

FISHERIES SCIENCE PARTNERSHIP

**Report on catches of Nephrops, cod, and other
species on the Farn Deeps ground by FV Luc
and FV Still Waters in spring 2004**

**Fisheries Management Group
CEFAS, Lowestoft
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Introduction

The DEFRA-funded Fisheries Science Partnership was established between DEFRA¹, CEFAS² and NFFO³ for the duration of financial year 2003/4. The objective was to enable the fishing industry to demonstrate the results of commercial fishing in a number of priority fishing areas nominated by the NFFO. Fishing vessels were chartered to fish commercially, usually under dispensation from the quota regulations, to obtain new data on the catch rate and size distribution of target species, and in some cases by-catch species. Ten projects were scheduled and completed. 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.

CEFAS acknowledges the help of the NFFO and skippers during the conduct of these studies. The data and results are the intellectual property of the vessel skippers, CEFAS and NFFO.

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

The Farn Deeps Nephrops project

This report presents the initial results of an FSP project carried out on the trawl fishery for Nephrops in the Farn Deeps off NE England in spring 2004. The project used two commercial Nephrops trawlers, the FV Luc and the FV Still Waters, from 1 March to 9 March. Both vessels fished with typical commercial trawl gear for Nephrops but the 80 mm codend was fitted with a 20 mm liner, as had been used previously for Nephrops surveys conducted by CEFAS between 1994 and 1999. The work plan involved trawling under dispensation from the quota regulations using the same station positions as used for the CEFAS surveys. No other trawl survey was undertaken by CEFAS in this region in the first quarter of 2004.

Here we present

- Catch per unit effort of Nephrops, cod, haddock, whiting, plaice, and lemon sole;
- The distribution of numbers at length for Nephrops, cod, and whiting.
- Species compositions of the catches.
- Selected results from the CEFAS surveys of the Farn Deeps for comparison with the FSP results.

Methods

The FV Luc (SN 36) is a steel trawler of 17m reg. length, gross tonnage 57, with a 169 kW engine. The FV Still Waters (SN 85) is a smaller steel trawler of 8.6m reg. length, gross tonnage 14, with a 119 kW engine.

Standard Nephrops trawls were used by both vessels. The Luc used a Stewart trawl, ground rope 180 ft. The Still Waters used a Dunbar trawl, fishing line 126 ft. Both nets were fitted with codends constructed from 80 mm mesh and fitted with a 20 mm mesh liner intended to catch small individuals as well as those large enough to be legally landed. In this way, the abundance of all ages of Nephrops could be assessed.

Shooting of the trawl was restricted to times between 07:00 and early afternoon because catchability of Nephrops is known to be affected by time of day, and, by limiting the spread of times, the comparability of catch rates from place to place should have been improved. The trawl was towed for 30 minutes. All Nephrops, cod, haddock, whiting, plaice, lemon sole, and sole were measured. Discards were separated but are not considered in this report because fishing did not follow normal commercial practices due to the small mesh codend liner and the grid arrangement of fishing stations. Weighing facilities were not available on either fishing vessel.

Results

Data summary

The position, date, and time of valid hauls, and the numbers of Nephrops and whitefish caught of six commercial species, are shown in Appendix 1. The catch data presented in the report are standardised to numbers per hour of towing although towing times were successfully kept constant at 0.5 hours. A cruise report prepared immediately after the survey can be found as Appendix 2.

Fishing stations

The survey was intended to repeat and update previous Nephrops surveys undertaken by CEFAS in the Farn Deep. The plan therefore was for the Luc, being the larger, more seaworthy vessel, to fish the stations furthest from shore while the Still Waters, being under 10m in length, fished the inshore stations. There were also to be a number of parallel tows to allow intercalibration of the fishing powers of the two vessels. In the event, because of good weather, it was possible for both vessels to fish stations across the whole survey area. Having completed this part of the work, 10 stations were successfully fished in parallel. Trip codes, dates, haul numbers, and average towing hours are summarised in Table 1. Locations of all stations are shown in Figure 1.

Table 1. Farn Deeps FSP trawl survey, March 2004: details of fishing activities.

| Code | Vessel | Dates in 2004 | N hauls | Average tow hrs. |
|-----------|-----------------|---------------|---------|------------------|
| Luc 1/04 | FV Luc | 1 Mar - 9 Mar | 35 | 0.50 |
| Stil 1/04 | FV Still Waters | 1 Mar - 9 Mar | 34 | 0.50 |

Parallel trawling trials

Table 2 shows the 10 pairs of stations fished by both vessels towing along close, parallel courses, and starting and finishing within a few minutes of each other. The two vessels would have encountered similar concentrations of Nephrops because of their proximity, and differences between their catches should mainly have reflected differences of catching power. Table 2 also shows the observed numbers of Nephrops caught per hour.

Table 2. Farn Deeps FSP trawl survey, March 2004: details of parallel trawling trials.

| FV Luc | | FV Still Waters | | Catch ratios: |
|----------------------|-------------------|-----------------|-------------------|---------------|
| Stn # | Nephrops N per hr | Stn # | Nephrops N per hr | Luc/SW |
| 22 | 616 | 21 | 374 | 1.65 |
| 23 | 158 | 22 | 110 | 1.43 |
| 24 | 10 | 23 | 14 | 0.71 |
| 25 | 822 | 24 | 596 | 1.38 |
| 30 | 320 | 29 | 106 | 3.02 |
| 31 | 338 | 30 | 152 | 2.22 |
| 32 | 238 | 31 | 254 | 0.94 |
| 33 | 3192 | 32 | 1375 | 2.32 |
| 34 | 980 | 33 | 637 | 1.54 |
| 35 | 344 | 34 | 172 | 2.00 |
| Average +/- st. err. | | | | 1.72 +/- 0.22 |

Since catches must always be zero or greater, relative catching power is best estimated on a multiplicative scale. [If, on the other hand, an additive scale were used, a zero catch by the more powerful vessel would nonsensically imply a negative catch by the less powerful vessel.] Table 2 therefore shows the catch ratios (Luc N per hour divided by Still Waters N per hour) for Nephrops for each station pair, together with the estimated average and standard error. Relatively good precision was achieved for this type of trial. The average, 1.72, was used below to standardise Nephrops catches by Luc to those by Still Waters so that geographic plots of catches per hour were not affected by the relative catching powers of the two vessels.

No standardisation was attempted for catch rates of fin fish by the two vessels.

Geographic plots by species

Geographic plots of numbers caught per hour for Nephrops and for 5 of the more numerous and valuable commercial species are described below.

1. Nephrops - Fig. 2a-c.

Fig. 2a shows numbers per hour of Nephrops caught by the 2 vessels over the survey area. Catch rates for FV Luc adjusted to the catching power of FV Still Waters by dividing by 1.72; see above. The highest concentrations of Nephrops were found in a band in the offshore part of the survey area, the band being located further offshore northwards. The largest standardised catch rate observed was 5228 Nephrops per hour. The standardised catch rates of the two vessels were in reasonable agreement except, most noticeably, in the southern part of the survey area where Luc sometimes took large catches when Still Waters did not.

To investigate variability of catch rates with time of day, standardised catch rates of the two vessels were plotted against time when the trawl was shot. See fig. 2b. It can be seen that shooting was successfully restricted to between 07:00 and 13:00 h. Within this time band there is little evidence of a consistent time of day effect. Therefore differences of catch rate of the two vessels apparent in fig. 2a probably were not the result of this factor. More likely, they resulted from varying states of the tide or from localised patchiness of Nephrops distributions.

Carapace length frequency distributions obtained by the two trawlers are shown in fig. 2c. Catch rates for the Luc were not standardised for this figure and were clearly higher over the range of lengths caught. For both vessels, males tended to be slightly more prevalent than females in the larger size categories (>35 mm), and, judging from the better defined distribution obtained by the Luc, slightly less prevalent in the small medium sizes ((22 - 30 mm). The modal (most common) length for both vessels was around 30 mm.

2. Cod - Fig. 3a-b.

The maximum catch rate of cod was 58 fish per hour. The geographic distribution of catches is shown in fig. 3a. Comparing figs. 2a and 3a, a tendency for cod to be relatively numerous where Nephrops were not can be seen. Length frequency distributions by vessel are shown in fig. 3b. There appear to be two main length groups, between 10 and 28 cm, and between 34 and 50 cm. The smaller group is obviously the result of using a 20 mm liner in the codends. The larger group is reasonably consistent with length frequency distributions observed for cod by FV Abbie Lee and FV Emulator using 80 mm mesh codends in the FSP NE coast cod survey of autumn 2003, as described in a companion FSP report. The two surveys were about 6 months apart, so growth, mortality, and possibly migration must be allowed for when making comparisons.

3. Haddock - Fig. 4a.

Haddock were found patchily distributed over the survey area, as shown in fig. 4a. The highest catch rate observed was 266 fish per hour but such a rate occurred at only one station. Comparing fig. 2a and 4a, the lowest catch rates for haddock tended to occur where Nephrops rates were highest.

4. Whiting - Fig. 5a-b.

Large numbers of whiting were caught all over the survey area. See fig. 5a. The highest catch rate was 1256 fish per hour. The length frequency distribution, fig. 5b, indicates that Luc caught more of the larger whiting, between 24 and 36 cm, while Still Waters caught more of the smaller, between 15 and 21 cm. Reasons for this are not clear but possibly the Luc caught more large whiting because of having a higher headline than Still Waters. The length distribution was clearly bimodal.

5. Plaice - Fig. 6a.

Plaice were patchily distributed with the largest numbers mostly inshore of the main concentrations of Nephrops. See fig. 6a. The highest catch rate was 202 plaice per hour.

6. Lemon sole - Fig. 7a

Lemon sole, like plaice, were patchily distributed with the largest numbers mostly found away from the main concentrations of Nephrops. See fig. 7a. The highest catch rate was 178 lemon sole per hour.

Species composition of catches

Species composition is of interest in relation to catch composition rules, and to concerns about the linkage between the catch of Nephrops and other species. Fig. 8a-b therefore makes paired comparisons between the numbers of Nephrops, cod, haddock, whiting, plaice and lemon sole caught by the FV Luc and Still Waters respectively. Each point in a panel of the figure represents the number of fish of a pair of species in one haul. In each row, the vertical location of a point is the number of fish of the species labelled in that row, whilst the horizontal location of a point in each panel is the number of fish of the species labelled in the appropriate column. The panels below the diagonal holding the names of the fish are a mirror image of those above.

If the nets selected strongly for one species to the exclusion of another, the points would tend to lie in vertical or horizontal strings, and if one species was strongly linked to another the points would tend to cluster round a 45° line. It can be seen from fig. 8, for both Luc and Still Waters, that the highest (in relative terms) catch rates of cod, haddock, whiting, and plaice occurred when Nephrops were absent. The reverse was not true: catch rates of the four species of fish were either low, or moderate when Nephrops catch rates were high. This finding and the geographic evidence presented above for high numbers of Nephrops to be found in localities where cod, haddock, plaice, and lemon sole (but not whiting) were present in low numbers suggests a negative relationship between Nephrops and the fish species. The reasons might be related to (1) biological competition, (2) to a preference by fish to avoid the type of fine sedimentary environments favoured by Nephrops, or (3) to Nephrops tending to stay in their burrows (and be less catchable) when a high density of predatory fish is present. Relationships among the fish species shown in fig. 8a-b, either positive or negative, were not clearly in evidence.

