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RV *Dana* (Danish Fisheries Research Institute)

Cruise 11/96 (**Marine Laboratory Aberdeen cruise 2196H**)

Collaborative cruise between Danish Fisheries Research Institute (DFU) and SOAEFD Marine Laboratory Aberdeen

REPORT

18 November - 19 December 1996

Personnel

M Heath	PSO (SOAEFD)
K Richardson	DFU (3-18 December)
A Christoffersen	DFU (20 November - 3 December)
S Jonsdottir	DFU
J Melbye	DFU (20 November - 3 December)
L Pedersen	DFU
M Sørensen	DFU
I Bruun	DFU (3-18 December)
J Dunn	HSO (SOAEFD)
J Hunter	PTO (SOAEFD)
H Madden	RAAU (SOAEFD)
A Bryant	RAAU (SOAEFD)

Objectives

1. To track the overflow of Norwegian Sea water along the southern face of the Iceland-Scotland Ridge.

2. To determine the distribution, development and physiological states of *Calanus finmarchicus* in relation to the oceanographic features of Iceland-Scotland Ridge.

3. To collect measurements of primary production and copepod egg production.

Narrative

Dana sailed from Hirtshals on 18 November and arrived in Aberdeen late the following day. SOAEFD equipment was loaded on the morning of 20 November and the vessel sailed in the evening of the same day. The vessel them made a passage around the north of Scotland to commence sampling at the shelf edge northwest of the Hebrides.

Between 21-28 November sampling was carried out along a line of 10 stations running across Rockall Bank and into the Iceland Basin as far as longitude 23°W. Various technical problems with the ARIES and CTD sampling equipment were encountered during this period which, combined with the persistently poor weather conditions, contributed to

A secondary problem with ARIES was that at high pressures (>2,100 m depth) the forces on the O-rings sealing the rotating motor shaft which drives the plankton net changing system became sufficient to stall the motor. Samples were collected down to 2,100 m, but the system failed thereafter. After communication with Aberdeen, a solution was devised, but remedial action had to wait until the vessel arrived in Torshavn allowing the motor unit to be dismantled for machining work. Following this work, the system functioned correctly down to the maximum achievable depth of 3,000 m.

Equipment failures also occurred with the SEABIRD CTD system mounted on ARIES. The temperature sensor housing leaked sufficiently to cause the sensor to fail. Fortunately a spare was available aboard the ship and a replacement was shipped to Torshavn.

Taken overall however, the equipment worked well considering the extreme conditions under which it was used. Forty-eight ARIES deployments were completed, plus one deployment for engineering trials and heel/pitch measurements. Out of these, a potential 2,499 plankton samples and 2,299 water samples could have arisen. A total of 1,940 plankton samples (77.6%) were realised, and close to 100% of the water samples. CTD data were obtained on 45 of the deployments, and 100% data return was achieved from the OPC.

In addition to the above, the Dual MIKT system (2.5 m^2 mouth opening, 1,500 micron mesh) was deployed at seven stations to a depth of 1,000 m, collecting samples from the upper 500 m and the lower 500 m separately. Twenty-three vertical haul plankton collections were carried out to obtain live specimens of *C. finmnarchicus* for physiological studies, and 25 primary production measurements were completed.

Results

The objective of the study was to map the wide scale distribution of overwintering *Calanus finmarchicus*. Numerical modelling studies carried out in advance of the survey had indicated key areas which should be investigated. Broadly, these divided into four regions:

- Atlantic south of the Iceland Scotland Ridge
- Faeroe-Shetland Channel
- Norwegian Sea
- The Iceland Scotland Ridge

The main Atlantic and polar water masses in the region were readily identifiable from their temperature-salinity characteristics. Surface water temperatures ranged from >10°C along the Scottish shelf edge to <0.5°C in the extreme northern part of the area. The subpolar front running parallel to the north face of the Iceland-Scotland Ridge was the dominant surface feature of the area as a whole. Subsurface overflow of Norwegian Sea deep water over the Iceland Scotland Ridge was identified at several locations, probably being strongest close to the Iceland shelf, and through the Faeroe Bank Channel.

