

R1/12

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FRV *Scotia*

Cruise 1598S

REPORT

1-18 September 1998

Loading: Aberdeen

Unloading: Aberdeen

Half-landing: Stornoway

Personnel

N Bailey	C1 (In charge)
J A M Kinnear	B2
C W Shand	B2
I Tuck	B2
A R Weetman	A4
J Drewery	A4

Objectives

- a) To obtain estimates of distribution and abundance of *Nephrops* in the Firth of Forth, Fladen Ground and North Minch using underwater television. If time permits the survey will include stations at the Noup and Moray Firth.
- b) To collect samples of the sediment at each TV station.
- c) To make use of the TV survey to estimate the densities of whelks and other shellfish species of potential commercial importance.
- d) To carry out *Nephrops* trawling in each stratum throughout the survey areas for size composition analysis and examination of biological features.

Out-turn days per project: M01T; 18 days

Narrative

Staff joined the ship at 0830 hours on Tuesday 1 September. Following delays caused by engine problems, *Scotia* departed from Aberdeen at 1530 hours and steamed for the first of the Firth of Forth stations at 56°01.86'N 02°59.46'W. Owing to bad weather, television survey work did not begin until 0800 hours on 2 September. After establishing that the most convenient and safe method of shooting the TV sledge was from the deck using the gamma frame, 26 TV stations were completed throughout the next 36 hours. Two trawl tows were then carried out before TV work recommenced at 2350 hours on 3 September. The final seven TV stations and remaining trawl tow were completed by 0900 hours on 4 September. *Scotia* then departed for the Fladen Ground.

Bad weather and a heavy swell delayed commencement of TV work until 0830 hours on 5 September. Working north from 57°44.34'N 0°11.88'E, 36 stations were covered before rapid deterioration in the weather during the afternoon of 7 September made it difficult and dangerous to use the TV sledge. It was decided that operations should shift to the North Minch ground.

Scotia arrived on station off the Point of Stoer at 1200 hours on 8 September and began working in a southerly direction towards the northeast of Skye. Fifteen TV stations and one trawl tow were completed before *Scotia* steamed north to grounds off Stornoway to carry out a further 17 stations. *Scotia* then steamed for the half landing in Stornoway docking at 0830 hours on 10 September.

Scotia resumed survey operations at 0900 hours on 11 September and completed the remaining four North Minch TV stations and two trawl tows before steaming for the Fladen Ground. Passage was via the Pentland Firth where water samples were collected. A total of 13 TV stations were completed in the northern and central parts of the Fladen Ground before bad weather forced a shift to the Moray Firth.

Work commenced in the western part of the Moray Firth Ground (57°53.00'N 3°32.00'W) at 0200 hours on 14 September. TV observations were made at 32 stations before conditions off Fraserburgh became unworkable at 1900 hours on 15 September. Three trawl tows were also made during this surveying period. *Scotia* steamed through the night to the Fladen Ground while conditions moderated slightly. During 16 September, work was intermittently possible on the remaining 11 offshore TV stations and trawl tows. Work was completed at the remaining three Moray Firth TV stations on 17 September and *Scotia* docked in Aberdeen at 0600 hours on 18 September. The full cruise track is shown in Figure 1.

Data Collection

Owing to time lost through bad weather, plans to survey the Noup grounds were abandoned. Adequate surveys were conducted in the remaining areas. BGS sediment data was used to locate stations on muddy superficial sediments within the statistical squares defining *Nephrops* stocks (as defined by the ICES WG).

A total of 164 television sledge runs of 10 minutes duration were made of which 147 were on suitable sediment and gave a clear picture; all seabed operations performed well. Calculation of the area surveyed in each run was facilitated by using a rangefinder to monitor height of camera off the bottom and an odometer to measure distance travelled. Preliminary counts of burrow numbers were made during TV camera observations and the material was recorded on video for more detailed analysis which has been completed at the Laboratory.

Sediment samples for size particle analysis were taken at each station using a Day Grab. Analyses of these in the Laboratory, using a laser particle size analyser, will take place shortly.

A Scotnet 50 mm Prawn Trawl (headline 176'), was used to make trawl hauls of 30 minutes as follows: Firth of Forth (three), Fladen Ground (four), North Minch (three), Moray Firth (four). Data on *Nephrops* sex ratio, size composition and ovary condition of *Nephrops* were collected from each haul.

Summary of TV survey results and data analysis

In those areas where BGS sediment data was utilized, the targeting of stations on soft sediments was generally successful. For each area, estimates of *Nephrops* burrow density

from Laboratory counts of video tape are given by station in Table 1. Poor visibility and difficult operating conditions caused some problems in Firth of Forth but, as in previous surveys, relatively high densities were obtained in the eastern parts of the ground. In the other two North Sea grounds surveyed, the densities were generally lower, particularly in the outer Moray Firth. *Nephrops* were generally more evenly distributed throughout the North Minch.

Table 2 shows mean densities for each survey stratum raised to overall areas of the "mud" sediments to provide abundance estimates. These figures were supplied to the recent ICES *Nephrops* Working Group. Results continue to show that the population at the Fladen ground is very large compared to other areas despite its relatively low densities. Moray Firth results are beginning to give cause for concern, the time series now shows a noticeable decline in abundance over the past few years.

J Morrison
20 May 1999

Seen in draft: P Ramsay, OIC

Table 1 Estimates of density (No.m⁻²) for each station in each area. Positions, depth and area of bottom (m²) surveyed by TV are also given

Firth of Forth

Station	Date	Longitude	Latitude	Depth	Area	Density
801	02/03/98	-2.991	56.031	no visibility		
802	02/03/98	-3.037	56.053	hard ground		
803	02/03/98	-3.001	56.019	16.28	168.49	0.13
804	02/03/98	-3.117	56.070	31.34	82.26	0.03
805	02/03/98	-3.047	56.116	24.42	174.71	0.17
806	02/03/98	-2.956	56.032	hard ground		
807	02/03/98	-2.989	56.114	hard ground		
808	02/03/98	-2.926	56.106	hard ground		
809	02/03/98	-2.905	56.129	37.42	205.30	0.54
810	02/03/98	-2.928	56.145	35.52	227.59	0.47
811	02/03/98	-2.977	56.148	poor visibility		
812	03/03/98	-2.951	56.136	48.62	203.06	0.28
813	03/03/98	-2.795	56.129	53.31	103.94	0.35
814	03/03/98	-2.753	56.161	49.11	155.51	0.38
815	03/03/98	-2.699	56.188	51.76	195.36	0.20
816	03/03/98	-2.626	56.185	45.43	129.51	0.23
817	03/03/98	-2.572	56.157	47.67	159.17	0.19
818	03/03/98	-2.525	56.118	45.94	160.20	0.25
819	03/03/98	-2.472	56.074	poor visibility		
820	03/03/98	-2.344	56.069	54.12	166.81	0.39
821	03/03/98	-2.263	56.020	62.37	166.95	0.55
822	03/03/98	-2.065	56.952	75.61	188.05	0.33
823	03/03/98	-2.119	56.025	70.95	149.50	0.68
824	03/03/98	-2.374	56.099	52.57	138.16	0.58
825	03/03/98	-2.437	56.123	50.62	137.37	0.43
826	03/03/98	-2.605	56.118	poor visibility		
827	03/03/98	-2.837	56.135	poor visibility		
828	04/03/98	-2.436	56.198	poor visibility		
829	04/03/98	-2.376	56.240	59.04	192.73	0.31
830	04/03/98	-2.311	56.233	50.33	200.69	0.00
831	04/03/98	-2.290	56.180	57.25	143.47	0.63
832	04/03/98	-2.345	56.157	59.67	132.57	1.06
833	04/03/98	-2.308	56.130	57.87	192.95	0.77

Fladen Ground

Station	Date	Longitude	Latitude	Depth	Area	Density
1	05/03/98	0.207	57.740	103.72	170.29	0.02
2	05/03/98	0.105	57.815	111.77	254.90	0.15
3	05/03/98	0.256	57.821	126.42	197.21	0.33
4	05/03/98	0.456	57.910	134.42	189.02	0.44
5	05/03/98	0.623	57.954	145.20	295.77	0.41
6	05/03/98	0.575	58.042	146.20	124.51	0.57
7	05/03/98	0.957	58.137	146.20	210.29	0.27
8	05/03/98	0.159	58.018	136.05	217.53	0.37
9	05/03/98	0.059	57.937	121.84	149.82	0.34
10	05/03/98	-0.121	58.043	126.40	173.60	0.28
11	06/03/98	0.198	58.115	141.90	183.67	0.67
12	06/03/98	0.161	58.241	140.91	237.05	0.49
13	06/03/98	0.209	58.264	142.99	194.12	0.43
14	06/03/98	0.105	58.330	140.26	227.08	0.30
14a	06/03/98	0.105	58.330	140.26	240.17	0.33
15	06/03/98	-0.113	58.281	133.14	161.89	0.35
16	06/03/98	-0.232	58.224	130.93	199.95	0.42
17	06/03/98	-0.201	58.331	132.84	183.05	0.34
18	06/03/98	0.119	58.432	142.72	128.66	0.58
19	06/03/98	0.115	58.525	145.18	208.15	0.27
20	06/03/98	0.126	58.540	145.29	260.01	0.34
21	06/03/98	0.227	58.574	146.20	230.65	0.18
22	06/03/98	0.369	58.593	145.12	180.57	0.28
23	06/03/98	0.863	58.205	145.20	148.49	0.49
24	06/03/98	1.180	57.901	109.56	242.82	0.04
25	07/03/98	1.255	58.195	133.46	203.75	0.56
26	07/03/98	0.853	58.305	146.20	209.09	0.29
27	07/03/98	0.837	58.394	141.46	58.94	0.37
28	07/03/98	0.848	58.499	143.63	280.07	0.35
29	07/03/98	1.227	58.461	129.98	271.71	0.31
30	07/03/98	1.225	58.633	127.43	179.01	0.31
31	07/03/98	0.934	58.591	145.07	195.65	0.28
32	07/03/98	0.790	58.636	142.08	280.42	0.24
33	07/03/98	0.782	58.611	145.88	222.85	0.26
34	07/03/98	0.591	58.625	146.20	239.14	0.44
35	07/03/98	0.492	58.595	140.40	261.37	0.29
36	12/03/98	-0.089	58.347	139.13	257.09	0.16
37	12/03/98	0.319	58.503	129.53	94.54	0.03
38	12/03/98	0.200	58.342	140.43	250.12	0.13
39	12/03/98	0.572	58.190	126.73	226.37	0.00
40	12/03/98	0.330	58.380	146.20	225.04	0.09
41	12/03/98	0.526	58.677	146.20	121.42	0.18
42	12/03/98	0.300	58.746	118.24	209.20	0.00
43	13/03/98	0.271	58.685	145.49	220.46	0.15
44	13/03/98	0.541	58.536	143.91	224.61	0.27
45	13/03/98	0.926	58.470	146.20	192.28	0.31
46	13/03/98	0.549	58.569	142.04	191.11	0.24

47	13/03/98	-0.097	58.543	140.77	148.18	0.31
48	13/03/98	-0.453	58.562	124.35	215.05	0.18
49	16/03/98	-0.260	58.134	140.43	151.61	0.20
50	16/03/98	-0.536	58.693	139.65	144.35	0.24
51	16/03/98	-0.143	58.635	107.42	219.18	0.00
52	16/03/98	-0.527	58.810	139.99	221.65	0.13
53	16/03/98	-0.420	58.709	125.74	161.15	0.11
54	16/03/98	-0.743	58.522	128.40	178.99	0.19
55	16/03/98	-0.736	58.432	123.26	194.37	0.10
56	16/03/98	-0.930	58.355	101.76	202.59	0.00
57	17/03/98	-1.340	58.644	109.95	197.14	0.16
58	17/03/98	-1.253	58.759	110.60	165.13	0.12
59	17/03/98	-1.803	58.685	95.26	212.72	0.00

Moray Firth

Station	Date	Longitude	Latitude	Depth	Area	Density
701	14/03/98	-3.823	57.885	58.49	174.41	0.47
702	14/03/98	-3.641	57.912	51.38	213.52	0.23
703	14/03/98	-3.670	57.866	44.08	230.40	0.54
704	14/03/98	-3.994	57.885	52.17	229.59	0.02
705	14/03/98	-3.690	57.778	43.17	144.12	0.68
706	14/03/98	-3.695	57.751	marginal ground		
707	14/03/98	-3.794	57.727	28.80	235.69	0.02
708	14/03/98	-3.856	57.678	33.79	262.20	0.36
709	14/03/98	-3.731	57.707	48.90	172.34	0.44
710	14/03/98	-3.680	57.705	53.00	192.16	0.27
711	14/03/98	-3.483	57.746	59.18	178.67	0.02
712	14/03/98	-3.395	57.781	65.46	193.25	0.43
713	14/03/98	-3.356	57.801	71.14	111.64	0.83
714	14/03/98	-3.308	57.848	hard ground		
715	14/03/98	-3.174	57.811	65.39	195.23	0.00
716	14/03/98	-3.120	57.828	82.68	210.05	0.22
717	14/03/98	-3.000	57.859	93.79	178.41	0.13
718	14/03/98	-2.927	57.859	98.52	181.26	0.14
719	14/03/98	-2.854	57.917	80.64	168.59	0.07
720	15/03/98	-2.906	57.910	91.31	181.53	0.07
721	15/03/98	-2.854	57.971	74.80	211.38	0.03
722	15/03/98	-2.812	57.962	80.17	179.09	0.24
723	15/03/98	-2.825	57.885	84.12	186.31	0.13
724	15/03/98	-2.698	57.837	83.21	195.24	0.08
725	15/03/98	-2.541	57.759	101.82	166.29	0.04
726	15/03/98	-2.534	57.778	85.02	204.99	0.07
727	15/03/98	-2.456	57.792	85.02	218.38	0.16
728	15/03/98	-2.343	57.800	110.67	169.34	0.20
729	15/03/98	-2.295	57.801	118.83	174.85	0.09
730	15/03/98	-2.263	57.836	95.46	194.06	0.17
731	15/03/98	-2.305	57.890	86.46	177.16	0.04
732	14/03/98	-2.242	57.806	aborted - poor conditions		
733	17/03/98	-2.132	57.821	78.76	187.01	0.00
734	17/03/98	-1.981	57.828	79.29	203.83	0.00
735	14/03/98	-1.937	57.83	hard ground		

North Minch

Station	Date	Longitude	Latitude	Depth	Area	Density
906	08/03/98	-5.583	58.273	101.73	220.26	0.23
907	08/03/98	-5.563	58.235	110.63	104.13	0.48
908	08/03/98	-5.522	58.221	no visibility		
909	08/03/98	-5.549	58.229	no visibility		
910	08/03/98	-5.467	58.181	aborted - poor conditions		
911	08/03/98	-5.936	57.771	146.20	135.64	0.20
912	08/03/98	-5.919	57.731	146.20	155.73	0.45
913	08/03/98	-5.917	57.695	146.20	158.58	0.29
914	08/03/98	-5.895	57.660	146.20	110.46	0.36
915	08/03/98	-5.928	57.667	138.74	169.57	0.42
916	08/03/98	-5.850	57.653	143.39	170.33	0.28
917	08/03/98	-5.823	57.605	129.12	170.15	0.15
918	08/03/98	-5.825	57.529	131.26	147.64	0.18
919	08/03/98	-5.886	57.722	67.49	226.81	0.32
920	08/03/98	-5.846	57.744	118.86	147.82	0.54
921	08/03/98	-5.729	57.967	126.51	201.61	0.64
922	08/03/98	-5.731	58.006	132.74	153.79	0.30
923	08/03/98	-5.589	57.853	115.67	148.62	0.81
924	08/03/98	-5.620	58.060	130.80	161.33	0.43
925	08/03/98	-5.659	58.113	98.45	183.49	0.48
926	08/03/98	-5.452	58.168	118.49	219.78	1.02
927	08/03/98	-5.473	58.182	109.39	134.71	0.54
928	08/03/98	-5.755	58.216	106.64	184.29	0.71
929	08/03/98	-5.819	58.065	108.95	206.69	0.25
930	08/03/98	-5.858	58.081	88.81	222.74	0.40
931	08/03/98	-5.878	58.150	112.89	185.33	0.19
932	08/03/98	-5.915				

Table 2 Analysis of Underwater Television results obtained during Scotia Cruise 1598S. For each area, summary statistics are provided for each stratum surveyed. Note that at the Fladen ground, stratification was based on sediment grade (% silt content), while in the other areas arbitrary 'rectangular' strata were used.

Stratum	Area (km ²)	Number of stations	Mean Burrow density (No.m ⁻²)	Observed variance	Total number (millions)	Stratum variance	Proportion of total variance
Fladen Ground							
>80	3248	13	0.406	0.018	1319	14588	0.063
55<80	4967	17	0.295	0.008	1464	12045	0.052
40<55	4304	18	0.239	0.022	1030	22956	0.099
<40	15634	12	0.088	0.009	1368	181881	0.786
Total	28153	60			5181	231470	1
Firth of Forth							
W	291	6	0.27	0.044	77	623	0.274
X	423	11	0.396	0.068	168	1108	0.487
Y	201	6	0.493	0.081	99	543	0.239
Total	915	23			345	2275	1
Moray Firth							
P	690	12	0.359	0.068	248	2708	0.819
Q	655	10	0.111	0.006	73	254	0.077
R	728	8	0.096	0.005	70	346	0.104
S	122	1	0		0		
Total	2195	31			391	3308	1
North Minch							
U	656	12	0.353	0.021	231	760	0.289
V	425	11	0.536	0.057	228	929	0.353
W	563	10	0.319	0.016	180	501	0.190
X	131	5	0.680	0.129	89	443	0.168
Total	1775	38			728	2633	1

note: Stratum X at the North Minch was surveyed during the 1998 Clupea cruise but is included here for completeness

Cruise Track FRV Scotia 1598S: 1st-18th September 1998