CEFAS Nephrops surveys

CEFAS undertook surveys of the Farn Deeps Nephrops stock using the FV Nimrod. The codend liner (20 mm) was the same as used by the FV Luc and Still Waters. Numbers caught per hour are shown in fig. 9a-d for four winter surveys between 1994 and 1998 for comparison with the present FSP results for Nephrops shown in fig. 2a. A later survey was conducted, in 1999, but in May towards the end of the season and catches were correspondingly much lower. This survey is therefore not illustrated here.

The Nimrod results demonstrate how patchy and variable the results of trawl surveys for Nephrops can be when repeated over different years. When comparing CEFAS results with those of Luc and Still Waters in fig. 2a, it is noticeable that the largest catch rates by Nimrod (noted at the bottom of each panel in fig. 9) in the 1990s ranged from 18 to 25 000 Nephrops per hour, whilst the results in fig. 2a which are standardised to the smaller vessel, the Still Waters, only ranged up to 5228 Nephrops per hour. (The highest, unstandardised catch rate for Luc was 8993 Nephrops per hour.) It is also noticeable that the larger catch rates shown in 2004, fig. 2a, tended to be further offshore than in 1994-1996 (fig 9a-c). Although the catching power of the FV Nimrod relative to Luc and Still Waters is not known and may have been affected by seasonal and tidal factors in these survey examples, there is a suggestion that the stock of Nephrops on the Farn Deeps is at a lower level now (2004) than it was in the early 1990s.

Summary and conclusions

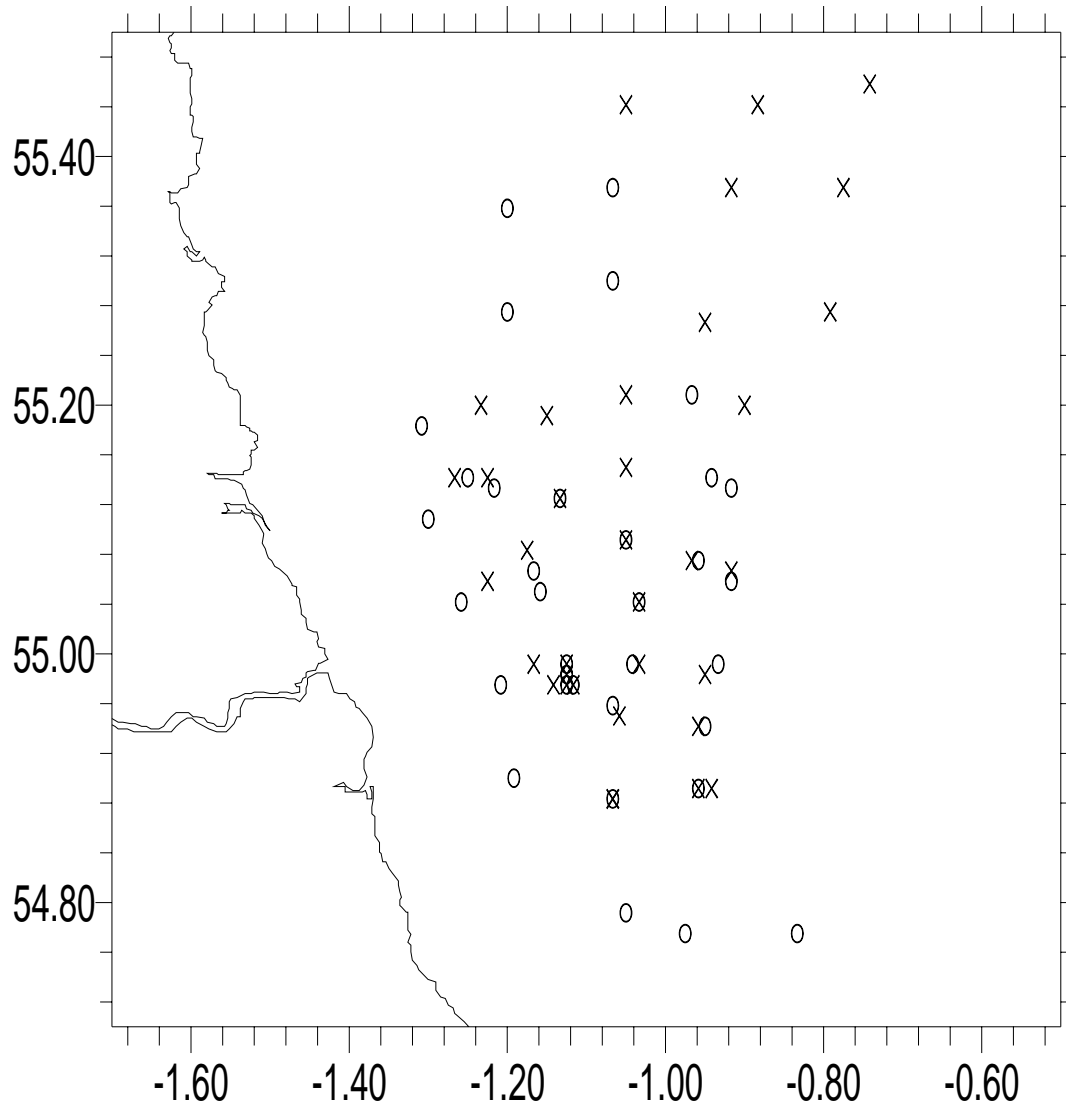
1. The highest concentrations of Nephrops were found in a band running almost parallel to the NE coast, slightly more offshore at the northerly end. Catches of several thousand Nephrops per hour were taken in this band. The FV Luc, on average, caught 1.72 times as many individuals as the smaller vessel, FV Still Waters, during parallel trawling trials. After standardising for this effect, catch rates of the two vessels were in general agreement at most fishing stations. Catch rates did not vary systematically with time of day within the restricted time band when fishing took place. The length frequency distribution for Nephrops obtained by both vessels showed one mode (peak) at 30 mm. There was evidence for slight differences between the sizes of males and females.
2. Up to 58 cod per hour were caught during the survey. The length frequency distribution showed two peaks, one between 10 and 28 cm, the other between 34 and 50 cm. The smaller group probably would not be caught by Nephrops vessels fishing commercially, i.e. without a 20 mm liner in the standard 80 mm codend.
3. Haddock, plaice, and lemon sole were patchily distributed. The largest observed catch rates were 266 haddock, 202 plaice, and 178 lemon sole per hour.

4. Whiting were caught in large numbers all across the survey area. The highest catch rate was 1256 individuals per hour. The length distribution was bimodal with Luc catching more of the large, and Still Waters catching more of the small whiting.

5. The best catches of cod, haddock, whiting, and plaice tended to occur when Nephrops were absent or nearly so but, on the other hand, large catches of Nephrops could occur whether or not the four fish species were present. Geographic plots of catch per hour suggested that, except for whiting, the fish species were tending not to occur in the offshore band favoured by Nephrops. There appeared to be negative relationships between numbers of Nephrops and cod, haddock, and plaice within the survey area.

6. A comparison between the CEFAS surveys with the FV Nimrod between 1994 and 1998 and the present FSP survey suggests that the stock of Nephrops on Farn Deeps has declined in recent years. However, the evidence for this is not strong because of the different vessels and months of the different surveys.

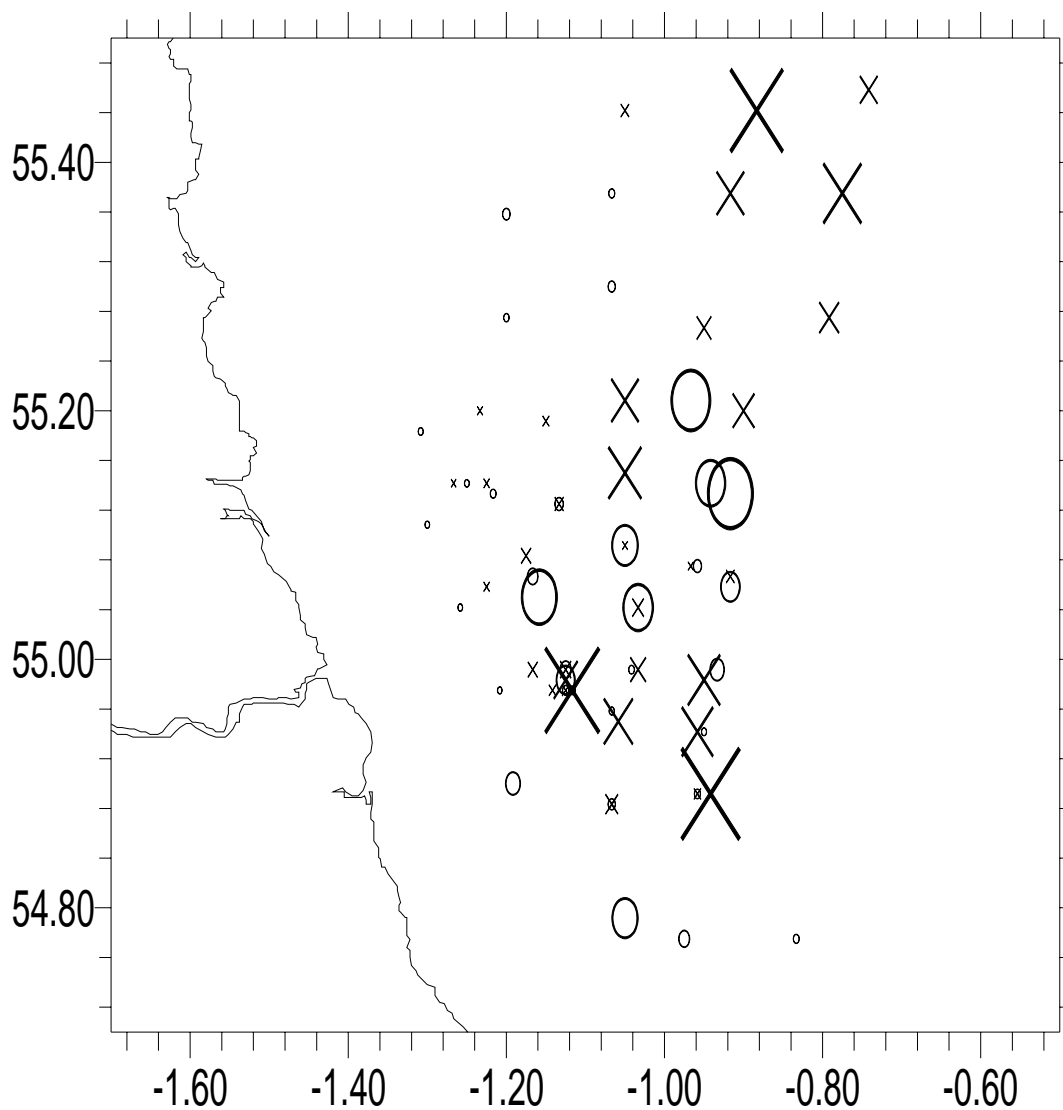
**Figure 1. Farn Deep FSP survey, spring 2004:
Station positions**



Crosses = Luc 1/04
Circles = Stil 1/04

**Figure 2(a). Farn Deeps FSP survey, spring 2004:
Nephrops, N per hour after adjusting for
different catching power of vessels**

Gear: Nephrops trawl with 20 mm mesh liner in codend.

