INSTITUTE FOR MARINE ENVIRONMENTAL RESEARCH

CRUISE REPORT
IMER C/6/78
RVB 10/78

VESSEL	RRS JOHN MURRAY	
CRUISE PERIOD	26 September - 10 October 1978	
PERSONNEL	H H Bottrell	SSO (Senior Scientist)
	D V P Conway	HSO
	J A Lindley	HSO
	A J Bale	SO
	A J Pomroy	ASO
	D Robins	ASO
	H Langworthy	ASO

ITINERARY

26 September	Departed Barry 1222.
27 September	Celtic Sea sampling grid from 1005 to 2032.
28 September	Live plankton collections from 0800 to 1100. Left Celtic Sea for shelter and to collect spares for plankton sampler. Docked Milford Haven 1534; sampler refitted from 1730 to 1900.
29 September	Storm bound in Milford Haven.
30 September	Storm bound in Milford Haven.
1 October	Departed Milford Haven 1645; live plankton collections at Celtic Sea site from 2030 to 2400.
2 October	Longhurst-Hardy Plankton Recorder (LHPR) hauls taken at 0000, 0630, 1200, 1800 and 2400; primary production and copepod feeding experiments from 0830 to 2030.
3 October	Copepod feeding experiments from 0700 to 1200; vertical profiles from 1230 to 2300; LHPR haul at 2330.
4 October	Continued vertical profiles from 0130 to 0600; left Celtic Sea 0610. Carmarthen Bay sampling grid from 1415 to 2300; live plankton collections from 2330 to 2400.
5 October	Sediment cores and live plankton collections from 0800 to 1700 and 2030 to 2300; copepod feeding and development-time experiments throughout the day.

6 October	Sediment cores, water bottle casts, live plankton collections, and copepod feeding and development time-experiments from 0830 to 2330.
7 October	Continued with sediment cores, water bottle casts, live plankton collections and experimental work from 0800 to 2300.
8 October	Copepod feeding and development-time experiments from 0730 to 1000; vertical profiles and sediment cores from 1015 to 2300.
9 October	Copepod feeding and development-time experiments from 0800 to 1200; Carmarthen Bay sampling grid from 1300 to 2330.
10 October	Docked Barry 1130.

OBJECTIVES

Programme Objectives

1. To compare the rates and processes which control the seasonal development of two species of copepod at two contrasting sites; one a near-shore embayment (Carmarthen Bay), the other offshore with a seasonally stratified water column (Celtic Sea).

2. To compare seasonal differences in the rates of nutrient turnover at two sites with emphasis on sediment-water column interactions in Carmarthen Bay.

Cruise Objectives

1. To measure nutrients, chlorophyll, microseston, particle concentration and size distribution, POC, PON, temperature, salinity, and the phytoplankton and zooplankton populations.

2. To measure the feeding rates and development times of Calanus helgolandicus and Acartia clausi.

3. To measure the rate of primary production and nitrate uptake by phytoplankton.

4. To measure the uptake and release of nutrients by micro-organisms.

5. To measure the release of ammonia by zooplankton.

6. To measure the nutrient concentrations and oxygen consumption of pore water, and the rate of exchange of nutrients between the sediment and water column.

PROCEDURES AND METHODS

As outlined in the Cruise Programme. The grids and stations were amended to suit the prevailing conditions.

EQUIPMENT AND OTHER FAILURES

1. Three days were lost due to bad weather when the vessel took shelter in Milford Haven. This loss of time and the generally poor weather conditions encountered on arrival in the Celtic Sea precluded any copepod development-time experiments being conducted at this site. Copepod feeding experiments using ^{14}C were terminated at both sites for reasons of safety in the heavy swell.

2. A Lowestoft 20" plankton sampler and IOS net monitor were lost overboard in heavy seas in the Celtic Sea. The sampler was hauled into the towing block at the top of the "A" frame and the towing strops were torn from the sampler. A second but incomplete sampling system was available; this was made operational after collection of spares from Milford Haven.

3. The Simrad echo sounder supplied by RVS developed an intermittent recording fault, but this had no serious affect on the work programme.

RESULTS

Weather conditions were generally poor (force 5-7 winds prevailing) but approximately 80% of the planned scientific work was completed successfully.

One sampling grid in the Celtic Sea (Appendix Ia) and two sampling grids in Carmarthen Bay (Appendix IIa,b) were completed. Nitrate, nitrite, phosphate, silicate, ammonia, chlorophyll, microseston, particle concentration and size distribution, temperature and salinity were measured at each station. POC, PON and particle composition were measured at every third station. Plankton net hauls were taken throughout the grids (Appendix Ib, IIc,d). Vertical profiles of all the above variables, except plankton hauls, were measured at five stations at both sites (Appendix Ic, IIe). Two sediment cores were taken at each of the vertical profile stations in Carmarthen Bay (Appendix IIf). Six oblique LHPR hauls were taken in the Celtic Sea as part of a 24 hour study of zooplankton vertical migration (Appendix Id).

