Scottish Marine Biological Association

Dunstaffnage Marine Research Laboratory

M/V "Dawn Sky"

2-15 June 1986

Cruise Report S.M.B.A. (All times GMT)

M/V "Dawn Sky"

on charter from Warbler Shipping 2-15 June 1986

First Leg from Fleetwood to Troon

Dates 2 - 7 June 1986

Second Leg from Troon to Dunstaffnage

Dates 7 - 15 June 1986

Personnel			
	R. Bowers		SMBA
	P. Bradley		SMBA/Glasgow University
	A. Edwards	(Principal Scientist)	SMBA
	J. Graham		SMBA
	C. Griffiths		SMBA
	K. Jones	(Leg 2)	SMBA
	N. MacDougall		SMBA
	C. Petre	(Leg 2)	SMBA
	J. Read	(Leg 1)	MAFF
	J. Robson	(Leg 1 till 5th June)	MAFF

Aims

There were eight principal aims:

(1) To service 9 MAFF current meter moorings in the Irish Sea.

(2) To service a MAFF tetrapod assembly and guard buoys in the northeast Irish Sea

(3) To work a twelve hour station near the relaid tetrapod in the northeast Irish Sea.

(4) To service three SMBA current meter moorings in the southern Clyde Sea.

(5) To service a SMBA current meter mooring in the Tiree Passage.

(6) To collect large volume water samples for radiocaesium determinations, in the Irish Sea and South Minches for MAFF, in the North Channel and on the Scottish continental shelf for SMBA/Glasgow University (Professor Baxter).

(7) To make temperature-salinity-depth surveys, in the Irish Sea, the Clyde Sea, and on the Scottish Shelf.

(8) To map nutrient and phytoplankton distributions in the Clyde Sea and on the Scottish Shelf.

Narrative

First Leg:

Some staff joined "Dawn Sky" on Saturday 31st May (RB, AE, JG, CG, NMcD) and on the 1st June put gear in order. The remainder of staff (PB, JR, JR) joined on 1st June when MAFF gear was loaded. The main problems were provision of a CTD winch and hydrographic winch: a slip ring winch provided by the vessel's owners was used as a take up spool for the CTD wire, which was hauled and veered by two turns on a trawl winch warping drum; a cargo winch warping drum was used as a winding drum for 300 m of armoured cable (provided by RVS, Barry), measured through a metering block hung on the ship's crane; these arrangements proved easy and reliable and we thank the vessel's officers and crew for their patience and ingenuity.

"Dawn Sky" sailed on the morning of 2nd June but was immediately delayed at anchor until 1800 h until the steering gear had been repaired. The ship then headed for station Y. The Neil Brown CTD and logging system was tested in about 25 m of water at 2100 Z and worked satisfactorily. Mooring Y was picked up at 0500 Z on the 3rd June,

serviced and relaid. In the rest of the day, moorings W, T and S were recovered and relaid at T and S. CTD and Caesium sampling was done at all these stations. Early on the 4th June, CTD and Caesium sampling was done at stations P, Q, Q1 and R. After daybreak the ship retracked to service moorings at P, Q and R, then proceeding in a NW 6/7 wind to AA to retrieve the tetrapod by 1845 h. Because of instrument damage, the tetrapod could not be relaid in its new position. Because of a choppy sea in a gusty north-westerly 5/6 wind it was impracticable to start a 12 hour station at the new tetrapod position. The vessel therefore headed to stations M and N for CTD and Caesium sampling in the night. On the 5th June in daylight moorings M and N were serviced in the forenoon and the "Dawn Sky" sailed in calmer weather to anchor off Whitehaven, where J. Robson was put ashore by boat in the early afternoon. The vessel sailed to new position AA' for a twelve hour programme of CTD, water sampling and current measurement at anchor in a depth of aboug 19 m. The station was started at 1330 Z in quiet conditions. Winds remained light, shifting from NW to SW, and then to NE early on the 6th June. Light transmission could not be measured because of instrument failure. After a shaky start, the Inter-Ocean S4 current meter, hung about 6 m deep, gave apparently good measurements. Sets of six water samples from surface, mid water and bottom were collected every hour for later measurement of suspended solids. The station was left at 0200 Z 6th June and the vessel steamed to line P from Isle of Man to Luce Bay for CTD work. The P line was completed by 0900 Z. CTD line Z in the North Channel was completed by 1900 Z and the ship completed the first leg of the cruise by working CTD lines Y and FR in the Clyde Sea during the night, docking at Troon at 0800 Z on the 7th of June. MAFF gear was unloaded, some for carriage to Oban and some to Lowestoft. J. Read left the ship. K. Jones and C. Petre joined.