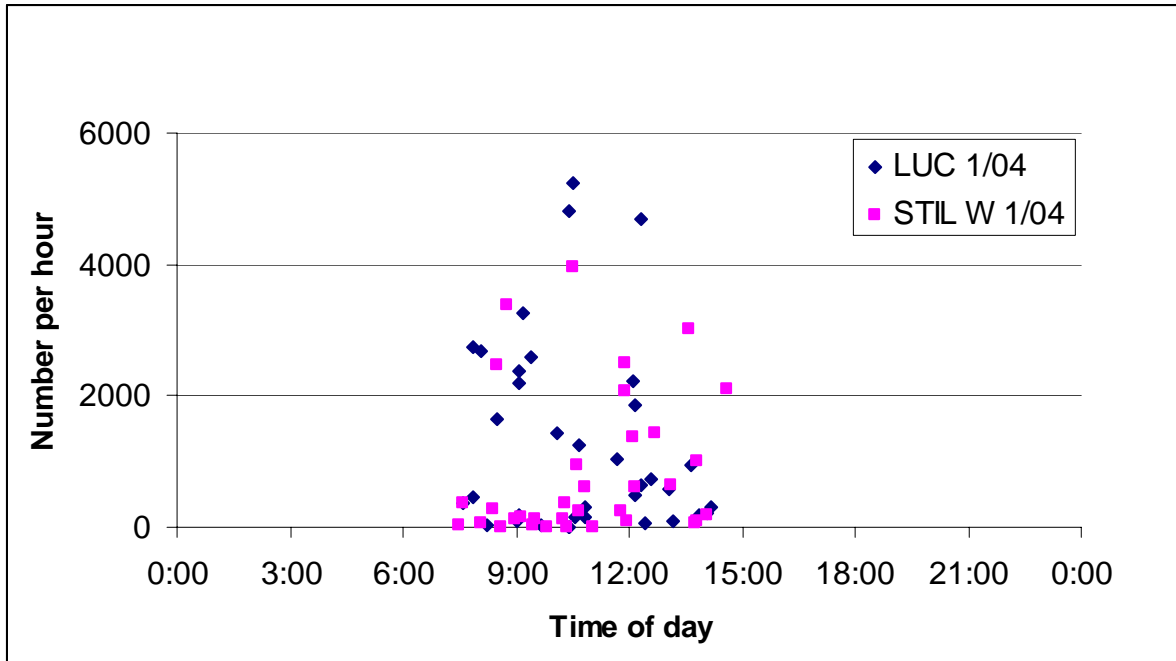


Crosses = Luc 1/04 (N per hr divided by 1.72)

Circles = Stil 1/04 (N per hr as observed)

Scaling: largest symbol = 5228 per hour

**Figure 2(b). Farn Deeps FSP Survey, spring 2004:
Nephrops: catches per hr (standardised to catching power of
FV Still Waters) against time of day.**



**Figure 2(c). Farn Deeps FSP Survey, spring 2004:
Nephrops: length frequency distributions by vessel
(unstandardised catch rates).**

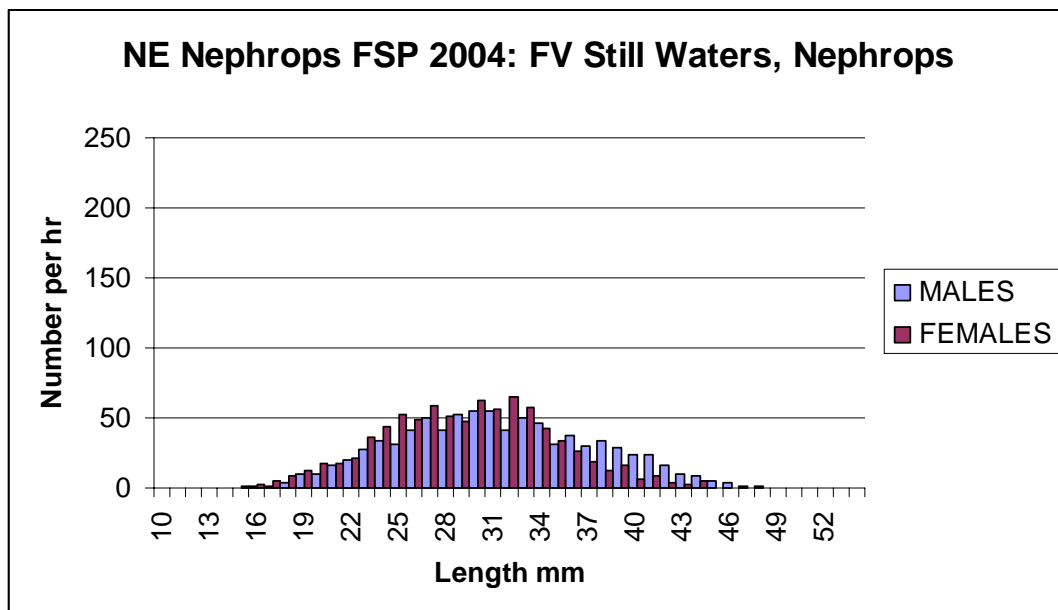
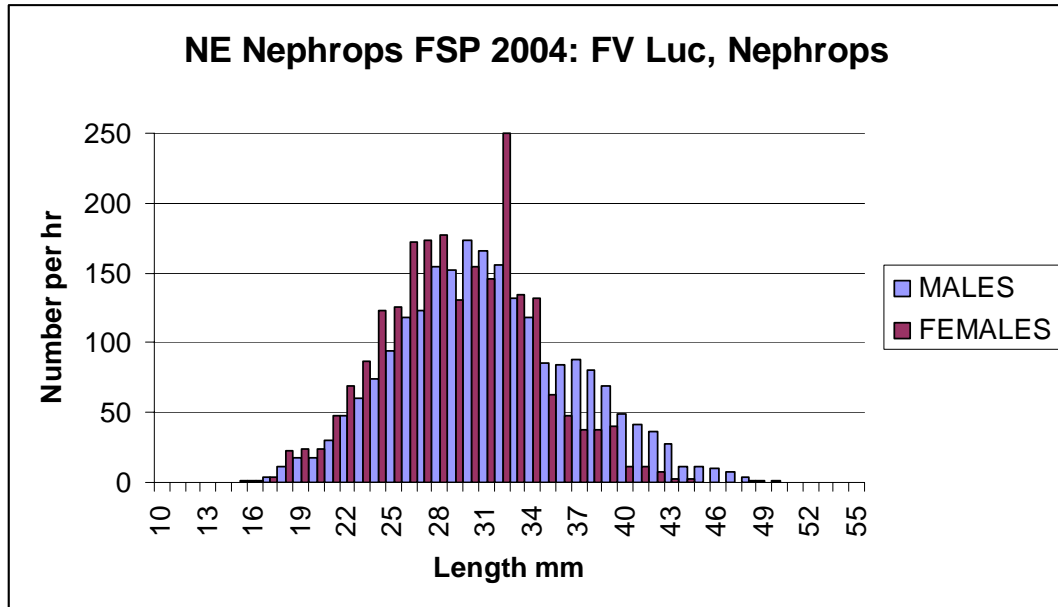
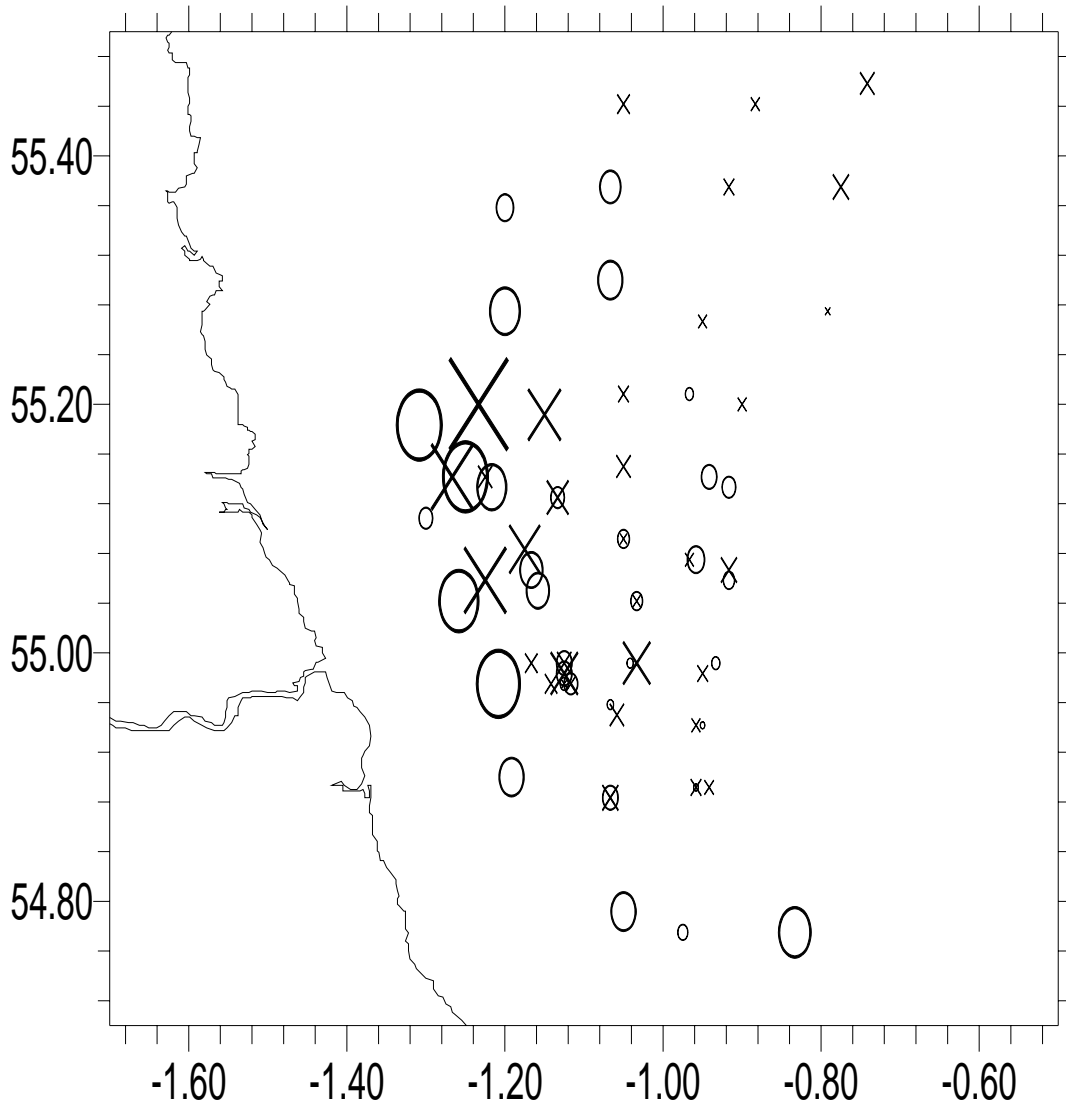


Figure 3(a). Farn Deeps FSP survey, spring 2004: Cod, N per hour

Gear: Nephrops trawl with 20 mm mesh liner in codend.



