to the full sampling specification expected for priority 1 stations. One priority 1 and one priority 2 station were not completed (Stations 45 and 17 respectively) due to deteriorating weather conditions throughout the last day (from SW 4-5 to NW 6-7).

At each station the volume of the whole catch was assessed. It was then sorted into a) commercial categories of mixed fish, whiting and large and small *Nephrops* and b) discard categories typically comprising mixed commercial species, whiting and non-commercial species. Each category was volumetrically assessed. Commercial fish were measured or sub-sampled and measured. Samples of *Nephrops* were sexed and measured. Discarded commercial species were measured or sub-sampled and measured. Discard non-commercial species were counted. When these data are analysed

together with the data from the other three vessels participating in the Farn Deeps *Nephrops* survey, it is expected that aims 1 to 4 will be accomplished in full.

**FISHERY CONSIDERATIONS:**

1. The mainstay of fishing effort this year has been concentrated to the north of the Farn Deeps this year.
2. It is possible that significant quantities of *Nephrops* are caught outside of the area of the CEFAS TV survey.
3. Due to bycatch limitations of Fisheries regulations, decisions have to be made as to whether an 80mm prawn net or a 120mm fish net is used. This is especially pertinent at the beginning and end of the *Nephrops* season, and can lead to financial difficulties for fishermen and unnecessary discarding of immature fish.