Second Leg:

"Dawn Sky" left Troon at 1310 Z in northwesterly winds force 6/7 and headed for mooring C6. This mooring was recovered around 1530 Z without the instrument wire and subsurface float. The ship sheltered in the lee of Arran in force 7 NW winds while a new mooring was assembled. The new mooring was relaid and the vessel then steamed to inspect moorings at C4 and C5. Both were in position but any work was impossible in choppy conditions and the ship went to CTD station 5Y to start a line of CTD and water sampling stations northwards through Kilbrannan Sound to Lower Loch Fyne. CTD station AB42 in the northern entrance to Kilbrannan Sound was completed by 0800 Z on the 8th of June and "Dawn Sky" returned to moorings C5 and C4 to recover and relay each of them successfully by mid afternoon. CTD and water sampling work was resumed in Inchmarnock Water at 1730 Z and continued in Loch Fyne and the Inner Firth during the night and morning of the 9th June. By 0700 Z, S/SW winds force 7/8/9 were making conditions unworkable south of the Cumbraes and the vessel sought shelter in Rothesay Bay until 1700 Z when work was resumed East of Arran on CTD sections and water sampling. This work continued through 10th June. DAFS mooring stations C1, C2 and C3 were sighted in the afternoon in apparently good condition. CTD and sampling stations continued in the night. Line A in the North Channel was completed in clear calm conditions before noon on the 11th June and the vessel left the Clyde Sea to start a line of CTD and sampling stations from Lough Foyle to the Oa of Islay. The line was complete by 2000 Z and course was set for the western end of the Sound of Mull to start line G. Line G was started in southerly winds in the early morning of 12th June but abandoned at G4 in a southerly gale. The ship sheltered in Bloody Bay until 1730 Z then headed east along the Sound of Mull to start CTD line FL at about 2100 Z.

This work continued during the 13th of June. Moorings M1 and M2 were sighted in satisfactory condition during the early afternoon and M3 was inspected closely in an effort to attach floats to the floating line from its sub-surface float. The line could not be found and this attempt was abandoned: otherwise the mooring was in good condition. The FL line was completed in freshening southerly winds and the ship headed for the start of the G line at Barra Head. The line was started in moderate southerly swell at 0120 Z on 14th June and completed in the early afternoon in calmer seas. Stations Muck 1 and 2 were worked to pass time until tidal conditions were right to service mooring Y in the Tiree Passage at 1700 Z. During the night, stations were worked down the Sound of Mull and the "Dawn Sky" docked at Dunstaffnage at 0900 Z on 15th June.

Results

(1) All 9 MAFF current meter moorings were visited and some were relaid. These mooring operations are summarised in Table 1.

(2) The MAFF tetrapod was recovered but could not be relaid because of equipment damage.

(3) The 12 hour tetrapod station was worked in large part, although light measurement was not possible.

(4) The 3 Clyde Sea SMBA moorings were all serviced and 3 DAFS moorings in the Clyde Sea were inspected. Mooring details are shown in Table 2.

(5) The SMBA Tiree Passage mooring was serviced satisfactorily.

(6) All required MAFF large water samples were obtained at mooring sites in the Irish Sea and along section G in the southern Minch. Similar acidified samples were collected for the University of

Glasgow along lines Z, A and FL (replacing line D). These samples are listed in Table 3.

(7) 148 CTD casts were made with the SMBA Neil Brown profiling CTD in the Irish Sea, Clyde Sea and Scottish continental shelf south of Barra. With frequent attention to various communications problems and small leakages, the instrument worked reasonably well. The casts are summarised in Table 4 and the lines of stations appear in Fig. 1.

(8) A large number of chlorophyll and nutrient measurements were made in the Clyde Sea and Scottish shelf areas. The results are tabulated in Table 5.

Acknowledgements

The scientific staff appreciate the cheerful competence of the captain - Mr Colin Spall - the officers and crew of the "Dawn Sky". Thanks to them, all teething problems were overcome speedily and the cruise aims achieved.

A. Edwards

15/6/86.

Table 1.

MAFF Moorings. June 86. Times GMT. CTD cast, bottom and surface samples for Caesium determination at all mooring stations (not AA).

Name	Uplifted Time	Relaid Time	New Position	Remarks
Y	0625/3rd	0920/3rd	53°36.1'N 4°37.38'W	0 meters recovered 2 meters relaid
W	1210/3	-	-	0 meters recovered
V	1450/3	1630/3	53°58.36'N 4°40.06'W	2 meters recovered 2 meters relaid
S	1935/3	2048/3	54°19.29'N 4°13.90'W	2 meters recovered 2 meters relaid
P	0815/4	0947/4	54°29.5'N 3°41.34'W	0 meters recovered 2 meters relaid
Q	1000/4	1115/4	54°27.35'N 3°49.2'W	2 meters recovered 2 meters relaid
R	1310/4	1420/4	54°22.59'N 4°3.05'W	2 meters recovered 2 meters relaid
AA	1745/4	-	-	Tetrapod recovery
M	0650/5	0813/5	54°34.99'N 4°22.12'W	2 meters recovered 2 meters laid
N	0905/5	-	-	1 meter recovered

Table 2.

SMBA Moorings. June 86. Times GMT.

Name	Time Up	Time Relaid	New Position	Remarks
C6	1531/7	1820/7	55°23.62'N 5°04.83'W	2 meters (4 m, 50 m from bottom). Depth 83 m.
C5	1144/8	1255/7	55°21.94'N 5°26.96'W	1 meter (10 over bottom) Depth 41 m.
C4	1335/8	1425/8	55°19.65'N 5°20.97'W	2 meters (7 m, 30 m over bottom). Depth 51 m.
Y	1625/14	1807/14	56°37.34'N 6°24.22'W	1 meter (10 m over bottom) Depth 45 m.

Table 3.

Caesium samples other than at MAFF mooring positions, June 86.
G (Glasgow). M (MAFF).