Crosses = Luc 1/04

Circles = Stil 1/04

Scaling: largest symbol = 58 per hour

**Figure 3(b). Farn Deeps FSP Survey, spring 2004:
Cod: length frequency distributions by vessel**

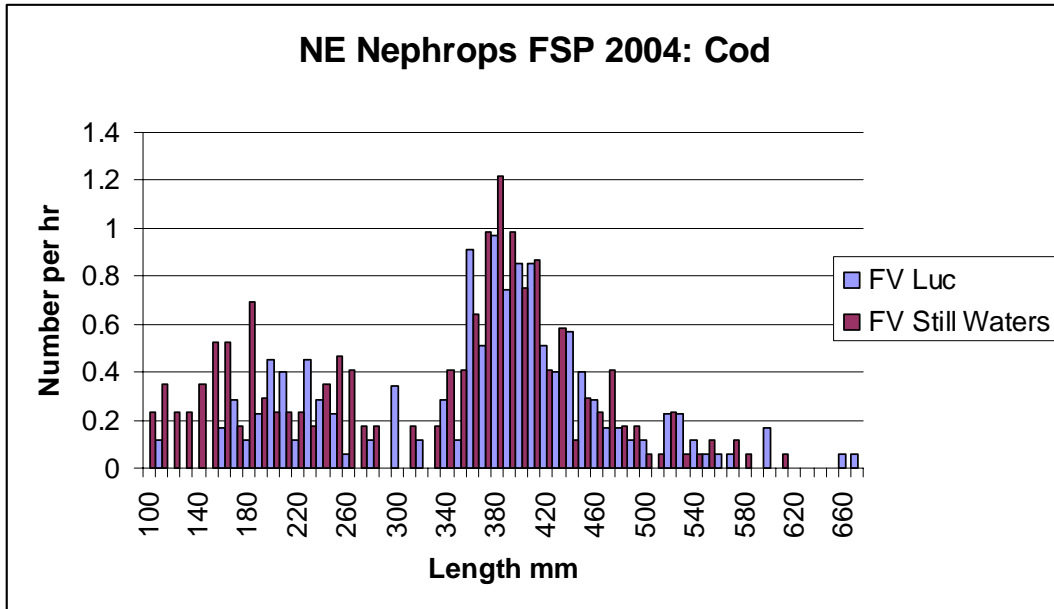
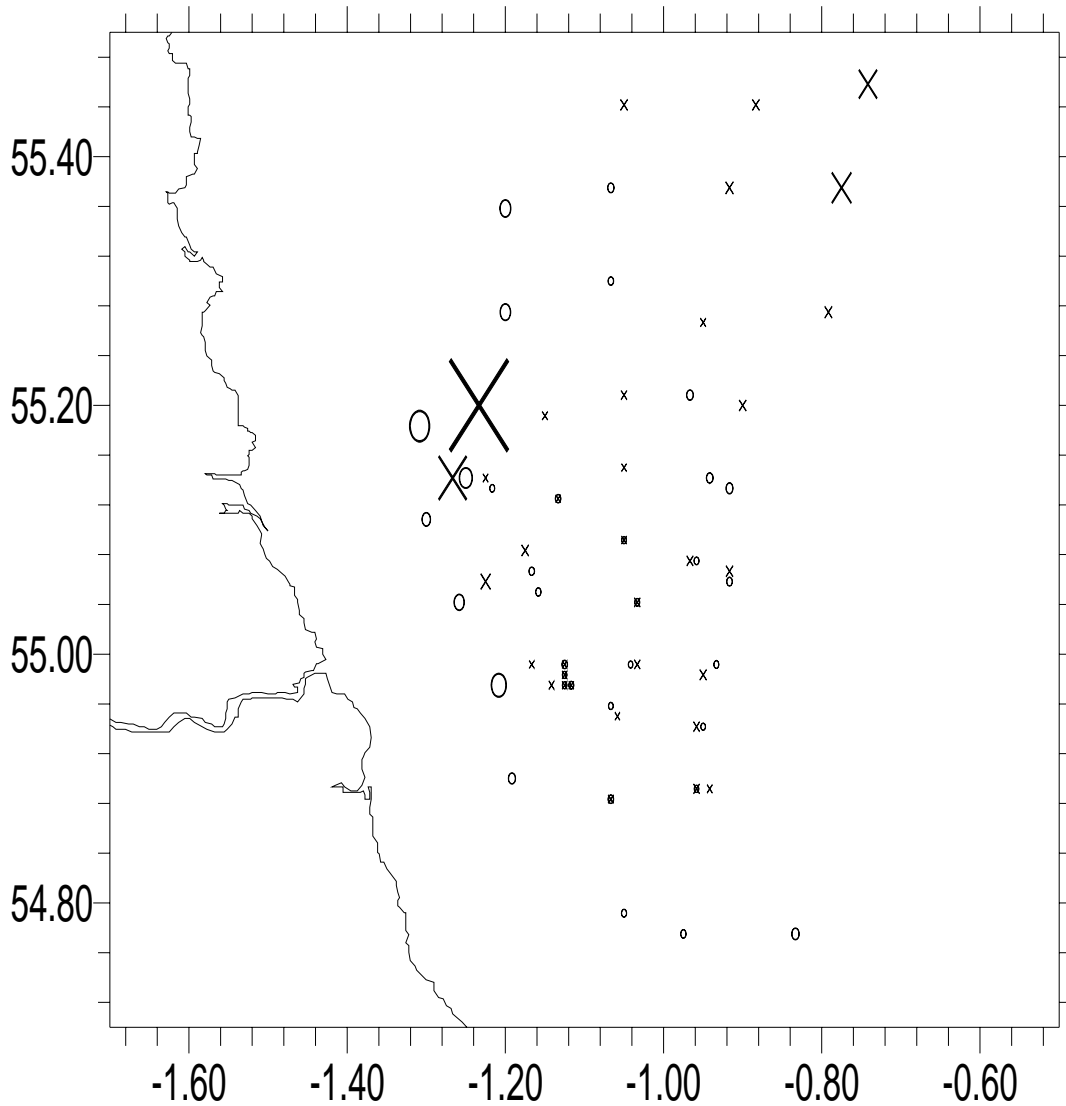


Figure 4(a). Farn Deeps FSP survey, spring 2004: Haddock, N per hour

Gear: Nephrops trawl with 20 mm mesh liner in codend.



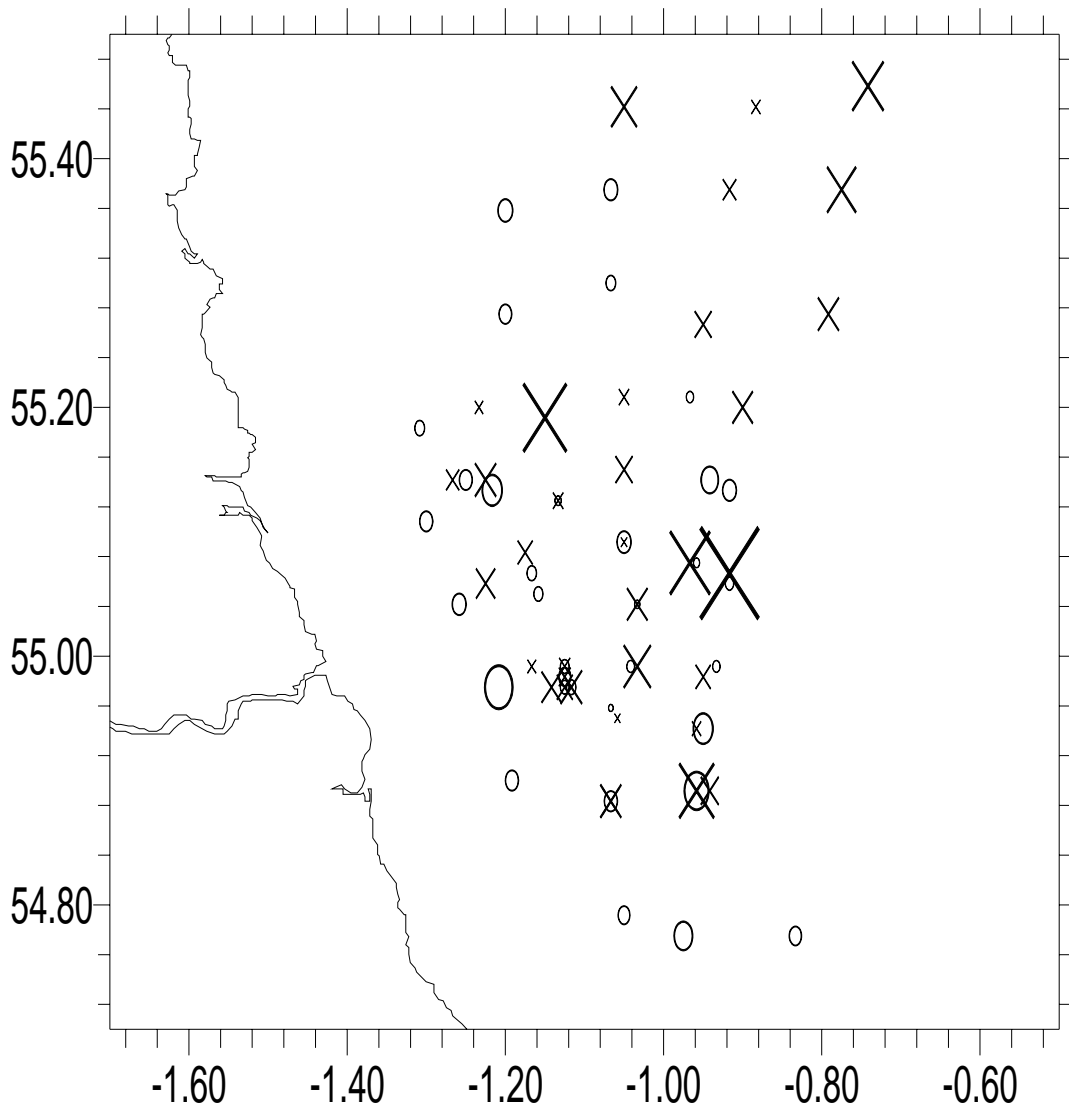
Crosses = Luc 1/04

Circles = Stil 1/04

Scaling: largest symbol = 266 per hour

Figure 5(a). Farn Deep's FSP survey, spring 2004: Whiting, N per hour

Gear: Nephrops trawl with 20 mm mesh liner in codend.



