

# **FRANKLIN**

National Facility  
Oceanographic Research Vessel

## **RESEARCH SUMMARY**

### **Cruise FR 4/91**

Sailed Hobart 0900 Thursday 2 May 1991

Called Queenscliff

Called Bell Bay Monday 20 May 1991

Arrived Sydney 0800 Thursday 23 May 1991

## **BASS STRAIT INTERDISCIPLINARY STUDIES**

**Drs Peter Craig and Peter Nichols**

CSIRO Division of Oceanography, Hobart

## **LOW FREQUENCY CIRCULATION AT THE WESTERN END OF BASS STRAIT**

**Dr John Middleton**

School of Mathematics, University of NSW

## **PHARMACOLOGY OF BASS STRAIT INVERTEBRATES**

**Dr Robert Capon**

The University of Melbourne

June 1991

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**Research Summary**  
**RV *Franklin* FR 4/91**

**Bass Strait Interdisciplinary Studies**

**Scientific Objectives**

- To determine present chemical levels in Bass Strait water and sediments, with emphasis on the coastal margins and anthropogenic inputs.
- By deploying instrument arrays at the eastern and western ends of Bass Strait, estimate and explain mass and energy fluxes through the Strait under both summer and winter conditions.
- Relate chemical distributions to the physical dynamics of the Strait through the use of numerical circulation and dispersion models.

**Cruise objectives**

- Retrieve five current meter moorings at the eastern end and six at the western entrances to the Strait.
- Conduct regular CTD stations and underway ADCP measurements along the cruise track.
- Collect and analyse underway surface water temperature, salinity and pH. The pH data will be used to estimate pCO<sub>2</sub> of surface waters.
- Collect water and sediment samples at stations throughout Bass Strait with particular reference to coastal margins. This sampling will include collection of sediment samples for the DO Tasmania/Bass Strait oil-seep survey program.
- Deploy and recover two small chemistry moorings, one at the Black Rock sewage outfall and the other in Burnie Harbour.

- Collect sediment samples off East Gippsland as part of collaborative studies with the School of Chemistry, University of Melbourne.
- Collect water samples for  $\Sigma \text{CO}_2$  and titration alkalinity to investigate carbon cycling.
- Collect atmospheric gas samples for the CSIRO Division of Atmospheric Research for the analysis of  $\text{CO}_2$  and other relatively important tracer gases.
- Time permitting, collect sediment and water samples adjacent to Sydney's sewage outfalls.

### **Low Frequency Circulation at the Western End of Bass Strait**

#### **Scientific Objectives**

- Determine the net flux of mass and energy scattered into the western mouth of Bass Strait as a fraction of that due to incident coastal-trapped waves from the Great Australian Bight.
- Determine the circulation on the shelf west of Bass Strait and in particular, the mechanism for upwelling of nutrients into the Strait itself.

#### **Cruise objectives**

- Five current meter moorings will be retrieved on the shelf west of Bass Strait
- CTD and ADCP measurements will be made at the mooring sites and across the shelf.

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### **Pharmacology of Bass Strait Invertebrates**

#### **Scientific Objectives**

- To collect marine invertebrates to detect sources of chemical, biochemical and pharmacological useful substances.

#### **Cruise Objectives**

- Collection of sponges (by dredging) at selected locations in Bass Strait

## Cruise Summary

For convenience this report divides the FR4/91 cruise into four legs:

- leg 1: Hobart to Hunter Island, comprising four north-south transects of Bass Strait.
- leg 2: Tasmanian and Victorian coastal transects including six nearshore intensive sections (Hunter Island to Queenscliff)
- leg 3: Mooring recovery at eastern and western boundaries of the Strait and off the west coast of Tasmania and Western Victoria (Queenscliff- Bell Bay)
- leg 4: Bell Bay to Sydney including CTD sections in the vicinity of the deepwater ocean outfall at Malabar (DOOM)

A full list of chemical sampling undertaken during the four legs is presented in Table 1 and cruise tracks for each leg are shown in Figures 1-4.

### Leg 1

Four north-south straitwide transects were undertaken at 147E, 146E, 145E and between Cape Otway and King and Hunter Islands (Figure 1). CTD stations were occupied in one of two ways.

- A. Detailed chemical station:
  - 1. CTD dip with samples taken for routine hydrology ( 2 depths) and other chemical assays
  - 2. Grab sample for sediment
- B. CTD station:
  - Samples taken for routine hydrology (as for 1 above)

With the exception of the hydrology and pigment samples, all samples were collected and stored for analyses upon return to the Marine Laboratories. Pigment samples collected during legs 1-3 were, for the first time during a CSIRO research cruise, extracted and analysed by high performance liquid chromatography (HPLC) during the cruise. HPLC analysis of pigments provides information on

phytoplankton abundance and species composition. Preliminary data interpretation shows Strait waters clearly subdivided according to phytoplankton pigment profiles. A separate report on the operation of the HPLC and associated equipment is appended (with recommendations for future cruises). In summary, the success of the equipment and high quality of data obtained during the cruise ensures that the system will be used on future research cruises aboard RV Franklin.

Two small chemistry moorings were deployed in Burnie Harbour adjacent to APPM (41° 03.385, 145° 56.2E; May 5, 1991; 18m water depth) and at the Black Rock sewage outfall (38° 18.260 S, 144 25.325S; May 6, 1991; 24m). Both moorings comprised a dual chamber sediment trap (4m from bottom) and a Seastar *insitu* water sampler (3m above bottom) which collects both particulate and dissolved material. The Burnie mooring was deployed with a concrete anchor and surface float, whilst the Black Rock mooring was subsurface and fitted with a Seastar acoustic release. Both moorings were designed so that the chemical instrumentation could be suspended under the A-frame during deployment. For future deployments of this or similar gear, care should be taken to ensure that floatation balls are held clear of the equipment and that the length of the mooring is such that the weight is lifted during deployment.

The CTD sections showed the Strait to be well-mixed in the vertical (e.g. Fig.5, 147°E transect). Horizontally, temperatures graded from around 16.3°C in the north-east to 14.9° in the south-west. In the very north-east, (in the 147°E and, later, the 148°E transects) there was an intrusion of cooler water, down to 15.3°C, out to 40km from the coast.

## Leg 2

During leg 2, sampling was undertaken along both the northern Tasmanian and Central Victorian coast-lines (Table 1, Figure 2). In addition, the transect between Banks Strait and Lakes Entrance, Victoria, was completed. During the coastal sampling six nearshore sections were completed. The sections comprised full chemical stations (see above and Table 1 for details) nominally at 0.5, 1,2,3,5 and 10 nautical miles from the shore or area of interest.

The six sections were as follows:

1. Burnie Harbour, chemistry mooring MC1 was successfully recovered May 7, 1991
2. Wesley Vale
3. Tamar River mouth
4. East Gippsland. Site of the proposed Latrobe Valley Water and Sewage Board outfall
5. Westernport Bay

6. Black Rock. Sewage outfall site. Chemistry mooring MC2 was successfully recovered on May 12, 1991. No trouble was encountered with the Seastar acoustic release.

Additional sediment samples were collected for dating and other specialised assays by Bruce Brady (Chemistry Department, University of Melbourne). All samples were collected during legs 1 and 2.

Summary of samples collected:

Station 15, 2 cores and 1 grab sample; 17, 3 cores; 19, 1 core; 23, 1 grab sample; 25, 2 cores; 27, 2 cores; 39, 2 cores; 44, 2 cores, 1 grab sample; 5, 1 grab sample; 56, 2 cores; 72, 75, 77, 84, 1 grab sample at each; 86, 2 cores, 1 grab sample; 87, 1 grab sample.

At the completion of leg 2, Franklin entered Port Phillip Bay on May 12 and anchored off Queenscliff from 1400 to 1600 (local). Scientific crew members and equipment were transferred courtesy of the Marine Science Laboratories' (MSL) Queenscliff launch. Visitors from MSL, CSIRO Division of Atmospheric Research and the University of Melbourne were provided with tours of the vessel during the layover.

### Leg 3

Leg 3 was the moorings-recovery leg of the cruise. In cruise FR1/91, we deployed moorings 1 to 5 at the eastern end of Bass Strait, moorings 6 to 10 (including 9 and 9A) at the western end, and the University of New South Wales' moorings, designated M1 to M5, to the west of the Strait. (see Fig.3)

The moorings were recovered in effectively reverse order of deployment, beginning at M5, working southward, then traversing Bass Strait and working southward again to mooring 1. We attempted to optimise our timing to allow recoveries during daylight, with other activities such as steaming, trawling and CTD's concentrated during the night. (CTD casts were repeated at every mooring site.)

Full details of the recoveries are provided in the enclosed Moorings Group report. Of the 16 moorings, only 9 were recovered. Table 2 summarises the returns and losses.

None of the Seastar releases operated. At moorings M5, 9A and M2, the releases responded with a range, but refused to release. We attempted and repeated a number of trawling techniques (see the moorings' report), but were successful only with M2. There we managed to snag the mooring and

break the connecting link between the release and the anchor. The release came to the surface still closed, but opened with no problems on deck.

Moorings M1 and 7 appear to have been trawled by fishermen. The current meter from M1 was returned to us in March by a fisherman, but we were able to find no trace of the anchor weight with its release (Seastar) and tide gauge. Mooring 7 was found 2 miles off location. When released, only the acoustic release and its flotation surfaced. We can only assume that the three current meters were caught in a net, dragged and eventually broken off or unfastened.

Of the remaining moorings, there was no trace of M4 or M3. Neither release (a Seastar and an EG & G respectively) gave any response. The same was true at mooring 3, except that here we twice (on successive days) managed to get a tantalising echo on the ship's sonar, within about 50m of the recorded mooring position. With the ship's movement, however, the signal could not be sustained for more than one or two minutes.

In terms of ease-of-handling, the success-story of the cruise was the acoustic doppler current profilers, that were deployed as moorings 8 and 9. The complete moorings, consisting of profiler, buoyancy and release, can be suspended under the ship's A-frame. Deployment and recovery can each be achieved in minutes.

