

VESSEL: RRS FREDERICK RUSSELL.

CRUISE PERIOD: 28 June - 8 July 1982.

PERSONNEL:

R. Williams	Principal Scientist
H. Bottrell	SSO
D.V.P. Conway	SSO
M. Jordan	HSO
A. Pomroy	SO
D. Robins	SO
G. Bailey	ASO
C. Hoyle	ASO

ITINERARY:

Tuesday	28 June	11.05	Departed Plymouth.
		14.05	Arrived Station A1. Water bottle cast (Table 1) and Chlorophyll profile (Table 2).
		15.40	Set course for Mevagissey Bay.
Wednesday	29 June	10.15	Sent boat into Mevagissey to collect glassware stand for TA II Coulter Counter.
		13.15	Set course for CS2.
		20.32	Tow 1 with UOR (Table 3).
Thursday	30 June	03.43	Recovered UOR at CS2.
		04.15	Started station work at CS2.
		04.42	XBT (Table 4).
		05.55	LHPR 1 (Table 5).
		06.37	Set course for Newlyn.
		14.30	Exchanged TA II Coulter Counter with replacement instrument brought from Plymouth.
		19.50	Set course for CS2.
		23.04	Tow 2 with UOR.
Friday	1 July	03.01	Recovered UOR.
		06.00	Started Station work on CS2 - see Tables.
Wednesday	7 July	21.38	Completed work on Station, UOR Tow 5. Set course for Scillies.
Thursday	8 July	00.08	Recovered UOR.
		07.58	Launched UOR off Dodman (UOR Tow 6). Set course for Bolt Head.
		16.05	Recovered UOR off the Eddystone.
		17.00	Docked Plymouth.
		18.00	Personnel departed, frozen samples in deep freezer transported to IMER.
Friday	9 July	08.00	Unload equipment.

OBJECTIVES: To measure the impact that the common herbivorous copepod Calanus helgolandicus makes on the level of primary production on shelf seas and to ascertain the flow of carbon through this secondary trophic level.

- 1) To measure in situ primary production and light in the water column at Station CS2.
- 2) To measure the abundance and vertical distribution of phytoplankton, bacteria and flagellates.
- 3) To measure the release of dissolved organic matter by phytoplankton and the concomitant uptake by bacteria.
- 4) To partition primary production into different size classes of phytoplankton.
- 5) To determine the vertical distribution, abundance and diel migration of all development stages of Calanus helgolandicus (eggs - adult).
- 6) To obtain living material for length/dry weight, gut contents, carbon, nitrogen, ash content, calorific value and lipid reserve.
- 7) To measure the feeding rate (ingestion) of Calanus on natural particulates from three selected depth strata under simulated ambient conditions.
- 8) To measure the assimilation rate and absorption efficiency by Calanus using radioactive tracer and gut enzyme analysis techniques.
- 9) To ascertain the horizontal and vertical structure of the biological and physical environment around CS2.
- 10) To measure primary production at selected Stations along the Plymouth to Roscoff UOR (PR) route.
- 11) To contribute towards a seasonal study of phytoplankton and zooplankton at Station A1 (Joint MBA/IMER project).

PROCEDURES AND METHODS:

Outlined in Cruise Programme IMER/C2/82.

EQUIPMENT AND OTHER FAILURES

Weather - winds of 4/5 prevailed for the first half of the cruise, but with the exception of the first night onboard, did not curtail the scientific programme. Time was lost because of the failure of IMER equipment. The faulty equipment was a TA II Coulter Counter which was replaced at Newlyn (30 June). The main problem with this equipment was the interference on the visual display unit. This was caused by spurious signals and noise. We were unable to trace the source of this interference to this Counter during the cruise.

The RVS acoustic command system did not function in the transmit phase. I abbreviated the programme because of the loss of this equipment. The constant temperature room was

totally inadequate. The system failed to lower the temperature below 15°C during the whole cruise and localised temperatures, in the vicinity of the phytoplankton cultures, were above 25°C. (See my Cruise Report of Proceedings).

