VESSEL RRS CHALLENGER

CRUISE PERIOD 6-20 June, 1983

PERSONNEL

S H Coombs	PSO	Senior Scientist
R H Bruce	SSO	
J A Lindley	SSO	
N R Collins	HSO	
C A Fosh	ASO	
I E Bellan	Ctsfmn	
M A Keen	Student	

ITINERARY

Monday 6 June	1600 hrs	Depart Plymouth. Deploy high frequency echo sounder.
Tuesday 7 June	1000	Trial UOR tow.
	1320	Commence UOR sampling.
Wednesday 8 June	2049	Complete first UOR transect.
	2328	Commence TTN and LHPR hauls back along UOR transect.
Friday 10 June	0806	Complete TTN and LHPR transect.
	1419	Various UOR trial tows.
Saturday 11 June	0143	Commence comparative UOR sampling exercise with RV CIROLANA.
	0300	Hove to due to deteriorating weather.
	0836	Trial UOR tow.
	1040	Continue with UOR comparative sampling.
Monday 13 June	1054	Hove to due to deteriorating weather.
Tuesday 14 June	0117	Continue with UOR comparative sampling.
	1400	Complete UOR comparative sampling.
	1506	LHPR haul.
	2109	Trial UOR tow.
Wednesday 15 June	0130	LHPR haul.
	0748	Commence intensive grid UOR sampling.
Thursday 16 June	1527	Complete intensive grid UOR sampling.
	1647	Commence intensive grid TTN and LHPR sampling.
Friday 17 June	0701	Complete intensive grid TTN and LHPR sampling.
	0826	Additional LHPR haul in intensive grid and repeat of abortive UOR tows.
Saturday 18 June	0803	Commence UOR tows and LHPR hauls along final transect.
Sunday 19 June	0506	Complete final transect, set course for Falmouth.
Monday 20 June	0900	Dock Falmouth; personnel and gear return to Plymouth.

OBJECTIVES

1. To determine the horizontal and vertical distribution of mackerel eggs and larvae in relation to temperature, salinity, oxygen, chlorophyll, light and plankton concentration.
2. To compare estimates of mackerel egg abundance taken by UOR sampling and by standard 20" plankton sampler hauls.
3. To investigate the horizontal variability of mackerel egg numbers and to estimate the point haul variance of standard plankton hauls for mackerel eggs.

4. To determine the density and buoyancy of mackerel eggs through development.
5. To estimate the natural mortality rate of mackerel eggs.

PROCEDURES AND METHODS

1. Sampling the same areas for mackerel eggs by UOR and standard 20" plankton tows.
2. Concurrent measurements of temperature, salinity and chlorophyll to be taken on UOR tows.
3. Vertically stratified plankton sampling by means of double net LHPR system at selected stations.
4. Concurrent depth profiles of temperature, chlorophyll, light intensity and oxygen concentration taken as possible on LHPR hauls.
5. Intensive sampling by UOR tows and standard net hauls at the centre of egg abundance.
6. Ring net hauls taken at intervals to provide material for measurements of mackerel egg density and buoyancy.

RESULTS

1. 55 undulating tows were made with the UOR over ∿ 960 miles as well as a number of single depth tows for various trials purposes. The UOR servo mechanism operated satisfactorily over an undulation range of 3 - 60 m on all 43 tows made above towing speeds of 7 - 7½ knots. On 11 tows made at slower towing speeds the UOR was undulated passively by winch control over a similar undulation range.

2. A self-contained digital tape recording system was operated inside the UOR on all tows taking measurements at intervals of 5 seconds from all sensors for depth, temperature, conductivity, chlorophyll a and water flow into the plankton net. Although various problems were experienced with data recovery from the recording system (see below) valid physical measurements were obtained for all variables over >85% of the ∿ 1200 undulation profiles completed by the UOR. The microprocessor based data processing system worked efficiently with only a few minor problems.

3. Valid plankton samples for mackerel eggs were obtained on all 43 undulating tows on which the net filtration system was fitted. Sampling was carried out in 16 rectangles in the central area as part of the comparative exercise with RV CIROLANA as well as on further transects along the central line and across the shelf edge further to the South. An intensive series of seven tows were made in the central rectangle where mackerel egg numbers were highest (see Fig. 1).

4. 20" plankton net hauls were made at 9 stations along a central transect and at 12 stations in the central rectangle to provide comparative estimates against UOR sampling and to investigate the small-scale spatial distribution of mackerel eggs. Valid plankton samples were obtained from all hauls.