Overall, the instrument return rate from the cruise was disappointing. According to the Master, the Franklin has not before lost a mooring. Here we lost 7. The loss rate highlights the risks associated with mooring-work in coastal waters subject to fishing. It also convincingly demonstrates the unreliability of Seastar releases.

Discussion of the cruise will no doubt, over time, lead to modification of our mode of operation in continental shelf waters. Some suggestions (which should read in conjunction with those of the moorings group) are as follows:

*Franklin equipment:*

- For recoveries, we could be better equipped with trawling gear, such as a pair of otter boards, and a trawl-line that would hook the mooring itself rather than the anchor weight.
- Consideration should be given to the purchase of a sonar system that could be used for reliably identifying subsurface moorings.

*Mooring design:*

Possibilities for modification include

- surface markers, with navigation lights and radar reflectors
- ground lines, to facilitate recovery by (deliberate) trawling
- pressure - activated satellite transmitters, to enable (accidentally) trawled moorings to be tracked.

The instrument tapes have yet to be read, so that we as yet do not know the final data return. For the *Bass Strait Interdisciplinary Study*, one complete mooring (3) is missing in the east, and another (7) plus the thermistor string (9A) in the west. This should still enable accurate estimations of the mass and energy flux across each boundary, so that the experiment should not be seriously compromised. For the University of New South Wales experiment, *Low frequency circulation at the western end of Bass Strait*, only one out of the original eight instruments survived the distance. The tide gauge recovered with M2 did not function.

During leg 3, gas samples were collected along the west coast of Tasmania for the CSIRO Division of Atmospheric Research (DAR). Samples were collected on the bow of the ship, from 0200-0600 and 2130-2400, May 15, and 0030 to 0200, May 16 under westerly wind conditions (see Table 3 for details). Surface seawater samples were collected simultaneously for total alkalinity and nutrient measurements for collaborative investigations between Dr Tilbrook (CSIRO DO climate research group) and DAR.

At the end of the leg 3 mooring recovery, Franklin steamed to Burnie Harbour and anchored overnight (19 May, 1991) at  $41^{\circ} 03.37S$   $145^{\circ} 56.20E$ , where the 18m CTD station #118 was performed. This station was approximately 400m closer to shore than station #39. Two Seastar water samplers were then suspended overnight from the ships starboard A-frame (at approximately 5 and 10m).

Beam trawls were undertaken for collection of sponges by Mark Butler (Chemistry Department, University of Melbourne). Trawls were performed during legs 1-3 after stations 9, 18, 19, 27, 28, 36, 46, 62, 65, 103, 106, and 114 with a further two on the leg 3 traverse of the Strait. Full catch details can be obtained from Mr. M. Butler and Dr R. Capon, University of Melbourne.

#### **Leg 4**

Following a five hour port call at Bell Bay to exchange scientific personnel and off-load chemistry samples and mooring gear, Franklin steamed directly to waters south of Sydney's deep water ocean outfall at Malabar (DOOM) offshore from Botany Bay. Thirteen CTD stations were undertaken (Table 1) and six sediment samples were collected (stations # 120, 126, 127, 128, 130 and 131, Figure 4) The Seatech transmissometer was used for all stations. In order to optimise the limited sampling time available, no water column hydrology or other chemical sampling was undertaken. On completion of station # 131 a Seastar water sampler was deployed overnight at a depth of 40m south of the DOOM outfall (deployment at approximately 33° 59.0S, 151° 17.9E).

Franklin docked at White Bay No. 6 berth, Balmain at 0800 May 23. Visitors from the Sydney Water Board, the NSW State Pollution Control Commission, ANSTO and CSIRO Centre for Advanced Analytical Chemistry were provided with tours of the vessel.

## Personnel

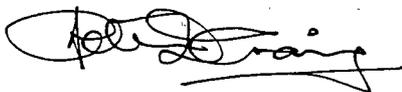
Peter Nichols	CSIRO Oceanography	Chief Scientist
Rhys Leeming	"	
Mark Rayner	"	
Harry Higgins	"	(legs 1 & 2)
Teresa O'Leary	"	(legs 1, 2 & 3)
John Volkman	"	(legs 1 & 2)
Peter Craig	"	(leg 3)
Fred Boland	"	(leg 3)
Danny McLaughlin	"	(leg 3)
Michael Turner	CSIRO Auditor	(leg 4)
Mark Butler	Uni. of Melbourne	(legs 1, 2 & 3)
Bruce Brady	"	(legs 1,2)
Erik Madsen	CSIRO-ORV	
Bob Beattie	"	
Val Latham	"	
Dave Terhell	"	
Garth Paltridge	IASOS Uni. of Tas	(leg 4)
	Chairman ORV Steering Committee	

## Ships Crew

Neil Cheshire  
Dick Dougal  
Mike McCauley  
Peter Noble  
Ron Parrott  
Ron Boulton  
Janick Hansen  
Kris Hallen  
Bluey Hughes  
Wayne Browning  
Jeff Snell  
Gary Hall  
Bob Clayton  
Steve Corr

## Acknowledgement

We extend our sincere thanks to the master and crew of the *RV Franklin* for their co-operation and assistance throughout the cruise.



Peter D. Craig



Peter D. Nichols

Table 1: FR4/91 chemistry station locations and sampling details

CTD No.	Location lat. (S)long. (E)	Date (UTC)(UTC)	Time (UTC)	Water depth	Mooring No.	Sampling depths	Pig. water	Hydro water	CHN water	Isotope water	Lipids water	DOC water	AOX water	AOX sed.	Lipids sed.	
Leg 1																
147 East transect																
2	40 57.57 147 08.73	3/5/91	115	30		0	4.6	x	0.5	2	43.2				1 jar	
						28	4.3	x	0.5	2	43.2					
3	40 42.45 146 59.92	3/5/91	330	71		0	4.75	x	0.5	2	43.2				1 jar	
						65	4.45	x	0.5	2	43.2					
5	40 10.88 146 60.00	3/5/91	733	75		0	4.7	x	0.5	2	43.2				1 jar	
						70	4.45	x	0.5	1.8	43.2					
7	39 39.90 146 59.98	3/5/91	941	75		0	4.75	x	0.5	2	43.2				1 jar	
						70	4.8	x	0.5	2	43.2					
9	39 08.01 146 59.81	3/5/91	1545	57		0	4.3	x	0.5	2	43.2				1 jar	
						55	4.2	x	0.5	2	43.2					
11	38 36.00 147 00.36	3/5/91	2020	22		0	4.15	x	0.5	2	43.2				1 jar	
						20	4.18	x	0.5	2	43.2					
146 East transect																
12	38 55.66 146 00.04	4/5/91	301	25		0	3.9	x	0.5	2	43.2				1 jar	
						20	4.8	x	0.5	2	43.2					
13	39 10.39 146 00.04	4/5/91	459	78		0	5	x	0.5	2	43.2				1 jar	
						70	4.75	x	0.5	2	43.2					
14	39 26.90 145 59.90	4/5/91	653	77		0	5	x	0.5	2	43.2					
						25	5.15	x	0.5	2	43.2					
						70	4.7	x	0.5	2	43.2					
15	39 43.76 146 00.06	4/5/91	852	80		0	4.85	x	0.5	2	43.2				1 jar	
						79	4.8	x	0.5	2	43.2					
16	39 59.90 146 00.05	4/5/91	1053	81		0	5.4	x	0.5	2	43.2					
						25	5.1	x	0.5	2	43.2					
						80	4.9	x	0.5	2	43.2					
17	40 16.02 145 59.98	4/5/91	1242	79		0	4.9	x	0.5	2	43.2				1 jar	
						74	4.1	x	0.5	2	43.2					
18	40 31.86 146 00.02	4/5/91	1437	75		0	4.82	x	0.5	2	43.2					
						75	4.8	x	0.5	2	43.2					
19	40 47.59 145 59.62	4/5/91	1718	71		0	4.85	x	0.5	2	43.2				1 jar	
						69	5.1	x	0.5	2	43.2					
20	41 02.55 145 60.00	4/5/91	2012	33		0	4.9	x	0.5	2	43.2					
						31	5.15	x	0.5	2	43.2					

Table 1 (continued)

CTD No.	Location lat. (S)long. (E)	Date Time (UTC)(UTC)	Water depth (m)	Mooring No.	Sampling depths	Pig. water	Hydro water	CHN water	Isotope water	Lipids water	DOC water	AOX water	AOX sed.	Lipids sed.
145 East transect														
21	40 23.96 145 22.00	5/5/91 430	28		0	4.65	x	0.5	2	43.2				1 jar
					20	4.95	x	0.5	2	43.2				1 jar
23	39 56.05 144 59.98	5/5/91 800	54		0	4.65	x	0.5	2	43.2				1 jar
					50	4.75	x	0.5	2	43.2				1 jar
25	39 27.98 144 59.99	5/5/91 1130	69		0	4.9	x	0.5	2	43.2				1 jar
					65	4.6	x	0.5	2	43.2				1 jar
27	38 59.14 145 00.02	5/5/91 1510	71		0	5.1	x	0.5	2	43.2				1 jar
					69	5	x	0.5	2	43.2				1 jar
28	38 44.09 144 59.98	5/5/91 1747	75		0	5.05	x	0.5	2	43.2				1 jar
					74	4.9	x	0.5	2	43.2				1 jar
29	38 32.06 145 00.07	5/5/91 1949	46		0	5	x	0.5	2	43.2				1 jar
					43	4.75	x	0.5	2	43.2				1 jar
30	38 18.40 144 25.50	5/5/91 2310	25	MCI	0	4.85	x	0.5	2	43.2				1 jar
					24	5.1	x	0.5	2	43.2				1 jar
Cape Otway-King Island-Hunter Island transect														
31	38 55.94 143 29.22	6/5/91 506	71		0	4.95	x	0.5	2	43.2				1 jar
					68	5.1	x	0.5	2	43.2				1 jar
32	39 05.74 143 37.15	6/5/91 640	92		0	4.75	x	0.5	2	43.2				1 jar
					87	4.9	x	0.5	2	43.2				1 jar
33	39 24.19 143 48.74	6/5/91 902	98		0	5.15	x	0.5	2	43.2				1 jar
					94	5.1	x	0.5	2	43.2				1 jar
34	39 41.01 144 11.23	6/5/91 1147	39		0	4.85	x	0.5	2	43.2				1 jar
					38	4.95	x	0.5	2	43.2				1 jar
35	40 09.46 144 15.89	6/5/91 1500	44		0	4.35	x	0.5	2	43.2				1 jar
					40	4.7	x	0.5	2	43.2				1 jar
36	40 17.44 144 30.04	6/5/91 1640	65		0	4.9	x	0.5	2	43.2				1 jar
					61	4.95	x	0.5	2	43.2				1 jar
Leg 2														
37	40 23.80 144 59.96	6/5/91 2030	28		0	5	x	0.5	2	43.2				1 jar
					-25	5.1	x	0.5	2	43.2				2 jars
38	40 44.94 145 19.91	6/5/91 2320	23		0	5.1	x	0.5	2	32.4				2 jars