S R Lovewell  
15 November 2004

**PRAWN SAMPLING STATIONS  
FV STAR DIVINE - 8-12/11/04**

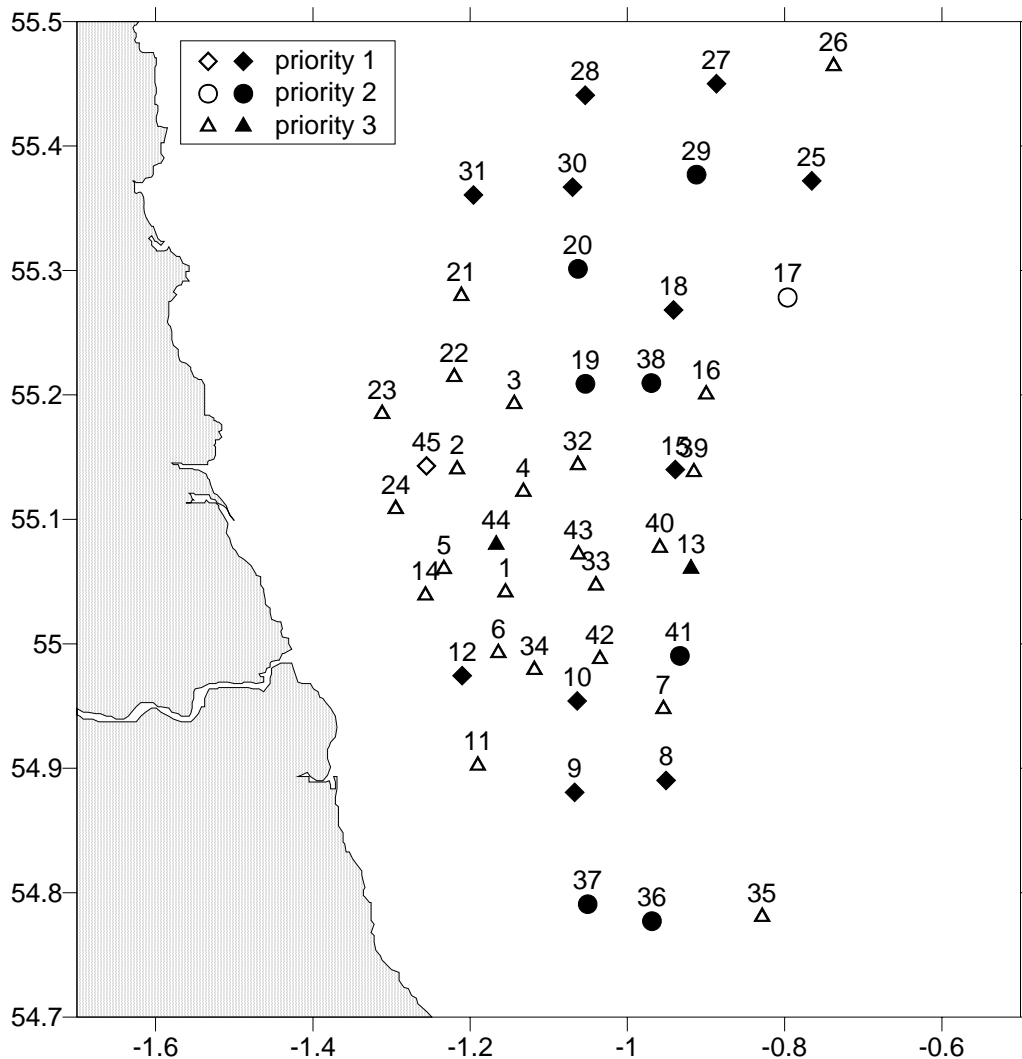


FIGURE 1. Trawl stations for the Farn Deeps *Nephrops* survey. Symbols show sampling priorities for FV Star Divine: priority 1, full sampling; priority 2, reduced sampling; priority 3, additional. Filled symbols show sampled stations 8-12/11/04 – all completed stations were sampled according to the full priority 1 sampling protocol.

## APPENDIX 2 contd.: Cruise reports

CENTRE FOR ENVIRONMENT, FISHERIES AND AQUACULTURE SCIENCE  
LOWESTOFT LABORATORY, LOWESTOFT, SUFFOLK NR33 0HT, ENGLAND

### 2004/05 FISHERIES SCIENCE PARTNERSHIP – FARN DEEPS *NEPHROPS* SURVEY

**REPORT:** FV Quo Vadis

**SKIPPER:** P Hammerberg

**CEFAS STAFF:** M Smith (15/11, 29/11, 1/12)  
D W Palmer (16/11, 30/11)  
D McCubbin (16/11, 30/11)

**LOCATION:** North East coast - Farn Deeps

**DATES:** 14 November to 2 December 2004

#### AIMS:

1. To describe commercial catch rates of *Nephrops* in the vicinity of underwater camera tows carried out on the Farn Deeps grounds in October 2004 by CEFAS.
2. To describe the size composition and mean size of *Nephrops* in the vicinity of underwater camera tows.
3. To describe the catch rates of fish by-catch species taken during trawling for *Nephrops* in different areas of the Farn Deeps grounds.
4. To describe the variation in commercial catch rates of *Nephrops* and by-catch species according to location, vessel and time of day.

#### NARRATIVE:

Staff travelled to North Shields on Sunday 14<sup>th</sup> November. The following morning CEFAS staff met the skipper and crew of FV Quo Vadis at the North Shields fishing quay. Sampling equipment was loaded and the vessel sailed at 0715h with Mike Smith of the scientific crew aboard. After a good start, deteriorating weather curtailed work during the afternoon. On 16<sup>th</sup> November the vessel sailed with Dave Palmer and Dave McCubbin aboard and, with improved weather, a full day was worked and time lost the previous day made up. However, on the morning of 17<sup>th</sup> November the weather was poor once again and, with a poor forecast for the remainder of the week it was decided that the scientific staff would return to Lowestoft and await a more settled period.

CEFAS staff returned to North Shields on Sunday 28<sup>th</sup> November. Over the following three days, with scientific staff again alternating, the survey was completed. Sampling equipment was unloaded in the evening of 1<sup>st</sup> December and staff returned to Lowestoft the following day. A total of five one-day fishing trips was made by the vessel FV Quo Vadis over the dates 15 November to 1 December 2004.