5. 12 LHPR hauls (including 2 repeat hauls) were taken at selected stations. All hauls were taken with the double 270 µm and 88 µm sampler and were deployed to give a depth discrimination of 5 m on the hauls to 120 m and 20 m on the two deep hauls (> 500 m). Valid samples were obtained for both systems on 9 hauls and for one of the systems on the remaining 3 (see Table 1).

6. Vertical profiles of chlorophyll a, temperature and light intensity were obtained on, or immediately after, 9 of the LHPR hauls. The poor stability of the mounting position on the LHPR tail plane for the light sensor reduced the validity of measurements from that sensor. Vertical profiles of oxygen were made after 2 LHPR hauls; only small changes were observed down the water column and the dissimilarities between the down and up profiles suggested that an improved deployment system is required. 59 XBT profiles were obtained between UOR tows and at selected LHPR and net stations.

7. Continuous records of surface temperature, salinity and chlorophyll a were made throughout the cruise. Frequent subsamples of water were filtered for subsequent laboratory calibration of chlorophyll. Occasional salinity samples were taken for laboratory determination.

8. 12 ½ m net hauls were made over a 24 hour period for live examination of mackerel eggs to determine time of spawning. Unfortunately, spawning activity was low during the sampling period and insufficient early stage eggs were taken to show any clear pattern.

9. Measurements of the density of ∿ 400 mackerel eggs were made throughout their embryonic development. Results showed an increase in density immediately before hatching. A series of measurements were made to determine their coefficient of thermal expansion.

10. A high frequency echo-sounder was used continuously throughout the cruise. The echograms showed variable oscillating traces in the upper 100 m of the water column which will be related to the LHPR profiles and to the contoured physical data from the UOR tows.

11. A satellite tracked drogue deployed in the central spawning area by R. Pingree from RRS RUSSELL in the previous week has been transmitting data on surface drift.

EQUIPMENT AND OPERATIONAL PROBLEMS

1. Prior to the cruise information received that the maximum realistic operating speed of CHALLENGER was 8½ knots, or less under typical sea conditions, (in contrast to a maximum of 10½ knots given in a NERC publication) required considerable pre-cruise trials and modifications to the UOR, in the form of additional wings being fitted to the body, to achieve satisfactory dive and climb forces at low towing speeds. Although these modifications were successful in achieving an undulation range of 0 - 60 m at speeds down to 7 - 7½ knots, at the expense of some oscillations in the profiles, below that speed alternator output was insufficient to operate the servo. satisfactorily. Because of this limitation and the ship's speed being reduced below 7 knots due to poor weather conditions it was necessary to use continuous winch deployment and retrieval on two of the six UOR transects to achieve the required undulation pattern. Because of this limitation, CHALLENGER should not be considered for UOR dedicated cruises, unless considerable down time is acceptable or the service speed can be increased.

   The digital recording system for the UOR sensor system gave persistent and recurrent errors on replay. These faults invalidated the data measurements on ∿ 10% of the UOR tows and lost up to 50% of the data on a further ∿ 20% of the

tows. However, because of the redundency in measurements taken, a scan of all sensors every 5 seconds, and the generally random occurrence of the lost data, most of the tows contained more than sufficient data to characterise the pattern of physical variability along each tow.

3. Mechanical and electronics faults with the LHPR systems resulted in a partial loss of data on four hauls (see Table 1) two of which were successfully repeated.

Prepared by: S H Coombs
Approved by: B.L. Bayne
Date: 6 July 1988.

Circulation List:

Internal: Bayne, Robinson, Williams, Coombs, Bruce, Conway, Collins, Lindley, Fosh, Bellam, Kean.

External: NERC Foxton; RVS Skinner; MBA Denton; DAFS MacIntyre; MAFF Lockwood, Bedford.

Table 1

LHPR Hauls

Tow No	Date	Time GMT	Position	Validity		Depth M	Other Profiles			
				Coarse	Fine		Temperature	Light	Chlorophyll	O_2
1A	9/6/83	0421	49°15'N 11°00'W	Jam	✓	120				
1B	9	0814	49°15'N 11°00'W	✓	✓	120	✓		✓	
2	9	1454	49°15'N 10°00'W	✓	✓	120	✓	✓	✓	
3	9	2029	49°15'N 9°00'W	✓	✓	120	✓		✓	
4	10	0230	49°15'N 8°00'W	✓	✓	120	✓		✓	✓
5	14	1506	49°45'N 12°00'W	✓	Chart paper ran off	>1000	✓		✓	✓
6a	15	0130	49°45'N 10°30'W	Jam	✓	120				
6b	15	0356	49°45'N 10°30'W	✓	✓	120	✓		✓	
7	16	1839	49°25'N 10°17'W	✓	✓	120	✓	✓	✓	
8	17	1536	49°06'N 10°29'W	✓	✓	110	✓	✓	✓	✓
9	18	1035	48°15'N 10°30'W	Jam after 600m depth	✓	700				
10	18	1839	48°15'N 09°30'W	✓	✓	*26	✓	✓	✓	

* haul curtailed due to possible interference by other vessel.

