

**DEPARTMENT FOR ENVIRONMENT, FOOD AND RURAL AFFAIRS  
CEFAS, LOWESTOFT LABORATORY, SUFFOLK, ENGLAND**

2004 RESEARCH VESSEL PROGRAMME

REPORT: RV CEFAS CORYSTES: CRUISE 04/04

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DURATION: 19 April - 05 May

LOCALITY: North Sea

AIMS:

1. To use acoustic & fishing survey methods to estimate the abundance and distribution of sandeels on sandeel fishing grounds on the North West Riff (Dogger Bank) & The Hills.
2. To use fishing survey methods to estimate the abundance and distribution of predatory fish feeding on sandeels on the sandeel fishing grounds on the North West Riff & The Hills.
3. To use fishing survey methods (Bongo net) to estimate the abundance and distribution of plankton on the sandeel fishing grounds on the North West Riff & The Hills.
4. To use QTC and Day grab to describing sediment type in relation to sandeel distribution and abundance on the sandeel fishing grounds on the North West Riff & The Hills.
5. To use acoustic & fishing survey methods to determine sandeel abundance outside traditional sandeel fishing areas.

Narrative: (All times are British Summer time).

Corystes sailed at 09:30 on Monday 19<sup>th</sup> April and progressed to the Leman Bank (53° 04' 00" N, 2° 10' 00" E) where an acoustic survey was made of the bank with the aim of finding sandeel shoals (aim 5). Subsequently Corystes headed for the first designated survey grid of the project in the vicinity of The Hills.

Work on the first survey grid commenced at 06:30 on the 20<sup>th</sup> April. A standard survey day ran as follows. Just after dawn (approx 05:30) a combined acoustic, bird, plankton and sediment survey was performed which lasted approximately 6 hours. In the afternoon the same route was performed in reversed with a series of 6 trawl stations using a Granton trawl. This was to assess the size of local fish populations and determine their feeding habits via stomach analysis. During the darkness (approx 22:30 – 04:30) the same route was repeated again using a modified scallop dredge to determine sandeel density in the sediment. There were 6 days of continuous sampling on each of the two grids, the second grid being located on the North West Riff.

At the end of the standard sampling program, a series of experimental studies were undertaken.

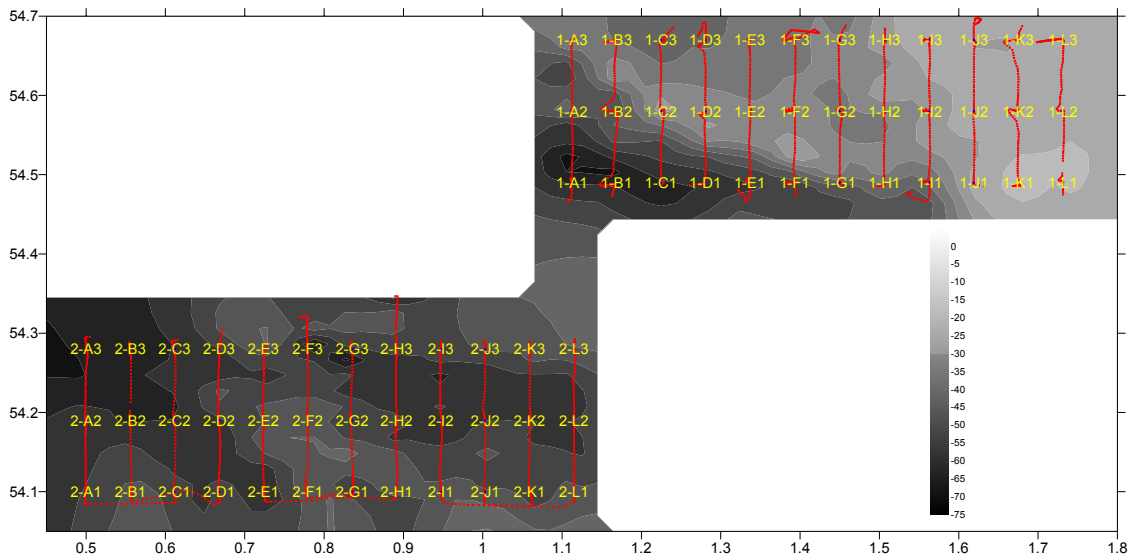
- 1) Short duration fishing trawls were made in order to determine the likelihood of catching live fish in good condition to service future tagging programs. A sample of live fish were kept in on-board tanks to assess their survivorship potential.
- 2) Fishing trawling after dusk and dawn was performed in order to determine if there was a significant difference in the freshness of prey in predator stomachs when compared to the standard afternoon trawls.
- 3) Acoustic and trawl surveys were made outside the grid on fishing grounds where commercial sandeel vessels were operating. Although commercial sandeel fishing is known to occur in both sampling areas, no vessels had been seen on these grounds during the cruise. Acoustic and trawl surveys were therefore made to determine if there were significant differences in the sandeel and predator populations between the current fishing grounds and the survey ground.
- 4) Additional sandeel dredging and acoustic work was undertaken in the Hills area. No sandeel shoals had been observed by the acoustic in the Hills area despite their presence in the sediment. Dredges were therefore undertaken in the most suitable habitat within the boundaries of the Hills grid.