#### RESULTS:

Trawl stations had been assigned a priority of 1, 2 or 3 based on the availability of scientific staff on board, and time available (see Appendix 3). In light of the experience of the first two days work, adjustments to the survey plan were made including removal of some of the most distant stations (for reasons of safety and steaming time for small vessels). It was assumed that an average sampling rate of 4 stations per day would be possible, each with a 30 min. tow duration. Thus it was expected that FV Quo Vadis would sample around 20 stations over the course of five days. This total was achieved, comprising 8 and 12 priority 1 and 2 stations respectively (Figure 1). On the occasions when only one CEFAS staff member was available, the assistance of the crew made it possible for an improvement to the expected protocol for priority 2 stations with all *Nephrops* and a proportion of commercial fish species being measured.

At each station the volume of the whole catch was assessed. It was then sorted into a) retained commercial fish, and large and small *Nephrops* and b) discard categories typically comprising mixed commercial species, whiting and non-commercial species. Each category was either weighed or assessed volumetrically. Samples of *Nephrops* were sexed and measured. At most stations retained fish and discarded commercial species were measured, or sub-sampled and measured. Discard non-commercial species were counted when two scientists were aboard. When these data are analysed together with the data from the other three vessels participating in the Farn Deeps *Nephrops* survey, it is expected that aims 1 to 4 will be accomplished in full.

#### **FISHERY CONSIDERATIONS:**

Both parts of this survey fell just after the top of the spring tide with the first being closer to the top and the second on a smaller set of tides. It is well known that *Nephrops* catch rates are heavily affected by tidal water movements and this will be an important source of variability in the data from these surveys.

Poor weather conditions will also affect catch rates, especially for relatively small vessels such as the Quo Vadis.

#### **ACKNOWLEDGEMENTS:**

CEFAS staff would like to thank the skipper and crew of the Quo Vadis for their hospitality, their help with scientific work, and the professional manner in which they undertook the survey.