Station	Date	Time	Lat. N.	Long. W.	Depths, m	Analyst
1Z	6	1150	54°40'	5°30'	0	G
2Z	6	1250	54°41'	5°25'	0, 35, 70	G
3Z	6	1320	54°43'	5°20'	0, 80, 160	G
4Z	6	1550	54°44'	5°15'	0, 140, 280	G
5Z	6	1720	54°46'	5°10'	0, 65, 130	G
6Z	6	1830	54°48'	5°05'	0	G
1A	11	0530	55°17'	5°43'	0	G
2A	11	0610	55°15'	5°47'	0, 160	G
3A	11	0720	55°13'	5°52'	0	G
4A	11	0830	55°11'	5°56'	0, 120	G
5A	11	0920	55°09'	6°00'	0	G
1G	12	0420	55°40'	6°08'	0, 50, 100	M
2G	12	0550	55°41'	6°17'	0, 35	M
FL10	13	0650	56°09'	6°20'	0	G
FL9	13	0720	56°10'	6°30'	0, 25, 50	G
FL8	13	1000	56°10'	6°45'	0	G
FL7	13	1130	56°10'	7°00'	0	G
FL6	13	1251	56°10'	7°15'	0, 45, 90	G
FL5	13	1451	56°10'	7°30'	0	G
FL4	13	1728	56°10'	7°45'	0	
FL3	13	1910	56°10'	8°00'	0, 90	G
FL2	13	2130	56°10'	8°15'	0	G
11G	14	0220	56°44'	7°40'	0, 20, 35	M
10G	14	0420	56°44'	7°30'	0	M
9G	14	0531	56°44'	7°20'	0, 70, 140	M
7G	14	0800	56°44'	7°00'	0, 65, 130	M
6G	14	1008	56°44'	6°45'	0, 35	M
4G	14	1144	56°44'	6°27'	0, 40, 80	M

Table 4

CTD Casts June 1986

Station	Lat. N.	Long. W.	Date	Time Z	Dip. No. Disc 9	Remarks
Y	53°36'	4°38'	3	0828	002	MAFF Mooring Site
W	53°47'	4°39'	3	1225	003	"
V	53°58'	4°40'	3	1515	004	"
S	54°19'	4°14'	3	2102	005	"
R	54°23'	4°04'	3	2253	006	"
Q1	54°25'	3°57'	4	0043	007	-
Q	54°27'	3°50'	4	0203	008	MAFF Mooring Site
P	54°30'	3°32'	4	0340	009	"
M	54°35'	3°21'	4	2335	010	"
N	54°30'	4°22'	5	0114	011	"
AA1	54°39'	3°44'	5	1336	012	Proposed MAFF
2	"	"	5	1436	013	tetrapod site.
3	"	"	5	1530	014	Suspended sediment
4	"	"	5	1630	015	samples also gathered
5	"	"	5	1728	016	at surface mid
6	"	"	5	1827	017	and bottom depths
7	"	"	5	1930	018	every hour on the
8	"	"	5	2032	019	hour. Water depth
9	"	"	5	2135	020	about 19 m.
10	"	"	5	2232	021	"
11	"	"	5	2330	022	"
12	"	"	6	0032	023	"
13	"	"	6	0130	024	"
P6	54°27'	4°26'	6	0518	025	Isle of Man
P7	54°29'	4°30'	6	0552	026	"
P8	54°32'	4°36'	6	0641	027	"
P9	54°34.5'	4°42'	6	0733	028	"
P10	54°38'	4°46'	6	0832	029	Luce Bay
1Z	54°40'	5°30'	6	1146	030	Belfast Lough, C samples
2Z	54°41'	5°25'	6	1244	031	"
3Z	54°43'	5°20'	6	1305	032	"
4Z	54°44'	5°15'	6	1532	033	"
5Z	54°46'	5°10'	6	1709	034	"
6Z	54°48'	5°05'	6	1829	035	Rhinns

Table 4 (Continued)

Station	Lat. N.	Long. W.	Date	Time	Dip. No.	Remarks
1Y	54°57'	5°14'	6	2013	036	North Rhinns
2Y	55°01'	5°20'	6	2113	037	"
3Y	55°05'	5°26'	6	2215	038	"
4Y	55°09'	5°32'	6	2310	039	"
5Y	55°13'	5°38'	7	0020	040	Mull of Kintyre
FR1	55°12'	5°26'	7	0127	041	South of Clyde Front
FR2	55°13'	5°24'	7	0205	042	
FR3	55°14'	5°22'	7	0235	043	
FR4	55°15'	5°20'	7	0315	044	
FR5	55°16'	5°18'	7	0340	045	
FR6	55°17'	5°16'	7	0403	046	
FR7	55°18'	5°14'	7	0428	047	
FR8	55°19'	5°12'	7	0451	048	
FR9	55°20'	5°10'	7	0513	049	
FR10	55°21'	5°08'	7	0536	050	
FR11	55°22'	5°06'	7	0554	051	
5Y	55°13'	5°38'	7	2222	052	Nutrients + chlorophyll
AB5A	55°16'	5°30'	7	2301	053	Nutrients + Chlorophyll
AB15	55°20'	5°28'	7	2356	054	
AB16	55°22'	5°27'	8	0040	055	Nutrients + chlorphyll
AB17	55°27'	5°28'	8	0142	056	Nutrients + chlorphyll
AB48	55°31'	5°23'	8	0250	057	
AB47	55°31'	5°27'	8	0337	058	
AB46	55°34'	5°25'	8	0419	059	Nutrients + chlorophyll
AB45	55°39'	5°26'	8	0545	060	
AB44	55°42'	5°21'	8	0627	061	Nutrients + chlorophyll
AB42	55°45'	5°16'	8	0809	062	Nutrients + chlorophyll
AB38	55°47'	5°14'	8	1738	063	
AB39	55°50'	5°17'	8	1856	064	
AB40	55°54'	5°23'	8	2044	065	
AB41	55°58'	5°23'	8	2221	066	
					Disc 10	
AB37	55°42'	5°09'	9	0132	067	
AB36	55°42'	5°04'	9	0243	068	
AB35	55°50'	4°58'	9	0415	069	
AB34	55°50'	4°55'	9	0452	070	
AB33	55°39'	4°55'	9	1923	071	