Copepod feeding rates and development-times were determined under ambient conditions. The feeding rates of Calanus helgolandicus (copepodites I-III, IV, V and adults) were measured at both sites, and Acartia clausi in Carmarthen Bay only. A total of 70 feeding bottles containing either 10-20 Calanus or 50 Acartia and 22 control bottles (no copepods) were set up and analysed using the multi-channel TAII Coulter Counter. A limited number of measurements of the development times of Calanus helgolandicus copepodites III, IV and V were made in Carmarthen Bay. Net hauls provided material for the determination of length, dry weight, ash weight, calorific value, CHN, lipids and gut contents of copepods.

Experiments were conducted to measure the rate of primary production and nitrate uptake by phytoplankton, amino-. acid uptake by heterotrophic microbes, and ammonia and phosphate excretion by copepods and euphausids.

A total of 28 sediment cores was obtained with the Craig corer in Carmarthen Bay. The sediment pore water was analysed for nitrate, nitrite, phosphate, silicate and ammonia from 9 cores and for ammonia only from 13 cores. Water bottle casts were taken at the same time as some of these cores and the same variables measured throughout the water column. A further five cores were frozen for later determination of wet weight, dry weight, CHN, and chlorophyll, and one core was used to examine interactions between pore water and the water column. (Appendix IIf,g).

Prepared by: H H Bottrell

Approved by: R S Glover

Date: 2 November 1978

Institute for Marine Environmental Research

CIRCULATION LIST - BRISTOL CHANNEL CRUISE PROGRAMMES AND REPORTS

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as at 13.10.78

Appendix Ia

Celtic Sea - Station positions 27 September 1978

Station	Time (BST)	Decca positions		Station	Time (BST)	Decca positions	
701	1016	A30.50	H61.00*	716	1551	J37.55	H72.70*
702	1041	J46.72	H62.35	717	1608	J34.81	H73.96
703	1056	J43.20	H63.60	718	1626	J32.05	H75.30
704	1127	J39.10	H65.48*	719	1647	J31.44	H78.68*
705	1144	J36.48	H66.80	720	1711	J34.35	H77.27
706	1200	J33.80	H68.30	721	1727	J36.92	H75.78
707	1229	J33.00	H71.75	722	1750	J40.31	H73.89*
708	1254	J36.15	H70.25*	723	1810	J42.98	H27.38+
709	1315	J38.92	H68.92	724	1830	J45.49	H71.30
710	1343	J42.45	H67.18*	725	1850	J44.40	H74.74*
711	1405	J45.00	H65.85	726	1909	J42.17	H75.66
712	1426	J47.54	H64.28	727	1930	J39.46	H77.05
713	1452	J46.45	H68.31*	728	1952	J35.95	H79.47*
714	1511	J43.72	H69.50	729	2010	J33.20	I50.41
715	1528	J41.13	H70.75+	730	2028	J30.46	I52.35*+

Nitrate, nitrite, phosphate, silicate, ammonia, chlorophyll, microseston, particle concentration and size distribution, temperature and salinity were measured at all stations; POC, PON, and particle composition(*), and salinity checks(+) were measured at the stations indicated.

Appendix Ib

Celtic Sea - 27 September 1978

Lowestoft 20" net.

	Time(BST)		Decca Positions	
Haul No.	Shoot	Recovered	Shoot	Recovered
1	1030	1106	J47.70 H61.30	J42.00 H64.30
2	1235	1258	J33.80 H71.24	J36.95 H69.96
3	1318	1343	J39.27 H68.72	J42.45 H67.18
4	1350	Sampler lost	J43.50 H66.70	-
5	1853	1928	J44.00 H75.26	J39.74 H76.94
6	1937	2007	J38.28 H77.75	J33.68 I50.22

Appendix Ic

Celtic Sea Site - Vertical Profiles 3 - 4 October 1978

Station	Time Cast (BST)		Decca Positions		Depths (m)
	Start	Finish			
801	1442	1646	A30.55	H61.25	75, 50, 30, 20, 10, 5, 1
831	1803	2009	J39.37	H71.71	85, 70, 50, 30, 20, 10, 5, 1
806	2145	2309	J34.35	H68.73	75, 50, 30, 20, 10, 1
825	0113	0306	J44.43	H74.94	85, 70, 50, 30, 20, 10, 5, 1
830	0440	0602	J31.14	H79.25	75, 50, 30, 20, 10, 5, 1

Nitrate, nitrite, phosphate, silicate, ammonia, chlorophyll, microseston, particle concentration and size distribution, POC, PON, particle composition, temperature and salinity were measured at all depths.