## ***Results.***

This was the first cruise of a planned programme of 6, the purpose being to build a time series of fish predation activity within the study areas. As such, complex statistical analyses have not been undertaken on the data set, but preliminary analyses showing the distribution of abundance and some details of stomach contents are given in the following plots.

## Topography:

Data from the 38khz acoustic sounder were used to profile the topography of the study sites. The map below gives depth in metres, the cruise path and the station positions. Grid 1 (upper right grid) is typically shallow, the eastern most section being on top of the Dogger Bank, while another shallow ridge runs at about 30° across legs A-H. Grid 2 (lower left grid) is generally much deeper but with shallower ridges running across the centre of the grid.

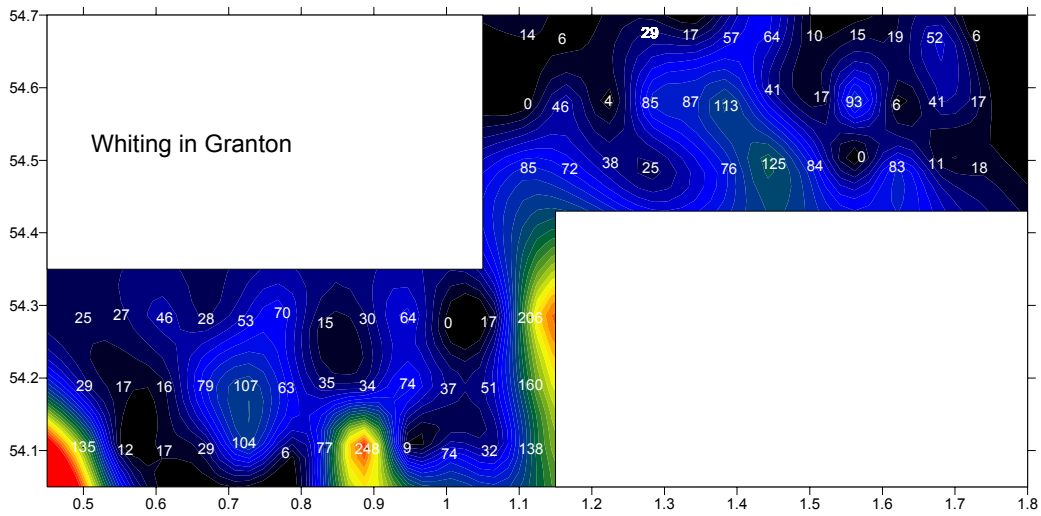
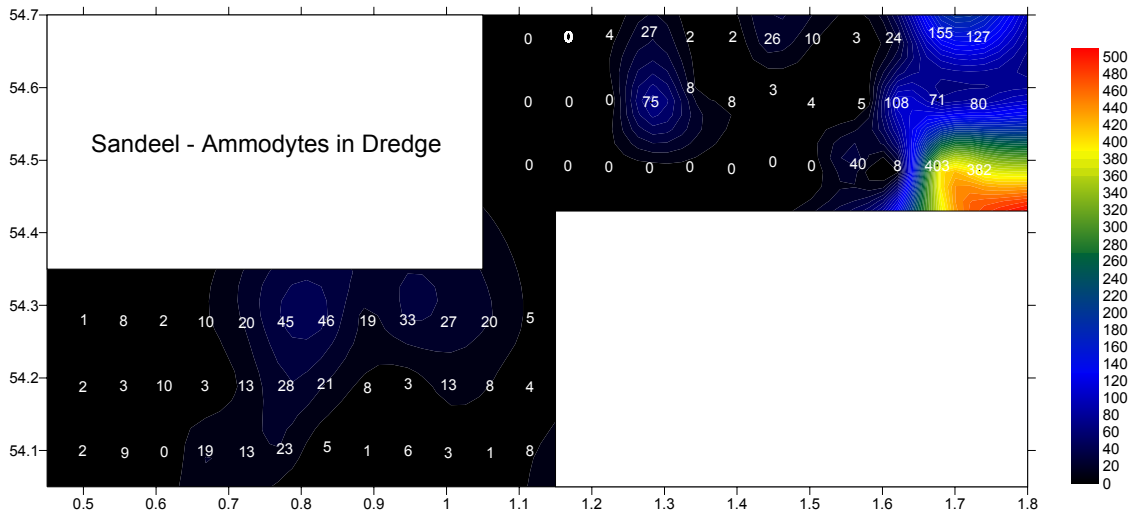