Table 4 (Continued)

Station	Lat. N.	Long. W.	Date	Time	Dip. No.	Remarks
AB32	55°38'	5°00'	9	2007	072	Nutrients + Chlorophyll
AB31	55°36'	5°05'	9	2120	073	
AB28	55°28'	4°45'	9	2315	074	
AB27	55°28'	4°50'	10	0004	075	
AB26	55°29'	4°55'	10	0044	076	
AB25	55°29'	5°01'	10	0132	077	Nutrients + Chlorophyll
AB30	55°34'	4°59'	10	0300	078	Nutrients, Chlorophyll and phytoplankton growth.
AB24	55°23'	5°05'	10	0507	079	Nutrients + Chlorophyll
AB23A	55°22'	4°51'	10	0655	080	
AB23	55°22'	4°58'	10	0749	081	
AB22	55°16'	4°56'	10	0914	082	Dip 998 upcast.
AB21	55°19'	5°05'	10	1014	083	
AB20	55°20'	5°08'	10	1054	084	Nutrients + Chlorophyll
AB19	55°22'	5°12'	10	1147	085	
AB18	55°24'	5°20'	10	1238	086	
AB16	55°22'	5°27'	10	1326	087	
AB14	55°19'	5°20'	10	1425	088	
AB13	55°16'	5°13'	10	1508	089	
AB12	55°14'	5°12'	10	1542	090	Nutrients + Chlorophyll
AB11	55°14'	5°03'	10	1645	091	
AB10	55°13'	4°58'	10	1745	092	
AB1	55°05'	5°04'	10	1831	093	
AB2	55°06'	5°08'	10	1858	094	No CTD Calibration
AB3	55°08'	5°13'	10	1946	095	Nutrients + Chlorophyll
AB4	55°09'	5°19'	10	2058	096	
AB5	55°12'	5°27'	10	2207	097	
AB5A	55°16'	5°30'	10	2302	098	
AB3A	55°04'	5°16'	11	0046	099	Nutrients + Chlorophyll
3Y	55°05'	5°26'	11	0250	100	Nutrients + Chlorophyll
1A	55°17'	5°43'	11	0536	101	Cs surface
2A	55°15'	5°47'	11	0606	102	Cs Surface + bottom
3A	55°13'	5°52'	11	0718	103	Cs Surface + Nutrients + Chlorophyll
4A	55°11'	5°56'	11	0825	104	Cs Surface + bottom
5A	55°09'	6°00'	11	0920	105	Cs Surface

Table 4 (Continued)

Station	Lat. N.	Long. W.	Date	Time	Dip. No.	Remarks
1C	55°14'	6°45'	11	1340	106	
2C	55°19'	6°41'	11	1443	107	
3C	55°23'	6°37'	11	1538	108	
4C	55°28'	6°33'	11	1640	109	
5C	55°33'	6°30'	11	1729	110	
6C	55°37'	6°26'	11	1827	111	
7C	55°42'	6°22'	11	1925	112	
1G	56°40'	6°08'	12	0422	113	Cs surface, mid bottom
2G	56°41'	6°17'	12	0550	114	Cs, Nutrients + chlorophyll
3G	56°42'	6°22'	12	0650	115	Surface salinity only
FL14	56°20'	5°41'	12	2108	116	Nutrients + Chlorophyll
FL13	56°17'	5°50'	12	2236	117	Nutrients + Chlorophyll
5E	56°16'	6°05'	12	2357	118	Nutr. + Chlor. + incubation
4E	56°14'	6°02'	13	0054	119	
3E	56°11'	5°59'	13	0153	120	
2E	56°08'	5°56'	13	0252	121	
1E	56°05'	5°53'	13	0338	122	Nutrients + Chlorophyll
FL11	56°12'	6°10'	13	0515	123	Nutrients + Chlorophyll
FL10	56°09'	6°20'	13	0647	124	Cs, Nutr. + Chlor.
FL9	56°10'	6°30'	13	0712	125	Cs, Nutr. + Chlor.
FL8	56°10'	6°45'	13	1000	126	Cs, Nutr. + Chlor.
FL7	56°10'	7°00'	13	1128	127	Cs, Nutr. + Chlor.
FL6	56°10'	7°15'	13	1255	128	Cs, Nutr. + Chlor.
FL5	56°10'	7°30'	13	1451	129	Cs, Nutr. + Chlor.
					Disc 11	
FL4	56°10'	7°45'	13	1728	130	Nutr. + Chl. No Cal.
FL3	56°10'	8°00'	13	1910	131	Cs, Nutr. + Chlor.
FL2	56°10'	8°15'	13	2130	132	Cs, Nutr. + Chlor.
11G	56°44'	7°40'	14	0220	133	Cs, Nutr. + Chlor.
10G	56°44'	7°30'	14	0420	134	Cs
9G	56°44'	7°20'	14	0531	135	Cs, Nutr. + Chlor.
8G	56°44'	7°10'	14	0700	-	Surface Salinity only
7G	56°44'	7°00'	14	0800	136	Cs, Nutr. + Chlor.
6G	56°44'	6°45'	14	1008	137	Cs, Nutr. + Chlor.
5G	56°44'	6°36'	14	1108	-	Surface Salinity only