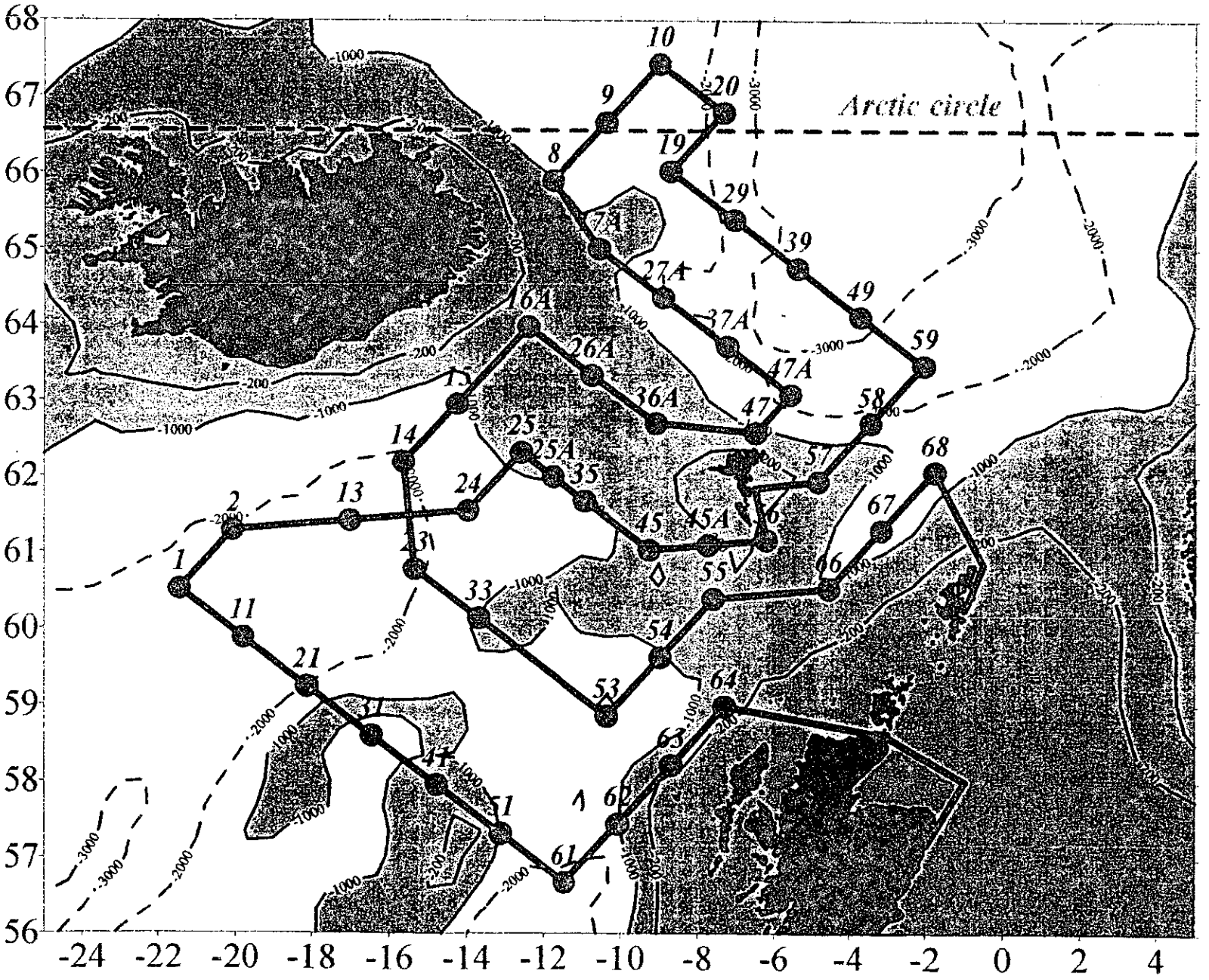
The net sampling system on ARIES was set to collect material over 40-60 m depth intervals during each tow. At the same time, the OPC was programmed to integrate particle size distributions over approximately 20 m depth intervals. Outstanding data returns were obtained from the OPC, and even on a qualitative basis it was possible to relate the occurrence of particular species in depth layers to the incidence of particle counts in certain size classes. *C. finmarchicus* were associated with particle counts in the range 1,200-1,400 microns equivalent spherical diameter. The larger *C. hyperboreus*, when