Crosses = Luc 1/04

Circles = Stil 1/04

Scaling: largest symbol = 1256 per hour

**Fig. 5(b). Farn Deeps FSP survey, spring 2004:
WHITING: Length frequency distribution**

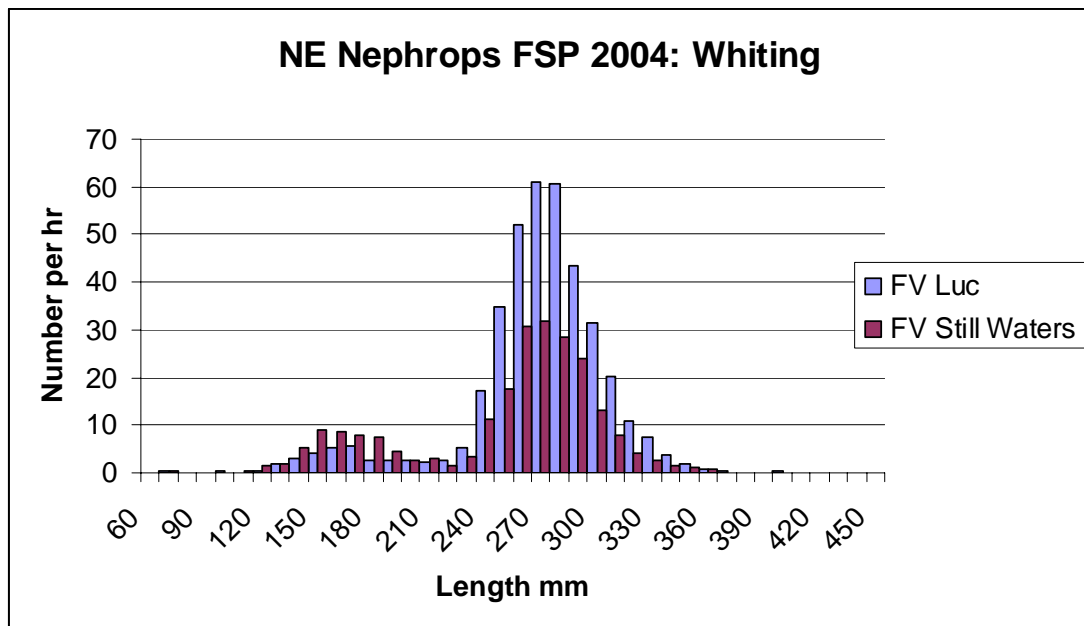
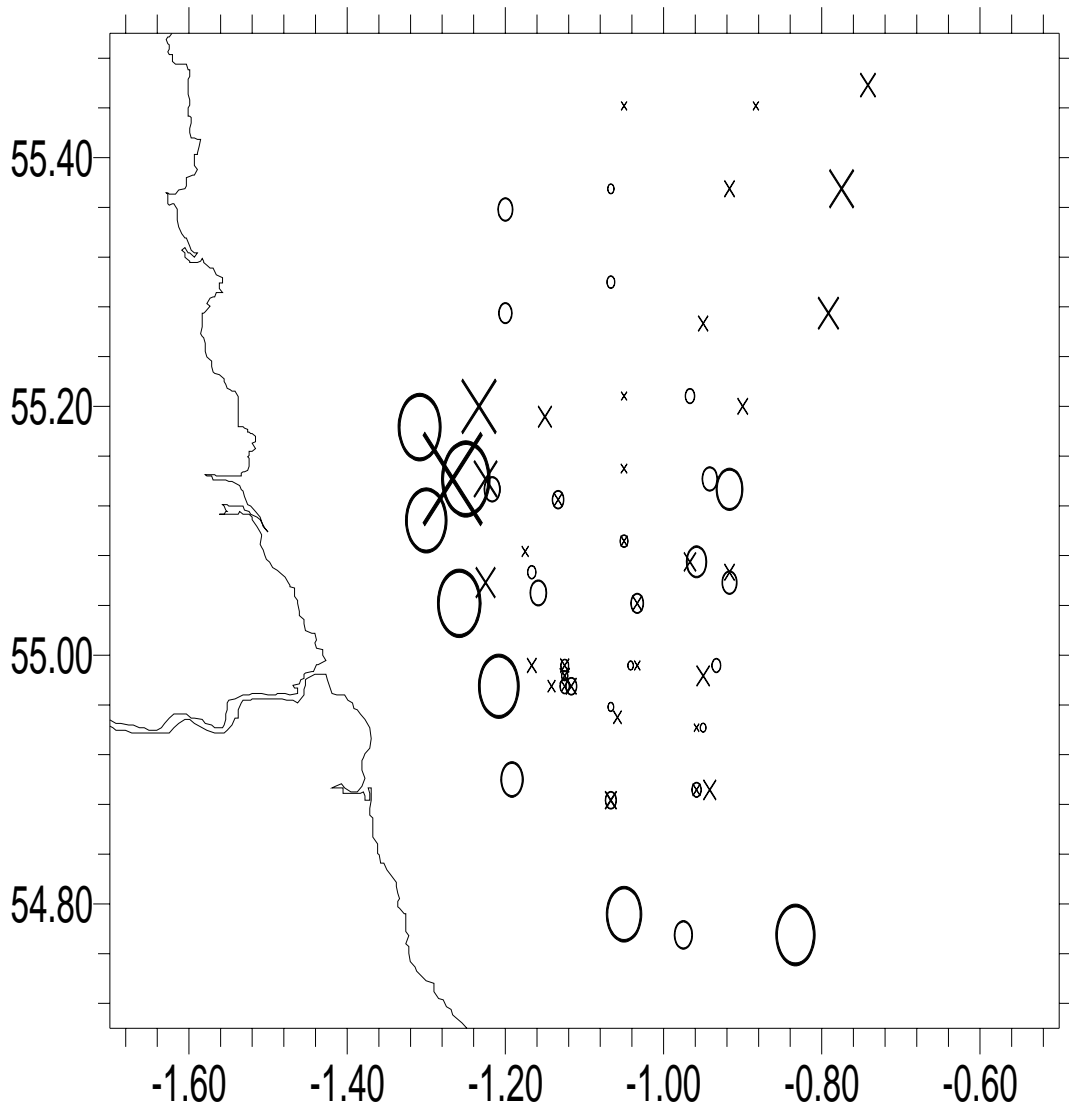


Figure 6(a). Farn Deeps FSP survey, spring 2004: Plaice, N per hour

Gear: Nephrops trawl with 20 mm mesh liner in codend.



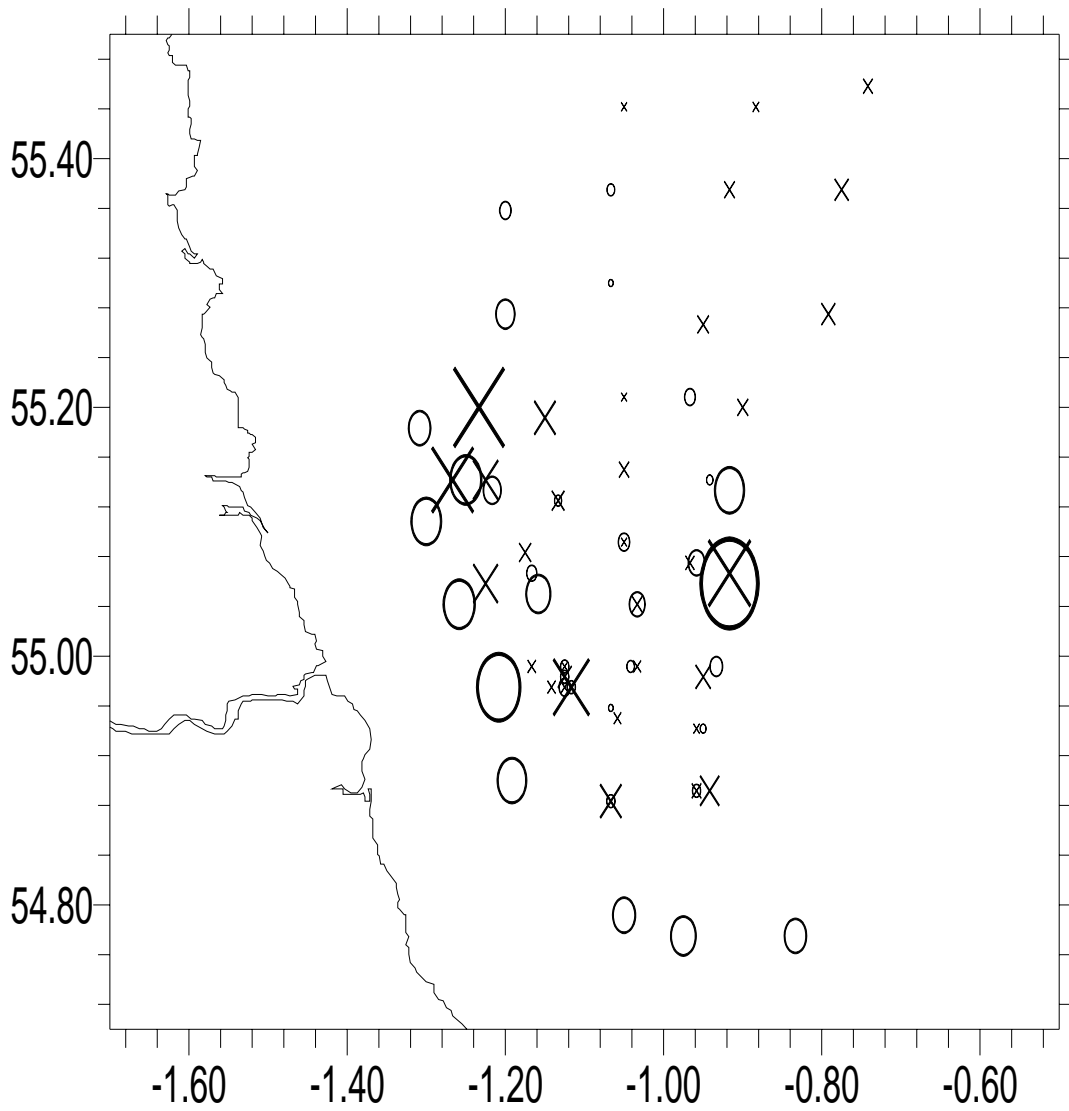
Crosses = Luc 1/04

Circles = Stil 1/04

Scaling: largest symbol = 202 per hour

Figure 7(a). Farn Deepes FSP survey, spring 2004: Lemon sole, N per hour

Gear: Nephrops trawl with 20 mm mesh liner in codend.