Station	Lat. N.	Long. W.	Date	Time	Dip. No.	Remarks
4G	56°44'	6°27'	14	1144	138	Cs, Nutr. + Chlor
MUCK 1	56°49'	6°12'	14	1341	139	No Calibration
MUCK 2	56°45'	6°16'	14	1504	140	No Calibration
ML 1	56°41'	6°13'	14	1856	141	No Calibration
ML 2	56°40'	6°08'	14	1936	143	" "
ML 3	56°37'	6°00.5'	14	2034	144	" "
ML 4	56°32.5'	5°54'	14	2125	145	" "
ML 5	56°31.5'	5°46.5'	14	2204	146	" "
ML 6	56°29.5'	5°38.5'	14	2300	147	" "
ML 7	56°24'	5°38'	15	0001	148	" "

Table 5

Summary of chlorophyll, nitrate and silicate results - M.V. Dawn Sky 1/86, June 7-15, 1986: (Chlor. = chlorophyll; Pheo = pheopigment; A.R. = acid ratio; ND = not determined.

Station	Depth	Chlor.	Pheo.	A.R.	Nitrate	Silicate
		mg m^{-3}			mg- at m^{-3}	
AB3	5	2.69	3.50	1.44	0.83	2.38
	15	2.84	0.26	1.94	2.10	2.61
	25	0.68	0.47	1.60	4.04	2.70
	35	0.28	0.27	1.51	5.03	3.77
	45	0.21	0.30	1.42	5.09	3.58
	55	0.24	0.34	1.42	5.09	4.22
AB 3A	5	3.40	0.05	2.01	1.49	2.43
	10	3.00	0.17	1.96	2.00	2.34
	20	1.34	0.20	1.89	3.33	2.89
	30	0.83	0.20	1.82	3.95	3.01
	40	0.27	0.17	1.63	4.67	3.17
	70	0.26	0.17	1.61	5.06	3.22
AB 5A	5	3.14	0.21	1.96	3.07	2.89
	20	1.15	0.25	1.84	5.37	3.28
	40	0.91	0.31	1.76	5.67	3.66
AB 12	5	6.16	0.09	2.01	0.18	1.56
	10	5.57	0.63	1.92	0.16	1.55
	15	4.82	0.72	1.89	0.46	1.82
	25	2.97	0.35	1.91	2.34	2.32
	30	0.25	0.65	1.28	5.35	3.51
	45	0.20	0.48	1.30	5.83	3.89
AB 16	5	3.74	0.58	1.88	1.65	2.28
	20	2.21	0.38	1.87	3.46	2.97
	40	1.12	0.91	1.56	4.51	3.31
AB 17	5	7.05	0.48	1.95	0.03	1.39
	30	0.21	0.46	1.32	5.65	4.82
	60	0.17	0.46	1.28	8.86	8.29

Station	Depth	Chlor.	Pheo.	A.R.	Nitrate	Silicate
		mg m^{-3}			mg- at m^{-3}	
AB 20	5	7.11	0.56	1.95	0.98	0.90
	10	6.91	0.70	1.93	0.80	1.12
	20	6.26	0.65	1.92	1.30	1.03
	25	3.86	0.47	1.89	3.24	1.55
	35	0.35	0.87	1.29	5.60	3.74
	50	ND	ND	ND	6.14	5.07
AB 24	5	5.58	0.46	1.94	0.98	0.90
	10	5.47	0.73	1.90	0.80	1.12
	15	1.71	0.90	1.67	1.30	1.03
	30	0.03	0.07	1.33	3.24	1.55
	50	0.19	0.48	1.29	5.60	3.74
	70	0.16	0.39	1.30	6.14	5.07
AB 25	5	2.85	0.72	1.81	4.95	2.35
	15	2.15	0.33	1.89	6.26	3.17
	30	0.51	0.50	1.52	8.21	4.41
	44	0.24	0.46	1.35	8.81	5.11
	90	0.11	0.39	1½23	7.75	5.87
	105	0.11	0.41	1.22	8.29	6.86
AB 30	5	3.73	0.59	1.88	2.48	1.97
	10	4.11	0.67	1.88	ND	ND
	15	2.12	0.55	1.81	4.29	2.31
	25	1.08	0.75	1.60	5.24	2.92
	40	0.20	0.73	1.22	7.12	4.27
	65	0.15	0.44	1.26	5.93	4.67
	95	0.22	0.32	1.42	7.84	6.36
AB 32	5	1.92	0.48	1.87	4.09	2.82
	15	1.69	0.66	1.73	4.74	2.67
	30	0.33	0.87	1.28	6.23	3.88
	50	0.17	0.72	1.20	6.95	5.01
	70	0.13	0.32	1.30	7.46	5.33
	130	0.09	0.23	1.29	10.13	7.58