MIAS 2920

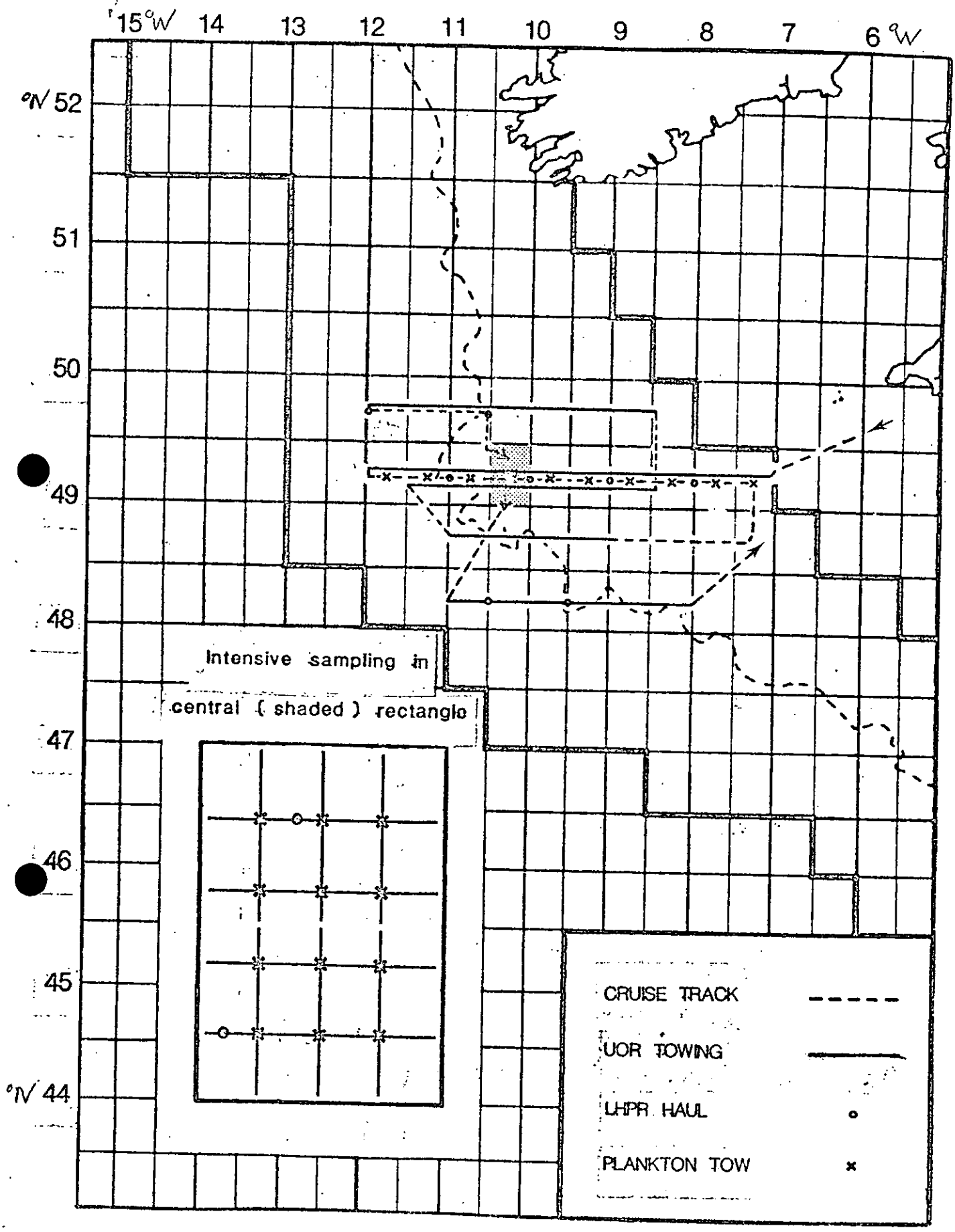

Figure 1 CHALLENGER 8/83