Appendix Id

Celtic Sea - Longhurst Hardy Plankton Recorder Hauls.

Haul No.		Date	Time(BST)	Shooting Position		Hauling Position		Number of samples	Depth attained (m)	Haul Status	Station No.
LHPR	1	2.10.78	0033	J39.06	H69.16	J38.72	H69.98	15	84	good	731, 732, 733
	2	"	0642	J38.65	H68.94	J38.18	H71.34	22	85	good	734, 735, 736
	3	"	1209	J39.20	H68.70	J38.73	H69.56	20	71	good	737, 738, 739
	4	"	1801	J38.95	H68.95	J38.25	H71.25	22	77	good	740, 741, 742
	5	"	2355	J39.14	H69.87	J38.47	H70.79	-	78	irregular silk movement	743, 744, 745
	6	3.10.78	2334	J38.88	H68.85	J38.47	H71.00	34	72	good	746, 747, 748

Measurements of chlorophyll, microseston, particle concentration, size distribution and composition, POC, PON, temperature and salinity were made at the start, middle and end of each haul (Stations 731 to 748).

Appendix IIa

Carmarthen Bay - Station positions 4 October 1978

Station	Time (BST)	Decca Position		Station	Time (BST)	Decca Position	
501	1322	F42.20	J67.75*+	516	1855	F34.46	A56.50*
502	1345	F39.50	J70.38	517	1911	F31.88	A60.00
503	1406	F36.76	J73.64	518	1919	F30.57	A61.75
504	1431	F33.40	J78.45*+	519	1940	F31.24	A65.32*
505	1449	F30.78	A52.00	620	1954	F32.46	A63.37
506	1505	E46.35	A55.60	521	2014	F34.98	A59.97
507	1529	E46.92	A59.40*	522	2038	F38.15	A55.80*
508	1556	F31.48	A55.83	523	2056	F40.68	A52.64
509	1621	F34.00	A52.54	524	2115	F43.20	J79.15
510	1656	F37.61	J78.15*	525	2136	F42.90	A54.18*
511	1721	F40.18	J74.97	526	2150	F40.98	A56.33
512	1745	F42.61	J71.88	527	2209	F38.58	A59.46
513	1805	F43.14	J75.94*	528	2239	F35.29	A63.50*+
514	1821	F40.42	J78.99	529	2253	F33.08	A66.20
515	1835	F37.91	A52.24				

Nitrate, nitrite, phosphate, silicate, ammonia, chlorophyll, microseston, particle concentration and size distribution, temperature and salinity were measured at all stations; POC, PON, and particle composition (*), and salinity checks(+) were measured at the stations indicated.

Appendix IIb

Carmarthen Bay - Station Positions 9 October 1978

Station	Time (BST)	Decca Position		Station	Time (BST)	Decca Position	
601	1305	F42.40	J68.40*	616	1831	F34.38	A56.61
602	1329	F39.80	J71.00+	617	1847	F31.95	A59.87+
603	1352	F37.15	J74.10*	618	1857	F30.50	A61.75*
604	1425	F33.53	J78.48	619	1918	F31.09	A65.32
605	1449	F31.00	A52.10	620	1930	F32.52	A63.35
606	1511	E46.45	A55.48*+	621	1952	F34.95	A60.05*+
607	1530	E47.00	A59.50	622	2026	F38.14	A55.75
608	1551	F31.60	A55.85	623	2048	F40.67	A52.58
609	1606	F33.92	A52.53*	624	2107	F43.26	A79.62*
610	1634	F37.44	J78.06	625	2124	F42.68	A54.30
611	1651	F40.10	J75.95+	626	2136	F40.88	A56.39+
612	1708	F42.72	J71.85*	627	2153	F38.32	A59.46*
613	1729	F43.00	J75.90	628	2217	F35.33	A63.58
614	1749	F40.32	J79.10	629	2238	F32.81	A66.27
615	1807	F37.95	A52.27*				

Nitrate, nitrite, phosphate, silicate, ammonia, chlorophyll, microseston, particle concentration and size distribution, temperature and salinity were measued at all stations; POC, PON, and particle composition(*) and salinity checks(+) were measured at the stations indicated.

Appendix IIc

Carmarthen Bay - 4 October 1978

Lowestoft 20" net

	Time (BST)		Decca Positions			
			Shoot		Recovered	
Haul No.	Shoot	Recovered				
1	1329	1355	F41.50	J68.55	F38.30	J71.75
2	1409	1426	F36.28	J74.30	F34.12	J77.26
3	1438	1452	F32.36	J79.95	F30.46	A52.45
4	1533	1548	E47.18	A59.10	F30.51	A57.00
5	1600	1619	F32.00	A55.25	F33.82	A52.80
6	1629	1652	F34.93	A51.44	F37.17	J78.71
7	1807	1842	F42.93	J76.42	F36.76	A53.47
8	1852	1917	F34.95	A55.88	F30.90	A61.38
9	1946	2002	F31.88	A64.82	F33.45	A62.03
10	2026	2046	F36.54	A57.60	F39.22	A54.50
11	2120	2132	F43.22	A50.84	F42.95	A53.39
12	2143	2158	F41.94	A54.93	F40.00	A57.32
13	2209	2225	F38.58	A59.46	F36.52	A62.05
14	2236	2247	F35.08	A63.75	F33.78	A65.72

Appendix IId

Carmarthen Bay - 9 October 1978

Lowestoft 20" net

	Time (BST)		Decca Position			
Haul No.	Shoot	Recovered	Shoot		Recovered	
1	1318	1346	F41.13	J70.15	F37.70	J73.15
2	1357	1416	F36.52	J75.00	F34.40	J77.46
3	1535	1546	E47.60	A59.90	F31.00	A56.90
4	1555	1612	F32.25	A54.90	F34.62	A51.84
5	1624	1639	F36.15	J79.95	F38.41	J76.74
6	1733	1754	F42.62	J76.63	F39.74	J79.78
7	1804	1819	F38.46	A51.54	F36.28	A54.28
8	1837	1852	F33.50	A57.82	F31.21	A60.84
9	1929	1941	F32.42	A63.48	F33.70	A61.56
10	1952	2004	F34.95	A60.05	F36.20	A58.72
11	2018	2033	F37.38	A56.75	F38.82	A54.78
12	2127	2141	F42.14	A54.97	F40.16	A57.23
13	2153	2206	F38.32	A59.46	F36.76	A62.26
14	2217	2226	F35.33	A63.58	F34.12	A65.13

Appendix IIe

Carmarthen Bay - Vertical Profiles 8 October 1978

Station	Time Cast (BST) Start	Finish	Decca Position		Depths (m)
530	1036	1120	F32.85	A66.38	10,5,1
531	1310	1357	F30.29	A52.66	20,10,5,1
532	1458	1549	F36.48	A53.82	20,10,5,1
533	1740	1830	F41.89	A53.33	20,10,5,1
534	2038	2145	F41.15	J70.80	30,20,10,5,1

Nitrate, nitrite, phosphate, silicate, ammonia, chlorophyll, microseston, particle concentration and size distribution, POC, PON, particle composition, temperature and salinity were measured at all depths. Sediment cores were taken at each of these stations (see Appendix II)

Appendix IIg

Carmarthen Bay - Sediment Cores 6-7 October

Station/Core	Time (BST)	Decca Positions	Variable measured
535/1	0858	F37.58 J75.90	5 cores: nitrate, nitrite, phosphate, silicate and ammonia.
535/2	0906	F37.40 J76.15	
535/3	0912	F37.27 J76.29	5 cores frozen for determination of: wet weight, dry weight, CHN and chlorophyll
535/4	0921	F37.05 J76.54	
535/5	0927	F36.88 J76.70	
535/6	0932	F36.82 J76.65	
535/7	0941	F36.71 J76.82	
535/8	0947	F36.64 J76.94	
535/9	1000	F36.62 J76.90	
535/10	1017	F36.58 J77.04	
535/11	1057	F36.80 J76.53	Water bottle cast at 28, 20, 10 1 m, analysed for nitrate, nitrite, phosphate, silicate and ammonia.
536/1	2116	F35.45 A55.42	nitrate, nitrite, phosphate, silicate and ammonia
536/2	2123	F35.50 A55.58	" "
536/3	2131	F35.41 A55.90	Water bottle cast at 30,20,10, 1 m analysed for nitrate, nitrite, phosphate, silicate and ammonia.
538/1	2135	F38.70 A59.60	Ammonia
538/2	2145	F38.72 A59.74	"
538/3	2145	F38.72 A59.82	"

Appendix IIf

Carmarthen Bay - Sediment cores associated with vertical profiles 8 October 1978

Station/core	Time(BST)	Decca Position	Variable Measured
530/1	1015	F32.94 A66.83	Ammonia
530/2	1022	F32.98 A66.50	"
531/1	1246	F30.05 A52.66	"
531/2	1249	F30.08 A52.55	"
532/1	1445	F36.45 A53.60	"
532/2	1452	F36.47 A53.72	"
533/1	1900	F42.33 A54.26	"
533/2	1905	F42.34 A54.30	"
534/1	2025	F42.24 J68.61	"
534/2	2030	F41.96 J68.98	"