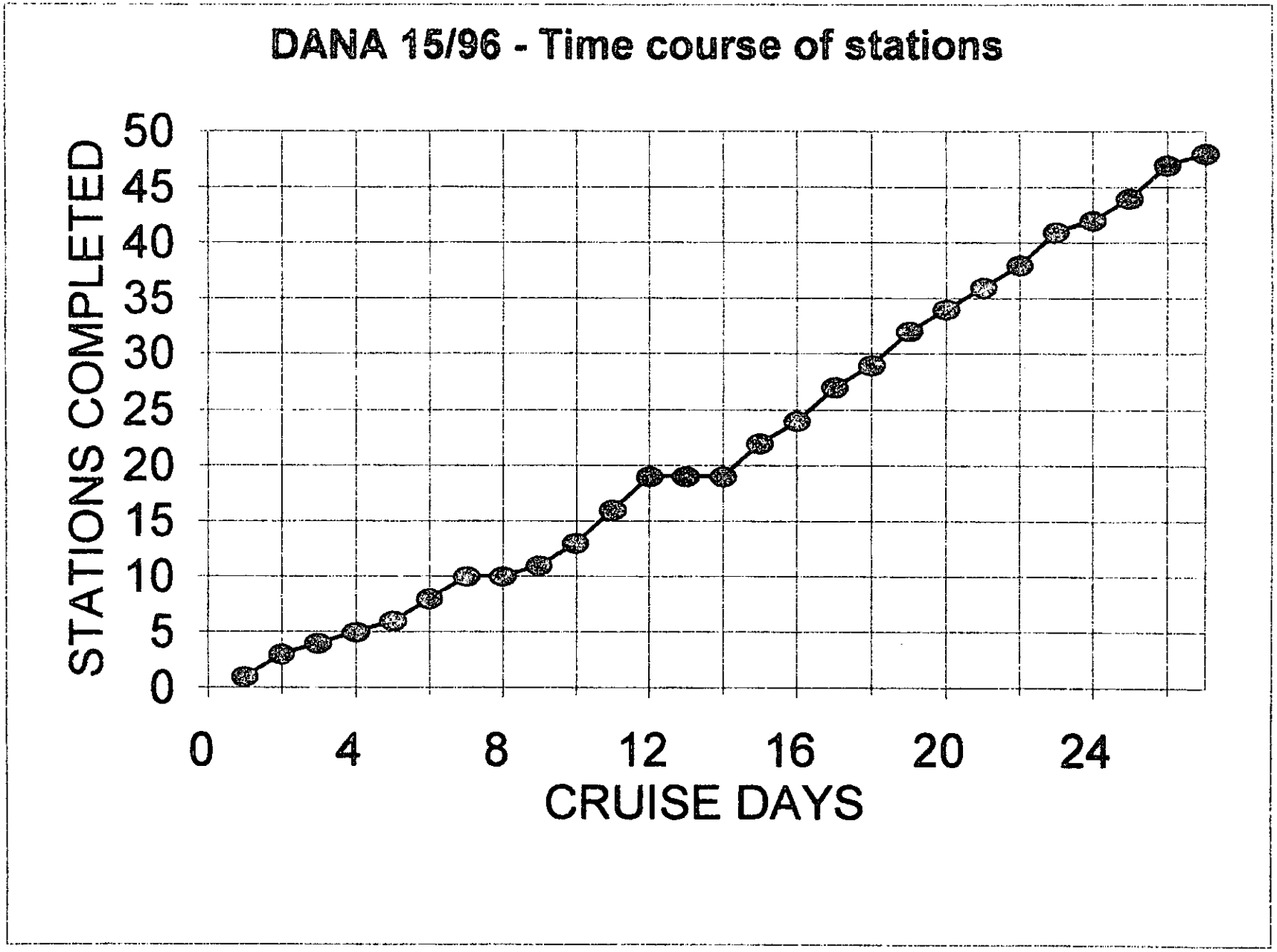
Station number	Date	ARIES/OPC deployment number	DMIKT deployment number	Vertical net station	CTD/primary production measurements
64	21/11/96	2		✓	✓
63	22/11/96	5			
62	22/11/96	12		✓	✓
61	23/11/96	15	18		
51	24/11/96	19			
41	25/11/96	24		✓	✓
31	26/11/96	29		✓	✓
21	26/11/96	34		✓	✓
11	27/11/96	37	40		
1	27/11/96	43		✓	✓
2	29/11/96	46			
13	30/11/96	50		✓	✓
24	30/11/96	53	56		
25	01/12/96	59		✓	✓
25A	01/12/96	62			
35	01/12/96	65			
45	02/12/96	70		✓	✓
45A	02/12/96	73			
56	02/12/96	77		✓	✓
57	05/12/96	82			
58	05/12/96	87		✓	✓
59	05/12/96	92	95	✓	✓
49	06/12/96	96			
39	06/12/96	101		✓	✓
29	07/12/96	104			
19	07/12/96	109		✓	✓
20	07/12/96	112			
10	08/12/96	116		✓	✓
9	08/12/96	119	122		
8	09/12/96	125		✓	✓
17A	09/12/96	128			
27A	09/12/96	133		✓	✓
37A	10/12/96	136	139		
47A	10/12/96	142		✓	✓
47	11/12/96	147		✓	✓
36A	11/12/96	152		✓	✓
26A	12/12/96	155			
16A	12/12/96	160		✓	✓
15	13/12/96	163			
14	13/12/96	166			✓
23	14/12/96	169			
33	14/12/96	172			✓
53	15/12/96	180		✓	✓
54	15/12/96	183			
55	16/12/96	186			
66	16/12/96	191	194	✓	✓
67	16/12/96	195			
68	17/12/96	198			