Station	Depth	Chlor.	Pheo.	A.R.	Nitrate	Silicate
		mg m^{-3}			mg- at m^{-3}	
AB 34	5	29.61	0.05	2.02	0.34	0.59
	12	29.30	0.37	2.01	0.52	0.67
	20	3.34	0.34	1.93	9.13	4.77
	35	0.25	0.55	1.32	7.92	4.71
	65	0.15	0.65	1.19	8.07	5.74
AB 37	5	2.73	0.94	1.76	2.16	3.21
	15	3.16	0.50	1.88	2.25	2.68
	25	0.15	0.31	1.32	6.83	4.09
	50	0.05	0.47	1.10	8.05	4.39
	100	0.11	0.24	1.31	8.31	5.57
	170	0.56	1.87	1.23	10.98	13.64
AB 38	5	2.94	0.34	1.91	4.64	4.13
	15	1.20	0.35	1.79	6.38	4.58
	30	0.07	0.37	1.16	9.22	5.00
	60	0.09	0.32	1.22	7.82	5.60
	90	0.10	0.30	1.26	7.81	5.58
	120	0.06	0.05	1.19	10.57	8.48
AB 39	5	1.67	0.67	1.73	5.54	4.36
	15	0.22	0.39	1.37	7.59	4.48
	25	0.08	0.39	1.17	8.89	5.41
	40	0.05	0.37	1.12	8.25	4.73
	60	0.07	0.35	1.17	8.34	5.05
	80	0.08	0.26	1.25	9.67	5.51
AB 40	5	1.15	0.37	1.77	7.11	5.17
	15	0.55	0.28	1.67	7.41	4.40
	25	0.09	0.28	1.26	9.57	5.57
	45	0.04	0.37	1.09	10.30	6.11
	80	0.10	0.27	1.28	10.60	7.40
	140	0.10	0.25	1.29	10.58	10.52

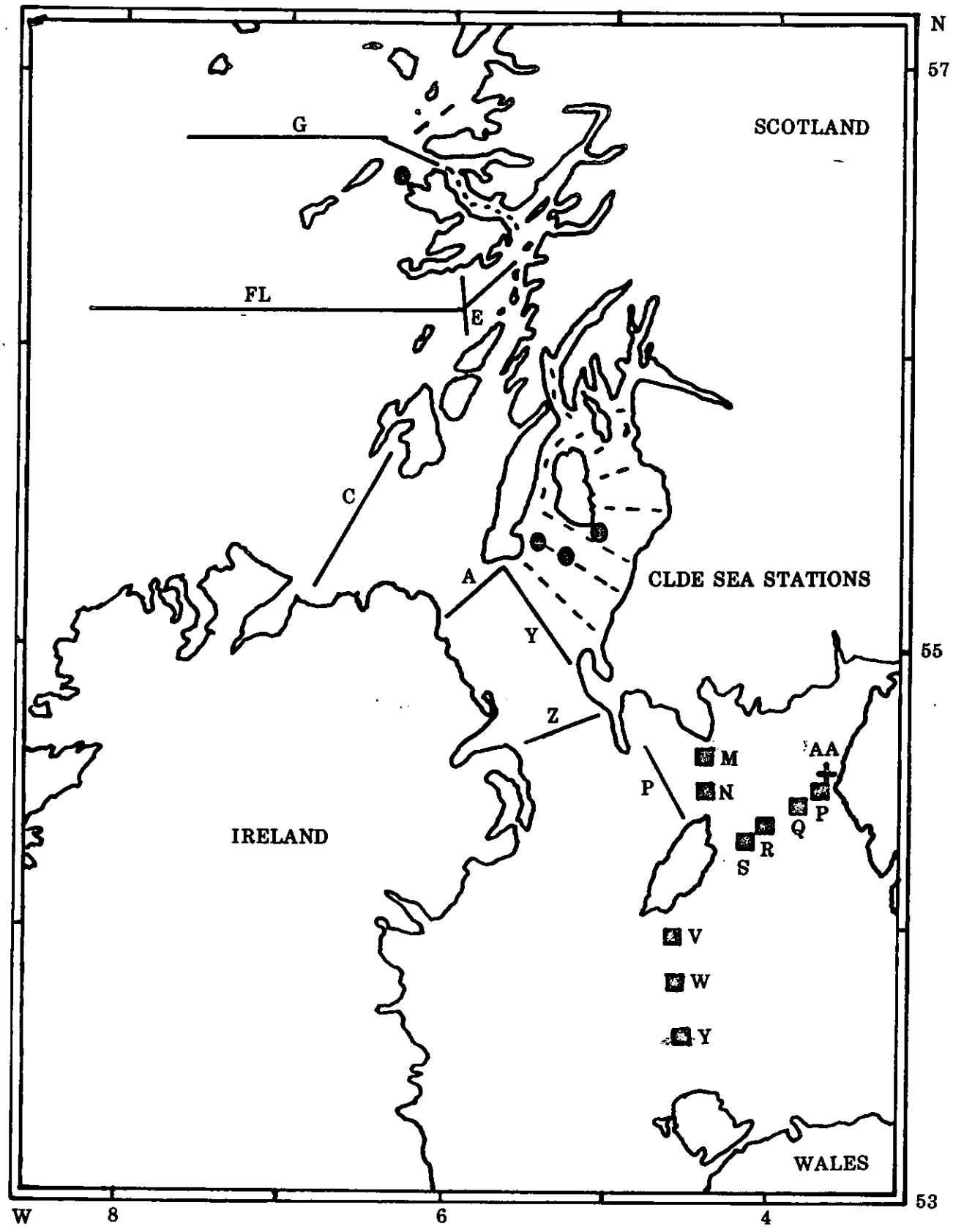
Station	Depth	Chlor.	Pheo.	A.R.	Nitrate	Silicate
		mg m^{-3}			mg- at m^{-3}	
AB 41	5	0.74	0.28	1.73	7.95	5.04
	15	0.70	0.12	1.87	8.32	5.05
	25	0.10	0.27	1.27	9.43	5.24
	45	0.06	0.29	1.58	10.01	5.71
	80	0.08	0.24	1.25	10.09	7.23
	120	0.08	1.03	1.07	10.25	10.23
AB 42	5	1.79	0.38	1.84	4.83	4.40
	15	0.98	0.50	1.68	5.47	3.99
	30	0.13	0.34	1.79	7.74	5.16
	45	0.09	0.34	1.21	8.74	5.74
	75	0.11	0.28	1.28	7.23	5.44
	95	0.12	0.29	1.30	7.88	4.98
AB 44	5	4.91	0.73	1.89	0.06	1.85
	10	2.35	0.65	1.80	2.86	2.91
	25	0.32	0.40	1.45	6.13	4.37
	40	0.11	0.33	1.25	8.80	5.76
	80	0.09	0.27	1.25	8.58	5.63
	110	0.11	0.25	1.32	8.94	6.42
AB 46	5	0.29	0.68	1.30	5.17	3.92
	10	0.64	0.76	1.47	4.14	2.72
	20	5.14	0.44	1.44	0.58	2.11
	30	0.16	0.33	1.33	8.60	5.99
	50	0.11	0.31	1.28	9.92	6.89
	80	0.15	0.27	1.36	10.31	7.16
37	5	2.44	0.16	1.96	2.10	2.39
	20	2.13	0.26	1.91	2.20	2.60
	30	0.34	0.20	1.64	5.10	3.08
	60	0.20	0.19	1.52	5.32	2.92
	80	0.24	0.29	1.46	5.41	3.20

Station	Depth	Chlor.	Pheo.	A.R.	Nitrate	Silicate
		mg m^{-3}			mg- at m^{-3}	
57	5	3.82	0.36	1.93	1.72	2.87
	20	0.72	0.28	1.73	6.06	3.81
	95	0.70	0.28	1.73	6.08	3.86
3A	5	2.57	0.45	1.67	1.57	2.13
	15	2.41	0.33	1.90	1.70	1.95
	25	1.94	0.43	1.83	2.05	2.00
	50	0.40	0.25	1.63	4.41	2.94
	80	0.23	0.17	1.59	5.23	2.81
	110	0.20	0.21	1.49	5.50	3.20
1C	5	1.20	0.50	1.72	0.79	0.88
	10	0.88	0.66	1.58	0.87	0.95
	15	0.95	0.52	1.66	0.81	2.04
3C	5	0.55	0.13	1.82	4.44	2.55
	20	0.51	0.20	1.73	3.76	2.39
	40	0.50	0.17	1.76	3.72	2.14
	80	0.54	0.16	1.79	3.70	2.22
5C	5	0.51	0.16	1.78	5.50	3.12
	10	0.39	0.16	1.72	5.56	3.69
	30	0.37	0.18	1.68	5.40	3.15
	60	0.36	0.18	1.68	5.21	3.11
	90	0.41	0.18	1.71	5.25	2.93
6C	5	0.83	0.47	1.68	4.79	2.32
	20	0.67	0.31	1.70	4.76	2.68
	40	0.78	0.37	1.69	4.86	2.67
FL2	10	1.40	0.13	1.93	2.12	0.75
	20	1.01	0.11	1.92	2.51	0.77
	40	0.51	0.12	1.83	4.65	1.70
	60	0.30	0.09	1.79	5.48	2.41
	80	0.06	0.11	1.37	7.70	5.16

Station	Depth	Chlor.	Pheo.	A.R.	Nitrate	Silicate
		mg m^{-3}			mg- at m^{-3}	
FL 3	5	0.41	0.08	1.85	4.18	1.25
	10	0.40	0.06	1.88	ND	ND
	25	0.42	0.09	1.83	4.26	1.61
	45	0.44	0.15	1.77	4.67	1.52
	55	0.44	0.17	1.74	4.33	1.46
	75	0.41	0.08	1.85	4.18	1.01
	95	0.47	0.12	1.82	4.74	1.31
FL4	5	1.38	0.21	1.88	3.82	1.83
	10	1.01	0.13	1.90	4.19	1.44
	25	0.36	0.14	1.73	5.61	3.09
	45	0.84	0.15	1.86	5.08	2.34
	65	0.27	0.16	1.64	5.68	3.05
	85	0.24	0.20	1.55	6.01	3.29
FL5	5	0.37	0.03	1.94	4.44	1.38
	12	0.37	0.03	1.95	4.46	1.49
	25	0.47	0.09	1.86	4.54	1.73
	40	0.18	0.09	1.68	6.37	2.17
	70	0.48	0.06	1.90	4.55	1.27
	80	0.04	0.10	1.31	6.79	3.64
FL 6	5	0.67	0.18	1.81	3.85	1.88
	15	0.81	0.20	1.82	3.93	2.05
	30	0.71	0.15	1.84	4.23	1.37
	50	ND	ND	ND	4.47	1.54
	70	0.28	0.12	1.72	4.78	2.42
	90	0.26	0.16	1.63	4.83	2.60
FL 7	5	0.66	0.25	1.74	3.36	2.39
	30	0.56	0.34	1.64	3.74	2.60
	60	0.43	0.33	1.58	4.07	2.65
FL 8	5	1.05	0.30	1.80	3.87	2.45
	15	0.80	0.42	1.67	3.79	2.54
	25	0.81	0.28	1.72	3.96	2.30
	40	0.51	0.56	1.51	3.83	2.69
	55	0.51	0.56	1.51	3.83	2.69

Station	Depth	Chlor.	Pheo.	A.R.	Nitrate	Silicate
		mg m^{-3}			mg- at m^{-3}	
FL 9	5	0.77	0.23	1.79	4.26	2.60
	15	0.79	0.21	1.81	4.32	2.55
	25	0.79	0.21	1.81	4.33	2.50
	35	0.74	0.32	1.71	4.20	2.35
	45	0.69	0.26	1.74	4.21	2.45
FL 10	5	1.54	0.30	1.85	3.96	2.64
	15	2.03	0.47	1.83	3.93	2.64
	30	0.93	0.35	1.74	4.23	2.29
	40	0.54	0.26	1.69	4.55	2.60
	60	0.38	0.34	1.54	4.38	2.99
FL 11	5	2.06	0.74	1.75	3.72	2.20
	10	2.30	0.12	1.97	3.92	2.45
	15	1.79	0.36	1.85	3.89	2.45
	30	1.37	0.37	1.80	4.18	2.38
	60	0.83	0.22	1.81	4.50	2.29
FL 12	5	1.56	0.31	1.85	4.04	2.66
(= E4)	10	1.50	0.23	1.89	4.14	2.62
	15	1.50	0.23	1.89	4.00	2.51
	30	1.40	0.27	1.85	4.02	2.80
	60	0.68	0.31	1.70	4.36	2.99
	75	0.56	0.33	1.64	4.94	4.04
FL 13	5	4.15	0.43	1.92	2.37	2.05
	15	2.05	0.23	1.92	3.12	2.42
	25	1.07	0.25	1.83	3.97	2.82
	35	0.76	0.23	1.79	4.26	3.01
	45	1.11	0.21	1.85	4.22	2.85
	70	0.57	0.17	1.79	4.74	3.41
FL 14	5	2.84	0.19	1.96	3.13	2.30
	15	3.23	0.24	1.95	3.45	2.21
	25	0.91	0.02	2.00	3.47	2.41
	50	1.38	0.29	1.84	3.91	2.54
	80	0.94	0.20	1.84	4.08	2.96
	110	0.61	0.29	1.69	4.34	2.93

Station	Depth	Chlor.	Pheo.	A.R.	Nitrate	Silicate
		mg m^{-3}			mg- at m^{-3}	
E1	5	2.41	0.26	1.92	3.82	2.27
	50	1.25	0.30	1.82	4.17	2.52
	100	1.06	0.23	1.84	4.22	3.32
2G	5	4.77	0.68	1.89	1.49	1.51
	10	4.55	0.04	2.01	1.52	1.49
	35	4.16	0.60	1.89	2.12	1.47
4G	5	3.94	0.82	1.84	<0.05	0.30
	15	4.82	0.81	1.87	0.28	0.47
	30	4.44	0.84	1.86	0.90	0.30
	50	2.42	0.54	1.83	2.09	1.61
	80	0.71	0.36	1.68	3.39	2.66
6G	5	6.73	0.07	2.01	0.12	<0.05
	15	1.33	0.96	1.59	0.26	0.35
	25	3.84	1.14	1.79	0.63	0.62
	35	7.50	0.63	1.94	2.43	1.80
7G	5	3.10	0.45	1.89	0.88	
	25	1.51	0.56	1.74	2.76	1.65
	45	0.67	0.25	1.75	3.74	2.39
	65	0.21	0.16	1.59	4.79	2.79
	85	0.19	0.13	1.60	5.13	2.67
	105	0.15	0.09	1.63	5.22	2.75
9G	5	1.29	0.18	1.90	2.90	2.03
	25	0.30	0.11	1.74	4.40	1.92
	50	0.61	0.22	1.75	3.32	1.64
	75	0.25	0.13	1.67	5.02	1.70
	100	0.13	0.08	1.64	5.65	2.46
	140	0.07	0.12	1.38	6.54	4.72
11G	5	4.67	0.34	1.95	0.54	0.37
	15	5.32	0.21	1.98	0.61	0.52
	35	1.16	0.64	1.66	3.22	1.80



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