Table 1 (continued)

CTD No.	Location lat. (S)long. (E)	Date Time (UTC)(UTC)	Water depth	Mooring No.	Sampling depths	Pig. water	Hydro water	CHN water	Isotope water	Lipids water	DOC water	AOX water.	AOX sed.	Lipids sed.	
					20	5.05	x	0.5	2	32.4					
Burnie transect															
39	41 03.18 145 56.43	7/5/91 300	19	MCI	0	4.75	x	0.5	2	64.8	x	431	x	3 jars	
					17	5	x				x	847			
40	41 02.38 145 56.32	7/5/91 440	22		0	5.1	x	0.5	2	32.4	x	565	x	1 jar	
					0			32.4							
41	41 02.13 145 57.39	7/5/91 615	25		20	5.1	x				x	507			
					0	4.6	x	0.5	2	43.2	x	784	x	1 jar	
42	41 01.18 145 58.06	7/5/91 745	38		23	4.6	x	0.5	2	43.2	x	11			
					0	4.95	x	0.5	2	43.2	x	2395	x	1 jar	
43	40 59.38 145 59.22	7/5/91 901	47		36	4.95	x	0.5	2	43.2	x	188			
					0	5.15	x	0.5	2	43.2	x	23	x	1 jar	
44	40 54.96 146 02.12	7/5/91 1010	69		45	5.15	x	0.5	2	43.2	x	1270			
					0	5.15	x	0.5	2	43.2	x	699	x	1 jar	
					65	5.15	x	0.5	2	43.2	x	5			
Wesley Vale transect															
45	41 00.39 146 23.91	7/5/91 1433	63		0	4.9	x	0.5	2	43.2	x	14	x	1 jar	
					63	4.97	x	0.5	2	43.2	x	c65			
46	41 05.17 146 24.00	7/5/91 1613	37		0	4.9	x	0.5	2	43.2	x	1124	x	1 jar	
					35	4.87	x	0.5	2	43.2	x	709			
47	44 07.20 146 23.99	7/5/91 1740	30		0	4.55	x	0.5	2	43.2	x	386	x	1 jar	
					28	4.8	x	0.5	2	43.2	x	4			
48	41 08.23 146 23.88	7/5/91 1903	24		0	4.95	x	0.5	2	43.2	x	779	x	1 jar	
					22	5	x	0.5	2	43.2	x	x142			
49	41 08.77 146 23.93	7/5/91 2035	17		0	4.87	x	0.5	2	86.4	x	1018			
50	41 08.82 146 23.86	7/5/91 2240	15		0	5.25	x	0.5	2	86.4	x	3028			
Tamar transect															
51	41 02.98 146 46.65	8/5/91 208	20		0	4.96	x	0.5	2	86.4	x	1172	x	1 jar	
52	41 02.33 146 45.27	8/5/91 352	24		0	4.9	x	0.5	2	43.2	x		x	1 jar	

Table 1 (continued)

CTD No.	Location lat. (S)long. (E)	Date Time (UTC)(UTC)	Water depth	Mooring No.	Sampling depths	Fig. water	Hydro water	CHN water	Isotope water	Lipids water	DOC water	AOX water	AOX sed.	Lipids sed.
53	41 02.18 146 45.27	8/5/91 507	26		0 22	5.05 4.95	x x	43.2 5	x x	43.2 43.2	x x	2005 2215		
54	41 01.36 146 44.38	8/5/91 610	38.5		0 37	5.05 5.05	x x	0.5 0.5	2 2	43.2 43.2	x x	2515 2350	x	1 jar
55	41 00.52 146 43.59	8/5/91 710	46.8		0 43	4.65 5.05	x x	0.5 0.5	1.7 2	43.2 43.2	x x	2064 2076	x	1 jar
56	40 56.06 146 40.34	8/5/91 824	67		0 65	5.05 5.1	x x	0.5 0.5	2 2	43.2 43.2	x x	2548 2177	x	1 jar
57	40 55.65 147 23.98	8/5/91 1340	32		0	5	x	0.5	2	43		2289	x	1 jar
59	40 51.68 147 50.46	8/5/91 1655	26		27 0 23	5.1 4.95 4.8	x x x	0.5 0.5 0.5	2 2 2	43.2 43.2 43.2		241		1 jar
148 East transect - Banks Strait-Lakes Entrance														
60	40 39.45 148 08.06	8/5/91 1920	37	1	0	5.05	x	0.5	2	43.2				1 jar
62	40 07.02 147 35.53	9/5/91 14	51		33 0	5.1 5.3	x x	0.5 0.5	2 2	43.2 43.2				1 jar
63	39 48.06 147 43.95	9/5/91 301	45		45 0	5.15 20	x x	0.5 0.5	2 2	43.2 43.2				1 jar
64	39 30.16 147 58.12	9/5/91 520	47	2	43 0	20 5.1	x x	0.5 0.5	2 2	43.2 43.2				1 jar
65	39 15.45 147 59.48	9/5/91 813	53		44 0	5.05 10	x x	0.5 0.5	2 2	43.2 43.2				1 jar
66	38 59.97 148 00.07	9/5/91 957	67	3	50 0	9.8 5.15	x x	0.5 0.5	2 2	43.2 43.2				1 jar
67	38 44.92 147 59.95	9/5/91 1148	77		65 0 25 50	5.15 5.1 5.05	x x x	0.5 0.5 0.5	2 2 2	43.2 43.2				1 jar
68	38 29.91 148 01.27	9/5/91 1336	68	4	75 0	5.15 4.85	x x	0.5 0.5	2 2	43.2 43.2				1 jar
69	38 14.93 148 0.24	9/5/91 1537	57		66 0 35 54	5.1 5.15 5	x x x	0.5 0.5 0.5	2 2 2	43.2 43.2				1 jar

Table 1 (continued)

CTD No.	Location lat. (S)long. (E)	Date (UTC)	Time (UTC)	Water depth	Mooring No.	Sampling depths	Pig. water	Hydro water	CHN water	Isotope water	Lipids water	DOC water	AOX sed.	AOX sed.	Lipids sed.	
70	38 00.06 148 01.02	9/5/91	1725	46	5	0	5.15	x	0.5	2	43.2				1 jar	
71	37 54.89 147 59.92	9/5/91	1855	25		0	5	x	0.5	2	43.2					
Latrobe Valley transect - site of proposed LVWSB outfall																
72	38 22.38 147 31.56	9/5/91	2234	44		0	5.2	x	0.5	2	43.2		x		1 jar	
74	38 19.35 147 27.61	10/5/91	39	35		40	5	x	0.5	2	43.2		x		1 jar	
75	38 17.92 147 25.76	10/5/91	240	26		33	5.05	x	0.5	2	43.2			2314	1 jar	
76	38 17.24 147 24.98	10/5/91	406	24.5		23	5.1	x	0.4	2	43.2	x		2588	1 jar	
77	38 16.58 147 23.89	10/5/91	525	22		22	5.05	x	0.5	2	43.2	x		2524	1 jar	
78	38 16.08 147 23.18	10/5/91	642	21		20	4.8	x	0.5	2	43.2	x		2022	1 jar	
						0	5.2	x	0.5	2	43.2	x				
						18	4.85	x	0.5	2	43.2	x				
79	38 43.38 146 52.34	10/5/91	1228	23		0	4.95	x	0.5	1.76	43.2				1 jar	
80	39 11.51 146 20.09	10/5/91	1725	76		20	4.9	x	0.5	2	43.2				1 jar	
						0	5	x	0.5	2	32.4					
						74	4.85	x	0.5	2	43.2					
Westport Bay transect																
82	38 30.92 145 04.50	11/5/91	100	32		0	5.03	x	0.5	2	43.2	x		2269	1 jar	
83	38 31.49 145 03.97	11/5/91	235	31		26	5.06	x	0.5	2	43.2	x		2233	1 jar	
84	38 32.42 145 03.94	11/5/91	358	36		26	5.05	x	0.5	2	43.2	x				
						0	5.05	x	0.24	2	42	x		2038	1 jar	
						0	5	x	0.5	2						

Table 1 (continued)

CTD No.	Location lat. (S)long. (E)	Date Time (UTC)(UTC)	Water depth	Mooring No.	Sampling depths	Pig. water	Hydro water	CHN water	Isotope water	Lipids water	DOC water	AOX water	AOX sed.	Lipids sed.	
85	38 33.43 145 04.02	11/5/91	512	27	32 0	5 4.85	x x	0.5 0.5	2 2	43.2 43.2	x	66	x	1 jar	
86	38 35.42 145 03.98	11/5/91	635	73	25 0	4.9 5	x x	0.5 0.5	2 2	43.2 43.2				2 jars	
87	38 40.43 145 04.12	11/5/91	816	76	69 0	4.15 5.3	x x	0.5 0.5	2 2	43.2 43.2			x	2 jars	
88	38 31.76 144 51.88	11/5/91	1119	42	73	5	x	0.5	2	43.2				1 jar	
89	38 22.42 144 41.94	11/5/91	1257	34	0 38 0 32	5.05 4.95 4.85 4.6	x x x x								
Black Rock sewage outfall transect															
90	38 28.77 144 28.80	11/5/91	1441	73	0	5.2	x	0.5	2	43.2				1 jar	
91	38 23.82 144 27.15	11/5/91	1620	60	73 0	4.95 5	x x	0.5 0.5	2 2	43.2 43.2				1 jar	
92	38 20.98 144 26.27	11/5/91	1750	50	57 0	4.7 5.05	x x	0.5 0.5	2 2	43.2 43.2	x	222	x	1 jar	
93	38 19.93 144 26.00	11/5/91	1915	40	47 0	4.95 5.2	x x	0.5 0.5	2 2	43.2 43.2	x	2520	x	1 jar	
94	38 18.95 144 25.55	11/5/91	2030	31	37 0	4.8 4.9	x x	0.5 0.5	2 2	43.2 43.2	x	2404	x	1 jar	
95	38 18.17 144 25.45	11/5/91	2300	26	25 0	5 5.05	x x	0.5 0.5	2 2	43.2 43.2	x	2012	x	1 jar	
					22	4.85	x	0.5	2	43.2	x				
Leg 3															
96	38 32.94 144 01.59	12/5/91	903	32	0	4	x	0.5	2	43.2					
97	39 14.01 142 26.12	12/5/91	1707	1280	30 0 50 100 0	4.3 3.65 3.2 4.3 4.8	x x x x x								
98	39 07.45 142 32.14	12/5/91	1909	512	0	4.4	x	0.5	2	43.2					