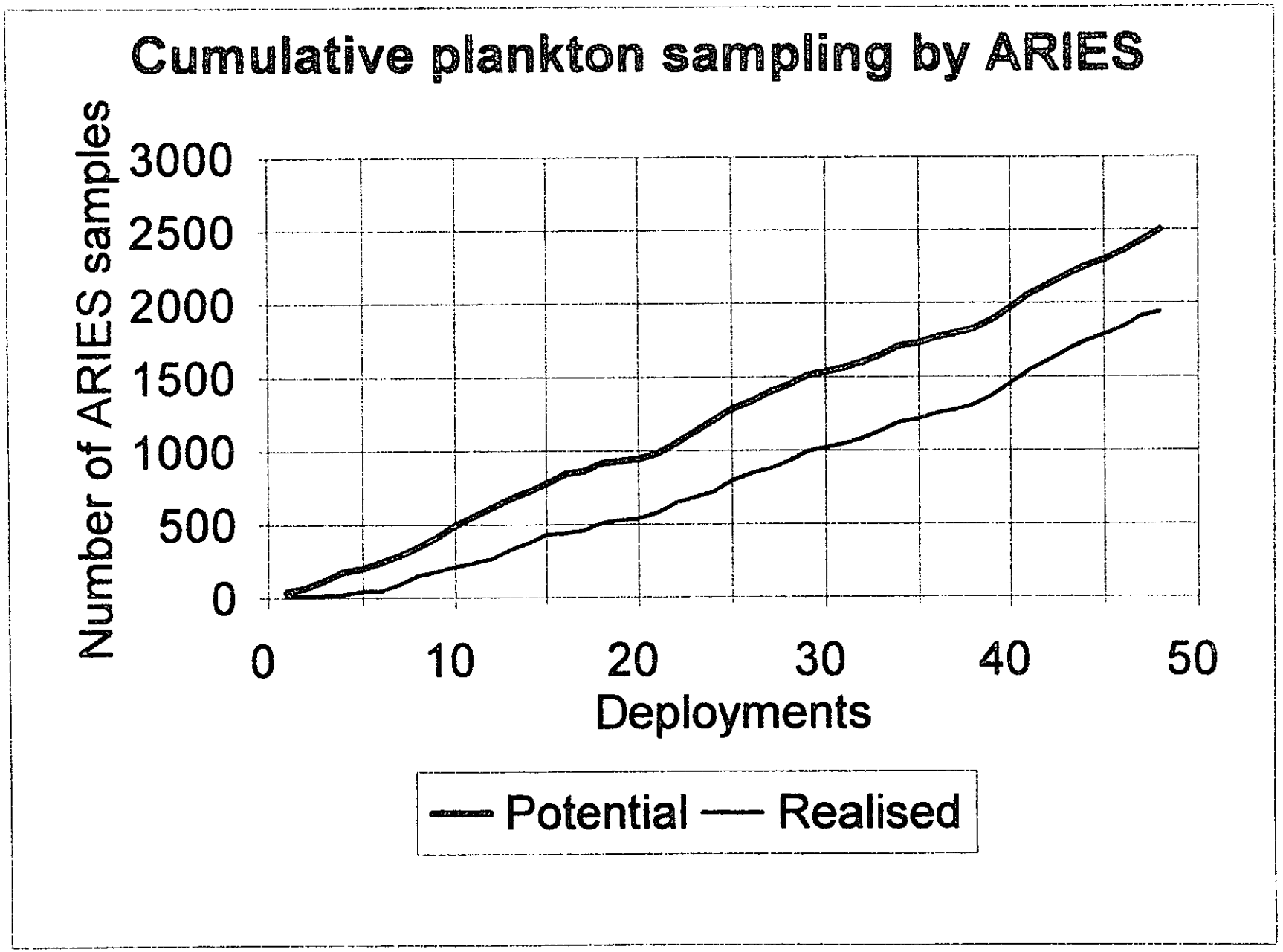
Summary of Optical Plankton Counter deployments