D W Palmer  
6 December 2004

**PRAWN SAMPLING STATIONS**  
**FV QUO VADIS - 15-16/11/04 & 29/11/04-1/12/04**

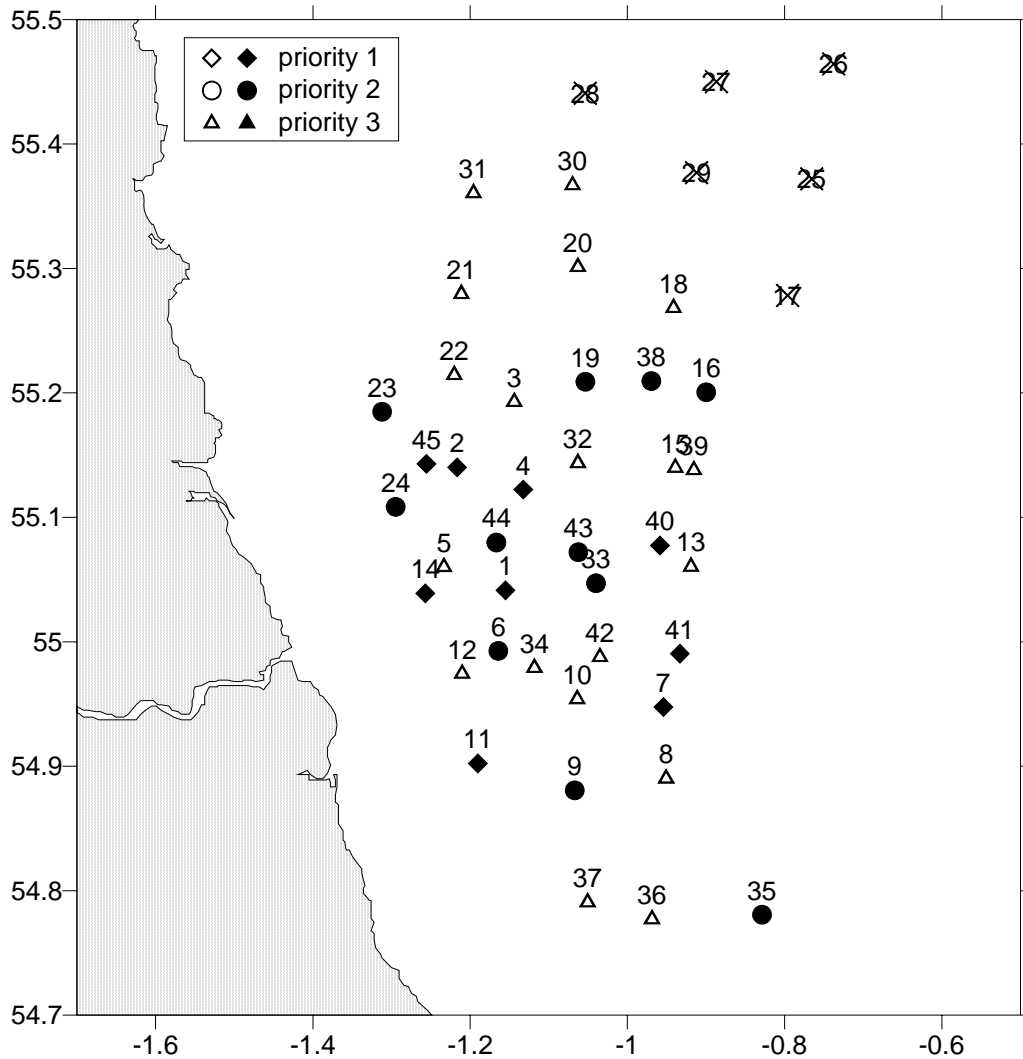


FIGURE 1. Trawl stations for the Farn Deeps *Nephrops* survey. Symbols show sampling priorities for FV Quo Vadis: priority 1, full sampling; priority 2, reduced sampling; priority 3, additional. Filled symbols show sampled stations 15-16/11/04 and 29/11/04-1/12/04. Crossed out numbers represent offshore stations excluded for safety and logistical reasons.

## APPENDIX 2 contd.: Cruise reports

CENTRE FOR ENVIRONMENT, FISHERIES AND AQUACULTURE SCIENCE  
LOWESTOFT LABORATORY, LOWESTOFT, SUFFOLK NR33 0HT, ENGLAND

### 2004/05 FISHERIES SCIENCE PARTNERSHIP – FARN DEEPS *NEPHROPS* SURVEY

**REPORT:** FV Gallant Venture

**SKIPPER:** P Dixon

**CEFAS STAFF:** D W Palmer (15/11, 29/11, 1/12)  
M Smith (16/11, 30/12)  
D McCubbin (15/11, 29/11, 1/12)

**LOCATION:** North East coast - Farn Deeps

**DATES:** 14 November to 2 December 2004

#### AIMS:

1. To describe commercial catch rates of *Nephrops* in the vicinity of underwater camera tows carried out on the Farn Deeps grounds in October 2004 by CEFAS.
2. To describe the size composition and mean size of *Nephrops* in the vicinity of underwater camera tows.
3. To describe the catch rates of fish by-catch species taken during trawling for *Nephrops* in different areas of the Farn Deeps grounds.
4. To describe the variation in commercial catch rates of *Nephrops* and by-catch species according to location, vessel and time of day.

#### NARRATIVE:

Staff travelled to North Shields on Sunday 14<sup>th</sup> November. The following morning CEFAS staff met the skipper and crew of FV Gallant Venture at the North Shields fishing quay. Sampling equipment was loaded and the vessel sailed at 0715h with Dave Palmer and Dave McCubbin aboard. After a good start, deteriorating weather curtailed work during the afternoon. On 16<sup>th</sup> November the vessel sailed with Mike Smith of the scientific crew aboard and, with improved weather, a full day was worked and time lost the previous day made up. However, on the morning of 17<sup>th</sup> November the weather was poor once again and, with a poor forecast for the remainder of the week it was decided that the scientific staff would return to Lowestoft and await a more settled period.

CEFAS staff returned to North Shields on Sunday 28<sup>th</sup> November. Over the following three days, with scientific staff again alternating daily, the survey was completed. Sampling equipment was unloaded in the evening of 1<sup>st</sup> December and staff returned to Lowestoft the following day. A total of five one-day fishing trips was made by the vessel FV Gallant Venture over the dates 15 November to 1 December 2004.