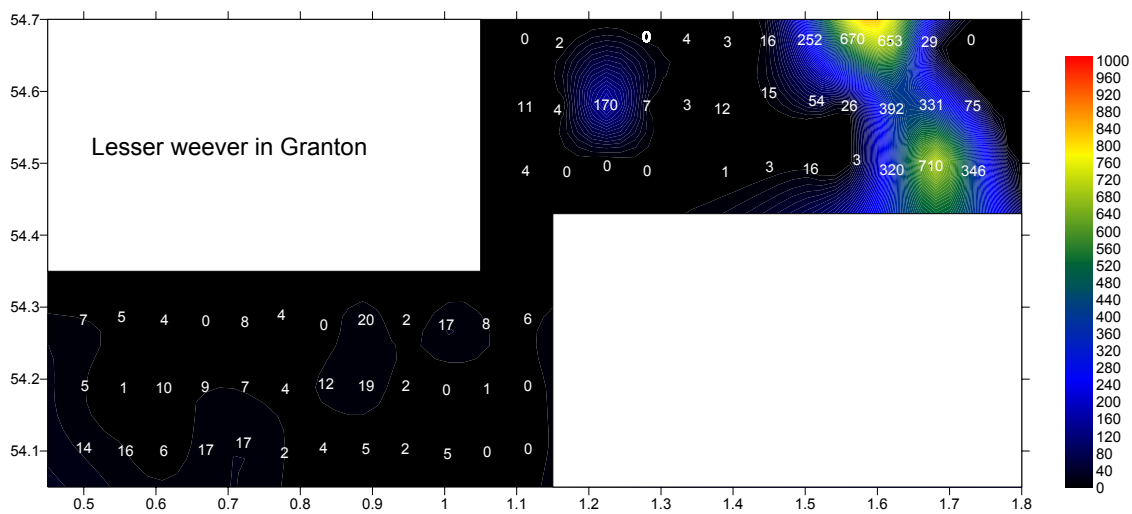
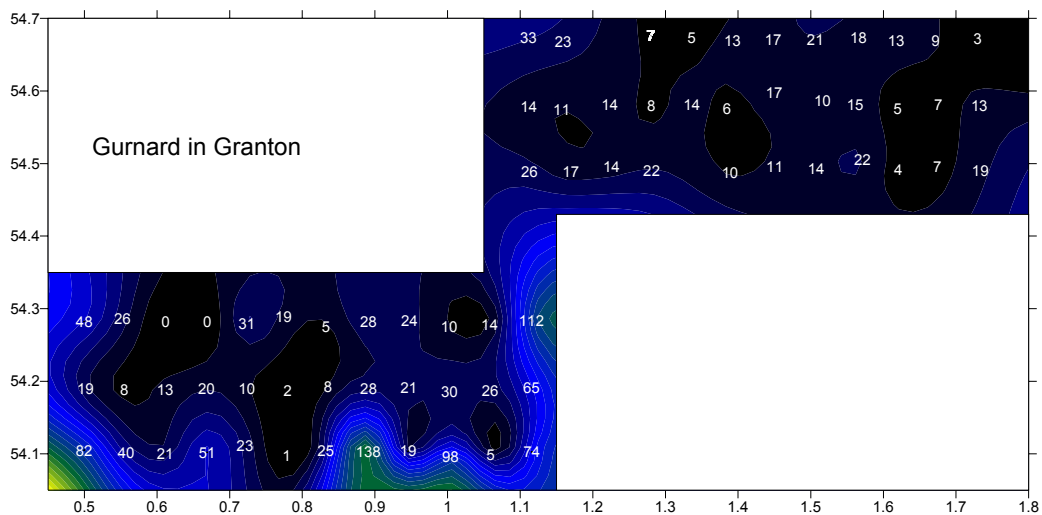
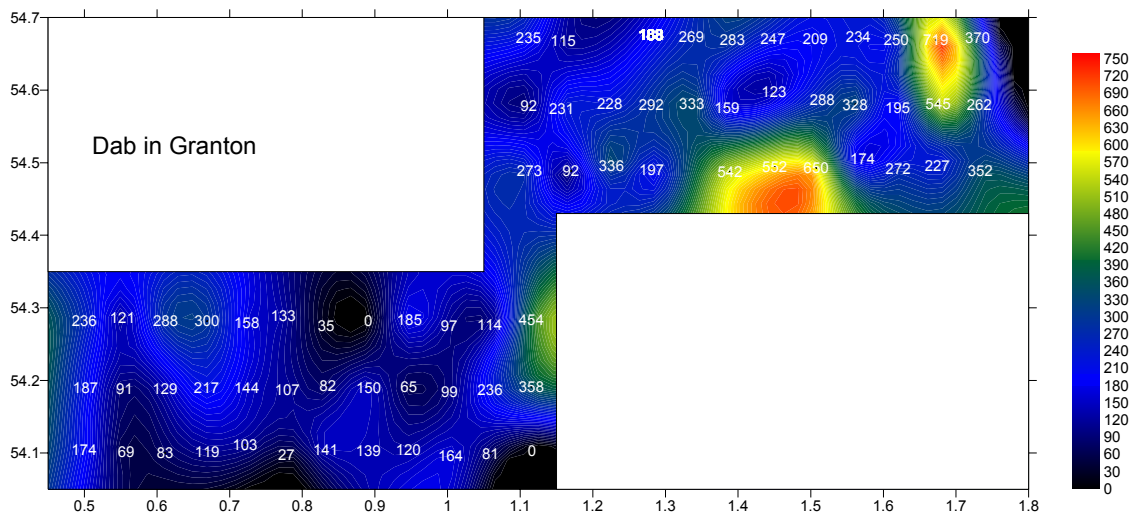
## Spatial distribution of abundance by species:

The following table (1) gives the number of individuals caught within each grid by species.

	Grid 1	Grid 2	<i>total</i>
Dab	9246	5206	14452
Lesser weever	4131	239	4370
Whiting	1385	2184	3569
Gurnard	443	1144	1587
Sprat	231	459	690
Solenette	563	17	580
Plaice	214	355	569
Lemon sole	287	18	305
Haddock	120	111	231
Herring	3	191	194
Poor cod	73	52	125
scaldfish	52	19	71
Cod	27	11	38
Dragonets	17	7	24
Long rough dab	18	2	20

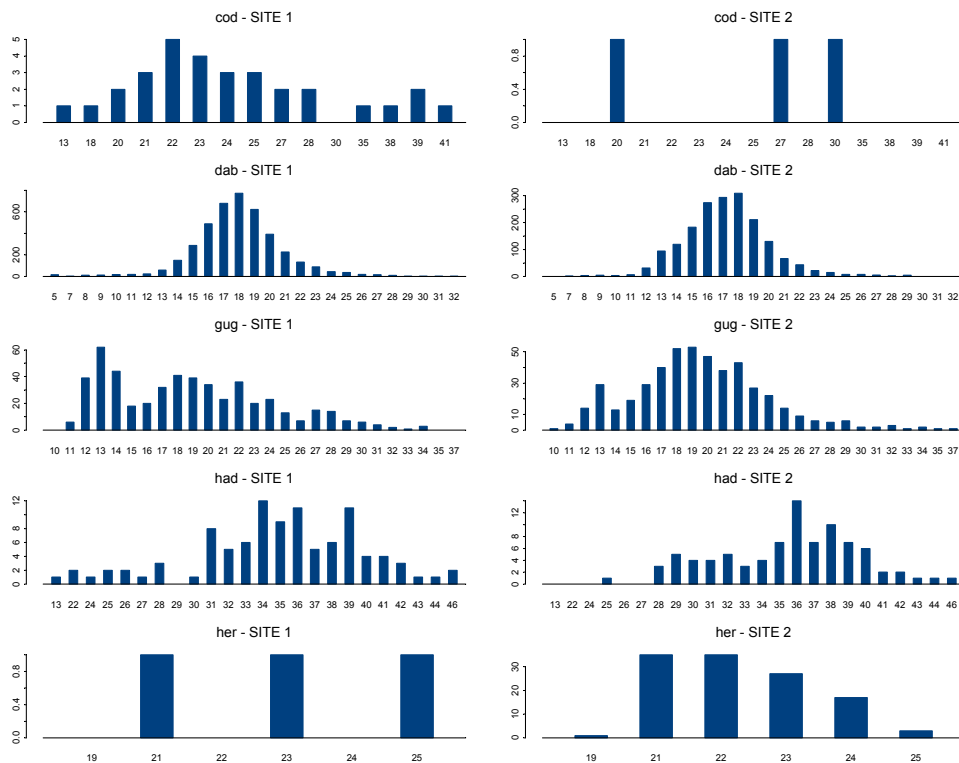
The following extended figure shows the spatial distribution of catch rates (numbers per standard 20 minute trawl). Species and gear type is given in each plot, note that the contouring has been given different scales depending on overall abundance.