Deploy number	Date	Start time	Mid latitude	Mid longitude	Number samples	Avg. echosnd	Max. depth
2	21/11/96	20:42:32	58,56.52N	007,21.90W	32	109	103
5	22/11/96	02:21:46	58,11.95N	008,42.71W	47	168	168
12	22/11/96	22:45:52	57,24.27N	010,03.62W	137	2000	1765
15	23/11/96	14:50:21	56,35.50N	011,30.28W	253	2500	2429
19	24/11/96	15:30:34	57,18.14N	013,07.92W	39	262	253
24	25/11/96	16:04:37	57,54.86N	014,50.01W	72	546	511
29	26/11/96	03:21:03	58,35.87N	016,32.07W	127	1215	1115
34	26/11/96	18:45:15	59,18.58N	018,08.64W	166	1650	1506
37	27/11/96	04:05:51	59,52.80N	019,31.91W	268	2680	2429
43	27/11/96	19:49:42	60,36.51N	021,23.08W	302	2540	2528
46	29/11/96	11:31:15	61,18.15N	019,51.89W	258	2380	2367
50	30/11/96	02:26:22	61,25.25N	016,42.44W	242	2400	2331
53	30/11/96	13:26:27	61,36.14N	013,51.63W	163	1650	1634
59	01/12/96	06:31:28	62,20.44N	012,33.41W	99	991	931
62	01/12/96	11:14:14	62,00.68N	011,41.99W	105	1170	1153
65	01/12/96	16:57:04	61,38.66N	011,00.25W	132	1235	1260
70	02/12/96	09:38:02	61,12.49N	009,02.33W	34	315	281
73	02/12/96	13:35:46	61,09.51N	007,46.73W	100	905	863
77	02/12/96	20:00:24	61,09.13N	006,11.62W	30	234	234
82	05/12/96	01:17:47	61,54.62N	004,49.07W	23	199	198
87	05/12/96	10:30:31	62,39.05N	003,23.01W	75	830	811
92	05/12/96	19:21:17	63,21.54N	002,03.13W	255	2460	2390
96	06/12/96	08:21:12	64,11.00N	003,43.51W	318	3120	2804
101	06/12/96	19:02:00	64,51.73N	005,22.31W	303	2839	2727
104	07/12/96	04:40:59	65,29.25N	006,59.38W	232	2136	1835
109	07/12/96	14:40:30	66,02.28N	008,37.02W	103	1059	1006
112	07/12/96	21:13:36	66,45.58N	007,08.03W	223	2140	2171
116	08/12/96	13:49:50	67,25.26N	008,50.49W	158	1720	1692
119	08/12/96	21:53:13	66,39.79N	010,25.19W	133	1481	1462
125	09/12/96	09:23:19	65,51.56N	011,42.37W	37	250	219
128	09/12/96	15:13:44	64,58.70N	010,33.09W	50	442	423
133	09/12/96	22:01:34	64,21.41N	008,51.53W	76	966	911
136	10/12/96	04:08:31	63,39.88N	007,12.81W	148	1499	1495
142	10/12/96	16:29:24	63,03.14N	005,43.19W	183	1912	1830
147	11/12/96	02:41:40	62,45.11N	007,02.12W	34	303	279
152	11/12/96	09:35:45	62,40.37N	008,59.63W	71	506	503
155	12/12/96	11:02:04	63,18.58N	010,40.93W	47	386	379
160	12/12/96	19:15:15	63,56.31N	012,29.70W	67	509	519
163	13/12/96	02:38:18	62,53.25N	014,19.75W	190	1614	1600
166	13/12/96	10:33:45	62,08.96N	015,25.87W	240	2200	2044
169	13/12/96	21:47:52	60,48.59N	015,17.08W	265	2220	2100
172	14/12/96	08:22:42	59,56.72N	013,49.59W	132	1196	1197
180	15/12/96	03:38:40	58,49.88N	010,16.15W	187	1850	1750
183	15/12/96	13:34:16	59,38.02N	009,06.19W	130	1410	1392
186	16/12/96	00:38:40	60,11.84N	006,34.23W	122	1211	1216
191	16/12/96	10:41:23	60,36.28N	004,38.82W	112	1087	1067
195	16/12/96	20:33:23	61,19.47N	003,13.77W	146	1305	1237
198	17/12/96	04:10:07	62,05.04N	001,45.68W	194	1596	1593