Crosses = Luc 1/04

Circles = Stil 1/04

Scaling: largest symbol = 178 per hour

Fig. 8. Farn Deeps FSP trawl survey, spring 2004. Numbers of individual Nephrops and 5 commercial species of fish per hr. for two fishing vessels.

a) FV Luc

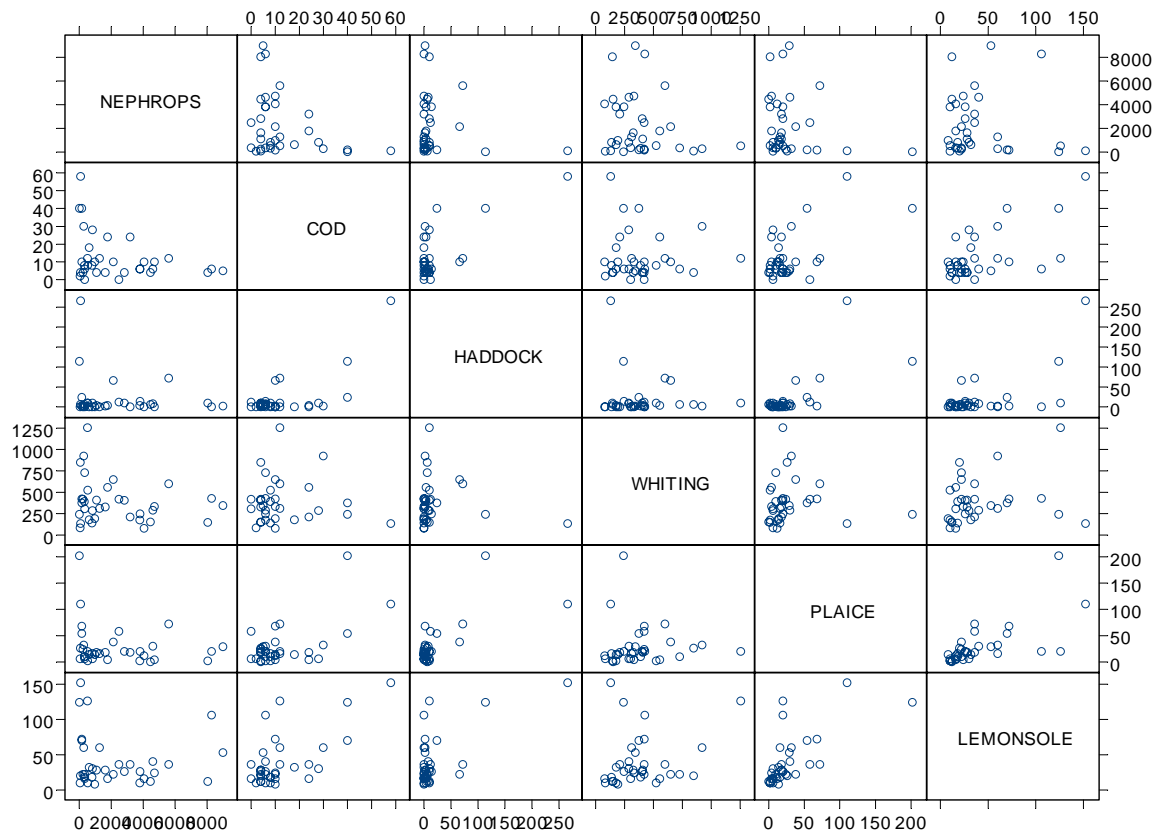


Fig. 8 continued.

b) FV Still Waters

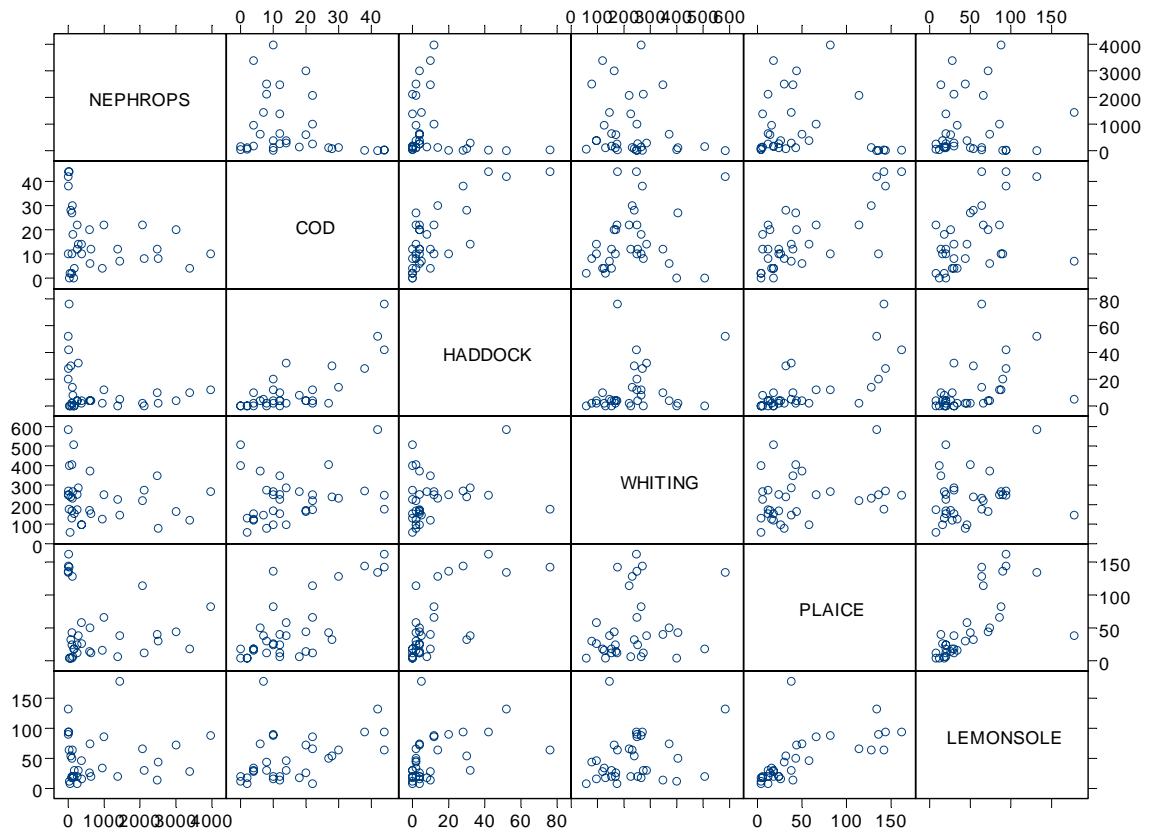
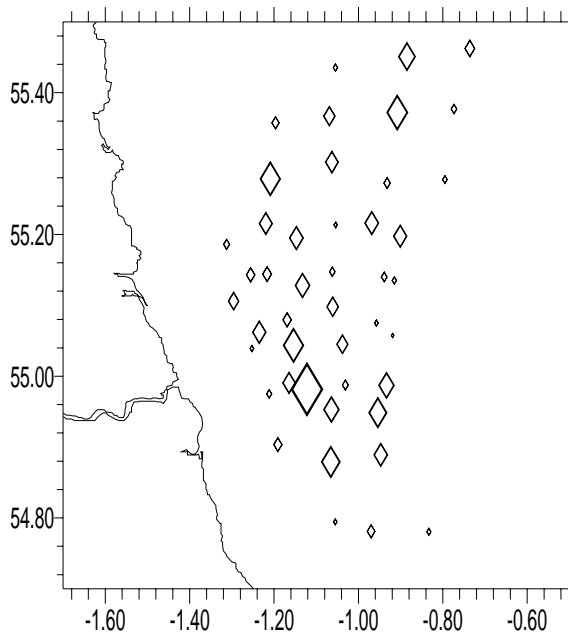


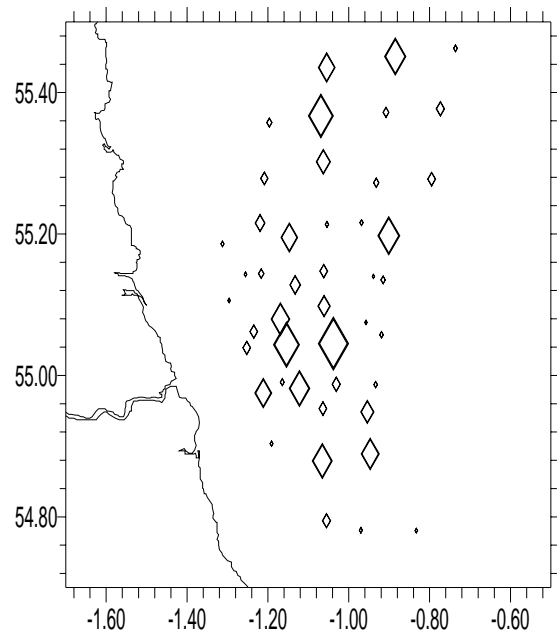
Figure 9. CEFAS surveys of Farn Deep: numbers of Nephrops caught per hour by FV Nimrod using a 20 mm codend liner.

a) November 1994



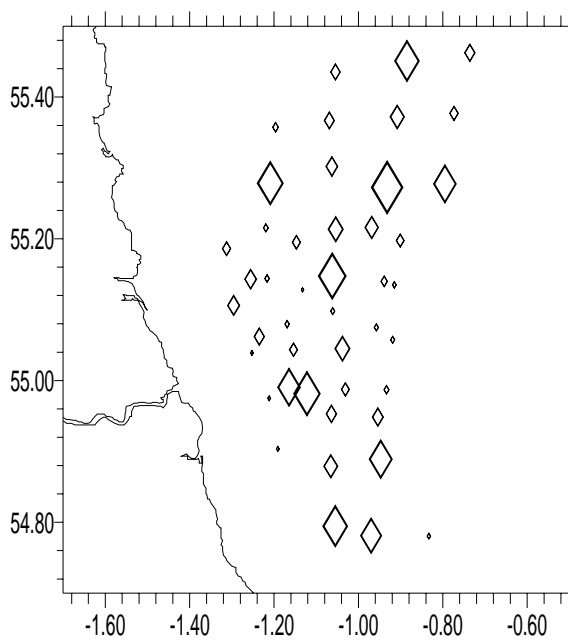
Scaling: largest symbol = 25160 per hour

b) November 1995



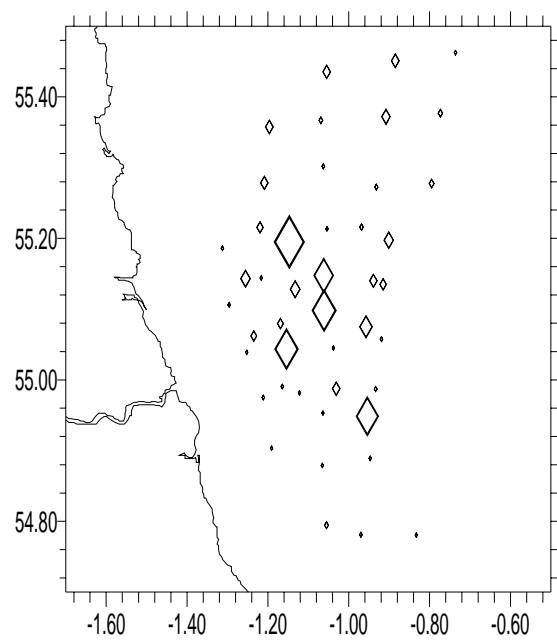
Scaling: largest symbol = 18144 per hour

c) November 1996



Scaling: largest symbol = 23808 per hour

d) December 1998



Scaling: largest symbol = 24288 per hour

APPENDIX 1: Farn Deeps FSP Survey, spring 2004: Station and catch details for 7 species.