## Length Frequency:

The following figures give the length frequencies by species, subdivided by site. The species codes are given in the legend. Several species, (including cod, herring, lemon sole, poor cod, solonette, sprat and lesser weaver) have too few measurements for meaningful comparisons. There is little difference in the length distribution of dab, plaice and whiting, but some differences in gurnard and sandeel. Changes to the length frequency will be monitored on future cruises.



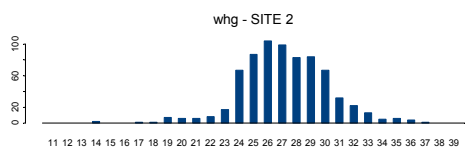
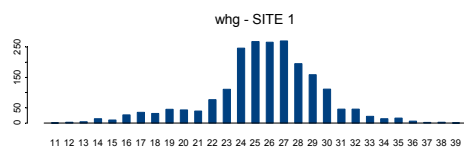
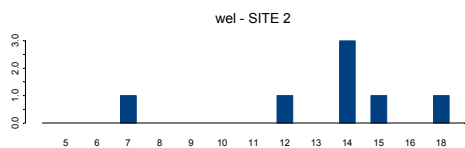
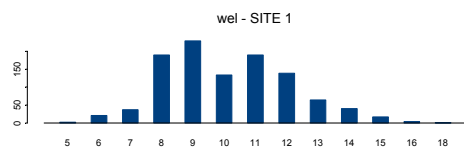
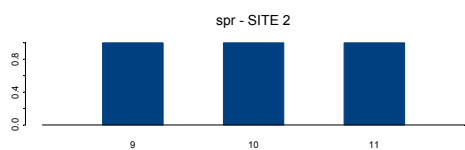
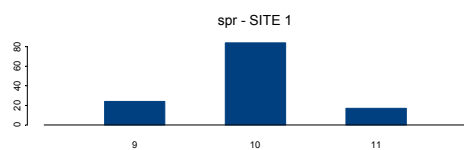
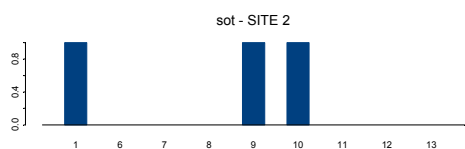
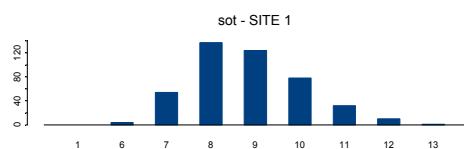
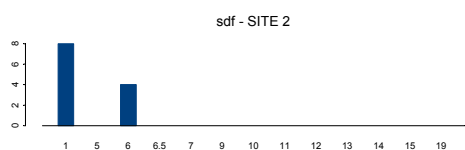
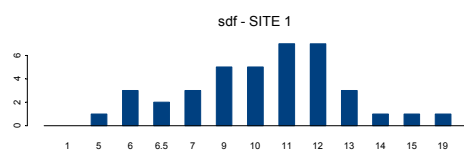
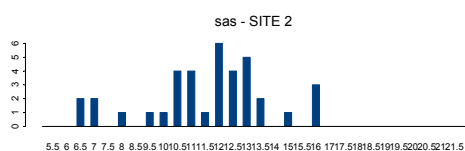
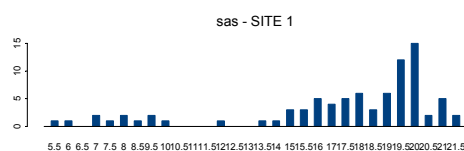
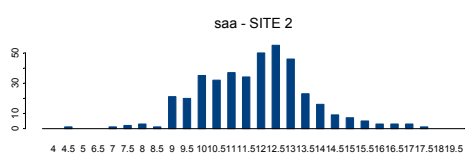
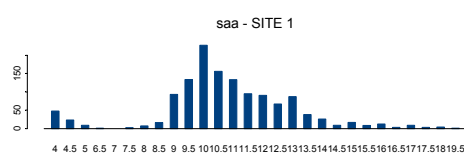
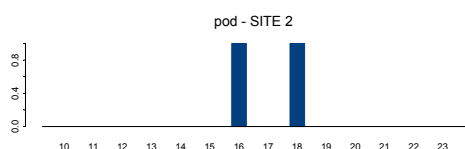
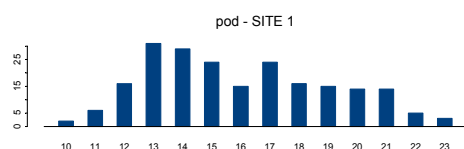
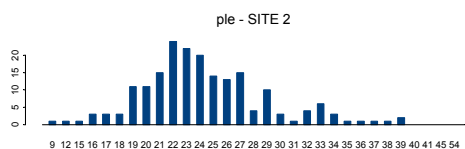
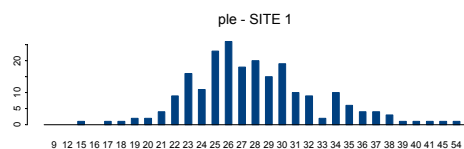
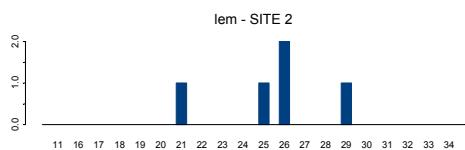
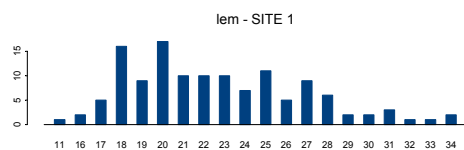


Figure 3. Length frequency by species and site. Code for species is as follows. cod=Cod, dab=Dab, gug=Grey Gurnard, had=Haddock, her=Herring, lem=Lemon Sole, ple=Plaice, pod=Poor Cod, saa=sandeel (*Ammodytes marinus*), sas=sandeel (*Gymnamodytes semisquamatus*), sdf=Scaldfish, sot=Solonette, spr=Sprat, wel=Lesser Weaver, whg=Whiting.

### Stomach contents:

On the main survey grid (i.e. excluding the additional stations) 1781 fish were examined. of which, 922 (51.77%) were empty. Several fish contained multiple prey types hence the total number of prey items in the table below is greater than the number of fish sampled. The classification of "other" includes stones and other non-organic material, unknown was recorded where type of prey could not be identified.

	Number of occurrences of prey type					<i>Total occurrence of prey item</i>	<i>Total number of predators</i>
species	empty	fish	invertebrates	other	unknown		
Whiting	437	187	67	10	109	810	755
Gurnard	369	52	138	5	36	600	568
Haddock	47	7	98	66	21	239	199
Plaice	54	60	61	9	24	208	180
Cod	6	18	28	2	2	56	34
Dab	4		2	1	2	9	9
Lesser Weever	2	1			1	4	4
Poor cod	2				1	3	3
Sandeel ( <i>lanceolatus</i> )	1		1			2	2
Dragonet					1	1	1
Flounder					1	1	1
Lemon sole			1			1	1
Mackerel		1				1	1
Scaldfish					1	1	1
Sprat			1			1	1
Herring					1	1	1
<i>Total occurrence of prey item</i>	922	326	484	6	200	1938	1781
<i>% occurrence of prey item</i>	51.77%	18.30%	27.18%	0.34%	11.23%		

Table 2. Stomach contents by predator and prey type.



The contents of 2178 fish were examined. 1093 (50.2%) had empty stomachs (empty stomachs were recorded when there was no sign of regurgitation and the stomach appeared contracted).