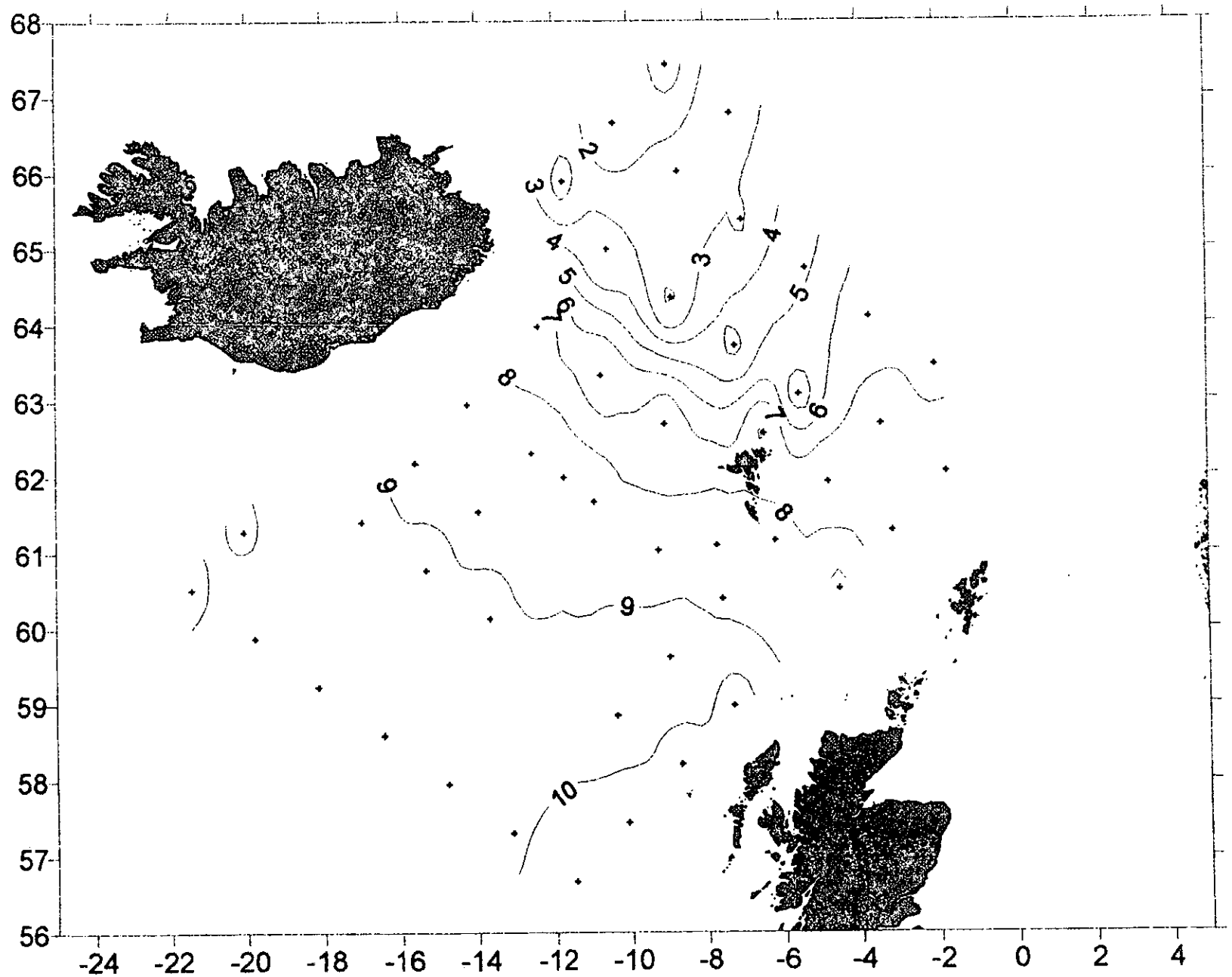
Dana 15/96 - survey track and sampling locations 20/11/96 - 17/12/96