Selected abbreviations: N=numbers caught, WHG=whiting, PLE=plaice, LEM=lemon sole, SOL=sole.

| Cruise | Stn | Rect | Shot Lon | Shot Lat | Haul Lon | Haul Lat | Date shot | Time shot | Tow hrs | NEP_ N | COD_ N | HAD_ N | WHG_ N | PLE_N | LEM_ N | SOL_N |
|----------|-----|------|----------|----------|----------|----------|-----------|-----------|---------|-----------|-----------|-----------|-----------|-------|-----------|-------|
| LUC 1/04 | 1 | 39E9 | -0.77 | 55.37 | -0.78 | 55.38 | 01-Mar-04 | 9:10 | 0.50 | 2797 | 6 | 36 | 300 | 36 | 18 | 0 |
| LUC 1/04 | 2 | 39E9 | -0.73 | 55.45 | -0.75 | 55.47 | 01-Mar-04 | 10:40 | 0.50 | 1067 | 5 | 33 | 325 | 19 | 11 | 0 |
| LUC 1/04 | 3 | 39E9 | -0.88 | 55.45 | -0.88 | 55.43 | 01-Mar-04 | 12:20 | 0.50 | 4024 | 2 | 5 | 73 | 1 | 6 | 0 |
| LUC 1/04 | 4 | 39E8 | -1.05 | 55.45 | -1.05 | 55.43 | 01-Mar-04 | 14:10 | 0.50 | 264 | 4 | 5 | 262 | 1 | 5 | 0 |
| LUC 1/04 | 5 | 39E9 | -0.92 | 55.20 | -0.88 | 55.20 | 02-Mar-04 | 8:30 | 0.50 | 1413 | 2 | 5 | 202 | 10 | 13 | 0 |
| LUC 1/04 | 6 | 39E9 | -0.80 | 55.27 | -0.78 | 55.28 | 02-Mar-04 | 10:05 | 0.50 | 1241 | 0 | 6 | 210 | 29 | 18 | 0 |
| LUC 1/04 | 7 | 39E9 | -0.92 | 55.38 | -0.92 | 55.37 | 02-Mar-04 | 12:05 | 0.50 | 1906 | 3 | 7 | 123 | 10 | 13 | 0 |
| LUC 1/04 | 8 | 39E9 | -0.93 | 55.27 | -0.97 | 55.27 | 02-Mar-04 | 13:40 | 0.50 | 812 | 2 | 1 | 163 | 9 | 14 | 0 |
| LUC 1/04 | 9 | 39E8 | -1.07 | 55.13 | -1.03 | 55.17 | 03-Mar-04 | 7:50 | 0.50 | 2359 | 5 | 0 | 166 | 2 | 12 | 0 |
| LUC 1/04 | 10 | 39E8 | -1.05 | 55.20 | -1.05 | 55.22 | 03-Mar-04 | 9:05 | 0.50 | 1896 | 3 | 2 | 88 | 1 | 5 | 0 |
| LUC 1/04 | 11 | 39E8 | -1.15 | 55.20 | -1.15 | 55.18 | 03-Mar-04 | 10:50 | 0.50 | 137 | 15 | 1 | 461 | 16 | 30 | 0 |
| LUC 1/04 | 12 | 39E8 | -1.23 | 55.22 | -1.23 | 55.18 | 03-Mar-04 | 12:25 | 0.50 | 44 | 29 | 133 | 66 | 55 | 76 | 0 |
| LUC 1/04 | 13 | 38E9 | -0.95 | 55.00 | -0.95 | 54.97 | 04-Mar-04 | 8:05 | 0.50 | 2306 | 3 | 4 | 144 | 15 | 20 | 0 |
| LUC 1/04 | 14 | 38E9 | -0.97 | 54.95 | -0.95 | 54.93 | 04-Mar-04 | 9:25 | 0.50 | 2227 | 2 | 3 | 76 | 0 | 6 | 0 |
| LUC 1/04 | 15 | 38E9 | -0.95 | 54.90 | -0.93 | 54.88 | 04-Mar-04 | 10:30 | 0.67 | 5995 | 3 | 1 | 230 | 19 | 35 | 0 |
| LUC 1/04 | 16 | 38E8 | -1.07 | 54.87 | -1.07 | 54.90 | 04-Mar-04 | 12:35 | 0.50 | 635 | 6 | 0 | 156 | 8 | 30 | 1 |
| LUC 1/04 | 17 | 39E8 | -1.18 | 55.00 | -1.15 | 54.98 | 05-Mar-04 | 7:50 | 0.50 | 403 | 4 | 0 | 69 | 8 | 9 | 0 |
| LUC 1/04 | 18 | 38E8 | -1.07 | 54.97 | -1.05 | 54.93 | 05-Mar-04 | 9:05 | 0.50 | 2033 | 5 | 0 | 39 | 6 | 8 | 0 |

APPENDIX 1 cont. : Farn Deeps FSP Survey, spring 2004: Station and catch details for 7 species.

Selected abbreviations: N=numbers caught, WHG=whiting, PLE=plaice, LEM=lemon sole, SOL=sole.

| Cruise | Stn | Rect | Shot Lon | Shot Lat | Haul Lon | Haul Lat | Date shot | Time shot | Tow hrs | NEP_ N | COD_ N | HAD_ N | WHG_ N | PLE_N | LEM_ N | SOL_N |
|----------|-----|------|----------|----------|----------|----------|-----------|-----------|---------|-----------|-----------|-----------|-----------|-------|-----------|-------|
| LUC 1/04 | 19 | 38E8 | -1.12 | 54.97 | -1.12 | 54.98 | 05-Mar-04 | 10:25 | 0.50 | 4145 | 3 | 0 | 213 | 10 | 53 | 0 |
| LUC 1/04 | 20 | 38E8 | -1.02 | 55.00 | -1.05 | 54.98 | 05-Mar-04 | 11:40 | 0.50 | 892 | 12 | 2 | 278 | 2 | 8 | 1 |
| LUC 1/04 | 21 | 39E8 | -1.22 | 55.03 | -1.23 | 55.08 | 05-Mar-04 | 13:10 | 0.50 | 84 | 20 | 12 | 187 | 27 | 35 | 3 |
| LUC 1/04 | 22 | 39E8 | -1.13 | 55.12 | -1.13 | 55.13 | 06-Mar-04 | 7:35 | 0.50 | 308 | 9 | 0 | 89 | 7 | 16 | 1 |
| LUC 1/04 | 23 | 39E8 | -1.22 | 55.15 | -1.23 | 55.13 | 06-Mar-04 | 9:00 | 0.50 | 79 | 5 | 1 | 211 | 34 | 36 | 2 |
| LUC 1/04 | 24 | 39E8 | -1.25 | 55.15 | -1.28 | 55.13 | 06-Mar-04 | 10:25 | 0.50 | 5 | 20 | 57 | 121 | 101 | 62 | 0 |
| LUC 1/04 | 25 | 39E8 | -1.15 | 55.08 | -1.20 | 55.08 | 06-Mar-04 | 12:10 | 0.50 | 411 | 14 | 5 | 143 | 3 | 15 | 0 |
| LUC 1/04 | 26 | 39E8 | -1.05 | 55.10 | -1.05 | 55.08 | 08-Mar-04 | 8:15 | 0.50 | 27 | 1 | 0 | 42 | 3 | 5 | 0 |
| LUC 1/04 | 27 | 39E9 | 0.97 | 55.08 | -0.97 | 55.07 | 08-Mar-04 | 9:40 | 0.50 | 38 | 2 | 3 | 424 | 13 | 10 | 0 |
| LUC 1/04 | 28 | 39E9 | -0.92 | 55.08 | -0.92 | 55.05 | 08-Mar-04 | 10:50 | 0.50 | 257 | 6 | 5 | 628 | 10 | 63 | 0 |
| LUC 1/04 | 29 | 39E8 | -1.03 | 55.05 | -1.03 | 55.03 | 08-Mar-04 | 12:20 | 0.50 | 542 | 2 | 2 | 204 | 9 | 14 | 0 |
| LUC 1/04 | 30 | 38E8 | -1.12 | 54.98 | -1.17 | 54.97 | 08-Mar-04 | 13:50 | 0.50 | 160 | 4 | 1 | 195 | 5 | 9 | 0 |
| LUC 1/04 | 31 | 38E9 | -0.97 | 54.90 | -0.95 | 54.88 | 09-Mar-04 | 9:05 | 0.50 | 169 | 3 | 3 | 364 | 5 | 11 | 0 |
| LUC 1/04 | 32 | 38E8 | -1.07 | 54.87 | -1.07 | 54.90 | 09-Mar-04 | 10:35 | 0.50 | 119 | 2 | 0 | 210 | 12 | 11 | 0 |
| LUC 1/04 | 33 | 38E8 | -1.12 | 54.97 | -1.13 | 55.00 | 09-Mar-04 | 12:10 | 0.50 | 1596 | 12 | 0 | 105 | 9 | 18 | 0 |
| LUC 1/04 | 34 | 38E8 | -1.13 | 55.00 | -1.12 | 54.98 | 09-Mar-04 | 13:05 | 0.50 | 490 | 5 | 0 | 96 | 7 | 4 | 0 |
| LUC 1/04 | 35 | 38E8 | -1.12 | 54.97 | -1.13 | 54.98 | 09-Mar-04 | 14:05 | 0.50 | 172 | 0 | 0 | 152 | 3 | 8 | 0 |

APPENDIX 1 cont. : Farn Deeps FSP Survey, spring 2004: Station and catch details for 7 species.