The Hydrographic wire was covered in grease which made the handling of water bottles extremely difficult; it will have also contaminated the water samples.

RESULTS:

Thirteen bottle casts were taken and the water samples analysed for chlorophyll, salinity, particle size distribution, nutrients, DOC, bacteria, flagellates and phytoplankton. The particle size distributions measured from the water bottle casts were similar over time and depth; the peak of abundance of 1.0 ppm occurred at 25 m. The majority of the particles were between 7 and 20 µm.

The IMER Chlorophyll/Temperature/Depth profiling equipment was used to obtain 25 profiles. The data recorded by the CTD were processed immediately using the computer. These data, together with the sub-surface light measurements, were used to select depths for the deployment of the ¹⁴C incubation bottles. Four ¹⁴C, 24 hr incubations were carried out in situ at 10, 6, 5 and 5 depths respectively. Eight, 12 hr incubations were completed at 4 simulated light levels. The data from the UOR Tow 4 (Figs. 1 and 2) show a consistent pattern of temperature and chlorophyll structure in the area of CS2. The 5°C thermocline at 28 - 30 m persisted over the whole cruise period with the sea-surface temperature increasing to 16°C by the end of the cruise period.

Nine LHPR profiles were taken including two horizontal tows (night and day) above and below the narrow thermocline. Euphausiids (Nyctiphanes) were abundant just below (2 m) the thermocline while the gastropod Limacina was associated with the thermocline (possibly with the chlorophyll maximum) and Calanus were abundant above it (2 m). The Calanus helgolandicus Stage V sampled from above the thermocline (0 - 30 m) were quite different from the Stage V copepodites sampled from deeper water (70 - 100 m). The deeper population had very large oil sacs and were pigmented differently. Both populations were sampled and specimens frozen for investigation of their somatic condition. Experiments were not carried out on these separate populations because of the failure of the RMT 1 acoustically controlled net system. Four feeding experiments with natural particulates, a reproductive effort experiment, 2 assimilation experiments, an egg viability experiment and an experiment on the effects of starvation on the extra-cellular enzyme activity were carried out using Calanus helgolandicus. Over 300 individual Calanus (Copepodite Stages VI female and male, V and IV) from these experiments were photographed and dried to study their somatic condition.

Four experiments were carried out to measure, from an anchored system, light continuously at 8 depth throughout the day. The data recorded by this system were enhanced by subsurface light profiles taken from the ship throughout the period on Station. The bottom of the euphotic zone corresponded with the thermocline at 30 m.

Prepared by: R. Williams
Approved by: B.L. Bayne
Date: 28 July 1982.

CIRCULATION LIST: Internal R.S. Glover, B.L. Bayne, G.A. Robinson, R. Williams
I.R. Joint, J. Aiken, H.H. Bottrell, D.V.P. Conway,
N.R. Collins, M.B. Jordan, A. Pomroy, D.B. Robins,
G.J. Bailey, C.M. Hoyle, Notice Board, File.

External NERC Foxtton (Swindon)
RVS Skinner (Barry)
IOS Mrs Edwards (MIAS)
MBA Denton
DAFS Parrish
MAFF Harden-Jones

Table 1 Water bottle casts

Profile No.	Day	Time (BST)	Position at start (Decca)	Depths (m)
1	28 June	15.16	A18.1 F42.5 B58.6	1, 5, 10, 20, 50
2	30 June	05.00	A16.1 F34.7 E55.8	1, 10, 20, 25, 30, 60, 90
3	1 July	07.05	A16.1 F35.2 E56.5	1, 2, 5, 7, 10, 15, 20, 25, 30, 40, 60, 80
4	1 July	15.00	A15.8 F33.2 E55.5	1, 5, 10, 20, 25, 30, 40, 60, 80
5	1 July	20.14	A16.4 F36.0 E56.0	"
6	1 July	22.32	A16.2 F35.5 E56.0	"
7	2 July	00.10	A15.9 F33.8 E57.0	"
8	2 July	05.50	A17.0 F37.0 E53.7	1, 2, 5, 7, 10, 15, 20, 25, 27, 30
9	3 July	06.00	A17.4 F37.6 E52.2	"
10	4 July	06.30	A17.2 F37.1 E52.8	"
11	5 July	06.10	A16.4 F35.8 E55.9	1, 5, 10, 20, 25, 30, 40, 60, 80
12	6 July	06.25	A15.9 F33.8 E55.6	"
13	7 July	06.30	A16.2 F34.8 E55.6	"

Water samples used for analysis of chlorophyll, salinity, particle size distribution, bacteria, flagellates, and phytoplankton (Lugol's iodine preserved)

Table 2 Chlorophyll, Temperature, Depth profiles

Profile No.	Date	Time (BST)	Position (Decca)			Remarks	
			R	G	P	Depth deployed (m)	
1	28 June	14.05	A17.4	F41.6	B59.4	50	data ok
2	30 June	04.15	A16.2	F34.8	E55.5	92	data ok
3	1 July	06.00	A16.3	F35.4	E55.9	92	T ⁰ good for half the profile
4	1 July	12.06	A16.3	F35.4	E55.9	92	Chlorophyll data good until 18 m
5	1 July	15.41	A15.7	F32.7	E55.6	41	data ok, cylinder leaked
6	1 July	20.48	A16.4	F36.1	E56.1	31	data ok, cylinder leaked
7	2 July	12.23	A16.8	F36.0	E53.5	29	data ok, cylinder leaked
8	3 July	00.04	A17.4	F37.2	E51.2	30	data ok, cylinder leaked
9	4 July	00.09	A17.4	F37.5	E51.8	35	data ok
10	4 July	12.06	A15.9	F34.7	E56.7	41	data ok
11	5 July	05.55	A16.6	F36.3	E55.8	40	data ok
12	5 July	06.32	A16.2	F35.4	E56.0	40	data ok
13	5 July	07.35	A16.1	F34.7	E56.1	40	data ok
14	5 July	09.35	A16.0	F34.6	E55.3	42	data ok
15	5 July	10.48	A16.2	F34.7	E55.4	40	data ok
16	5 July	11.40	A16.2	F34.8	E55.4	40	data ok
17	5 July	12.39	A16.2	F34.6	E55.5	41	data ok
18	5 July	13.39	A16.2	F34.6	E55.6	42	data ok
19	5 July	14.38	A15.9	F33.8	E55.1	40	data ok
20	5 July	15.40	A16.0	F34.1	E55.9	41	data ok
21	5 July	16.35	A16.0	F33.9	E56.0	40	data ok
22	5 July	17.38	A15.8	F33.5	E56.1	40	data ok
23	6 July	06.00	A15.9	F33.8	E55.6	41	data ok
24	6 July	12.10	A16.35	F35.2	E55.3	40	data ok
25	7 July	06.45	A16.2	F34.8	E55.6	40	data ok

Table 3 Undulating Oceanographic Recorder

Two No.	Day	Time	Position			Course
1	29.6	20:32	B 4.44	F48.0	C75.6	314° 1
		23.06	B18.2	F37.4	D77.2	311½° A/C
	30.6	00.00	A15.7	F34.5	E57.2	315° AC
		00.40	A14.2	F32.8	E64.4	180°
		01.45	A19.1	F43.1	E51.2	090°
		02.55	A18.3	F37.9	D76.7	315°
	03.43	A16.7	F35.5	E54.2	I/B	
2	30.6	23.04	B 7.1	F47.4	C68.8	O/B
		1.7	A16.9	F37.1	E52.4	
		03.01	A16.5	F36.1	E54.4	I/B
3	7.7	14.08	A17.6	F37.7	E51.4	O/B
		14.30	A15.8	F34.5	E56.0	WP1
		15.11	A13.9	F31.4	E65.2	WP2
		16.08	A12.4	E41.5	E64.5	WP3
		16.20	A12.7	E42.3	E63.8	I/B
4	7.7	18.18	A11.9	E39.8	E65.6	O/B
		19.20	A16.2	F35.3	E56.0	WP1
		20.00	A19.3	F42.9	E50.2	WP4
		20.56	A19.56	F38.36	D76.70	WP5
		21.05		F37.80	D76.20	I/B
5		21.38	A18.66	F37.03	D75.98	OB
		22.45	A23.93	F44.62	D60.31	A/C
		24.00	B 5.20	F30.85	C74.62	
		00.08	B 5.60	F31.1	C73.1	I/B
6	8.7	07.58	A18.4	G35.0	B66.4	OB
						C 090
		11.20	A23.42	A38.10		AC 212°
		13.30	C19.2	D40.3	A50.7	A/C 000°
		16.00	A10.1	C35.4	A66.2	Hauling UOR
		16.65	A 9.2	C35.2	A67.4	I/B

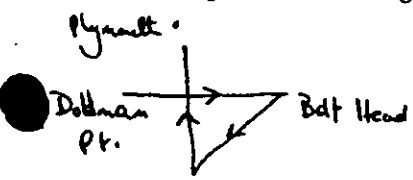
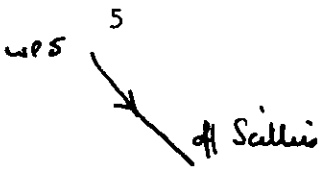
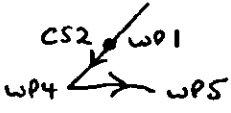
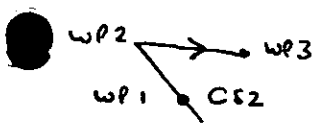
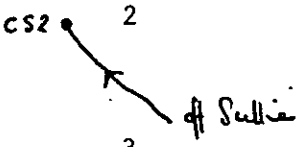
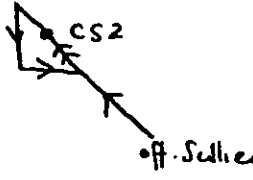


Table 4 Expendable Bathythermograph profiles

Profile No.	Day	Time (BST)	Position	Depth (m)
1	29 June	23.12	50° 25.7'N 06° 52'W	107
2	30 June	00.21	50° 32.7'N 07° 04'W	105
3	30 June	00.42	50° 35'N 07° 09'W	108
4	30 June	01.47	50° 25'N 07° 09'W	107
5	30 June	02.54	50° 24'N 06° 50'W	107
6	30 June	04.42	50° 29.8'N 06° 58.6'W	103
7	1 July	07.05	50° 30'N 07° 01'W	104
8	1 July	13.05	50° 30'N 07° 00'W	106
9	1 July	21.30	50° 29'N 07° 03'W	-
10.	2 July	00.50	50° 30'N 07° 03'W	102
11	2 July	13.22	50° 28'N 06° 57'W	104
12	3 July	01.35	50° 28'N 06° 58'W	105
13	3 July	14.04	50° 28.7'N 07° 00'W	105
14	4 July	01.18	50° 28'N 07° 01'W	107
15	5 July	06.48	50° 30'N 07° 00'W	108
16	7 July	14.34	50° 29'N 07° 00'W	108
17	7 July	15.15	50° 35'N 07° 07'W	110
18	7 July	16.20	50° 34'N 06° 52'W	105
19	7 July	19.24	50° 28'N 07° 01'W	108

Table 5 Longhurst-Hardy Plankton Recorder hauls

Haul No.	Date	Time (BST)	Position (Decca)		Number of samples	
			G	P	Coarse net	fine net
1	30 June	05.55	F34.1	E56.5	22	22
2	1 July	08.13	F35.0	E57.2	26	27
3	1 July	13.35	F32.8	E56.5	-	21
4	1 July	18.36	F37.5	E54.2	22	42
5	2 July	01.01	F33.7	E57.3	20	26
6	2 July	13.29	F36.4	E53.8	22	22
7	3 July	00.38	F37.1	E51.1	26	25
8	3 July	13.06	F36.9	E51.8	28	26
9	4 July	00.38	F37.4	E52.2	32	29

Coarse net samples - 198 Fine net samples - 240

50° 38' N
 06° 45' W
 Figs 1. UOR Tow. 4.
 Deployed 18.18hr BST
 Recovered 21.05 .. BST 7.8.82
 50° 25' N 07° 07' W

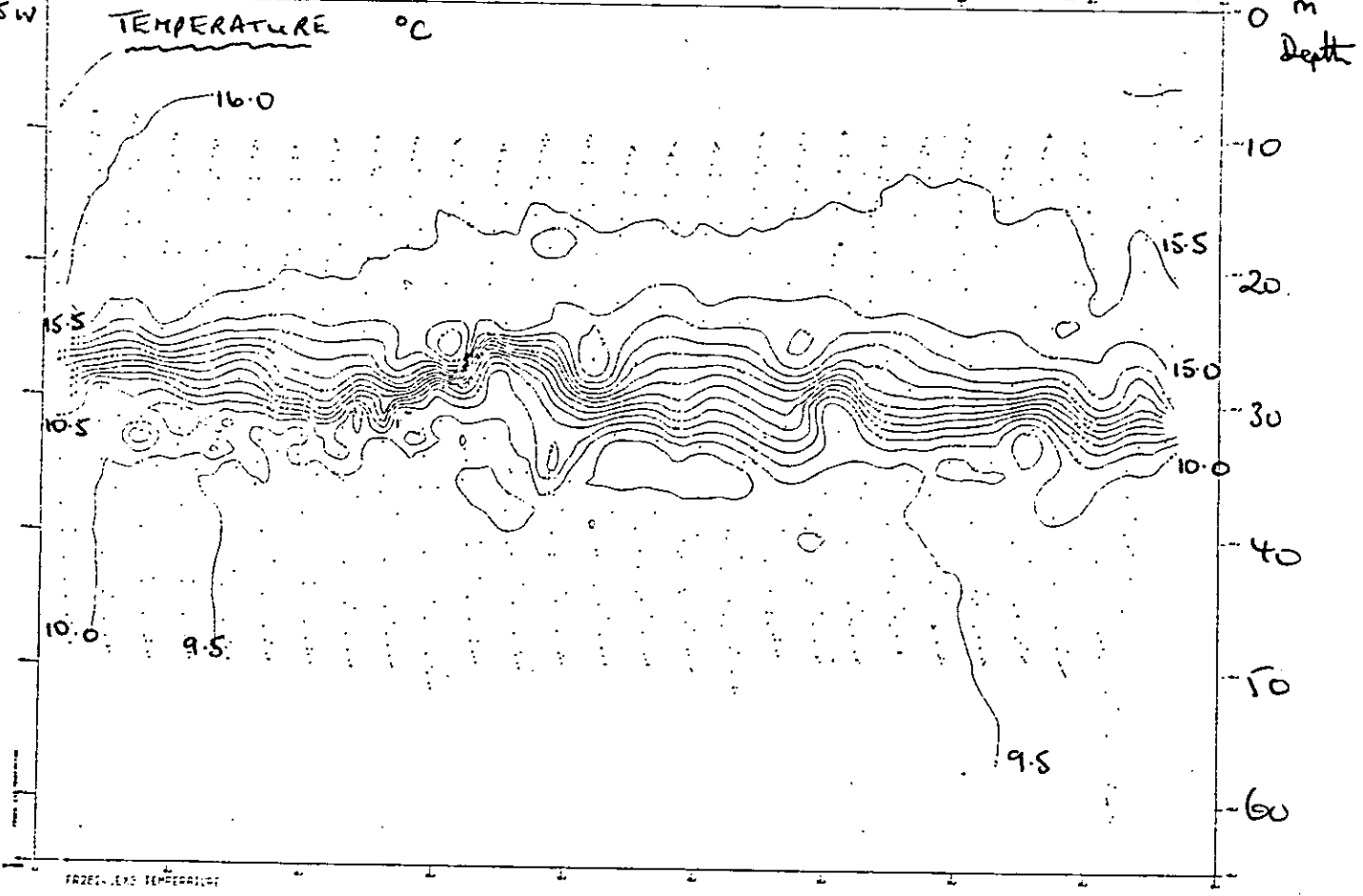


Fig. 2.

