Cruise Report: R.R.S CHALLENGER Cruise 92 RVS: P12/92/92

Dates: 23 May - 10 June 1992

Personnel:

S.H. Coombs	*PML*
D.V.P. Conway	*PML*
N.C. Halliday	*PML*
C.D. Barrett	*PML*
I.R.B. McFadzen	*PML*
L.D. Peters	*PML*
C.O.M. Wotton	*PML*
S. Morley	*Polytechnic South West*
C.E. Stelfox	*Polytechnic South West*
C. Smith	*University College of Wales*
A. Hufschmidt	*Hamburg University*

Itinerary:

23 May	Depart Plymouth for Santander.
25 May	Dock Santander, collect I. McFadzen and A. Hufschmidt and load equipment.
26 May	Depart Santander to commence survey working to east.
28 May	Complete transects 1 - 5 to east of Santander.
29 May	Detailed pollution transect and LHPR hauls off Bilbao.
30 May	Commence transect 6 working west from Santander.
1 June	Complete sampling up to end of transect 11.
2 June	Detailed sampling and LHPR hauls at station 44.
3 June	Commence transect 12 working to west and south.
6 June	Complete transect 20 with LHPR station. On passage to north coast with intermediate coastal bongo tows worked on way.
7 June	Complete extra bongo stations to north and north east of Cape Ortegal. LHPR hauls at station 50.
8 June	Complete final bongo stations in offshore sector of north coast. Set course for UK.
10 June	Dock Barry.

Overview: The main objectives of the cruise, to determine hydro/biological conditions and the distribution of larval sardine (*Sardina pilchardus*) along the north and west coasts of Spain was completed successfully. No major gear or operational problems were encountered.

Results:

(1) 90 standard bongo tow net stations were completed (Fig. 1 ; Table 1). Coarse mesh samples (200 μm) were sorted for sardine larvae and subsequently preserved in formalin. At each station one fine mesh sample (53μm) was preserved in formalin for taxonomic counts, the other was frozen (-20^{o}C) for biomass estimation.

(2) The distribution of sardine larvae was more dispersed than on previous cruises in the 1992 series. Two main concentrations were observed: in the region off Santander/Bilbao, as in March, April and May, and offshore between Gijon and Cape Ortegal (Fig. 2). Smaller larvae were taken in the Bilbao region (Fig. 3). Lower concentrations of sardine larvae extended south towards Vigo.

(3) At the eastern end of the survey (Bilbao/San Sebastian region) sampling was curtailed due to replacement of sardine larvae by anchovy, *Engraulis encrasicolus* (Fig. 4). Hydrographic data indicated an association between abundance of larval anchovy and warmer (>17.5^{o}C), less saline water (< 35.2 psu) than observed in areas of larval sardine abundance.

(4) Over 3000 sardine larvae were preserved for the various condition analyses (Table 2).

(5) 7 vertical distribution hauls (3 x day/night pairs) by cored-cable LHPR were carried out at three station positions (Table 3; Fig. 1). Sardine larvae from the coarse mesh samples were analysed on board to give vertical distribution plots (Fig. 5) Larvae at all sizes were found consistently above the thermoline. The fine mesh samples were preserved in formalin for subsequent estimation of food availability.

(6) At two contrasting sites, off Bilbao (Station 5) and offshore north east of Cape Ortegal (Station 44) detailed sampling was carried out for sardine larvae for pollution studies. A short inshore transect of stations was worked off Bilbao (12 bongo tows) to assess changes along a potential pollution gradient. At the offshore site where pollution was anticipated to be at relatively low levels, replicate sampling (10 bongo tows) was carried out in the same water mass following a radio-tracked drifting buoy (Table 4).

(7) Hydrographic measurements were obtained by CTD profiles and UNDULATOR tows along alternate transects (Fig. 1). A total of 113 CTD casts were completed to 120 m depth or within 5m of the bottom where shallower; parameters measured included temperature, conductivity (salinity), chlorophyll *a* fluorescence, upwelling and downwelling irradiance, light transmission, pH and computed density (σ_t). 13 UNDULATOR transects were completed with observations of temperature, conductivity (salinity), chlorophyll *a* fluorescence and computed density (σ_t) at intervals of 5 seconds, from the surface to 65m depth (Table 5).

(8) Highest surface temperatures (5m depth) were recorded to the west of Bilbao (>17.5°C, Fig. 6). A band of cool surface water (<15°C) extended from La Coruna around Cape Ortegal. Temperature stratification became progessively less (>6°C to <1°C) along the north coast (Figs 7 and 9); south of Finisterre there was again some stratification in more inshore areas.

(9) Surface salinity was generally lower inshore with minimum values (<35.2 psu) being recorded in the region of San Sebastian (Fig. 8). Saline stratification was evident both to the east of Gijon and south of Finisterre (Fig. 10). Around Cape Ortegal high salinity water of oceanic origin (>35.7 psu) occurred through much of the water column.

(10) In all areas concentrations of chlorophyll *a* were recorded at mid-water depths associated with the thermocline (Fig. 11). Highest values were recorded to the west of Santander where stratification was most marked.

(11) Particle size distributions (5-156 μm) were obtained by Coulter Counter analysis at 80 CTD stations. Total particulate volume (TPV) was reduced below the thermocline and highest at the chlorophyll maximum (Fig. 12). At 5m depth highest concentrations were recorded along the north coast, particularly to the east of Santander (Fig. 13). Lowest values were in the Finisterre/Cape Ortegal region where there was low larval abundance, high salinity and little water column stability.

(12) Characteristic particle size distributions were observed in different regions. West of Gijon variable size modes of around 32-50 μm, 16-24 μm and <8 μm were observed (Fig. 14). Between Gijon and Cape Ortegal there were less clearly defined modes with a more prominent increase in abundance of particles <10 μm in equivalent spherical diameter. A similar pattern continued to the south with the addition of a mode at 32-50 μm.

Operational and Equipment Problems:

(1) Information on crew overtime payment arrangements were advised only on joining ship; similarly working practices for RVS staff were only advised informally one week before sailing and compromised agreements made at the pre-cruise planning meeting.

(2) It was expected that permission to sample in French waters had been applied for. Cruise programme showed stations in that area.

(3) Position of the most southerly transect was apparently in Portugese waters. Information on exact border as available on the ship was inadequate.

(4) Full portfolio of charts for Spanish coast was not available. This prevented inshore sampling in the Bilbao region.

(5) Reception of satellite images was prevented by failure of the modem; communications with, and via RVS were poor.

(6) Print quality of satellite images is poor; no provision to print images on laser printer. Screen colours and print colours on colour printer conflict.

(7) Ship's speed sensors give variable readings. Accurate measurements of speed through the water is required for both slow speed net deployment and for UNDULATOR tows.

(8) Use of 10 kHz beacon with Simrad Sounder does not give adequate depth/bottom approach monitoring for use with towed nets.

(9) NMEA format GPS position information should be available for input to scientific equipment.

(10) PML laser printer became inoperative due to a fault in the heater mechanism; HP Deskjet coped with most printing/plotting functions.

(11) On the LHPR frame the eyebolt holding the 50 kg depressor failed when the frame was lifted from the deck on its second deployment.

(12) The coarse mesh cod-end unit jammed on haul 4 due to capture of a swimming crab.

(13) Insufficient sardine eggs were available for ongrowing to provide material for experimental studies.

(14) Signals from the 1804 kHz radio buoy were clearly received and should be reliable for DF and tracking. The hand-held receiver was inadequate and gave poor direction indication.

S. H. COOMBS 16-6-92

Circulation:

Internal:

B L Bayne
I R Joint
D Livingstone
Cruise Personnel
File VES 1.1

External:

NERC, Swindon, R Paul, N R Collins, S White
IOSDL, Wormley, C Summerhayes, M Angel, Library
POL, Bidston, B McCartney, Library
SMBA, Oban, J L Matthews
RVS, Barry, C Fay, C Adams, I Innes, R. Powell, H. Anderson
DAFS, Aberdeen, A Hawkins
MAFF, Lowestoft, J Shepherd

Overseas:

J Alheit, Bremerhaven
W Nellen, Hamburg
E Lopez-Jamar, La Coruna
P Re, Lisbon
R Knust, Bremerhaven
B Ueberschar, Kiel
J Hakanson, La Jolla

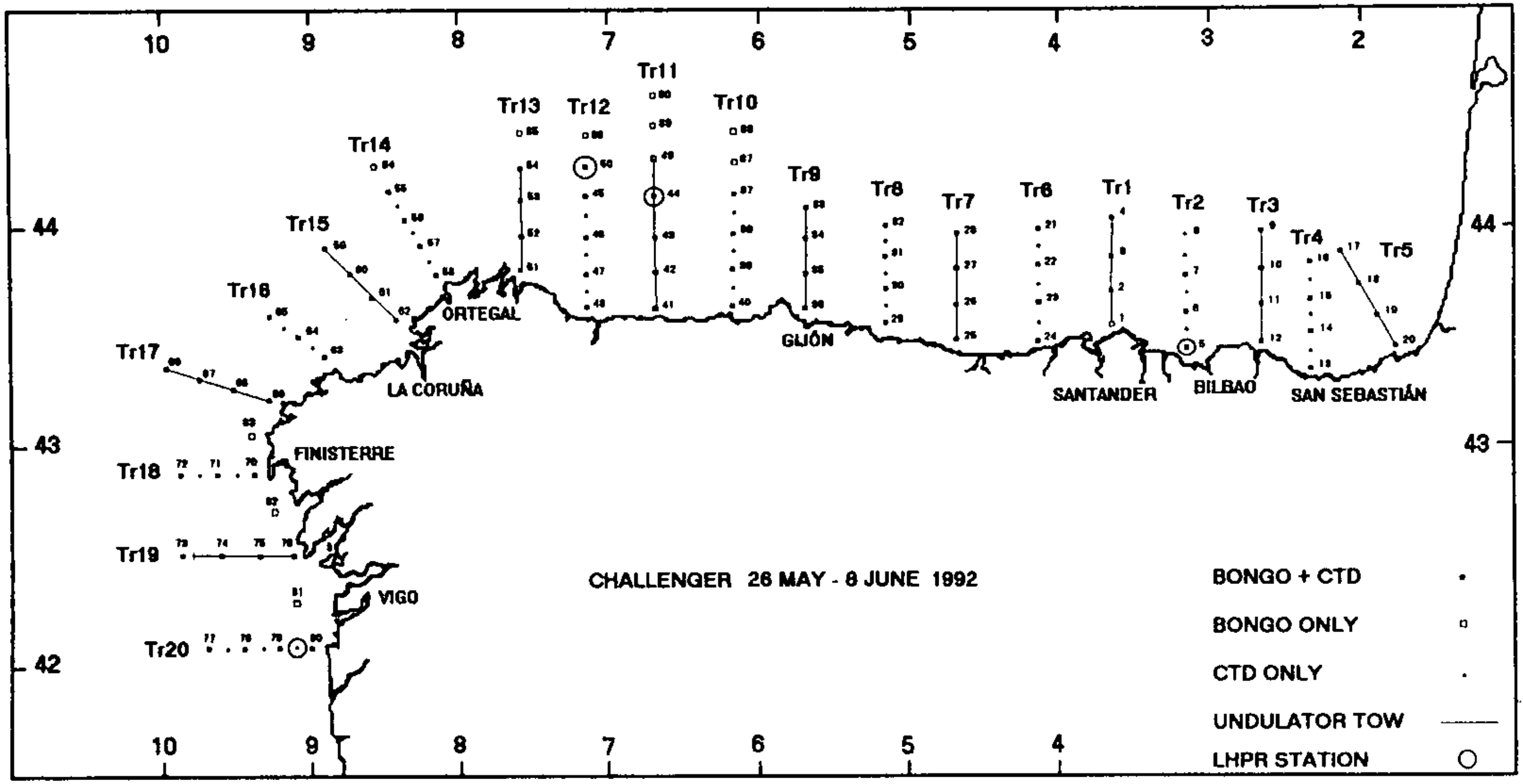

Fig. 1. Station positions and transect numbers.

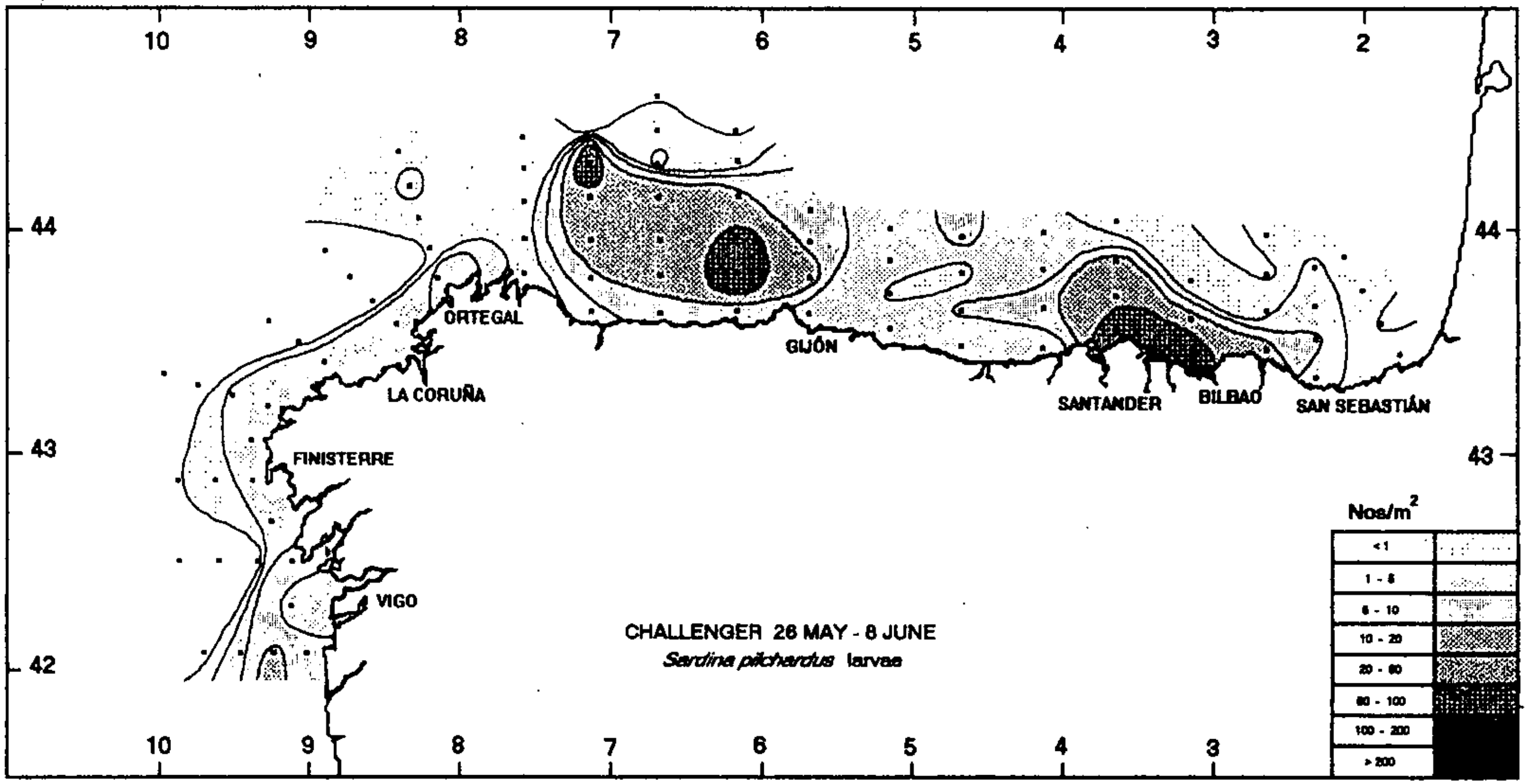

Fig. 2. Distribution of sardine larvae.

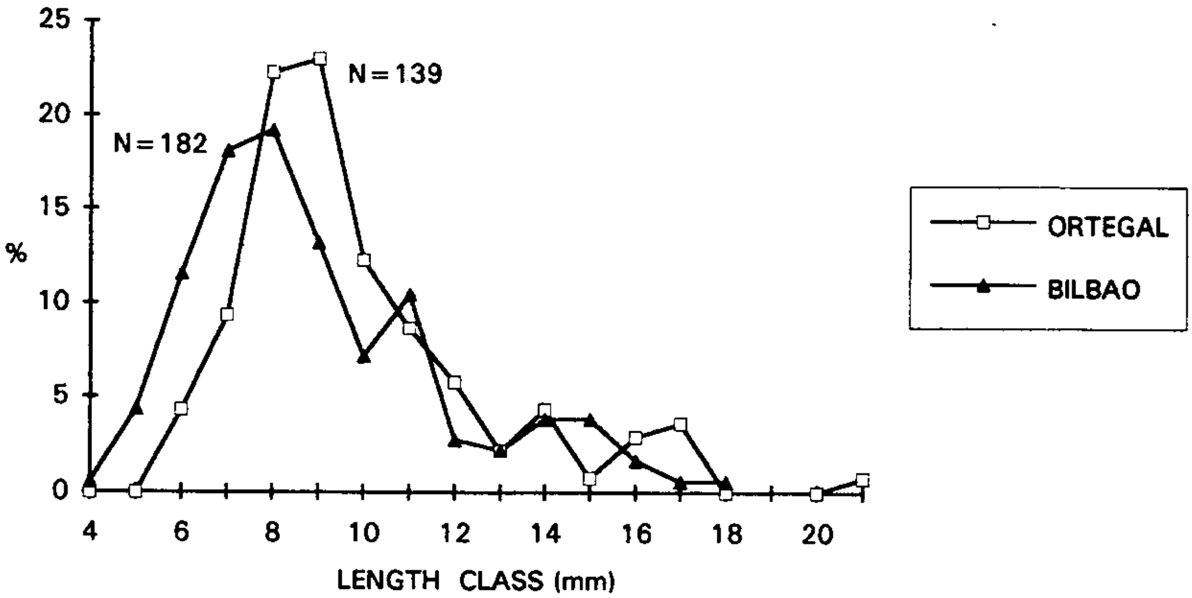

Fig. 3. Size distribution of sardine larvae.

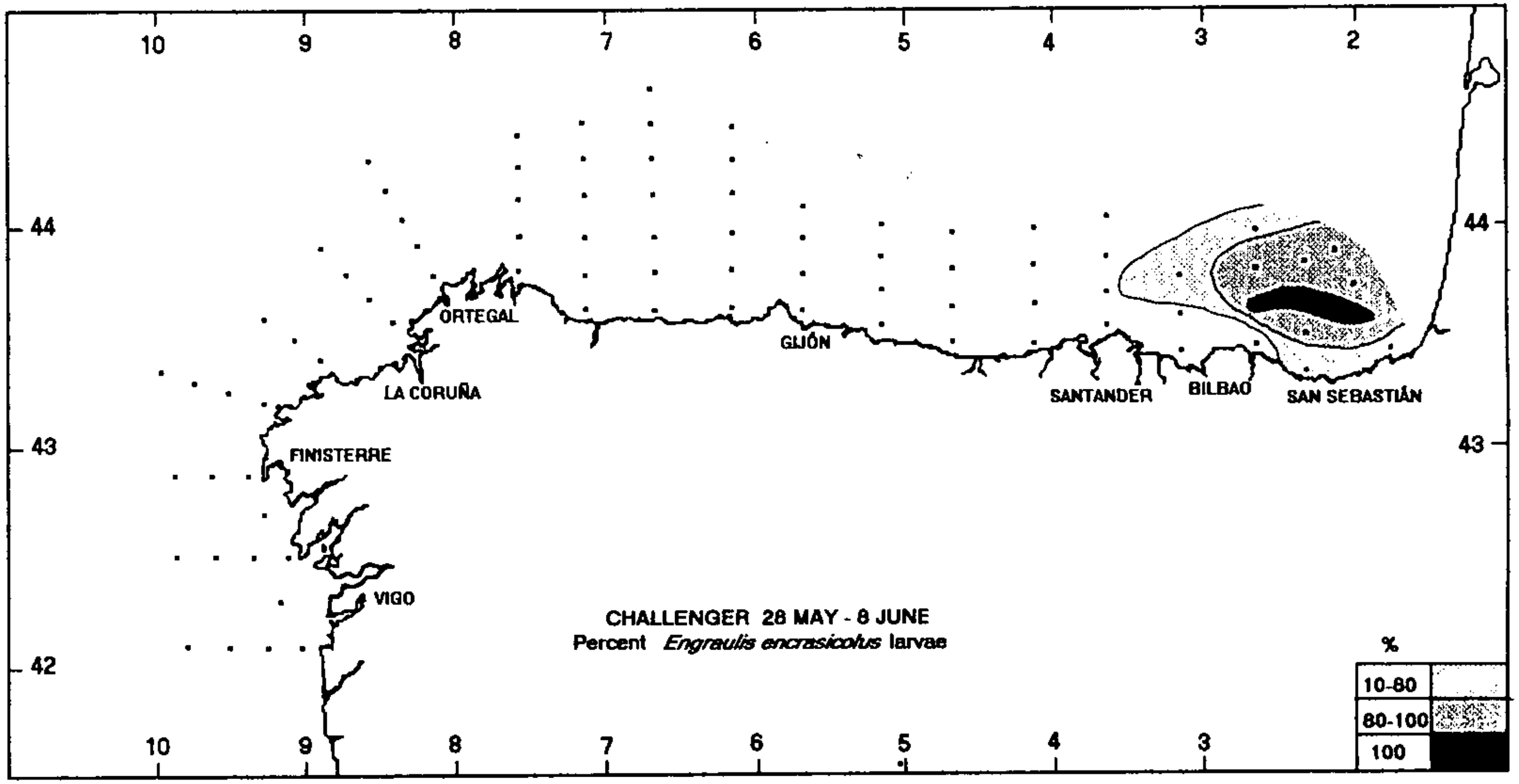

Fig. 4. Distribution of anchovy larvae.

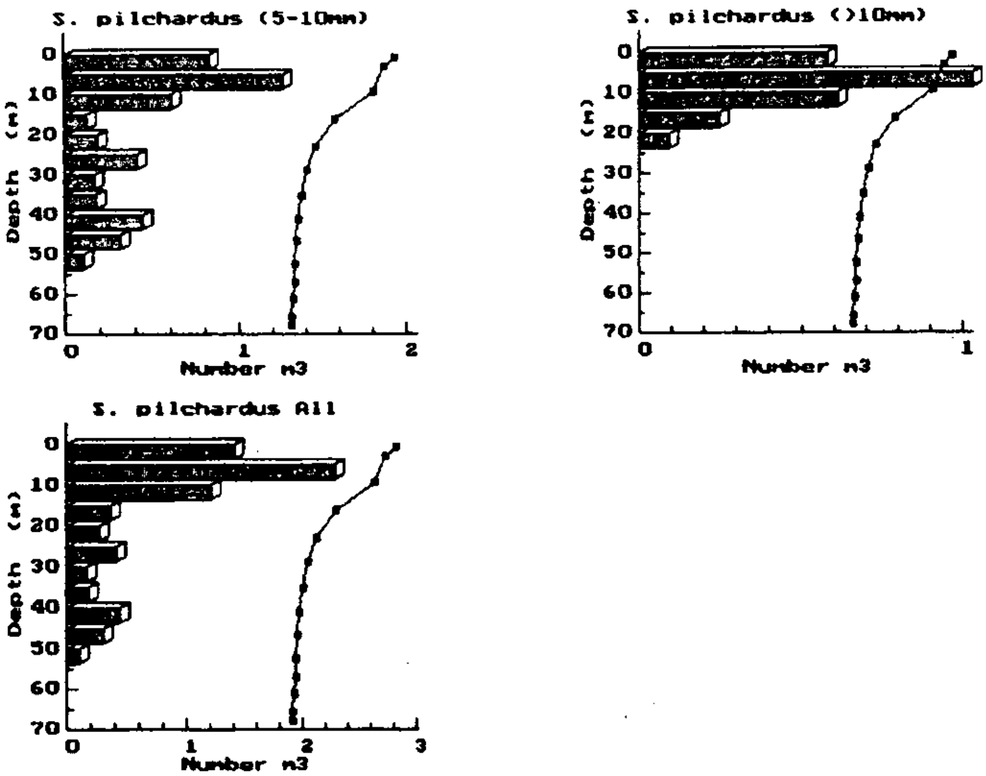

Fig. 5. Vertical distribution of sardine larvae and temperature.

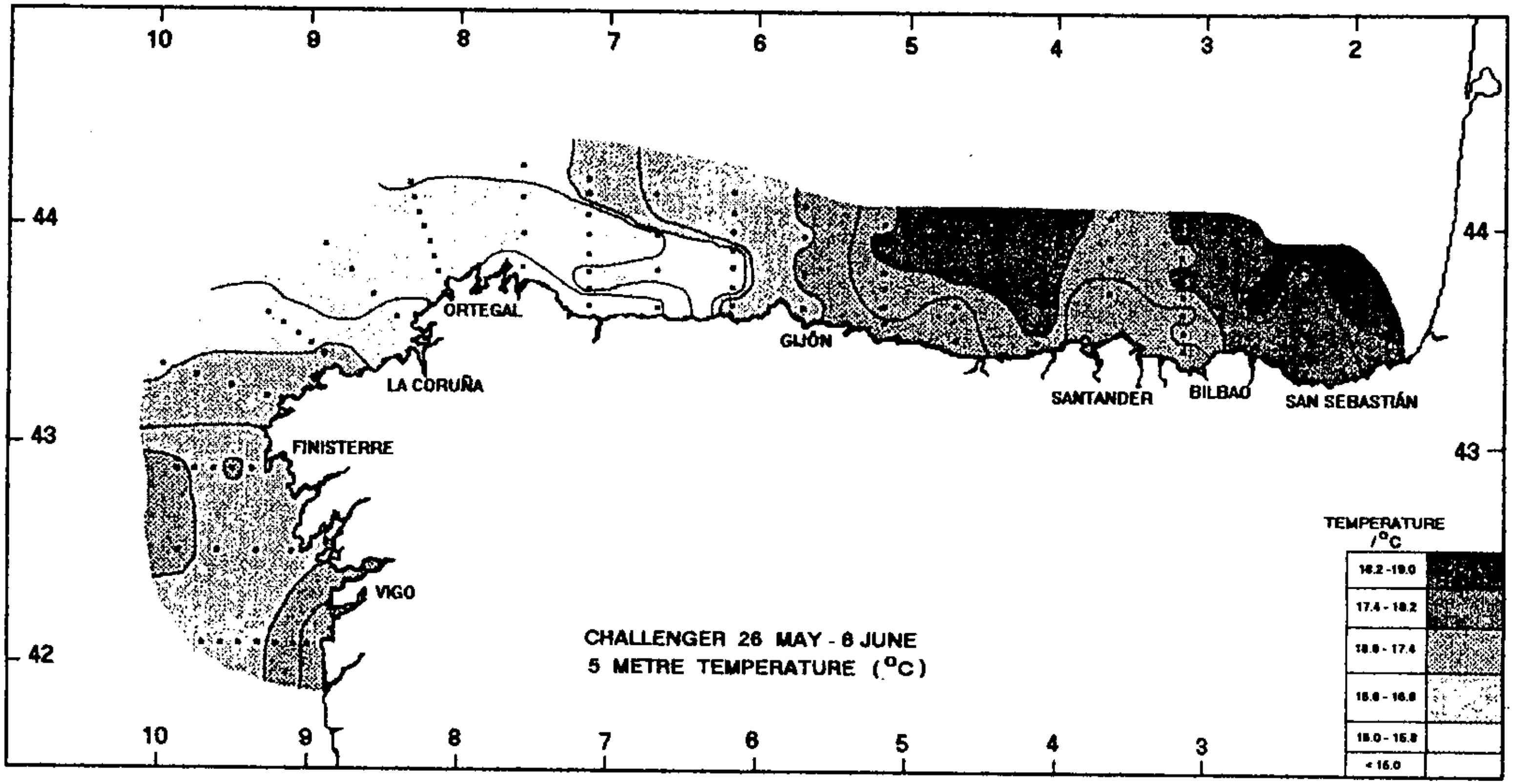

Fig. 6. Surface temperature.

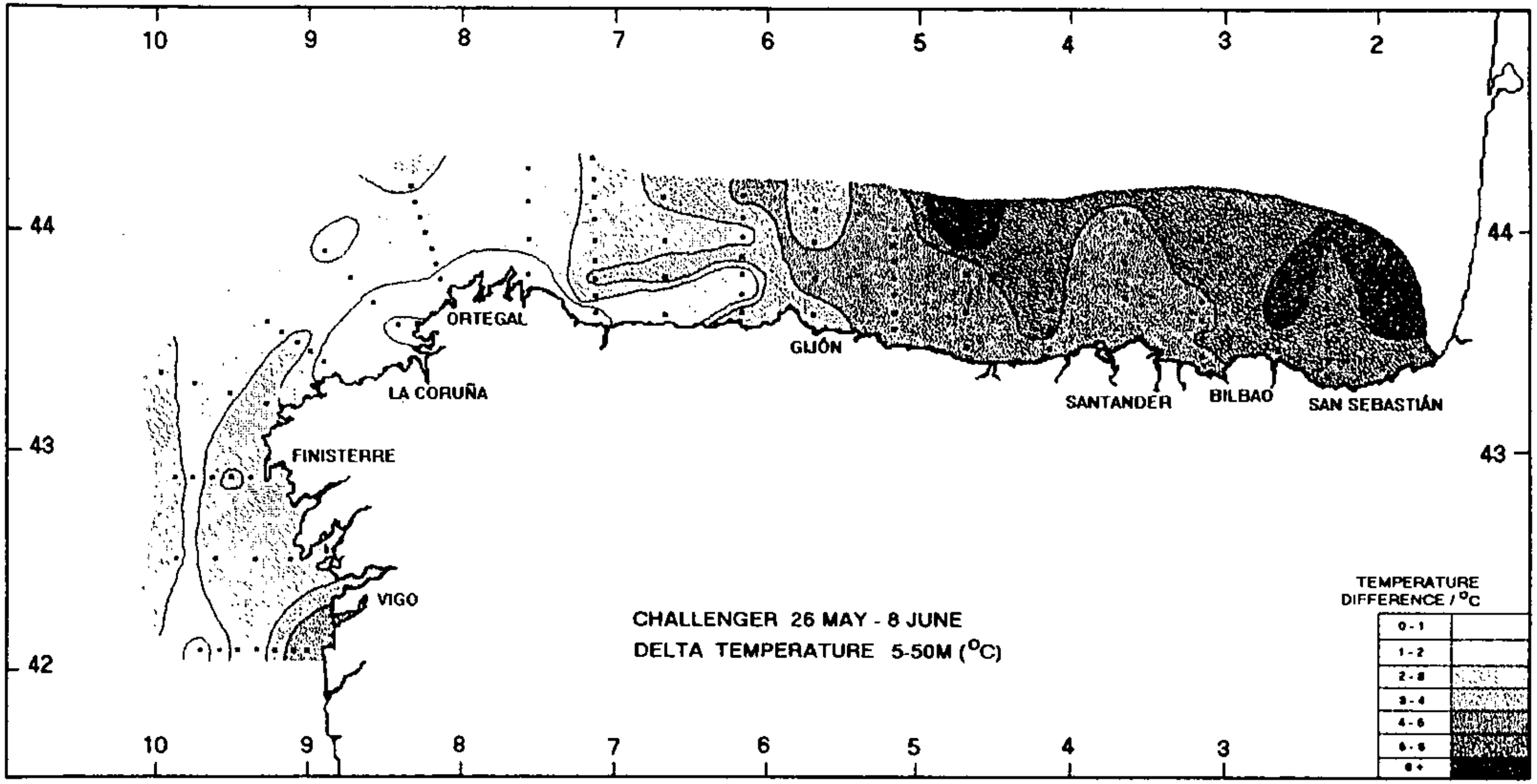

Fig. 7. Temperature stratification.

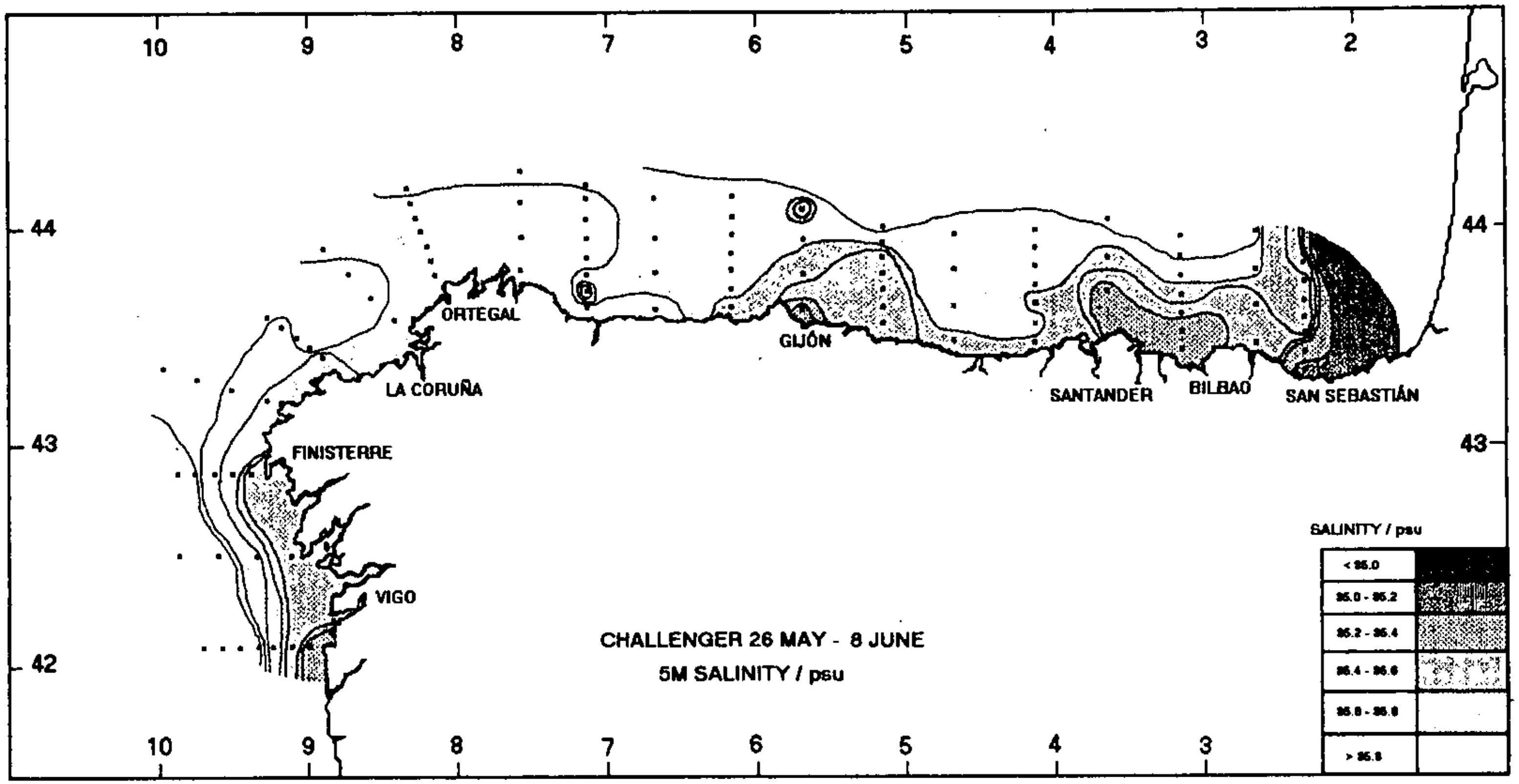

Fig. 8. Surface salinity.

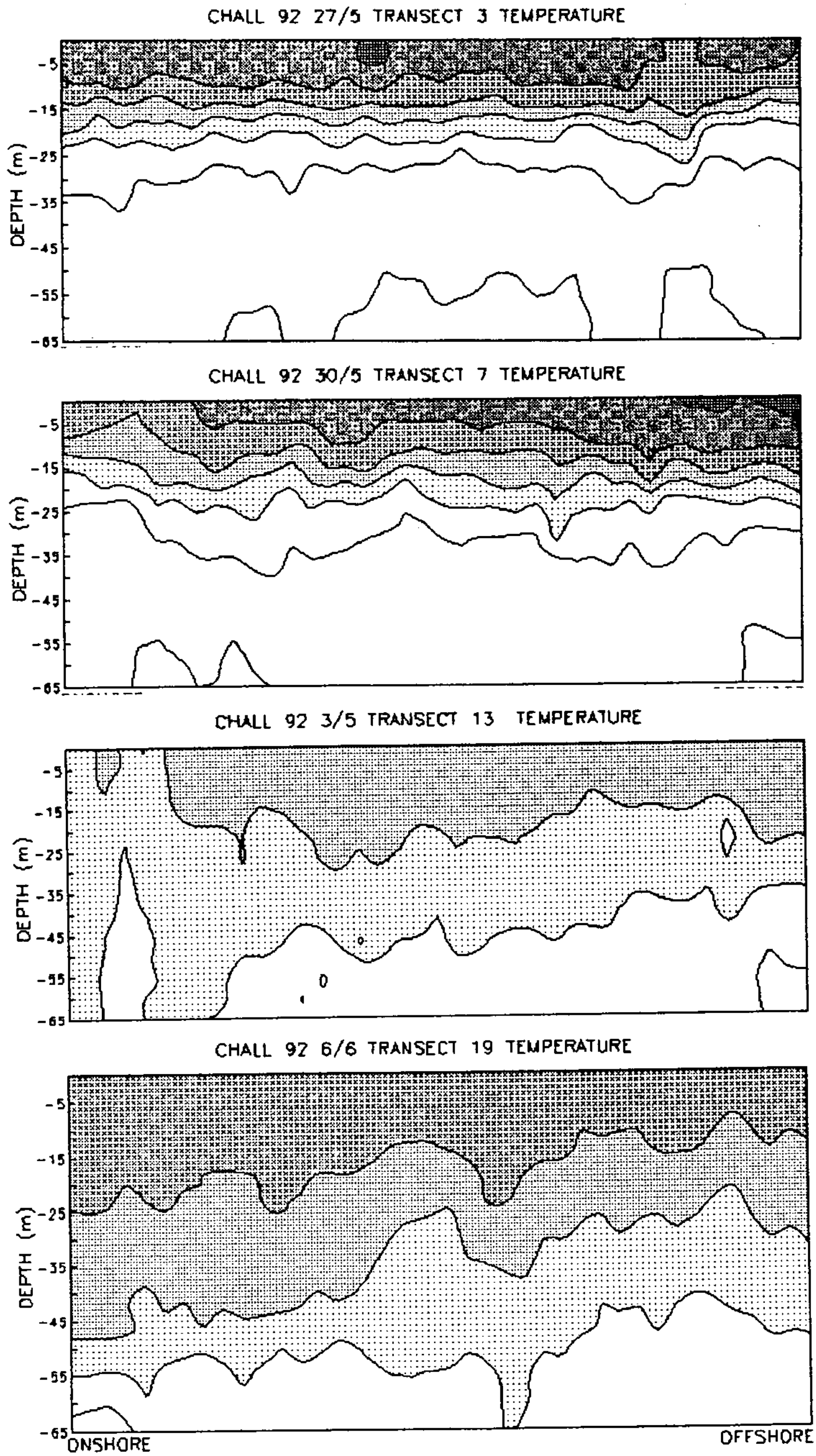

Fig. 9. Selected temperature transects from UNDULATOR sampling.

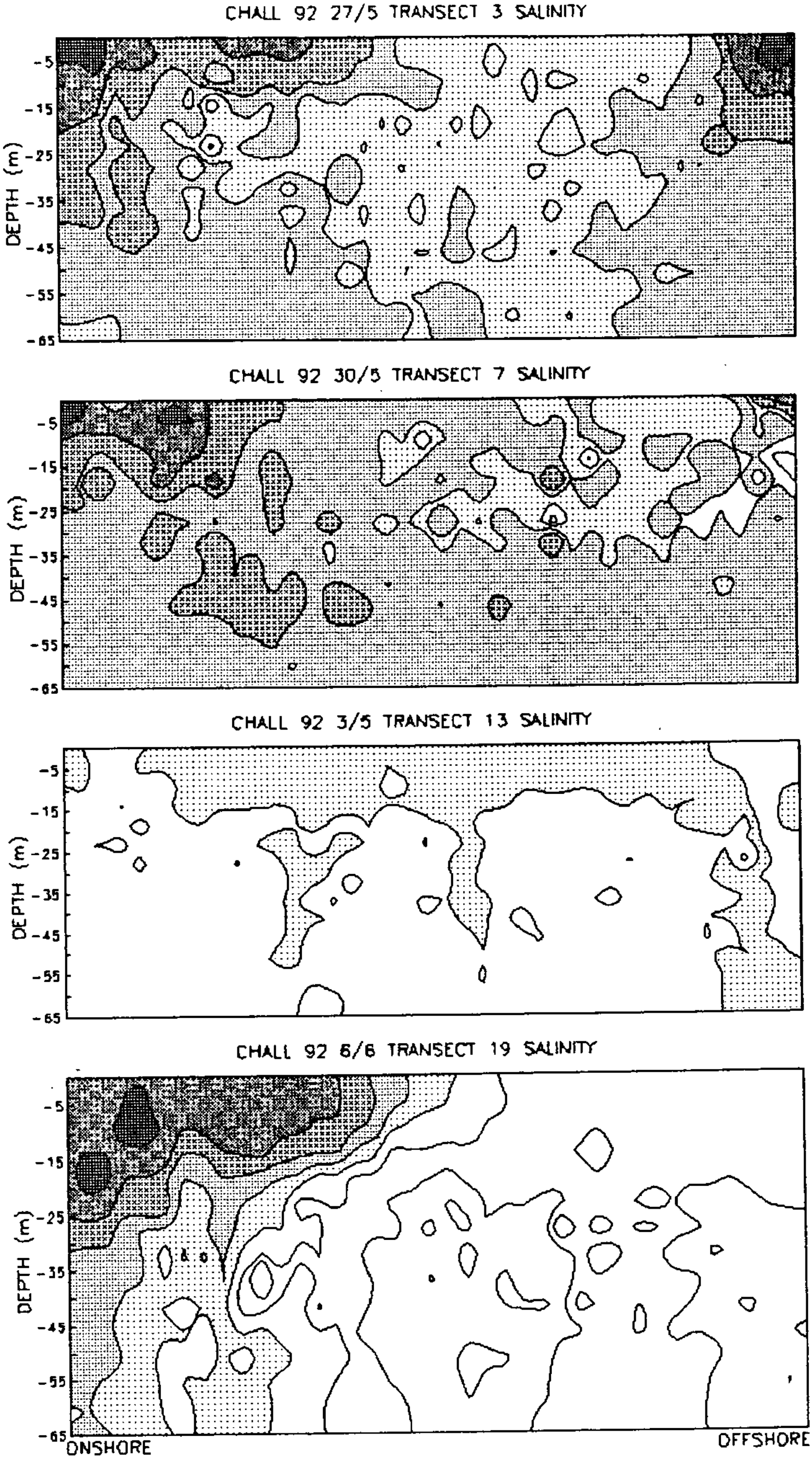

Fig. 10. Selected salinity transects from UNDULATOR sampling.

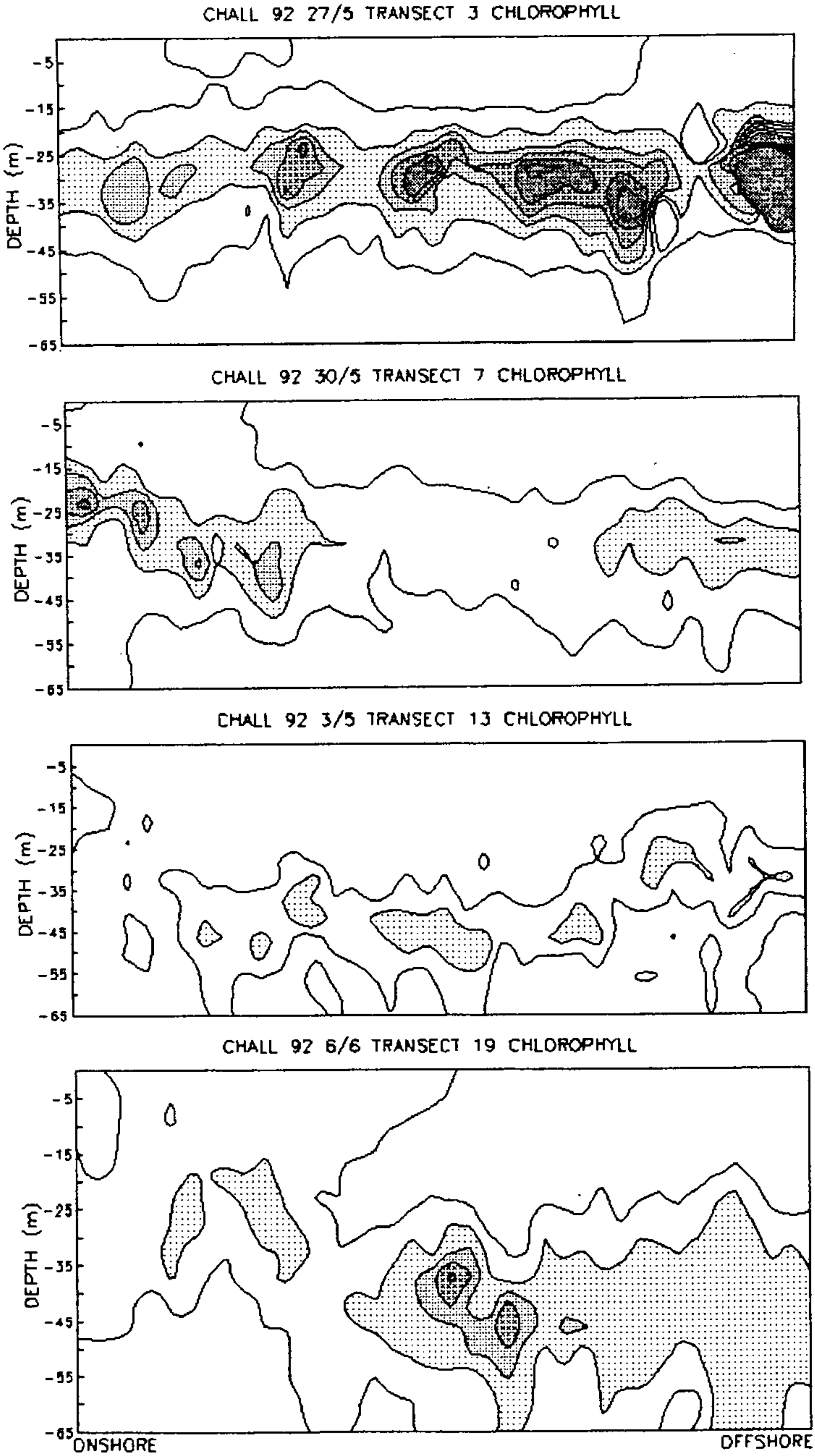

Fig. 11. Selected chlorophyll transects from UNDULATOR sampling.

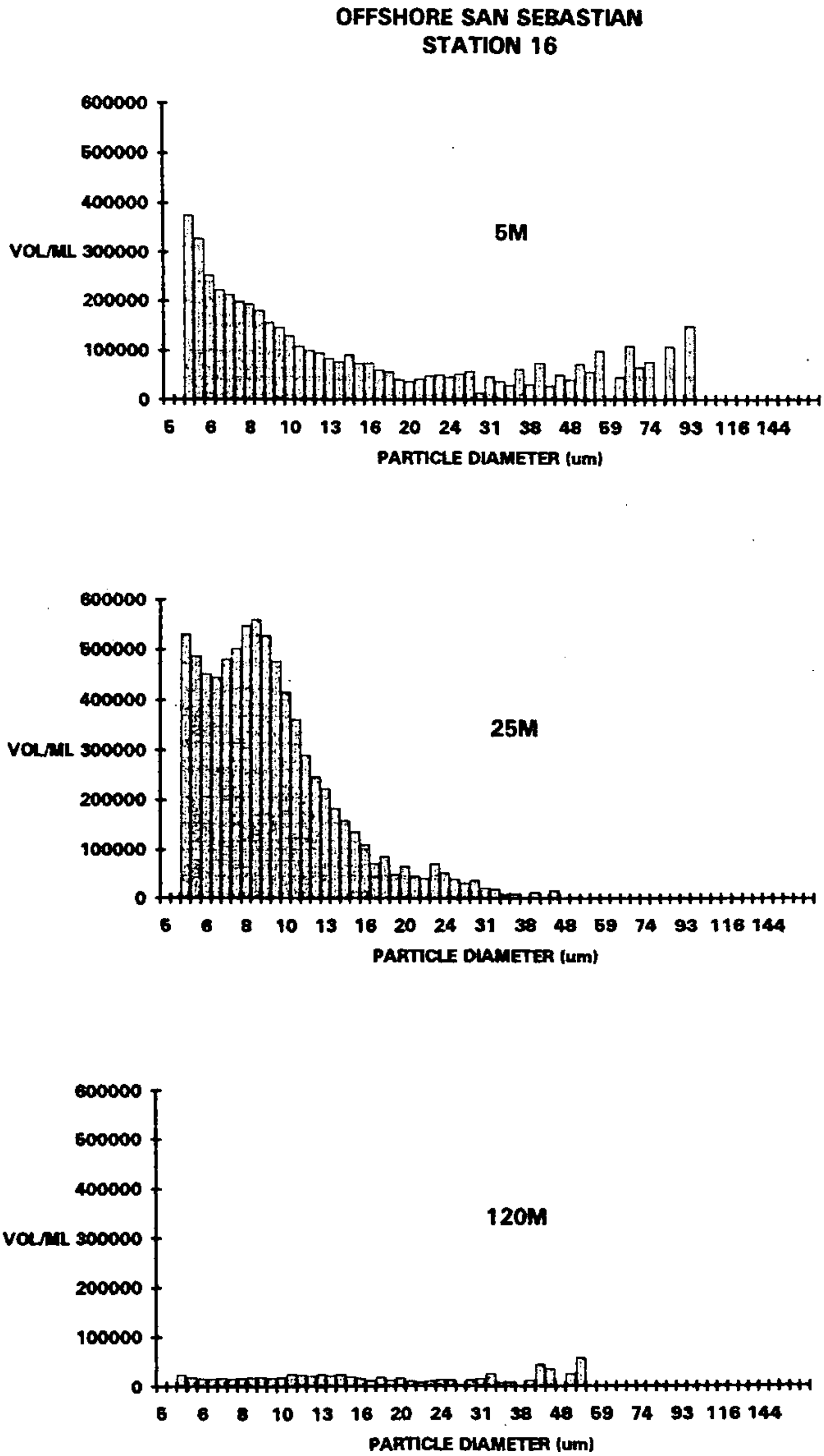

Fig. 12. Vertical profile of particulates.

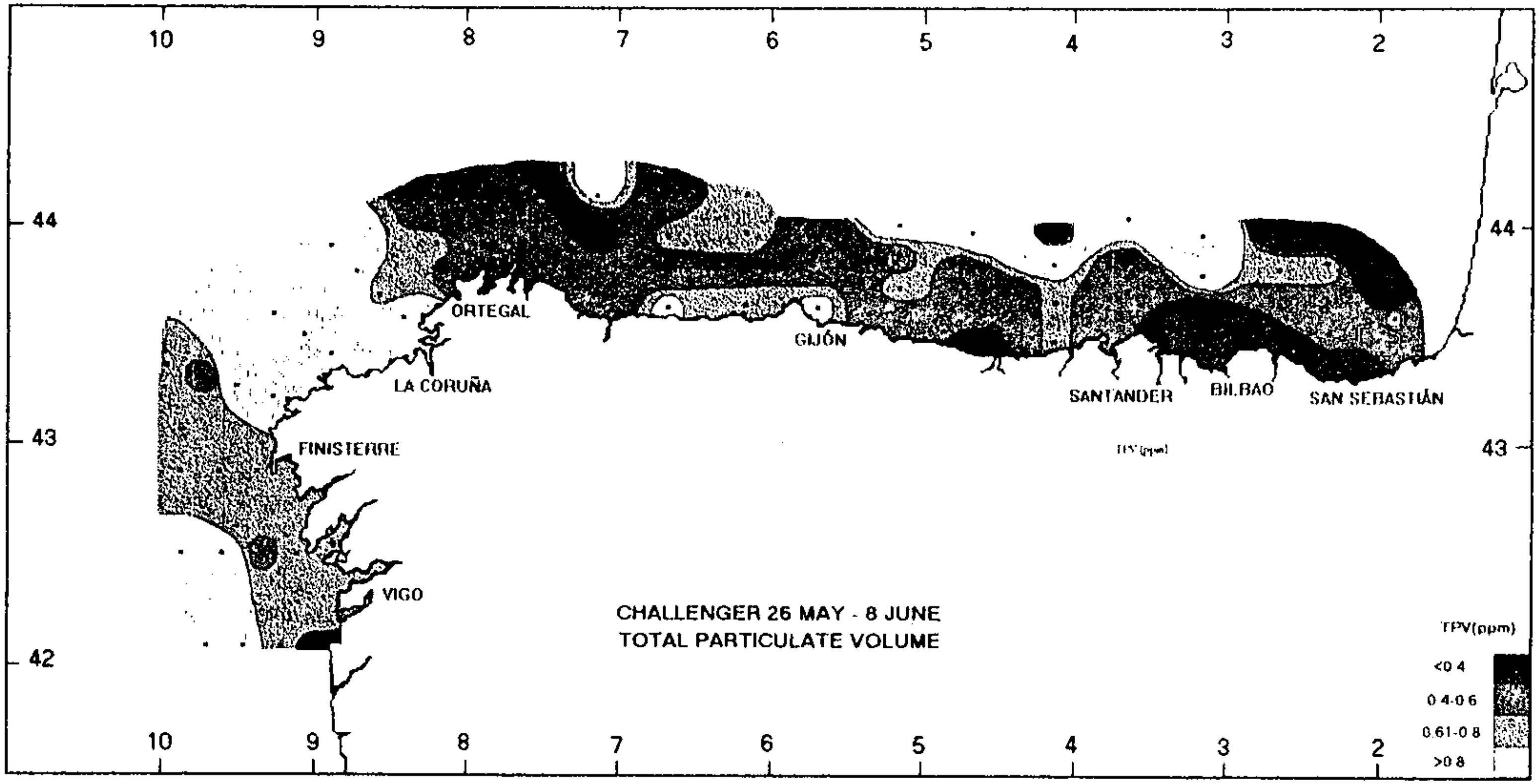

Fig. 13. Distribution of total particulate volume.

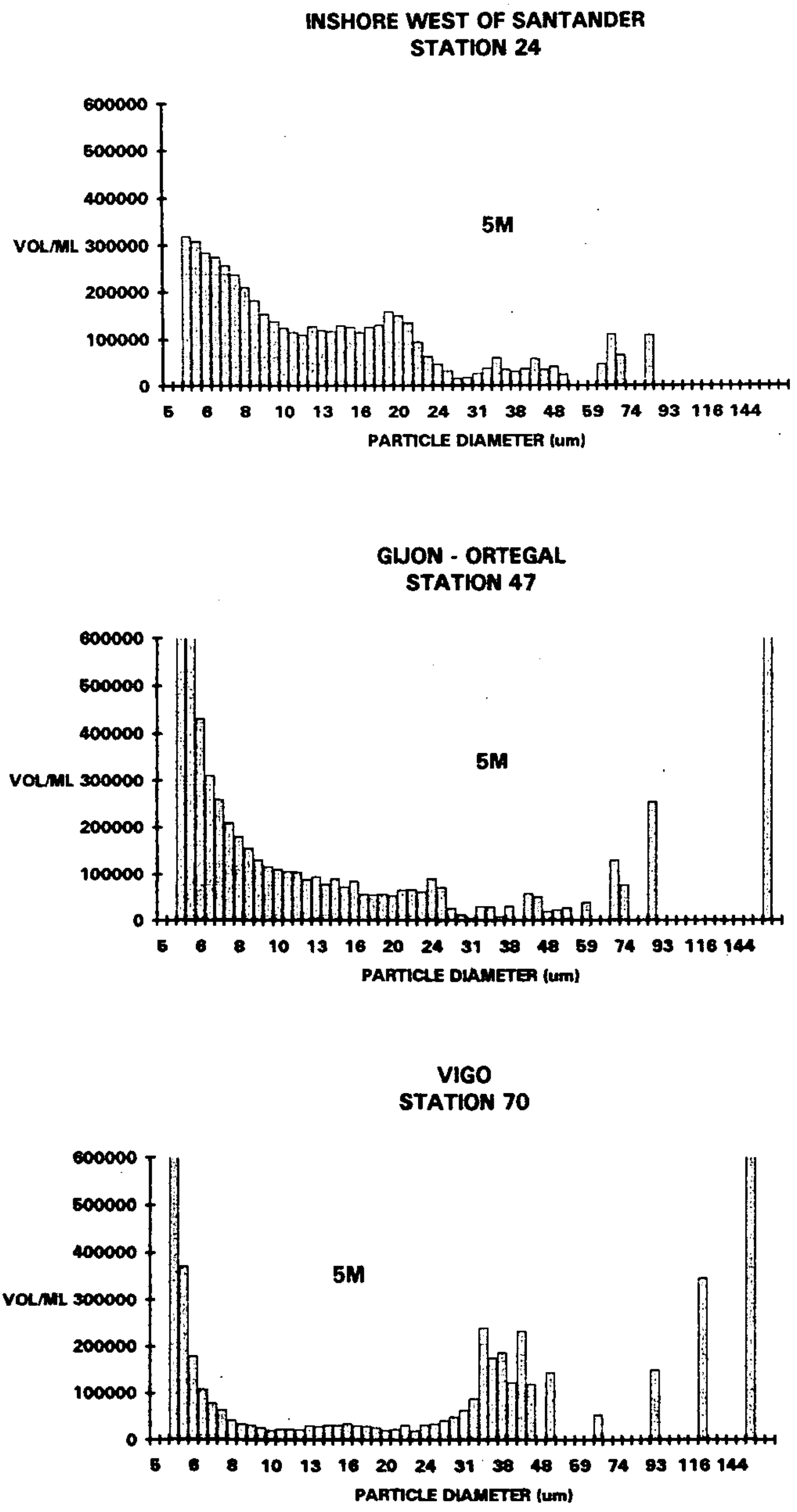

Fig. 14. Representative particulate distributions.

STN	Latitude	Longitude	GEAR	TIME	Nos OF LARVAE	Revs start	Revs end	Revs diff	FLOW (cu m)	Depth sampled	Nos sq m
1	43.33.60 N	03.40.7 W	50cm Bongo	0028	260	862042	899633	37591	393.7	45	29.72
2	43.40.00	03.40.30	50cm Bongo	1319	96	669520	729980	60440	633.0	110	16.68
3	43.48.50	03.40.60.	50cm Bongo	1531	100	729960	795811	65851	689.7	100	14.50
4	43.55.80	03.40.10	50cm Bongo	1722	2	795817	862044	66227	693.6	105	0.30
5	43.26.60	03.11.00	50cm Bongo	0634	198	899633	934333	34700	363.4	39	21.25
6	43.34.20	03.10.90	50cm Bongo	0858	42	934335	1009442	75107	786.6	95	5.07
7	43.42.20	03.11.00	50cm Bongo	1125	1	1009443	1089138	79695	834.7	78	0.09
9	43.50.90	02.40.90	50cm Bongo	1638	4	89138	163861	74713	782.5	90	0.46
10	43.43.70	02.40.00	50cm Bongo	1834	0	163850	229078	65228	683.2	100	0.00
11	43.36.40	02.40.10	50cm Bongo	2033	4	229078	278364	49286	516.2	120	0.93
12	43.29.60	02.39.40	50cm Bongo	2255	71	278364	310024	31660	331.6	80	17.13
13	43.21.40	02.19.40	50cm Bongo	0723	10	310025	346535	36510	382.4	75	1.96
14	43.28.80	02.19.00	50cm Bongo	0936	21	346578	399079	52501	549.9	110	4.20
15	43.37.20	02.18.90	50cm Bongo	1209	8	399079	474971	75892	794.8	100	1.01
16	43.45.30	02.18.80	50cm Bongo	1430	20	474972	549991	75019	785.7	90	2.29
17*	43.50.20	02.02.70	50cm Bongo	1646	0	634862	720015	85153	891.8	92	0.00
18*	43.44.10	01.59.00	50cm Bongo	1835	2	634862	720015	85153	891.8	92	0.21
19*	43.36.20	01.54.60	50cm Bongo	2030	0	720012	793038	73026	764.8	90	0.00
20*	43.30.10	01.51.00	50cm Bongo	2214	1	793035	869297	76262	798.7	95	0.12
21	43.51.50	04.10.40	50cm Bongo	0832	11	465902	526073	60171	630.2	95	1.66
22	43.44.22	04.10.56	50cm Bongo	1041	7	526076	559267	33191	347.6	117	2.36
23	43.36.51	04.10.68	50cm Bongo	1248	57	559273	617575	58302	610.6	90	8.40
24	43.28.23	04.10.44	50cm Bongo	1453	33	617578	674768	57190	599.0	85	4.68
25	43.28.10	04.39.40	50cm Bongo.	1757	24	674767	732668	57901	606.4	110	4.35
26	43.35.60	04.40.60	50cm Bongo	1932	16	732670	783333	50663	530.6	182	5.49
27	43.43.35	04.40.25	50cm Bongo	2110	2	783429	830229	46800	490.2	92	0.38
28	43.51.61	04.39.67	50cm Bongo	2251	31	830245	887826	57581	603.1	110	5.65
29	43.32.80	05.09.40	50cm Bongo	0631	14	887831	925807	37976	397.7	85	2.99
30	43.39.55	05.11.12	50cm Bongo	0813	3	925807	992277	66470	696.2	112	0.48
31	43.48.41	05.10.86	50cm Bongo	1007	13	992277	1029604	37327	390.9	110	3.66
32	43.55.91	05.11.56	50cm Bongo	1157	16	29603	85195	55592	582.2	120	3.30
33	44.03.75	05.38.79	50cm Bongo	1452	32	85195	147933	62738	657.1	110	5.36
34	43.56.50	05.39.38	50cm Bongo	1628	40	147957	212343	64386	674.3	110	6.52
35	43.48.60	05.39.60	50cm Bongo	1800	85	212317	280266	67949	711.7	95	11.35
36	43.40.20	05.39.50	50cm Bongo	1935	23	280267	347349	67082	702.6	70	2.29
37	44.02.12	06.09.39	50cm Bongo	0459	51	347348	406825	59477	622.9	125	10.23
38	43.54.44	06.10.67	50cm Bongo	0554	240	406824	477676	70852	742.1	95	30.73
39	43.46.76	06.10.62	50cm Bongo	0843	330	477678	542176	64498	675.5	100	48.85
40	43.38.27	06.10.31	50cm Bongo	1019	45	542179	574813	32634	341.8	65	8.56
41	43.36.59	06.39.67	50cm Bongo	1306	31	574813	604931	30118	315.4	70	6.88
42	43.42.35	06.40.76	50cm Bongo	1427	93	604930	674206	69276	725.6	105	13.46
43	43.52.17	06.40.90	50cm Bongo	1510	91	674206	739598	65392	684.9	92	12.22

Table 1. Coarse mesh bongo tow data.

STN	Latitude	Longitude	GEAR	TIME	Nos OF LARVAE	Revs start	Revs end	Revs diff	FLOW (cu m)	Depth sampled	Nos sq m
44	44.01.70	06.41.10	50cm Bongo	1757	173	739605	815313	75708	792.9	85	18.55
45	44.06.80	07.03.81	50cm Bongo	2020	64	815313	869161	53848	564.0	125	14.19
46	43.57.95	07.04.90	50cm Bongo	2226	92	869161	936093	66932	701.0	110	14.44
47	43.47.71	07.04.81	50cm Bongo	0031	82	936903	1013580	76677	803.1	90	9.19
48	43.37.74	07.04.74	50cm Bongo	0220	22	13585	58014	44429	465.3	60	2.84
49	44.13.82	06.41.15	50cm Bongo	0859	0	58027	119890	61863	647.9	118	0.00
50	44.16.42	07.03.91	50cm Bongo	0157	196	781017	843289	62272	652.2	115	34.56
51	43.47.12	07.35.60	50cm Bongo	0947	3	843297	888053	44756	468.7	75	0.48
52	43.56.89	07.35.45	50cm Bongo	1119	5	888053	950796	62743	657.1	130	0.99
53	44.06.78	07.35.49	50cm Bongo	1308	5	950798	1019486	68688	719.4	105	0.73
54	44.16.73	07.35.33	50cm Bongo	1457	4	19487	78253	58766	615.5	130	0.84
55	44.14.15	08.16.28	50cm Bongo	1852	39	78257	156407	78150	818.5	73	3.48
56	44.05.77	08.13.75	50cm Bongo	2102	0	156404	219417	63013	660.0	105	0.00
57	43.56.11	08.09.64	50cm Bongo	2304	1	219423	284003	64580	676.4	100	0.15
58	43.46.27	08.07.18	50cm Bongo	0112	27	284003	325162	41159	431.1	82	5.14
59	43.57.67	08.48.44	50cm Bongo	1009	0	325161	386670	61509	644.2	100	0.00
60	43.50.62	08.40.38	50cm Bongo	1129	1	386670	439213	52543	550.3	130	0.24
61	43.42.33	08.32.33	50cm Bongo	1326	0	439213	500688	61475	643.8	100	0.00
62	43.34.46	08.24.32	50cm Bongo	1600	16	500684	541974	41290	432.4	80	2.96
63	43.23.40	08.53.90	50cm Bongo	1810	11	541968	596784	54816	574.1	95	1.82
64	43.29.00	09.04.10	50cm Bongo	2015	0	596786	671947	75161	787.2	90	0.00
65	43.35.44	09.14.25	50cm Bongo	2216	0	671947	721223	49276	516.1	115	0.00
66	43.16.48	09.50.19	50cm Bongo	0654	0	721222	789146	67924	711.4	100	0.00
67	43.14.30	09.39.90	50cm Bongo	0702	0	789151	854280	65129	682.1	90	0.00
68	43.12.00	09.29.30	50cm Bongo	0835	10	854280	916495	62215	651.6	95	1.46
69	43.09.94	09.18.84	50cm Bongo	1004	10	916499	972599	56100	587.6	95	1.62
70	42.50.87	09.19.97	50cm Bongo	1145	15	972400	1014892	42492	445.0	110	3.71
71	42.50.40	09.30.34	50cm Bongo	1444	1	14893	74618	59725	625.5	125	0.20
72	42.50.70	09.41.30	50cm Bongo	1647	0	74618	152676	78058	817.5	75	0.00
73	42.32.80	09.42.80	50cm Bongo	1924	0	152676	225763	73087	765.5	90	0.00
74	42.31.71	09.33.88	50cm Bongo	2057	0	225762	295002	69240	725.2	85	0.00
75	42.31.64	09.23.86	50cm Bongo	2223	0	295002	353069	58067	608.2	120	0.00
76	42.31.54	09.11.92	50cm Bongo	2353	22	353068	379315	26247	274.9	82	6.56
77	42.06.83	09.31.45	50cm Bongo	0850	0	379319	441245	61926	648.6	115	0.00
78	42.07.02	09.21.19	50cm Bongo	1012	23	441247	497777	56530	592.1	108	4.20
79	42.07.01	09.10.09	50cm Bongo	1204	55	497785	554363	56578	592.6	120	11.14
80	42.07.01	08.58.73	50cm Bongo	1348	27	554363	585988	31625	331.2	100	8.15
81	42.17.20	09.04.60	50cm Bongo	1753	15	585988	632172	46184	483.7	87	2.70
82	42.40.74	09.15.21	50cm Bongo	2050	10	632173	691757	59584	624.0	90	1.44
83	43.00.90	09.24.10	50cm Bongo	2337	6	691757	746895	55138	577.5	85	0.88
84	44.22.39	08.22.07	50cm Bongo	1023	3	746949	806412	59463	622.8	95	0.46
85	44.28.59	07.36.90	50cm Bongo	1408	1	806410	852987	46577	487.8	110	0.23
86	44.25.51	07.04.16	50cm Bongo	1956	0	568340	615831	47491	497.4	85	0.00
87	44.12.00	06.09.80	50cm Bongo	0729	1	926846	992085	65239	683.3	110	0.16
88	44.21.42	06.09.97	50cm Bongo	0850	0	992085	1062593	70508	738.5	90	0.00
89	44.23.84	06.39.09	50cm Bongo	1126	1	62592	143871	81279	851.3	80	0.09
90	44.32.99	06.40.49	50cm Bongo	1249	0	143863	223900	80037	838.3	80	0.00

Table 1. Cont.

STATION No	CHN	RNA/ENZYMES	LIPIDS	HISTOCHEMISTRY	OTOLITHS	GUT CONTENTS	BIOCHEMISTRY	No OF NETS SORTED	TOTAL No LARVAE	CLOGGING
1	5	5	7	6	22	84	0	1	260	NO
2	5	0	10	5	23	5	0	1	96	NO
3	4	5	0	5	5	6	0	2	25	NO
4	0	0	0	0	0	2	0	2	2	NO
5	5	5	5	5	42	37	0	1	198	NO
6	5	6	6	5	41	30	0	2	93	NO
7	0	0	0	0	2	0	0	2	2	NO
9	6	0	4	5	22	15	0	2	52	NO
10	0	0	0	3	4	0	0	2	7	NO
11	5	0	0	0	0	3	0	2	8	NO
12	5	12	6	10	24	14	0	2	71	NO
13	5	6	6	8	13	10	0	2	48	NO
14	0	4	7	9	0	15	0	2	35	NO
15	5	0	0	5	6	0	0	2	16	NO
16	0	0	6	5	4	5	0	2	20	NO
17	0	0	0	0	0	0	0	2	0	NO
18	0	0	0	0	0	0	0	2	2	NO
19	0	0	0	0	0	0	0	2	0	NO
20	0	0	0	0	0	0	0	2	1	NO
21	0	5	4	2	0	0	0	2	11	NO
22	0	5	2	0	0	0	0	2	7	NO
23	0	8	8	12	14	15	0	2	57	NO
24	3	9	7	6	5	3	0	2	33	NO
25	5	5	0	5	9	0	0	2	24	NO
26	0	5	5	6	0	0	0	2	16	NO
27	0	2	0	0	0	0	0	2	2	NO
28	0	5	6	6	8	6	0	2	31	NO
29	0	0	0	5	4	5	0	2	14	NO
30	0	3	0	0	0	0	0	2	3	NO
31	0	4	4	5	0	0	0	2	13	NO
32	0	4	0	4	8	0	0	2	16	NO
33	4	0	6	10	5	7	0	2	32	NO
34	6	10	10	5	9	0	0	2	40	NO
35	5	0	7	8	53	12	0	2	85	NO
36	2	0	9	12	0	0	0	2	23	NO
37	6	5	6	10	10	14	0	2	51	NO
38	13	10	10	50	50	42	65	2	240	NO
39	8	11	10	10	40	42	209	2	330	NO
40	6	4	5	5	19	6	0	2	45	NO
41	3	0	10	10	0	8	0	2	31	NO
42	8	8	4	14	73	34	0	2	93	NO
43	6	12	7	20	21	25	0	2	91	NO
44	3	7	10	22	30	30	71	2	173	NO
45	0	10	8	8	28	10	0	2	64	No
46	5	7	9	7	42	22	0	2	92	NO
47	4	8	9	23	18	20	0	2	82	NO
48	3	5	6	0	3	5	0	2	22	NO
49	0	0	0	0	0	0	0	2	0	NO
50	6	52	15	8	59	56	0	2	196	NO
51	0	0	0	3	0	0	0	2	3	NO
52	0	0	0	0	0	5	0	2	5	NO
53	0	0	0	0	5	0	0	2	5	NO
54	0	0	0	0	0	4	0	2	4	NO
55	0	0	5	13	17	9	0	2	39	NO
56	0	0	0	0	0	0	0	2	0	NO
57	0	0	0	0	1	0	0	2	1	NO
58	0	0	8	8	0	11	0	2	27	NO
59	0	0	0	0	0	0	0	2	0	NO
60	0	0	0	0	1	0	0	2	1	NO
61	0	0	0	0	0	0	0	2	0	NO
62	0	8	8	0	0	0	0	2	16	NO
63	0	0	0	0	11	0	0	2	11	NO
64	0	0	0	0	0	0	0	2	0	NO
65	0	0	0	0	0	0	0	2	0	NO
66	0	0	0	0	0	0	0	2	0	NO
67	0	0	0	0	0	0	0	2	0	NO
68	0	0	0	5	5	0	0	2	10	NO
69	0	0	0	5	5	0	0	2	10	NO
70	0	0	0	5	5	5	0	2	15	NO
71	0	0	0	0	1	0	0	2	1	NO
72	0	0	0	0	0	0	0	2	0	NO
73	0	0	0	0	0	0	0	2	0	NO
74	0	0	0	0	0	0	0	2	0	NO
75	0	0	0	0	0	0	0	2	0	NO
76	0	0	3	5	11	3	0	2	22	moderate
77	0	0	0	0	0	0	0	2	0	NO
78	0	0	5	7	8	0	0	2	25	NO
79	6	80	8	7	20	6	0	2	56	NO
80	5	0	5	8	8	6	0	2	27	NO
81	0	0	5	3	5	0	0	2	19	NO
82	0	6	0	0	4	0	0	2	10	NO
83	0	0	0	1	6	0	0	2	7	NO
84	0	0	0	0	3	0	0	2	3	NO
85	0	0	0	0	1	0	0	2	1	NO
86	0	0	0	0	0	0	0	2	0	NO
87	0	0	0	0	1	0	0	2	1	NO
88	0	0	0	0	0	0	0	2	0	NO
89	0	0	0	0	1	0	0	2	1	NO
90	0	0	0	0	0	0	0	2	0	NO

Table 2. Larval preservation details.

HAUL No	STATION	DATE	TIME IN BST	TIME OUT BST	POSITION	No OF SAMPLES - FINE	No OF SAMPLES - COARSE	COMMENTS
1	Stn1 - P2	29/5/92	1344	1418	43 27.5 N 03 10.7 W	22	22	Good haul
2	Stn 2 - P2	29/5/92	2321	2345	43 26.7 N 03 11.0 W	14	14	Good haul
3	Stn 44	2/6/92	1327	1425	44 01.6 N 06 40.7 W	21	21	Good haul
4	Stn 44	2/6/92	2156	2251	43 59.8 N 06 41.3 W	-	-	Coarse mesh jam, (swimming crab)
5	Stn 79/80	6/6/92	1447	1547	42 07.0 N 09 04.6 W	24	24	Good haul
6	Stn 50	7/6/92	1639	1742	44 16.5 N 07 03.5 W	22	22	Good haul
7	Stn 50	7/6/92	2154	2200	44 15.6 N 07 04.0 W	25	25	Good haul

Table 3. LHPR haul information.

STATION No	CHN	RNA/ ENZYMES	LIPIDS	HISTO-CHEMISTRY	OTOLITHS	GUT CONTENTS	BIO-CHEMISTRY	NETS SORTED	No of LARVAE	CLOGGING
P1-2	0	0	0	0	0	0	108	2	108	NO
P1-3	0	0	0	12	0	0	67	2	79	NO
P1-4	0	0	0	0	0	0	73	2	73	NO
P2-1	0	0	0	0	0	0	100	2	100	NO
P2-2	0	0	0	0	0	0	66	2	66	NO
P2-3	0	0	0	0	0	0	103	2	103	NO
P3-1	0	0	0	0	0	0	130	2	130	NO
P3-2	0	0	0	0	0	0	63	2	63	NO
P3-3	0	0	0	0	0	0	74	2	74	NO
P4-1	0	0	0	0	0	0	101	2	101	NO
P4-2	0	0	0	6	0	0	141	2	147	NO
P4-3	0	0	0	0	0	0	120	2	120	NO
44-A	7	0	0	0	0	0	60	2	67	NO
44-B	6	0	0	55	0	0	42	2	103	NO
44-C	4	0	0	7	0	0	29	2	40	NO
44-D	5	0	0	11	0	0	106	2	122	NO
44-E	5	0	0	15	0	0	35	2	55	NO
44-F	5	0	0	15	0	0	58	2	78	NO
44-G	5	0	0	5	0	0	99	2	109	NO
44-H	0	0	0	0	0	0	63	2	63	NO
44-I	5	0	0	7	0	0	103	2	115	NO
44-J	5	0	0	8	0	0	135	2	148	NO

Table 4. Preservation details for pollution sites.

TOW No	DATE	TIME IN (BST)	LENGTH (MINS)	START POSITION	END POSITION	NOTES
1	26/5/92	2033	140	43 57.1 N 03 40.1 W	43 37 N 03 40.5 W	No undulations, alternator cable fault
2	27/5/92	1253	52	43 50.5 N 3 10.1 W	43 50.8 N 2 59 W	Test tow
3	27/5/92	1912	40	Test	Test	Test tow
4	27/5/92	2305	150	43 30.4 N 2 39.3 W	43 52.75 N 2 40.67 W	Towed S-N . Transect 3 Good tow
5	28/5/92	2259	154	43 30.3 N 1 51 W	43 51.85 N 2 04.64 W	Towed SE-NW . Transect 5 Good tow
6	30/5/92	0220	180	43 32.1 N 3 40.9 W	44 00.2 N 3 40 W	Towed S-N.Transect 1.Towed past N end (winch problem). Good tow.
7	30/5/92	2317	165	43 52.6 N 04 39.6 W	43 27.3 N 04 40.9 W	Towed N-S Ttransect 7. Good tow
8	31/5/92	1950	172	43 38.9 N 05 40.0 W	44 05.5 N 05 39.4 W	Towed S-N. Transect 9.Good tow.
9	2/6/92	0428	232	43 36.7 N 06 40.8 W	44 14.6 N 06 41.2 W	Towed S-N. Transect 11. (extended by one stn). Good tow.
10	3/6/92	0602	180	44 17.2 N 07 35.9 W	43 47.2 N 07 35.6 W	Towed N-S.Transect 13. Good tow.
11	4/6/92	0603	192	43 33.9 N 08 24.0 W	43 58.5 N 08 48.6 W	Towed SE-NW.Transect 15. Good tow.
12	5/6/92	0114	176	43 09.8 N 09 17.8 W	43 17.3 N 09 52.8 W	Towed E-W. Transect 17. Good tow
13	6/6/92	0006	159	42 31.5 N 09 11.7 W	42 31.7 N 09 44.6 W	Towed E-W. Transect 19. Logger batteries failed at 2 hr 15 min.

Table 5. Details of UNDULATOR tows.