Selected abbreviations: N=numbers caught, WHG=whiting, PLE=plaice, LEM=lemon sole, SOL=sole.

| Cruise | Stn | Rect | Shot Lon | Shot Lat | Haul Lon | Haul Lat | Date shot | Time shot | Tow hrs | NEP_ N | COD_ N | HAD_ N | WHG_ N | PLE_N | LEM_ N | SOL_N |
|----------|-----|------|----------|----------|----------|----------|-----------|-----------|---------|-----------|-----------|-----------|-----------|-------|-----------|-------|
| STIL1/04 | 1 | 39E8 | -1.20 | 55.35 | -1.20 | 55.37 | 01-Mar-04 | 8:24 | 0.50 | 144 | 7 | 16 | 143 | 19 | 15 | 0 |
| STIL1/04 | 2 | 39E8 | -1.07 | 55.38 | -1.07 | 55.37 | 01-Mar-04 | 10:15 | 0.50 | 66 | 9 | 4 | 133 | 3 | 9 | 0 |
| STIL1/04 | 3 | 39E8 | -1.07 | 55.32 | -1.07 | 55.28 | 01-Mar-04 | 11:48 | 0.50 | 125 | 11 | 2 | 87 | 6 | 4 | 0 |
| STIL1/04 | 4 | 39E8 | -1.20 | 55.28 | -1.20 | 55.27 | 01-Mar-04 | 13:43 | 0.50 | 37 | 14 | 15 | 120 | 16 | 27 | 0 |
| STIL1/04 | 5 | 39E9 | -0.97 | 55.22 | -0.97 | 55.20 | 02-Mar-04 | 8:46 | 0.50 | 1689 | 2 | 5 | 60 | 9 | 14 | 0 |
| STIL1/04 | 6 | 39E9 | -0.92 | 55.15 | -0.92 | 55.12 | 02-Mar-04 | 10:29 | 0.50 | 1983 | 5 | 6 | 133 | 41 | 44 | 0 |
| STIL1/04 | 7 | 39E9 | -0.92 | 55.05 | -0.92 | 55.07 | 02-Mar-04 | 12:41 | 0.50 | 1364 | 7 | 5 | 139 | 36 | 169 | 0 |
| STIL1/04 | 8 | 39E8 | -1.05 | 55.10 | -1.05 | 55.08 | 02-Mar-04 | 14:34 | 0.50 | 1058 | 4 | 0 | 137 | 6 | 15 | 0 |
| STIL1/04 | 9 | 39E9 | -0.93 | 55.15 | -0.95 | 55.13 | 03-Mar-04 | 8:29 | 0.50 | 1238 | 6 | 5 | 174 | 20 | 7 | 0 |
| STIL1/04 | 10 | 39E9 | -0.97 | 55.08 | -0.95 | 55.07 | 03-Mar-04 | 10:17 | 0.50 | 185 | 7 | 1 | 48 | 29 | 23 | 1 |
| STIL1/04 | 11 | 39E8 | -1.03 | 55.05 | -1.03 | 55.03 | 03-Mar-04 | 11:54 | 0.50 | 1251 | 4 | 1 | 39 | 15 | 22 | 0 |
| STIL1/04 | 12 | 39E8 | -1.15 | 55.07 | -1.17 | 55.03 | 03-Mar-04 | 13:34 | 0.50 | 1501 | 10 | 2 | 82 | 22 | 36 | 0 |
| STIL1/04 | 13 | 38E9 | -0.82 | 54.78 | -0.85 | 54.77 | 04-Mar-04 | 9:30 | 0.50 | 59 | 15 | 7 | 116 | 64 | 32 | 0 |
| STIL1/04 | 14 | 38E9 | -0.97 | 54.77 | -0.98 | 54.78 | 04-Mar-04 | 10:48 | 0.50 | 305 | 3 | 2 | 186 | 25 | 37 | 0 |
| STIL1/04 | 15 | 38E8 | -1.03 | 54.78 | -1.07 | 54.80 | 04-Mar-04 | 11:53 | 0.50 | 1036 | 11 | 1 | 110 | 57 | 33 | 0 |
| STIL1/04 | 16 | 38E8 | -1.18 | 54.88 | -1.20 | 54.92 | 04-Mar-04 | 13:48 | 0.50 | 497 | 11 | 6 | 125 | 33 | 43 | 1 |
| STIL1/04 | 17 | 39E8 | -1.32 | 55.20 | -1.30 | 55.17 | 05-Mar-04 | 7:29 | 0.50 | 13 | 22 | 38 | 88 | 71 | 32 | 0 |
| STIL1/04 | 18 | 39E8 | -1.30 | 55.12 | -1.30 | 55.10 | 05-Mar-04 | 8:37 | 0.50 | 2 | 5 | 10 | 125 | 68 | 45 | 0 |
| STIL1/04 | 19 | 39E8 | -1.27 | 55.05 | -1.25 | 55.03 | 05-Mar-04 | 9:49 | 0.50 | 3 | 19 | 14 | 135 | 72 | 47 | 47 |

APPENDIX 1 cont. : Farn Deeps FSP Survey, spring 2004: Station and catch details for 7 species.

Selected abbreviations: N=numbers caught, WHG=whiting, PLE=plaice, LEM=lemon sole, SOL=sole.

| Cruise | Stn | Rect | Shot Lon | Shot Lat | Haul Lon | Haul Lat | Date shot | Time shot | Tow hrs | NEP_ N | COD_ N | HAD_ N | WHG_ N | PLE_N | LEM_ N | SOL_N |
|----------|-----|------|----------|----------|----------|----------|-----------|-----------|---------|-----------|-----------|-----------|-----------|-------|-----------|-------|
| STIL1/04 | 20 | 38E8 | -1.22 | 54.98 | -1.20 | 54.97 | 05-Mar-04 | 11:02 | 0.50 | 0 | 21 | 26 | 292 | 67 | 66 | 1 |
| STIL1/04 | 21 | 39E8 | -1.13 | 55.12 | -1.13 | 55.13 | 06-Mar-04 | 7:36 | 0.50 | 187 | 5 | 2 | 48 | 13 | 8 | 0 |
| STIL1/04 | 22 | 39E8 | -1.22 | 55.15 | -1.22 | 55.12 | 06-Mar-04 | 8:58 | 0.52 | 57 | 14 | 1 | 209 | 22 | 26 | 0 |
| STIL1/04 | 23 | 39E8 | -1.23 | 55.15 | -1.27 | 55.13 | 06-Mar-04 | 10:21 | 0.50 | 7 | 22 | 21 | 124 | 81 | 47 | 0 |
| STIL1/04 | 24 | 39E8 | -1.15 | 55.07 | -1.18 | 55.07 | 06-Mar-04 | 12:08 | 0.50 | 298 | 10 | 2 | 85 | 7 | 13 | 0 |
| STIL1/04 | 25 | 38E8 | -1.07 | 54.97 | -1.07 | 54.95 | 08-Mar-04 | 8:04 | 0.50 | 27 | 1 | 0 | 29 | 2 | 4 | 0 |
| STIL1/04 | 26 | 38E9 | -0.95 | 54.95 | -0.95 | 54.93 | 08-Mar-04 | 9:28 | 0.50 | 18 | 0 | 0 | 200 | 2 | 6 | 0 |
| STIL1/04 | 27 | 38E9 | -0.95 | 54.98 | -0.92 | 55.00 | 08-Mar-04 | 10:38 | 0.50 | 475 | 2 | 1 | 63 | 8 | 17 | 0 |
| STIL1/04 | 28 | 38E8 | -1.02 | 55.00 | -1.07 | 54.98 | 08-Mar-04 | 11:57 | 0.50 | 51 | 1 | 0 | 65 | 2 | 9 | 0 |
| STIL1/04 | 29 | 38E8 | -1.12 | 54.98 | -1.12 | 54.97 | 08-Mar-04 | 13:47 | 0.50 | 53 | 5 | 1 | 84 | 12 | 10 | 0 |
| STIL1/04 | 30 | 38E9 | -0.97 | 54.90 | -0.95 | 54.88 | 09-Mar-04 | 9:06 | 0.50 | 76 | 0 | 0 | 253 | 9 | 10 | 0 |
| STIL1/04 | 31 | 38E8 | -1.07 | 54.87 | -1.07 | 54.90 | 09-Mar-04 | 10:40 | 0.50 | 127 | 6 | 2 | 126 | 12 | 10 | 2 |
| STIL1/04 | 32 | 38E8 | -1.12 | 54.97 | -1.13 | 55.00 | 09-Mar-04 | 12:06 | 0.50 | 688 | 6 | 0 | 113 | 3 | 10 | 0 |
| STIL1/04 | 33 | 38E8 | -1.13 | 55.00 | -1.12 | 54.98 | 09-Mar-04 | 13:06 | 0.50 | 319 | 6 | 2 | 77 | 6 | 10 | 0 |
| STIL1/04 | 34 | 38E8 | -1.12 | 54.97 | -1.13 | 54.98 | 09-Mar-04 | 14:05 | 0.50 | 86 | 2 | 0 | 77 | 9 | 15 | 0 |

APPENDIX 2: Farn Deep Trip Report, 2004

**CENTRE FOR ENVIRONMENT, FISHERIES & AQUACULTURE SCIENCE
LOWESTOFT LABORATORY, LOWESTOFT, SUFFOLK, ENGLAND**

2004 Fisheries Science Partnership Report

Programme: Unit 10 – NE coast Nephrops survey

STAFF: J M Elson
S R Lovewell
A R Lawler

DURATION: 29 February – 10 March 04

LOCALITY: North Sea (English NE Coast)

AIMS:

1. To carry out a standard Nephrops trawl survey of the NE coast Nephrops grounds using two fishing vessels and 80mm mesh commercial Nephrops trawls with 20mm mesh liners, in the area 55° 30' N – 54° 40' N and 1° 30' W – 00° 40' W. In addition to sampling Nephrops all commercial species will be sampled and non commercial species identified and counted.
2. To carry out comparative tows to determine the difference in catch between the two vessels for identical stations.
3. If time allows, to carry out commercial tows over parts of the ground identified as areas of interest from analysis of the data collected earlier in the survey. The size of the catch and/or the species diversity of the earlier tows would determine which areas would be fished.

NARRATIVE:

After postponing the start of the survey, because of weather, staff eventually departed from Lowestoft on the 29th February to begin the survey from North Shields at 0430 1st March. The original survey took between 12 and 14 days to complete for one vessel so to complete the survey in this instance the stations had to be shared between the two vessels, FV Luc (over 10m) and FV Still Waters (under 10m). The original suggestion was that the Luc, fished the further and outer stations and the under 10m vessel Still Waters fished the inshore stations. In practice, because of good weather it was possible to share the stations across the whole survey area. The fine weather meant we were able to sample at least four stations a day and as a consequence all the stations had been fished at least once by the end of 6th March. The last few days were used to either sample stations already sampled by the other vessel or to carry out comparative tows:

1. The purpose of fishing the other vessels stations was so that each vessel covered the entire survey grid if not all the stations. This way if the results

from the comparative tows did not provide adequate conversion factors, each vessels survey might stand on their own merit.

2. For the comparative tows, stations were selected where Nephrops catches had been relatively high. Each vessel fished the station independently (at their own speeds) but alongside each other. The catches were sampled using the same protocols used for the survey.

After the first days survey the sampling protocols for each vessel were reviewed and methods adopted for the rest of the survey. Methods had to be adopted that were slightly different on each vessel but would provide comparable data. On Still Waters the gear was smaller and consequently the catches after each half hour tow were smaller. Even though there was only one scientist on board, because the two-man crew got heavily involved in processing and sampling it was possible to sort and process the entire catch. On Luc the gear was different and the catches were generally larger. The gear and catch was worked differently on board and the crew contributed by sorting the commercial component of the catch from everything else. Each catch component had to be sampled separately so on occasion it was only possible to sort and process a sub sample of the 'discard' component.

After 9 days the survey had been completed; each vessel had fished some of the other vessels stations to improve on spatial coverage; and comparative tows had been carried out. Staff returned to Lowestoft on 10th March.

RESULTS:

1. By the 7th March all 45 stations had been fished by at least one of the vessels. Measurement samples were made of all Nephrops by sex and commercial species (by sex where possible) and all non-commercial finfish species identified and counts made of them.
2. The vessels fished alongside each other on 10 stations so that direct comparisons could be made of the catching power of each vessel and their gear. Eight stations were revisited using the other vessel to improve on the spatial coverage for each vessel.

JON ELSON

12 March 2004

INITIALLED:

DISTRIBUTION: