R1/12

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FRV *Scotia*

Cruise 1199S

REPORT

1-24 July 1999

Half landing: 12 July, Lerwick

Personnel

E J Simmonds (In charge)
P Fernandes
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M Mathewson
A Brierley
N Millard
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Objectives

1. To participate in an ICES – coordinated acoustic and mid-water trawling survey in the north western North Sea and North of Scotland between 58° to 62°N 4° 30' W to 2°E excluding Norwegian and Faroes waters.

2. To obtain samples of herring for biological analysis, including age, length, weight, sex, maturity and ichthyophonus infection.

3. To obtain thermosalinograph recordings of surface temperature and salinity throughout the survey area. CTD (and XBT) profiles of temperature and salinity at depth for analysis with herring distributions.

4. To obtain measurements of herring density using autosub

5. To carry out an acoustic intercalibration with RV *Tridens*

Out turn costs per project: 20 days MO1T; 4 days CI94

Narrative

Scotia carried out preliminary trials with Autosub-1 on 29 and 30 June in Aberdeen Bay. *Scotia* sailed at 1100 hours on 1 July 1999 and made passage to Scapa Flow anchoring at 2300 hours to calibrate the acoustic instruments on both *Scotia* and Autosub-1. At 0500 hours FRV *Scotia*

left Scapa Flow and rendezvoused with FRV *Tridens* at 0600 hours GMT at 58° 35' N 2° 45' W. FRV *Scotia* and FRV *Tridens* carried out a joint inter-calibration on the fish traces found in this area and completed this by 1150 hours (58° 20' 2° 55' W).

FRV *Scotia* commenced the survey at 1330 hours on 2 July (58° 04'N 3° 00'W). The survey was carried out on east west transects on a 15 nmi spacing progressing northwards between 2E, the Scottish mainland, and the Orkney and Shetland Islands from 0200 to 2200 hours GMT (Fig. 1). Additional short transects were added into the survey in areas of expected higher herring abundance. FRV *Scotia* ceased the survey at 0730 hours (60°34'N 1° 45'E) and docked in Lerwick at 0930 hours on 12 July for a mid-cruise break. *Scotia* sailed again at 0930 hours on 13 July and recommenced the survey at 60° 49'N 1° 45'E at 1000 hours GMT. FRV *Scotia* continued the survey north to 61° 34'N and then progressed southwards to the west of Shetland and Orkney and finished the survey at 0945 hours GMT on 23 July (58° 42'N 3° 27'W). FRV *Scotia* then proceeded to Scapa flow and subsequently to Sinclair Bay in order to attempt a second calibration of the acoustic instruments, however, was unable to do so due to gale force winds and therefore sailed to Aberdeen and docked at 0630 hours BST on 24 July 1999.

Main Activities

Throughout the acoustic survey acoustic data was collected using a Simrad EK500 echosounder operating at 38 and 120 kHz, with raw data collected using EchoView software.

The autonomous underwater vehicle Autosub-1-1 was deployed from FRV *Scotia* during the survey as part of MLA's commitment to the USIPS project*. A total of 13 Autosub-1-1 missions were accomplished (Fig. 1): five of these were with FRV *Scotia* in close attendance, maintaining contact with the vehicle at all times, and eight were totally unattended. This was the first time that any AUV had undertaken a fully autonomous mission beyond communication range of its support facility. Echosounder data was collected onboard Autosub-1-1 on 12 of the missions, using the same type of instrumentation as that onboard FRV *Scotia*. In most cases the vehicle travelled at depths set between 15 and 30 metres from the surface, with one transducer (usually 38 kHz) orientated toward the bottom and the other (120 kHz) toward the surface. This combination provided, for the first time, fisheries echosounder data from virtually the whole water column, including the previously unsampled area close to the surface. Over 800 MB of data were collected.

Fishing with a PT160 midwater trawl was carried out on observed fish traces on an opportunistic basis. The locations of the trawl hauls are shown in Figure 2 and catch data summarised in Table 1; and 39 trawls were taken, 27 of which contained more than 400 herring. In addition to length frequency data (up to 500 herring per haul), a total of 2,694 herring were sampled for weight, sex, maturity, otolith and microscopic evidence of ichthyophonus infection. The thermosalinograph was run throughout the cruise, a total of 50 CTD stations were carried out, one at each of the trawl stations and one at 2200 hours GMT each night (Fig. 2). A total of 35 XBT stations were carried out during the survey to provide information on temperature profiles between CTD stations, these were located at 3 hour (30 nmi) intervals along the track after each CTD unless replaced by a CTD (Fig. 2).

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* Under Sea Ice and Pelagic Surveys (USIPS) is a collaborative research programme funded by the National Environment Research Council, Marine Laboratory Aberdeen and British Antarctic Survey. The aim of the programme is to assess the potential of Autonomous Underwater Vehicles for fisheries research and to collect data from environments that are inaccessible to conventional sampling platforms (see http//www.marlab.ac.uk/usips/usips.html for details).

Results

All the survey objectives were met. The intercalibration with FRV *Tridens* was completed successfully. The survey was completed successfully, with no time lost due to weather with the exception of a second equipment calibration. The total mileage surveyed was approximately 2,790 nmi. (Fig. 1) with a total of 1,116 acoustic log intervals recorded. One successful calibration was carried out, which gave consistent results with 1998 with a difference of less than 0.1 dB for the 38kHz system.

Extensive continuous low to medium density concentrations of herring were found North of 58° 30'N to 59° 30'N between 1°W and 1°E. High concentrations of herring were found east of Balta, the north east of Poby Bank, west of Muckle Flugga and west of Orkney. A full stock estimate and survey report will be prepared shortly.

Ichthyophonus infection within North Sea herring remains at a relatively low level, but is higher than last year at 25 of the 2,694 herring examined.

The Autosub-1 data is of excellent quality due principally to three factors: the influence of surface wave action was negligible because the vehicle traveled at depth; the slow speed (maximum 3 knots) and high sampling rate (1 ping per second) resulted in high resolution; and an absence of shipbourne noise.

Although the data from Autosub-1 will require careful analysis before any firm conclusions can be drawn, some elementary observations are worthy of note. Fish schools were detected on all missions, and on one particular occasion a very large mid water school was detected at less than 7 metre range above Autosub-1. This provides good evidence that fish are not sensitive to the vehicle's presence beyond this distance. Autosub-1 is, therefore, unlikely to induce any significant avoidance reaction such that the data collected during missions where FRV *Scotia* was in attendance, will provide evidence to examine research vessel avoidance. Detection of fish near the surface (from the upward looking transducer) was rare; the one mission during which surface schools were prevalent was in an area where FRV *Scotia* detected schools in the upper water column. This suggests that in the area of the North Sea where FRV *Scotia* conducts the acoustic survey, surface schools, which may be under-sampled by the vessel, are not common.

Autosub-1 was deployed and recovered using its dedicated gantry, which was installed in the hydrographic hangar: without this gantry handling difficulties would have limited operations significantly. The hangar proved to be an excellent storage area for the vehicle, and provided good sheltered work space for the support team's activities.

A number of factors presently limit the potential of Autosub-1 as a tool for large scale surveying. The constraints of battery power and vehicle speed in particular currently restrict its range. The vehicle has, however, proved itself as an excellent platform for echosounders, and with advances in battery technology will no doubt become an extremely useful sampling device for fisheries research.

J Simmonds
24 July 1999

Seen in draft: P Ramsay, Master
FRV *Scotia*

Table 1 Trawl Summary Table

Trawl shooting position						Estimated Raised Numbers Caught by species												Sample	
No	Date	Time	Latitude	Longitude	depth	Herring	Mackerel	Sprat	NPout	Bl whiting	Haddock	Whiting	Argentine	L sole	G gurnard	C Dab	T minutus	(kg)	
275	2/7/99	21:20	58 04.20N	001 29.20W	50														O grp Pout meshed
276	3/7/99	06:00	58 04.03N	000 42.36W	104	14160	30												
277	3/7/99	17:55	58 11.00N	361 29.84E	105	460			12		42	1							
278	4/7/99	09:55	58 19.70N	001 39.90W	114	1800			25		20	35							Omm 5
279	5/7/99	04:29	58 33.86N	000 43.52W	131	2190	180		415		10								
280	5/7/99	08:05	58 33.80N	000 02.90W	100														O grp Pout meshed
281	6/7/99	06:05	58 49.00N	360 01.08E	130	2030	5		245			5							
282	6/7/99	12:28	58 49.13N	001 18.83W	112	3698	8		1238			15							
283	7/7/99	05:07	59 03.93N	000 54.53W	133	12175			4900		275	75	25					70	
284	7/7/99	21:20	59 19.00N	360 26.03E	132	4392	17		125		8	8							
285	8/7/99	05:55	59 11.85N	000 31.52W	140	27540			1620			180							
286	8/7/99	14:20	59 25.53N	360 00.13E	136	13354			1716			22						106	
287	8/7/99	21:10	59 19.00N	001 15.60W	111	1725	21		141		156	117	27	12	9	3		98	
288	9/7/99	04:12	59 19.01N	001 53.21W	104														O grp Pout meshed
289	9/7/99	11:21	59 34.46N	001 34.20W	80														O grp Pout meshed
290	9/7/99	13:30	59 39.94N	001 11.13W	113	1440	69		307		75	83	5	3	3	3	3		
291	10/7/99	09:35	59 48.80N	360 17.00E	124	15880			1400										
292	11/7/99	04:10	59 58.31N	001 08.24W	94														O grp Pout meshed
293	11/7/99	07:00	60 03.96N	000 53.42W	105	85	8		93		42	13	1					32	3 Sebasties,1 Scad
294	13/7/99	13:08	60 11.97N	000 21.78W	127	21			250		4		1						1 Hake
295	13/7/99	15:44	60 11.77N	000 12.48W	137	5	15		262	1	8	1							1 Scad 1 Cod ! Saithe
296	13/7/99	21:00	60 26.90N	000 37.30W	130	1647			213		10								
297	14/7/99	04:00	60 34.11N	000 30.76W	144	1587			200				7						
298	14/7/99	08:55	60 33.90N	360 09.60E	135				3450		5		15						
299	14/7/99	11:53	60 33.93N	360 34.15E	143	23500	50		15300		50							96	
300	15/7/99	04:06	60 49.01N	360 01.33E	155	12525	75												
301	15/7/99	09:10	60 41.90N	000 31.70W	128	701	2		174		15	2	6						
302	16/7/99	08:49	61 03.19N	361 15.15E	148	285	4		1691	787								200	
303	17/7/99	06:03	61 19.04N	000 00.34W	170	1005	2		492		1	16							
304	17/7/99	21:00	60 56.32N	001 00.19W	104	332	26												1 Scad 7 Cod
305	18/7/99	15:46	60 39.96N	001 35.68W	106	5													
306	18/7/99	20:45	60 40.06N	002 14.02W	137	555	76											102	
307	19/7/99	08:26	60 31.94N	002 08.43W	140	2905	5												
308	19/7/99	14:00	60 18.98N	002 18.91W	122	767	42												
309	20/7/99	07:49	60 04.16N	002 10.36W	95		4					2							O grp Pout meshed
310	21/7/99	15:21	59 26.55N	003 37.45W	165	890													
311	22/7/99	05:10	59 18.95N	003 25.39W	115	591	1				1								8 Spurdog
312	22/7/99	13:55	59 07.00N	003 53.34W	107	3393	53	7											
313	23/7/99	06:46	58 59.39N	003 59.34W	60														O grp Pout meshed

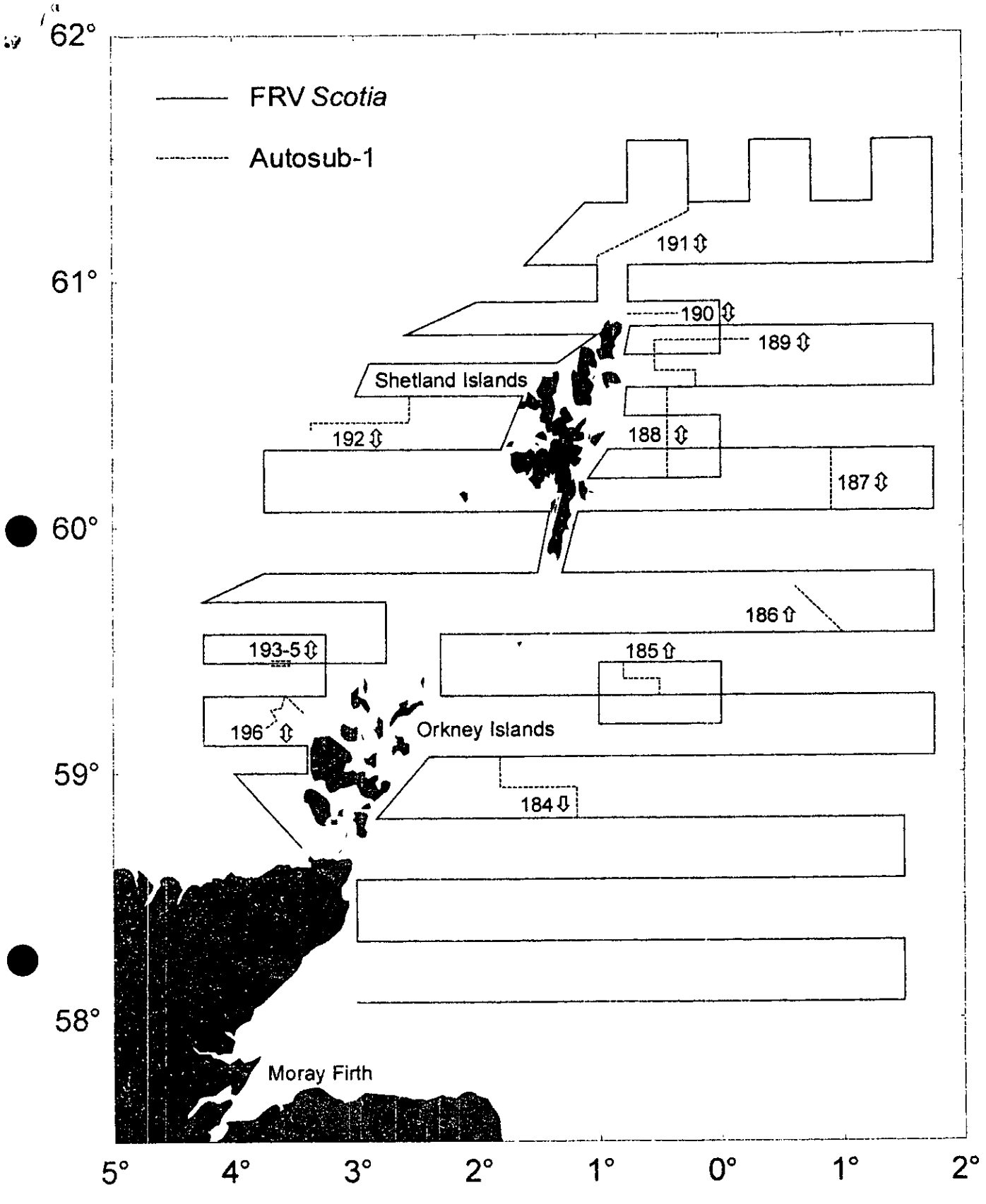
62°
61°
60°
59°
58°
5°
4°
3°
2°
1°
0°
1°
2°
FRV Scotia
Autosub-1
191
190
189
Shetland Islands
192
188
187
186
193-5
185
196
Orkney Islands
184
Moray Firth