#### RESULTS:

Trawl stations had been assigned a priority of 1, 2 or 3 based on the availability of scientific staff on board, and time available (see Appendix 3). In light of the experience of the first two days work, adjustments were made including removal of some of the most distant stations (for reasons of safety and steaming time for small vessels). It was assumed that an average sampling rate of 4 stations per day would be possible, each with a 30 min. tow duration. Thus it was expected that FV Gallant Venture would sample around 20 stations over the course of five days. This total was achieved, comprising 8 and 12 priority 1 and 2 stations respectively (Figure 1). On the occasions when only one CEFAS staff member was available, the assistance of the crew made it possible for an improvement

to the expected protocol for priority 2 stations with all *Nephrops* and a proportion of commercial fish species being measured.

At each station the volume of the whole catch was assessed. It was then sorted into a) retained commercial fish, and large and small *Nephrops* and b) discard categories typically comprising mixed commercial species, whiting and non-commercial species. Each category was either weighed or assessed volumetrically. Samples of *Nephrops* were sexed and measured. At most stations retained fish and discarded commercial species were measured, or sub-sampled and measured. Discard non-commercial species were counted when two scientists were aboard. When these data are analysed together with the data from the other three vessels participating in the Farn Deeps *Nephrops* survey, it is expected that aims 1 to 4 will be accomplished in full.

#### **FISHERY CONSIDERATIONS:**

Both parts of this survey fell just after the top of the spring tide with the first being closer to the top and the second on a smaller set of tides. It is well known that *Nephrops* catch rates are heavily affected by tidal water movements and this will be an important source of variability in the data from these surveys.

Poor weather conditions will also affect catch rates, especially for relatively small vessels such as the Gallant Venture.

#### **ACKNOWLEDGEMENTS:**

CEFAS staff would like to thank the skipper and crew of the Gallant Venture for their hospitality, their help with scientific work, and the professional manner in which they undertook the survey.

D W Palmer  
6 December 2004

**PRAWN SAMPLING STATIONS**  
**FV GALLANT VENTURE - 15-16/11/04 & 29/11/04-1/12/04**

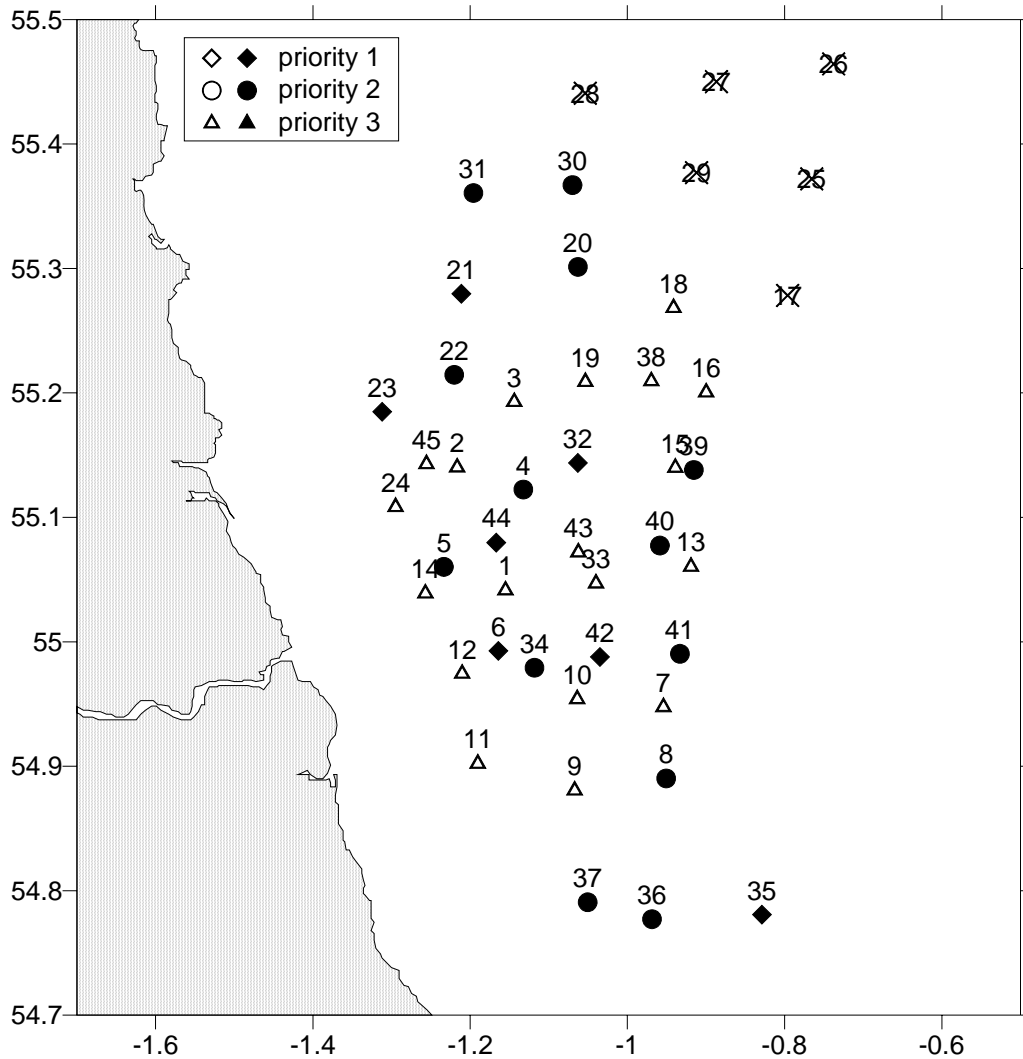


FIGURE 1. Trawl stations for the Farn Deeps *Nephrops* survey. Symbols show sampling priorities for FV Gallant Venture: priority 1, full sampling; priority 2, reduced sampling; priority 3, additional. Filled symbols show sampled stations 15-16/11/04 and 29/11/04-1/12/04. Crossed out numbers represent offshore stations excluded for safety and logistical reasons.

## APPENDIX 3. Sampling protocols for *Nephrops* trawl stations

### Sample specifications

#### Full sample (2 scientist operation – priority 1 stations)

1. Quantify bulk and species composition of catch, landings and discards.
2. Measure *Nephrops* carapace lengths by sex in graded samples of catch.
3. Measure lengths of commercial fish species in samples of landings and discards.

#### Reduced sample (1 scientist operation – priority 2 stations)

1. Quantify bulk and species composition of catch, landings and discards.
2. Retain samples of *Nephrops* from ungraded landings and discards for measurement ashore (if possible).

This will allow:

- calculation of catch, landings and discards per unit effort (volume / hour) for *Nephrops* and fish by-catch species at all stations sampled;
- calculation of size composition of landings and discards for *Nephrops* and commercial by-catch species at fully sampled (priority 1) stations;
- calculation of less representative size compositions for *Nephrops* at some (possibly all?) stations with reduced sampling (priority 2).

### Survey coverage

It is assumed that on average four stations will be sampled on each day (likely to be more or less than this on any given day, depending on steaming time). The vessel is provided with a priority list of fully sampled stations (priority 1), to be covered when two scientists are aboard. A second list of reduced sampling stations (priority 2) is provided, with priority given to those stations not listed as fully sampled by any vessel. Reduced sampling stations are intended to be covered by the single scientist operation. If time or proximity to other fully sampled stations allows, the priority stations among the reduced list could instead be sampled as full stations. A third list is given for each vessel (priority 3) – stations not included on the other two lists, that could be sampled (full or reduced) if the sampling rate is more than expected.

The lists are given to identify priorities and should be considered as the target for ‘best endeavour’ rather than an inflexible programme. For operational reasons, the choice of stations sampled on each day may differ from these ideal priorities.

### Gear

The gear used by a vessel will be the usual commercial gear used for prawn fishing by that vessel, deployed in the customary way. No net liner will be used. The fishing will depart from normal commercial practice only in that the tow duration is set at 0.5 hours.