Table 1 (continued)

CTD No.	Location lat. (S)long. (E)	Date (UTC)(UTC)	Time (UTC)	Water depth	Mooring No.	Sampling depths	Pig. water	Hydro water	CHN water	Isotope water	Lipids water	DOC water	AOX water	AOX sed.	Lipids sed.
99	38 39.51 142 56.83	13/5/91		736	55	M2	0	4.85	x						
							52	4.4	x						
100	38 53.62 142 44.87	13/5/91		1730	74	M3	0	5.2	x						
							40	4.8	x						
							70	5.2	x						
101	38 54.48 143 33.13	13/5/91		2220	71	10	0	4.8	x						
							67	5.15	x						
102	39 04.72 143 37.76	14/5/91		710	91	9	0	4.74	x						
103	39 23.54 143 49.62	14/5/91		924	97	8	0	4.15	x						
							95	5.1	x						
							86	5.2	x						
104	39 40.37 143 49.94	14/5/91		1213	88		0	4.55	x						
							85	4.68	x						
105	41 20.75 143 49.94	14/5/91		2110	2060		0	5	x						
							50	5	x						
106	41 13.22 144 06.65	15/5/91		904	465	M2	0	4.45	x						
107	41 10.95 144 13.66	15/5/91		1039	105	M1	0	4.6	x						
108	40 08.58 144 15.90	15/5/91		2145	56	7	0	4.4	x						
109	40 19.62 144 20.51	16/5/91		50	69	6	0	4.4	x						
							50	4.55	x						
110	37 59.94 148 00.06	16/5/91		2140	43	5	0	4.6	x						
							67	4.6	x						
111	38 29.89 147 59.56	17/5/91		52	67	4	0	4.8	x						
							38	4.9	x						
112	38 59.07 148 01.18	17/5/91		807	60	3	0	4.5	x						
113	39 29.61 148 59.68	17/5/91		1231	43	2	0	4.3	x						
							58	4.6	x						
114	39 37.65 147 50.24	17/5/91		1346	46		0	4.6	x						
							43	4.82	x						
115	40 01.70 147 36.93	18/5/91		1134	49		0	4.5	x						
							43	5.05	x						
116	40 19.44 147 43.64	18/5/91		1341	43		0	4.75	x						
							43	4.8	x						
117	40 39.71 148 08.76	18/5/91		2035	45	1	0	5.1	x						
							40	4.4	x						
118	41 03.37 145 56.20	19/5/91		640	19		0	4.25	x						
							36	5	x						
							0	4.4	x						
							19	5	x						

Table 1 (continued)

CTD No.	Location lat. (S)long. (E)	Date (UTC)(UTC) depth	Water depth No.	Mooring No.	Sampling depths	Fig. water	Hydro water	CHN water	Isotope water	Lipids water	DOC water	AOX water	AOX sed.	Lipids sed.
Leg 4														
Sydney Deepwater Ocean Outfall Malabar														
(no calibration or other samples collected, transmissometer used)														
119	34 01.56	151 15.26	22/5/91	400	52						1 jar			
120	34 00.07	151 16.21	22/5/91	439	54									
121	33 58.33	151 16.63	22/5/91	516	46									
122	33 58.21	151 17.10	22/5/91	532	64									
123	34 00.05	151 17.31	22/5/91	601	85									
124	34 01.81	151 16.25	22/5/91	631	88									
125	34 01.77	151 17.22	22/5/91	700	98									
126	34 00.03	151 18.39	22/5/91	750	90									
127	33 58.84	151 18.42	22/5/91	833	86									
128	33 58.13	151 18.53	22/5/91	906	81									
129	33 58.26	151 19.62	22/5/91	938	88									
130	34 00.02	151 19.62	22/5/91	1010	98									
131	34 01.76	151 18.58	22/5/91	1045	113									

x --- denotes samples taken

Abbreviations: Fig., pigments; Hydro, Hydrology samples; CHN, carbon-hydrogen-nitrogen;

DOC, dissolved organic carbon; AOX, adsorbable organohalides

For pigments, CHN, isotope and lipid (water) samples, numbers indicate volume of seawater filtered.

**Table 2 Summary of mooring recoveries**

**Bass Strait Interdisciplinary Studies**

<b>Mooring</b>	<b>Location</b>	<b>Status</b>	<b>Instruments recovered</b>	<b>Instruments lost</b>
1	40-39.45S 148-08.20E	recovered	3cm 1 ar	—
2	39-30.00°S 148-00.40°E	recovered	3cm 1 tg 1 ar	—
3	38-59.15S 148-00.5E	lost	—	3cm 1 ar
4	38-29.83S 147-59.98E	recovered	3cm 1 ar	—
5	38-00.00S 147-59.82E	recovered	3cm 1 tg 1 ar	—
6	40-08.63S 144-15.02E	recovered	3cm 1 ar	1 tg
7	40-18.35S 144-28.89E	trawled?	1 ar	3cm
8	39-23.64S 143-49.74E	recovered	1 ADCP 1 ar	—
9	39-04.13S 143-38.51E	recovered	1 ADCP 1 ar	—

Table 2 (continued)

Mooring	Location	Status	Instruments recovered	Instruments lost
9A	39-04.98S 143-38.04E	still in place	—	1 ts 1 ar 1ctd
10	38-54.73S 143-32.55E	recovered	3cm 1 tg 1 ar	—

Low frequency circulation at the western end of Bass Strait

M1	40-50.23S 144-08.50E	trawled	1cm	1tg 1ar
M2	41-10.94S 144-13.74E	recovered	1cm 1 tg 1 ar	—
M3	41-13.35S 144-05.87	lost	—	1cm 1ar
M4	38-38.90S 142-56.76E	lost	—	1cm 1tg 1ar
M5	38-54.11S 142-43.89E	still in place	—	1cm 1ar

cm — current meter

tg — tide gauge

ADCP — acoustic doppler current profiler

ts — thermistor string

ar — acoustic release

ctd — moored conductivity - temperature - depth gauge

Table 3: Collection details for gas samples

Date	Time	Time	Flask	Position	Position	Wind	Wind Speed
local	local	UTC		lat.	long.	Direction	(knots)
15/5/91	0200*	1600	M-36	40°19.13S	143°45.12E	219	8.8
15/5/91	0230	1630	M-35	40°25.84S	143°45.47E	223	8.2
15/5/91	0300*	1700	M-34	40°31.44S	143°45.55E	226	8.7
15/5/91	0330	1730	M-33	40°38.22S	143°45.90E	216	10.9
15/5/91	0400*	1800	M-32	40°44.05S	143°46.37E	229	9.2
15/5/91	0430	1830	M-31	40°50.70S	143°47.20E	237	9.7
15/5/91	0500*	1900	G-12	40°56.11S	143°48.07E	246	12.1
15/5/91	0530	1930	G-13	41°2.54S	143°48.47E	239	14.0
15/5/91	0600*	2000	G-14	41°8.05S	143°48.79E	245	13.0
15/5/91	2130*	1130	G-15	41°7.74S	144°13.56E	267	11.6
15/5/91	2200	1200	G-17	41°4.03S	144°13.36E	245	9.4
15/5/91	2230*	1230	G-18	40°59.65S	144°12.95E	287	14.3
15/5/91	2300	1300	M-18	40°55.46S	144°11.18E	275	13.7
15/5/91	2330*	1330	M-17	40°52.01S	144°9.49E	276	16.6
16/5/91	0030*	1430	M-16	40°47.97S	144°9.21E	248	9.7
16/5/91	0100	1500	M-15	40°43.84S	144°10.17E	247	9.7
16/5/91	0130*	1530	M-14	40°40.10S	144°11.26E	251	11.8
16/5/91	0200	1600	M-13	40°36.52S	144°12.53E	258	14.4

\* Denotes surface seawater samples taken for alkalinity and nutrients,

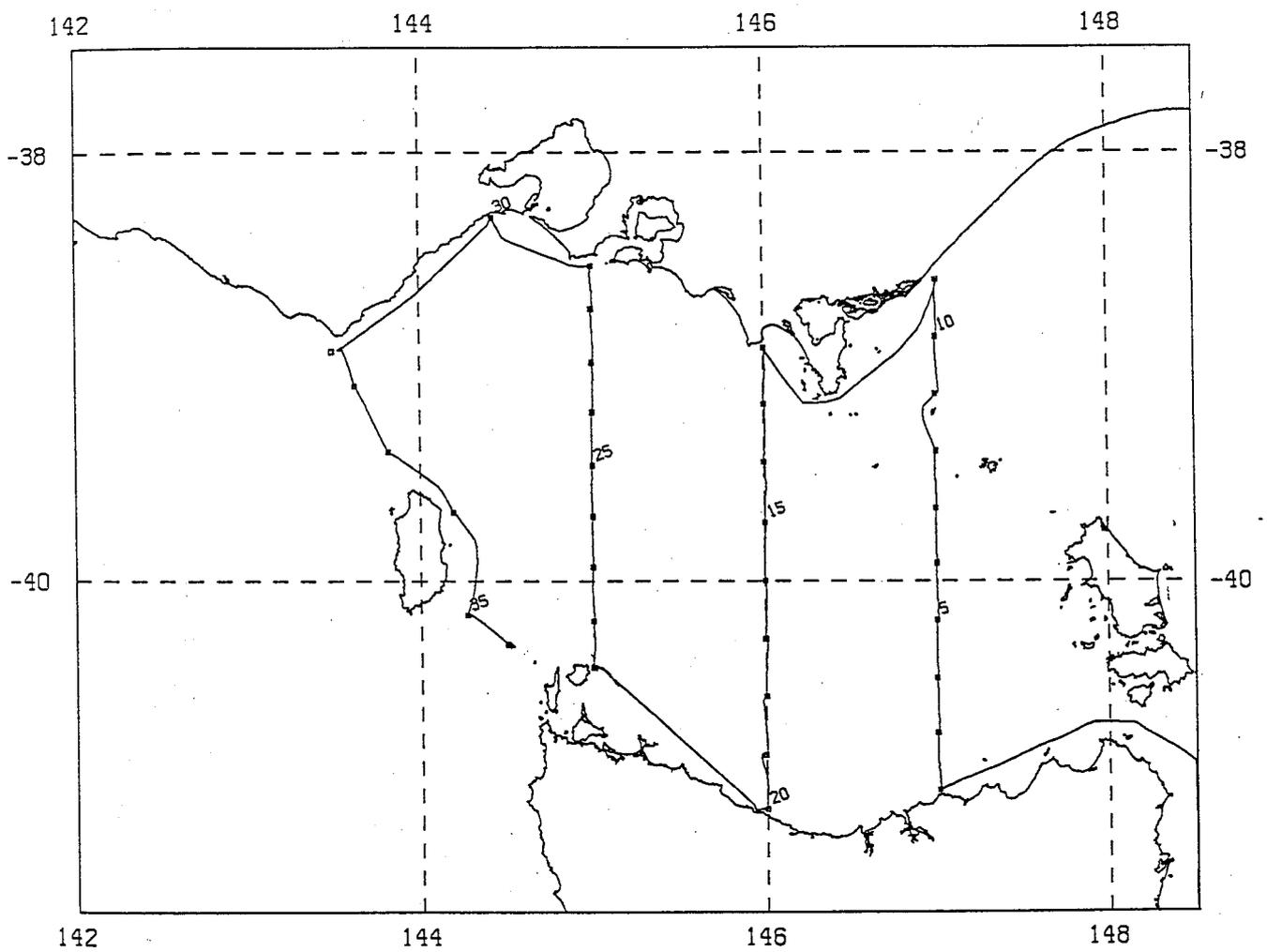


Figure 1 FR04/91 Leg 1 Bass Strait transects

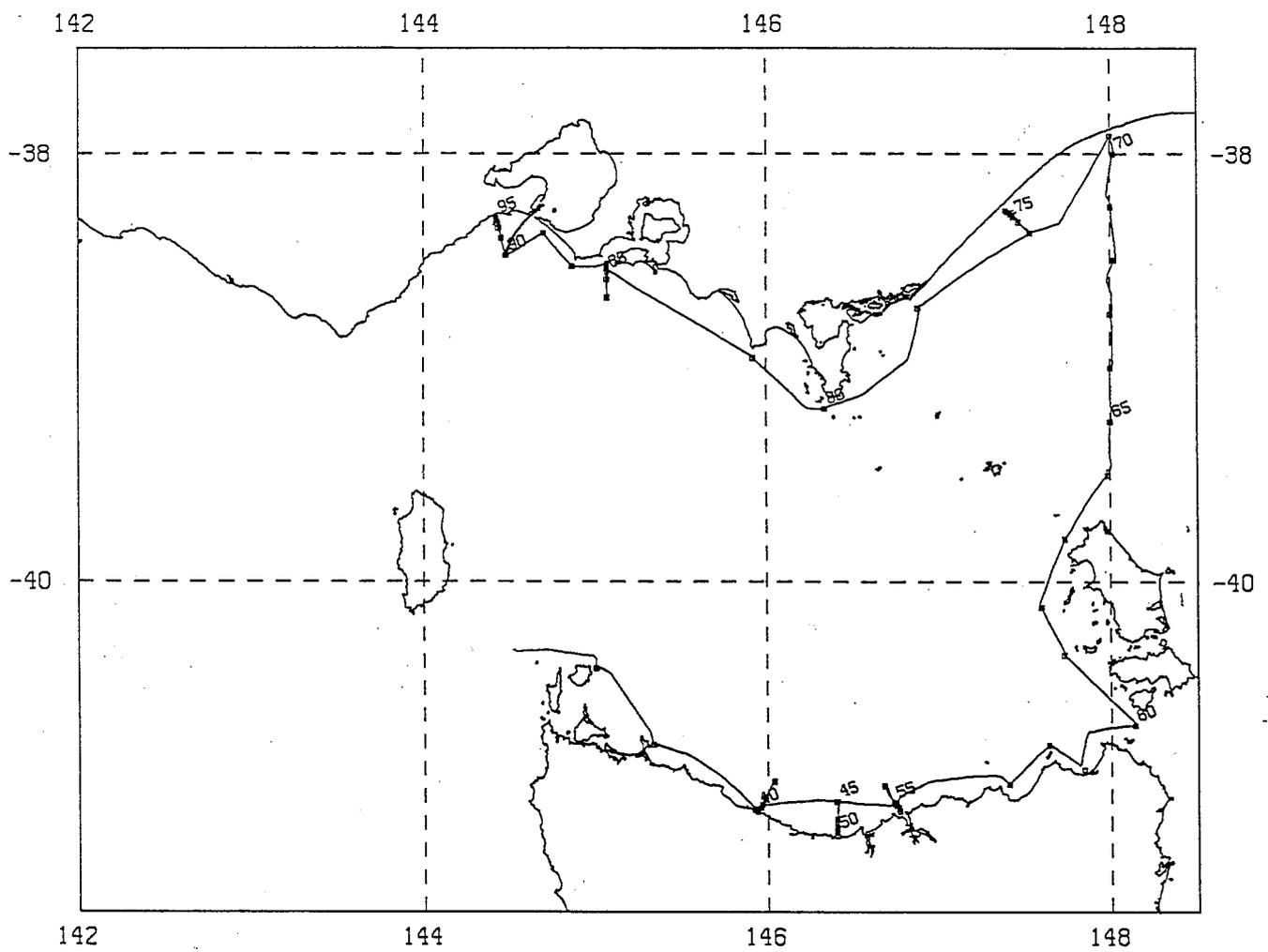


Figure 2 FR04/91 Leg 2 Nearshore sampling

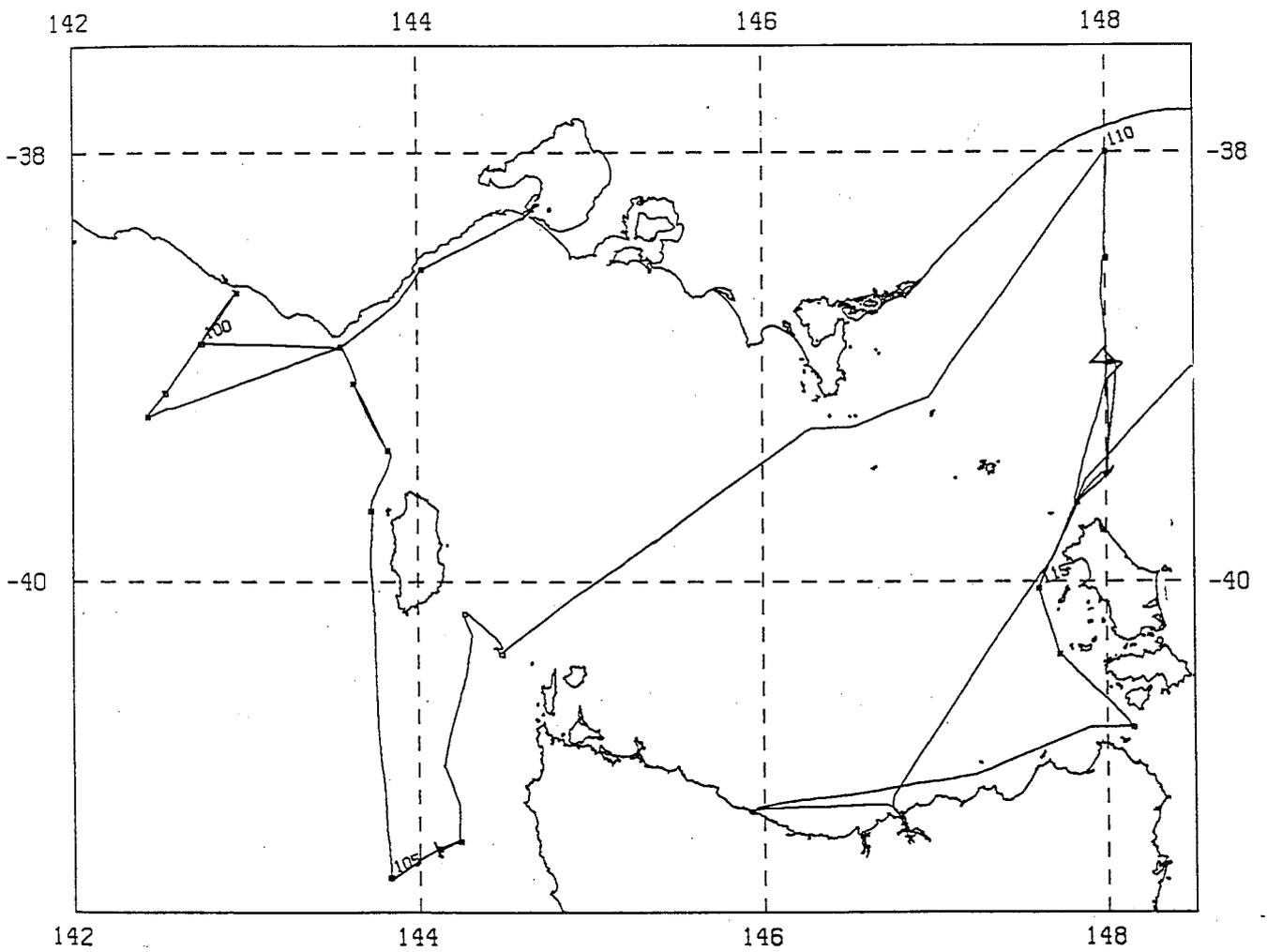


Figure 3 FR04/91 Leg 3 Mooring retrieval

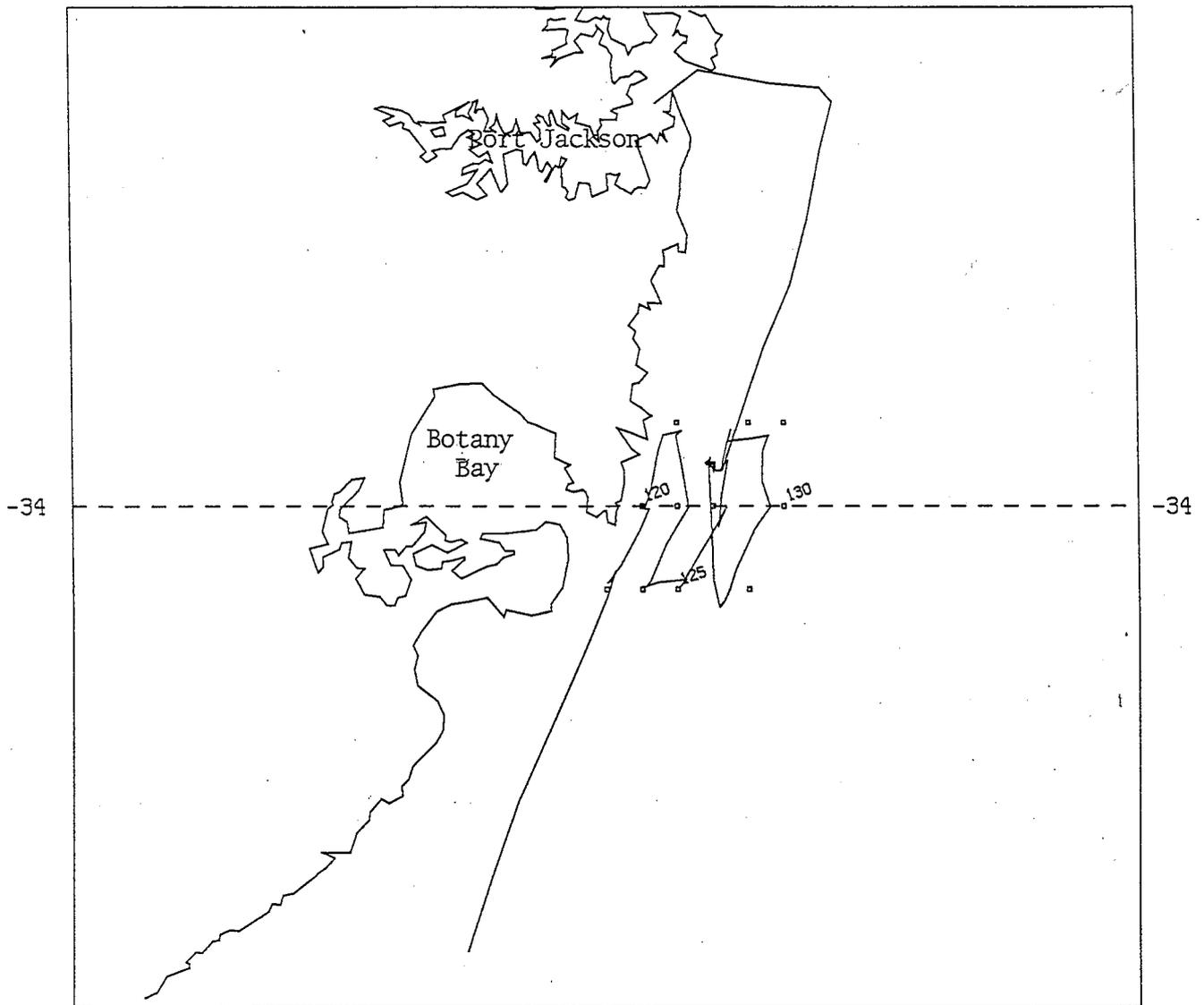


Figure 4 FR04/91 Leg 4 Ocean outfall sampling  
(Based on preliminary navigation data)

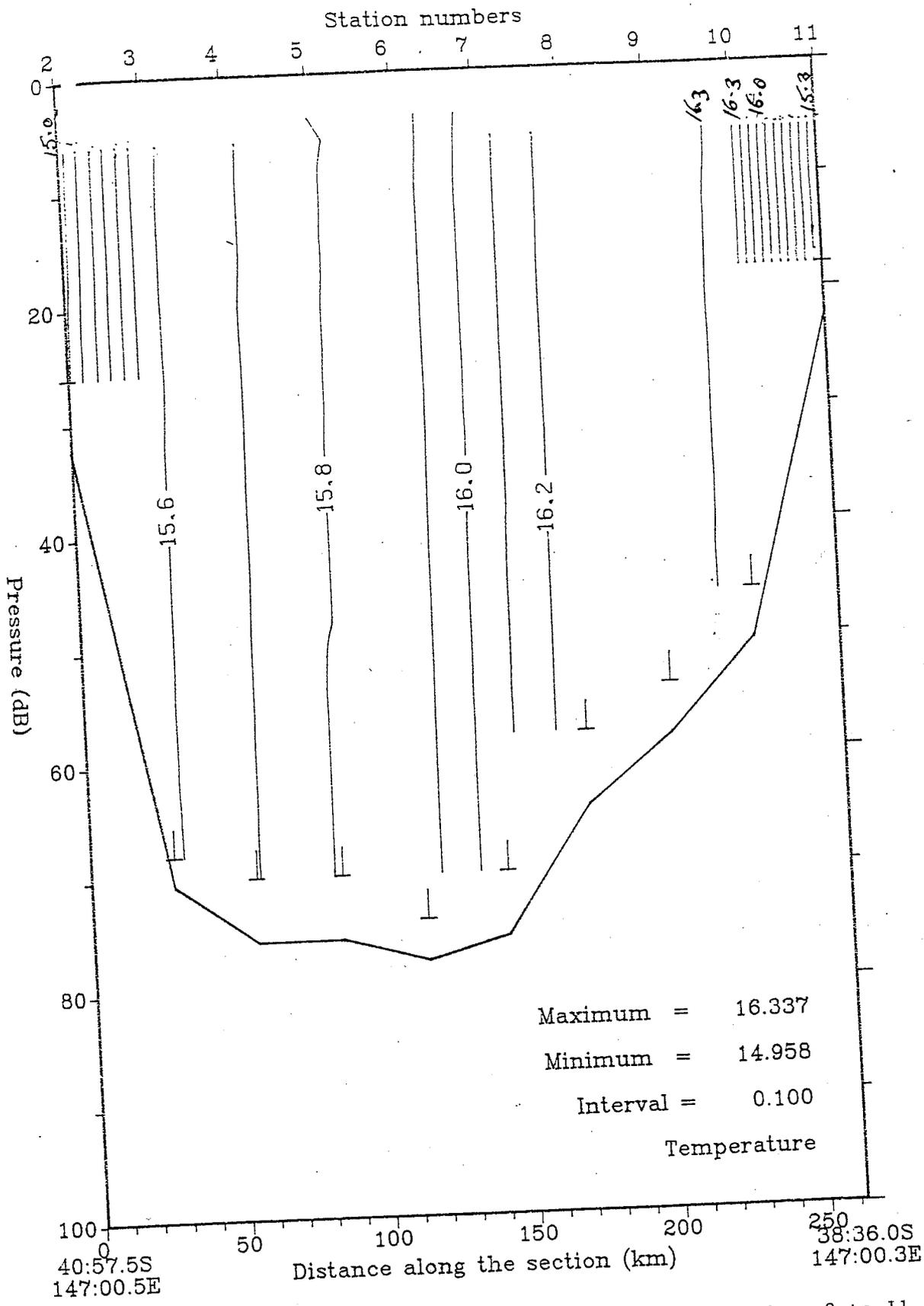


Figure 5. Temperature section across Bass Strait, stations 2 to 11, May 1991.

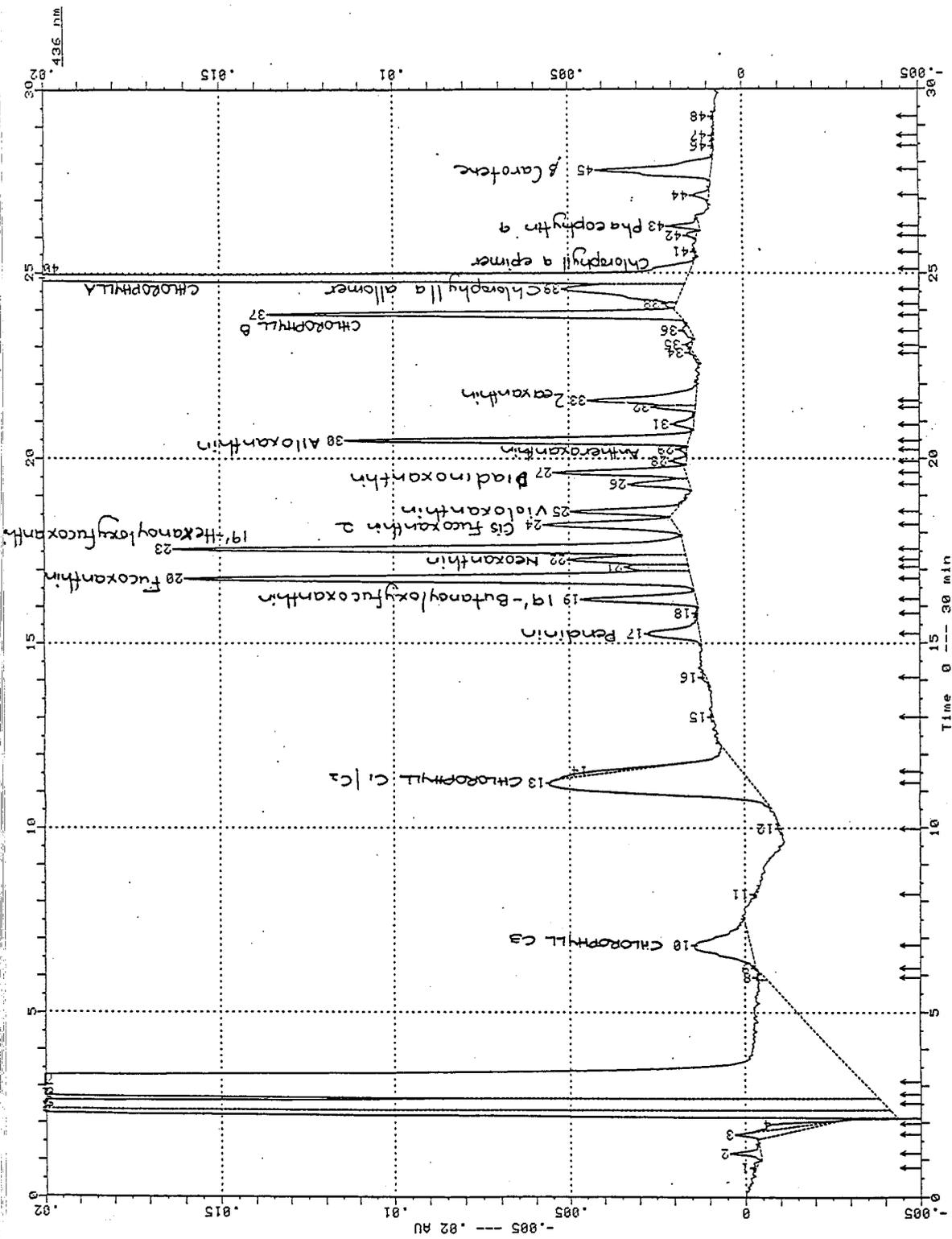


Figure 6. High performance liquid chromatogram of chlorophyll and carotenoid pigments: station 20, surface water. Detection: 436 nm, photodiode array detector.

## REPORT ON PIGMENT SAMPLING AND HPLC OPERATION ON FR4/91

### SAMPLE COLLECTION

Samples for pigments were collected at all chemistry sampling sites in legs 1 and 2 and at all CTD stations in leg 3. The pressurized filtration system was used for all samples in legs 1 and 2. Glass fibre filters were used in conjunction with Nuclepore filter holders. The system worked efficiently and did not appear to rupture cells (ie. low levels of breakdown products were observed in traces). During leg 3 size fractionation was attempted using 2 um and 0.8 um Nuclepore filters. Several methods of filtration were tried but none were particularly satisfactory. If size fractionation is to be carried out a more efficient method is required.

### EXTRACTION PROCEDURE

Extractions were carried out using the method developed for trichromatic chlorophyll estimations. The long six hour stand time needs to be investigated. It may be possible to maximise extraction by carrying out probe sonication in short bursts and by reducing stand time. The fume cupboard in the GP lab was used and there were no problems with spillage or lack of ventilation.

### HPLC

#### Assembly

Whilst setting up the HPLC difficulties arose due to the confined space in the clean container. These could be overcome by modifying the instrument boxes so they can be fixed to the bench after the cables are connected.

It was advantageous to assemble and test the system before leaving the wharf. We strongly recommend that this practise continues for future cruises.

#### Power Supply

The power supply for the clean container was taken from the aft deck power outlet. This is adequate to power the air-conditioning and the fume hoods. Large power surges caused system shutdown on a regular basis despite the use of a portable line conditioner. The problem was solved by running an extension cord from an UPS outlet in the chemistry lab into the clean container through one of the fume hood inlets. We suggest a more permanent UPS connection be fitted to the clean container for use with critical scientific instrumentation.

*J O'Leary* *M W Kleg*

RV FRANKLIN ELECTRONICS REPORT  
CRUISE FR04/91  
E. MADSEN 22nd May 1991.

Only equipment and instruments which required attention before, or during the cruise are reported on, all other equipment can be assumed to have performed correctly.

**CTD SYSTEM.**

The 1150 deck unit gave full scale on all displays, on system start up, this was traced to insufficient sea cable current supply, this was adjusted such that there is 29 volt compliance at the under water unit with all external sensors operating.

**SEATECH FLUOROMETER**

This failed On the first cast due to a flat battery, caused by the off state charging wiring when used in the Transmissometer position, continuation of the problem was overcome by disabling the off state charging circuit in the battery pack.

**THERMO SALINOGRAPH.**

The Linseis 2025 chart recorder failed on 5th. of May, with a burned out pen motor and worn out pen potentiometer, these were replaced from onboard spares, parts number for replacement motor kit is LO 141.

**TITRON PH SENSORS**

The new sensors, received on 30th. of April, appear to be excessively noisy ( $\pm 0.03$  PH units), this gave cause to a sinusoidal trace on the real time display. Numerous tests were done in order to eliminate ctd deck unit, underwater unit and PH electronics module from being the cause of the noise.

**CABLESYS.**

As the pdp11 soft ware was not available for this, a switch was installed above micro2 to allow switching the three inputs directly to the bridge monitor, for legs one and two of the cruise this was coupled to the hydro winch and worked well, on one occasion we had excess strain indication, however this disappeared with resetting the toshiba.

The bridge display software, received in Queenscliff, worked after some minor modifications to the pdp11 soft ware, but pressure and altimeter data is at this stage only available during down casts and sample bursts. Ctd pressure data, displayed on the Toshiba is delayed, compared with the direct remote pressure display, plus the deck unit pressure offset is not included in bridge data

Another observation made this cruise, is that the toshiba display can not be viewed through polaroid sun glasses.

#### MET STATION.

To correct the +1.4 C° temperature offset the temp/humid. interface card was modified as follows. R3 was changed from 47K to 120K and R4 was changed from 120K to 100K trimpot, V. offset was changed from -0.833v. to -0.807v. This brought the Met. temperature within 0.1 C° of the mercury thermometer on the Monkey Island.

However, daily observations indicated a random error of +/- 0.6 C°.

A 10.5 millibar offset applied to the micro1 pressure software reduced this error to -0.5 millibar, a further offset will be made at end of cruise.

Daily observations indicated random errors of about +/- 0.5 mBar

#### TURNER FLUOROMETER.

This had to be dismantled to repair a faulty span potentiometer.

#### COMPUTERS

Micro1 crashed repeatedly on the first day, and was stripped down, backplane and connectors cleaned and an ill fitting memory card relocated. The problem was later, by substitution found to be an intermittent cpu board.

Micro3 crashed once for no apparent reason.

## SHIPS EQUIPMENT.

### TRIACIAL CONTROL SYSTEM.

On the first (test) ctd station it was evident that the TAC Computer could not hold a heading, this was eventually traced to a missing phase in the gyro junction box.

### WATER SEPARATOR.

The power supply for the Engine room oil/water separator controller was repaired.

### SEWAGE SYSTEM.

A new mercury float switch for the sewer pump was made from a small sample tube.

### SHIP TV SYSTEM.

A faulty Tv distribution amplifier was repaired during leg three of the cruise..

### TRIMBLE NAVTRAC GPS.

The Navtrac had a stroke on the night before departure which corrupted the stored way points, but fixed the display error which was evident from the last glitch (fr03/91).

On night of 8th. of May, the glitch was repeated twice. with resultant random errors in stored way points and the display locking up each time route edit function was selected. After a further two weeks, this fault condition disappeared as well.

The Navtrac is being returned to Marcom Watson for repairs after cruise.

### WESMAR SIDE SCAN SONAR.

Attempts at locating moorings with this instrument was not very successful, the sonar declares a sound dome failure on power up system check. Without any technical manuals or spares, no repairs could be done.

I will seek advise from Marcom Watson on this fault on my return to Hobart.

## Computing Report for Cruise FR04/91

### VAX

The Vax booted with the incorrect time at the start of the cruise and it would 'hang' when an attempt was made to reset the time. The time was successfully set after the error log files had been deleted.

Vax FRNMON exited several times during the cruise & had to be restarted.

The Mac is now on a Vax DMF modem port. This had to be jumpered pins 4-5-8 and 6-20 and set to /MODEM before it would work.

The user disk filled up on 22nd May. Sundry junk files were deleted, which relieved the situation slightly, but the disk still had 137k blocks of data in [CROOKS.CRUDAT], (including 55k blocks of GPS) and 158k blocks of ADCP data.

### MET LOGGING

1. Added a pressure gain and offset to the calibration file, corrected the temperature calibration and activated the 'Licor', 'Battery Test' and 'watering system' channels. The data is much better, further work is required. (See Erik's electronics report.)

These changes were implemented late on 2nd May. Any data on the Exabyte tape that precedes this should be ignored. All the Vaxed data is OK.

2. Corrected a problem that caused many output records to be incorrectly flagged as having no corrected wind data.

If multiple MET.LOG files are archived on a single MTSPOL tape, only the most recent version is copied to Exabyte tape.

### BRIDGE DISPLAY

The latest version was installed on MICRO2. The calibration file format has been modified. It now includes the gain and offset for each channel rather than the 'data pairs' previously used. This will make it much easier to change the calibrations without introducing errors.

There are some outstanding problems:

- The ctd data is only sent to the display when it is being logged. ie the Bridge only get ctd pressure displayed when the sample bursts are being taken. This will not be a problem when the UDAPS-based logging package is installed.
- The ctd pressure and altimeter data is only being updated every 3 secs. This no doubt contributed to it lagging 2-3m behind the Bridges direct readout of pressure (with a decent rate of 20m/min). The pressure data

should be sent by the logging program rather than by the real time display task (RTD)

- There is a 2m offset between the direct display and the remote display. Does RTD remove the ctd's pressure offset before sending the data?
- The present LCD display on the Bridge is totally unsuited to daytime use.
- The Bridge pc does not seem to be fast enough to consistently process the screen setup data. eg occasionally some of the special function keys may be omitted or the ctd screen messages ignored.

## MTSPOL

Installed a new version of MTSTRT that opens new versions of the Console Log and Error Log files prior to the end-of-cruise cleanup. The console and error log files are now named <nodnam>CO.LOG and <nodnam>.ERR resp.