Figure 1

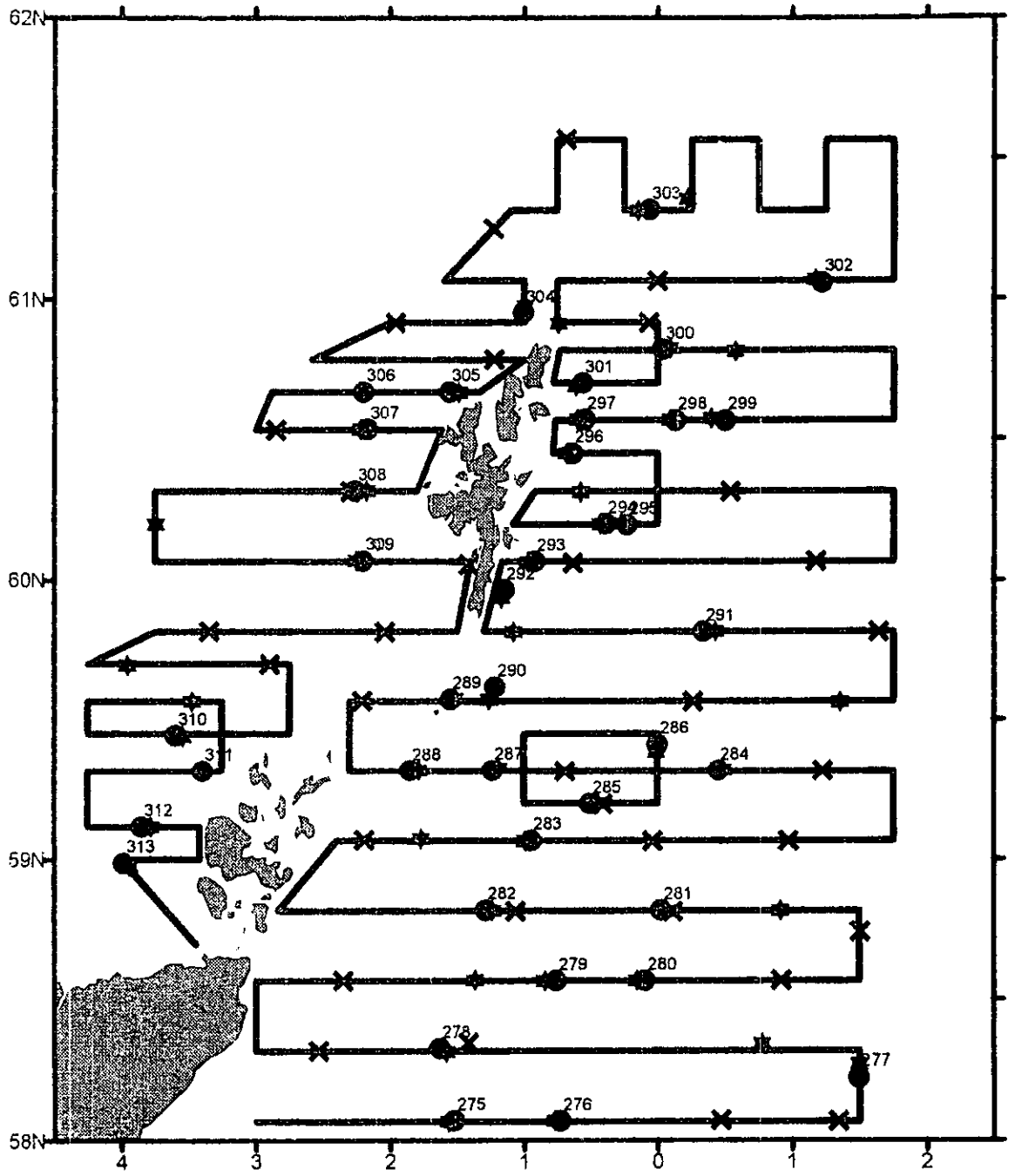

Figure 2. Cruise track, trawl stations (●), CTD stations (✱), XBT Stations (✕)
FRV Scotia 1-24 July 1999