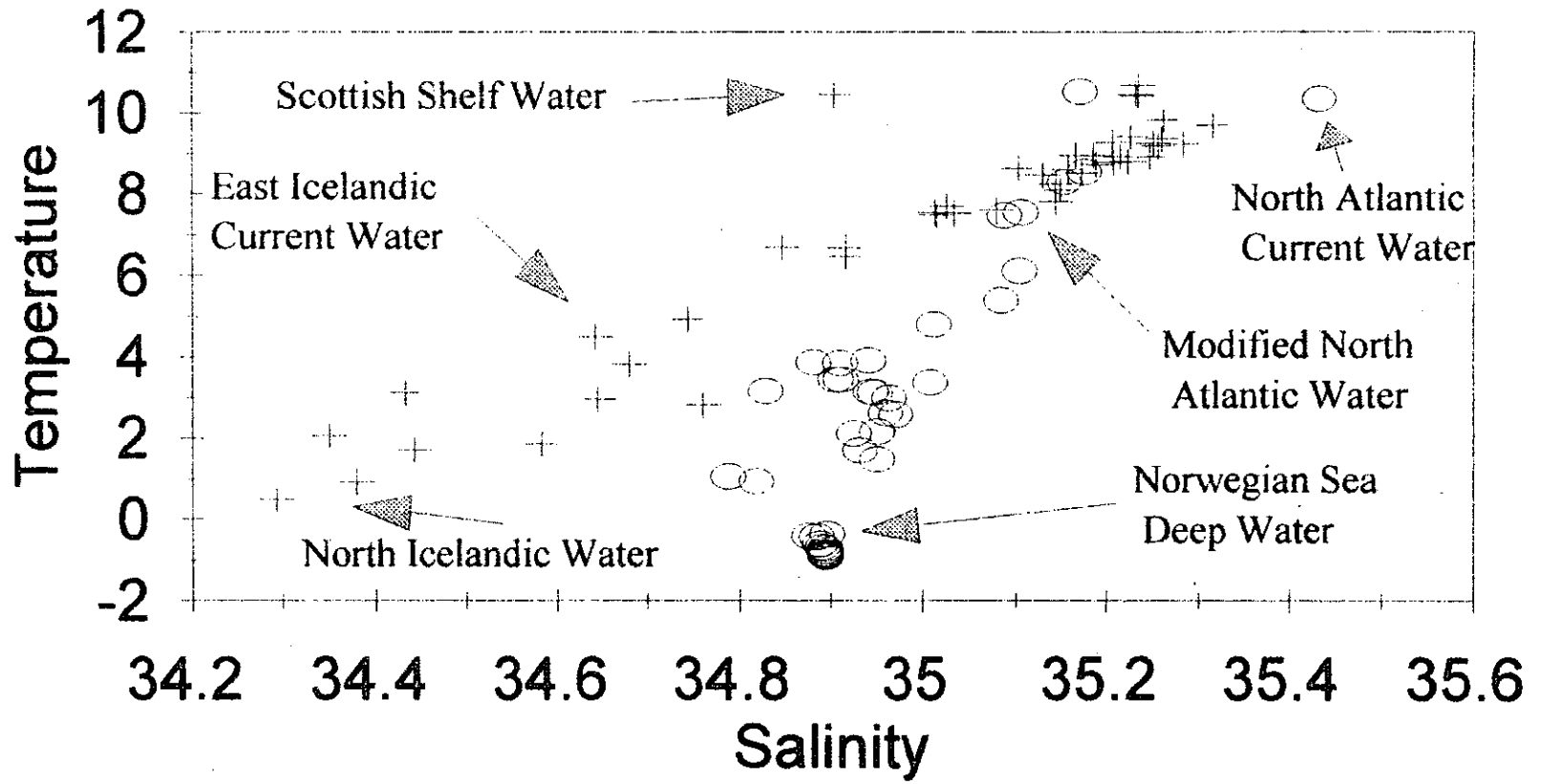

DANA 15/96 - Time course of stations
STATIONS COMPLETED
0
5
10
15
20
25
30
35
40
45
50
0
4
8
12
16
20
24
CRUISE DAYS


Cumulative plankton sampling by ARIES
Number of ARIES samples
3000
2500
2000
1500
1000
500
0
0
10
20
30
40
50
Deployments
Potential
Realised

Dana 15/96 Sea surface temperature



Dana 15/96 Surface & bottom temperature-salinity relationship



Integrated OPC particles/m^2 in size range 1200-1400um and depth range 400-1500m