In order to gain information regarding meal size for predators, the stomach contents of some predators were weighed. The following figure shows the relationship between stomach contents weight and the length of the predator. This information will be used in later modelling exercises.

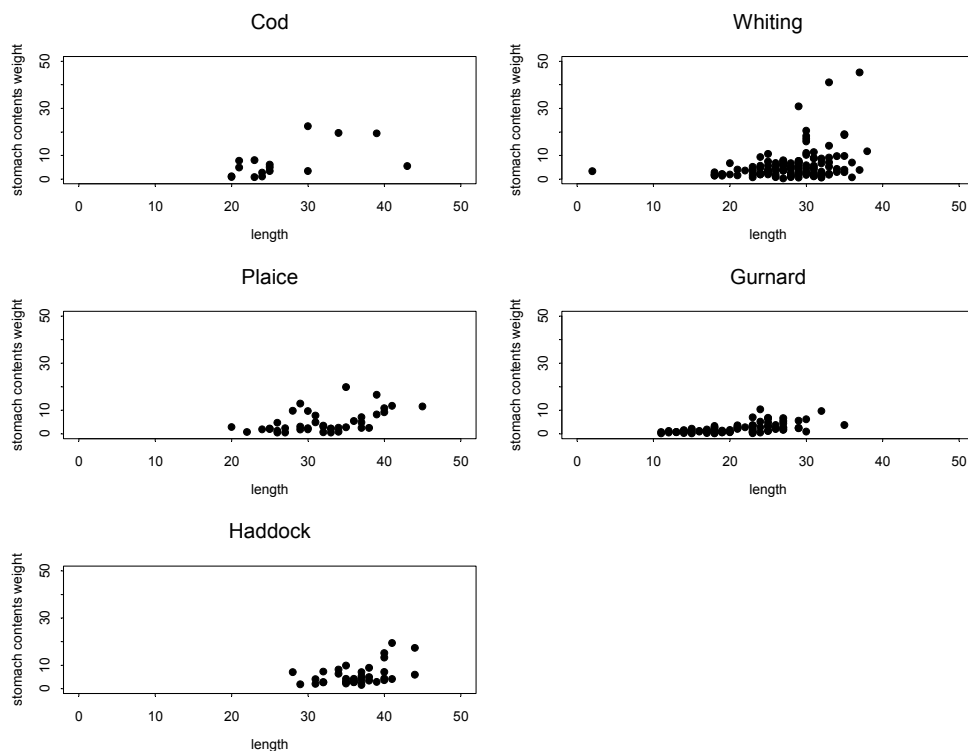


Figure 4. Stomach contents weight by predator length.

## Dawn/Dusk trawling

The exercise of Granton trawling at dawn and dusk was undertaken to investigate potential differences in stomach contents, their digestion stage and the scope for identification. Three hauls were conducted at either time category and catch rates were quite similar for many species. Notable differences in catch rates were observed in lesser weevers and poor cod (table 3). There is, however, relatively little difference in the stomach contents between the two trawling times (table 4).

	dawn	dusk	Grand Total	% dawn
Dab	2620	2256	4876	53.7%
Whiting	206	197	403	51.1%

Lesser weever	135	13	148	91.2%
Poor cod	104	35	139	74.8%
Solonette	49	84	133	36.8%
Gurnard	48	35	83	57.8%
Plaice	45	27	72	62.5%
Haddock	21	15	36	58.3%
Lemon sole	18	18	36	50.0%
Rays	2	10	12	16.7%
Scaldfish	5	5	10	50.0%
Cod	3	5	8	37.5%
Dragonets	4	2	6	66.7%
Sprat		5	5	0.0%
Pogge	1	2	3	33.3%
Bullrout	2		2	100.0%
Long rough dab		2	2	0.0%
Dogfish		2	2	0.0%
Horse mackerel	1		1	100.0%
Sole		1	1	0.0%
Pipefish	1		1	100.0%
Red mullet	1		1	100.0%
Sandeel (semisquamatus)	1		1	100.0%
Grand Total	3267	2715	5982	

Table 3 catch numbers by species comparing hauls performed at dawn and dusk.

	empty	fish	invertebrates	unknown
Dusk	51.95%	11.69%	19.48%	16.88%
Dawn	43.98%	12.57%	29.84%	12.57%

Table 4. Stomach contents and type by trawling time.