### *Outstanding problems:*

- The general data files for approx 0900-1250 2nd May were vaxed some 6 times. This was during the period MICRO1 was crashing periodically because of the faulty cpu. Similar problems probably occurred with other data files at this time. Duplication may also have occurred for the 0000-0600 12 May data and part of the 9 May data.

This problem should never have arisen, as the successful VAXing should have been recorded in the queue file.

- The error log files are not archived to tape, even though they were included in EXTFIL.DAT, the end-of-cruise cleanup list.
- MTSPOL continues to copy files to MICRO1 (without archiving them) after it has experienced a fatal tape error. These files are left on MICRO1 and give rise to 'File already exists' errors during the end-of-cruise cleanup.
- The interim copies of the data files should be stored in a different account to the program sources. This would make it easier to delete stray data files.
- The end of cruise cleanup takes much too long.

I had thought that this was, in part, due to the time spent opening, reading & then closing the queue file at least once for every queue entry. I experimented with using 'Open by file ID' instead of the normal OPEN statement, but found that this increased the file access speed by only 12%.

If the queue file was not closed during the cleanup, the cleanup time taken for a typical 20 day cruise would be reduced by only 10 - 15 mins.

## CTDCLE

The ctd archiving program does not correctly calculate the length of tape used when the stations are shallow. A tape was filled, without CTDCLE realizing it, and the file system requested that a continuation tape be mounted. This was fine, except that every time the volume had to be re-mounted for another cleanup run, the first tape had to be mounted & scanned through before further data could be written to the second tape!

## DELP

Fixed a minor bug that caused cpu's to be reported as 'up' if they had been down for more than 32000/15 seconds.

## ADCP

MNU will accept the same numbers for the min & max velocity limits on the real time plot. This causes DSP to crash with a 'floating zero divide' error.

## NCAR Plotting

A new NCAR metacode translator had been installed prior to the cruise. It supported the new laser printer but could not handle multiple zeta and laser plots correctly. An updated translator was installed on 21st May. It fixed the problem with the Zeta, but still cannot send multiple plots to the laser printer.

A procedure [CRUISPROG]PLASER.COM was therefore written to queue multiple laser plots from the one plot file. It can be accessed from the [CRUISUTIL] account by typing 'PLASER'.

## Cruise Track Plotting

The interactive section of the cruise track plotting program was rewritten so that the default plot options could be read from an editable option file. If the options are changed, they are written back to the file.

The satnav file no longer has to be manually copied from the ADCP account. Both NAVUPD and the ADCP programs open the adcp's SATNAV file for shared access. If this was done more generally, it would eliminate much unnecessary duplication of data files and stop the disk from filling up as quickly!

[ADCP]SUBMIT\_ADCP.COM can now schedule a batch job NOAD\_JOB to pick up the Satnav data when no ADCP data is being logged. (NOAD\_JOB and ADCP\_JOB shut themselves down at the end of a cruise.)

## Problems

- NAVUPD does not always update the Nav data correctly. We seemed to get a slightly different cruise track every time we re-initialized & re-ran NAVUPD!

### *Suggestions*

- NAVUPD should get its GPS data from the [CROOKS.CRUDAT] GPS data file instead of from the ADCP data. This would be slower but would mean that GPS data would not just be available when the ADCP is running!
- Users should not have to enter the times for which updates are required. NAVUPD should do the updates automatically from the times of the last available data - Satnav first & then GPS.

## **DENIS**

DENIS was modified to handle duplicate data records correctly. The batch job that runs DENIS now shuts down automatically at the end of a cruise.

## **Documentation**

The Cookbook and the VAXUtil and MET manuals were updated.

Some manuals don't have their source documents on the Mac or, if they are present, they are for earlier editions than the printed versions, eg the Cruise Track Plotting manual.

## **HARDWARE**

MICRO1's 11/73 cpu board failed early in the cruise & was replaced. The cpu would hang intermittently and occasionally showed a cache memory error during its pre-boot self test. MICRO3's cpu crashed with a cache memory error on 22nd May and was replaced. The previous (2) 11/73 boards to fail had the same or similar problems.

The spare DM02 disk controller is unable to communicate with diskettes & will have to be repaired.

It was confirmed that pre-cruise 'disk' problems experienced on MICRO2 were in due to a combination of a faulty backplane and a corrupted checkpoint task file.

A floating point accelerator chip was installed on the MICRO6 cpu board. This has given it 3.5x the floating point performance of an 11/73 without the accelerator & approx 70% of the floating point performance of the VAX 11/750.

The Computer Room A/C unit iced up number of times. It gave no further problems after the engineers had managed to adjust its water supply. The VAX was shut down for several hours while the A/C condensers were cleaned.

12/05/91 Sunday. "Franklin" departed Queenscliff with F. Boland and D. McLaughlin from the the mooring group on board.

13/05/91 Monday. We were on station for UNSW #5 at 0700 LT. The first reply from the SEASTAR Release was at 0715, range 210 metres. A release command was sent at 0720 and the reply "release mechanism activated" received. Further release commands produced the same reply but nothing surfaced. Some time was taken to triangulate the mooring position, the resulting position believed accurate to about 40 metres, and the grappling wire put over. The recovery attempt was abandoned at 1400 in order to reach UNSW #4 in daylight. We arrived at the site at 1600. No reply was received from this SEASTAR Release. This, and the presence of a fishing boat anchored near the site, discouraged any attempt to drag. A further attempt was made back at #5 during the night. The mooring was moved twice and each time a new position was measured. The operation was abandoned at 0330 on the following morning with just two bent grapples to show for our efforts. The final position of the mooring is 38 53.78S, 142 44.09E.

14/05/91 Tuesday. On station for CSIRO #10 at 0700. The release transponder was not working and the release signal was sent at 0748. Recovery was completed at 0815. All the meters were heavily fouled but the mooring was in good condition. At 0930 we were on station for CSIRO #9 and the release was fired at 0941. This was the first of the ADCP's and it was on deck at 0956. There was very little fouling and the transducer heads were clean. The next stop was at CSIRO #9(a) with another SEASTAR Release. This was transponding but again not releasing. No recovery was attempted, instead we went direct to CSIRO #8 to take advantage of the remaining daylight. At #8, the release was fired at 1534 and the ADCP was on deck at 1547. This must be a new record. Fourteen minutes from the Enable signal to the end of the operation. The second ADCP also had very little fouling. We then returned to #9a and tried a drop line between the ship and rescue boat without success. Time allowed only one try with the wire before we had to leave for the next site. A final position check showed the mooring still on its original site.

15/05/91 Wednesday. On station at UNSW #3 at 1000. This one had one of our releases, a 395. No reply was heard and after a release signal was sent, nothing was sighted. Rather than use up daylight time dragging we moved onto UNSW #2. Here there was a familiar story. The release was transponding but not letting go. This one was pulled up with the wire, our only success to date. On deck, the release jaws were firmly closed, but the mechanism worked perfectly when tested. There was no fouling on the mechanism and very little material was missing from the zinc anodes. I saw no evidence of the anodes plating onto the magnets as had been suggested by G. Nippard at UNSW. We returned to #3 and dragged without much hope until 1830. During the night on passage to King Island a brief search was made for UNSW #1. This one was hit by a trawler 2 months and cut in half. No reply was heard around the position.

16/05/91 Thursday. At 0700 we were on station for #6. The release was fired at 0707 and the mooring was on deck at 0740. The only casualty here was an Applied Microsystems Tide Gauge on the bottom. Its mounting bracket pulled out by the root and left the meter behind. Next stop was #6. This was located after a short search 1.8 miles from its listed position. The release signal was sent at 1019 but the only

thing to surface was the Acoustic Release and the back-up flotation. The shackle on top of the floats was still moused. This shackle was attached to an Aanderaa spindle. Clearly the spindle pin had been removed. Whoever moved the mooring has the complete current meter string on board. We were still short of time so decided to abandon further recovery attempts in the western part of the Strait and head for the Gippsland coast.

17/05/91 Friday. The day started off in a very promising fashion. #5 was released at 0719 and on deck at 0726. #4 was released at 1023 and on deck at 1049. At #3 there was no reply from the release and nothing appeared on the surface after sending the release command. A brief sound search was made 1 mile to the south and east. Returning to the site a sonar echo was seen about 50 metres from the position and the rest of the afternoon was spent grappling with the wire. The attempt was abandoned at dusk. At 2230 mooring #2 was interrogated to see if it was talking and after a positive response we decided to spend the following morning attempting to recover #3.

18/05/91 Saturday. After slight modification to the grapple, a glass ball added to the end to lift the hook off the bottom, we started dragging at 0630. After breakfast at 0900 we streamed a drifting drag line, again without result. Long periods at the sonar failed to produce the same contact we had seen the day before. A contact was sighted while the drop line was out, but the ACR hydrophone could hear lots of porpoises and the echo was identified as a school of fish. At mid-day we stopped and made a sweep around the area at a radius of 4 miles listening for the transponder. No replies were heard. At no time while we were dragging did we get the faintest indication that we might have hit the mooring. It seems likely that there was nothing there. Accordingly we moved off to #2, sent the release signal at 1619 and had the mooring on deck at 1636.

19/05/91 Sunday. Mooring #1 was released at 0707 and was on board at 0728.

#### DISCUSSION

This was clearly a very bad result. We can draw a few conclusions.

- 1) Do not use SEASTAR releases unless the deployment is for a short time in shallow water and an alternative recovery method is available.
- 2) The ship is not well equipped for mooring recovery. Because we have had so few losses in past years this has been neglected. In particular a good line drop line and floats should be on board for future recoveries and better grapples should be built.
- 3) It has become a regrettable practice to recover moorings as late in the cruise as possible. This leaves very little time available if any trouble develops.
- 4) The Wesmar Sonar is practically useless for this sort of work. The manual provides very little information about its use and there are no specifications included.
- 5) We do not know how many moorings are still there and recoverable. Certainly UNSW #5 and CSIRO #9(a) are in position and probably could be recovered. CSIRO #3 may also be near its listed position. Only a good sonar or side-scan sonar could find it.
- 6) Never put out moorings for anybody else. It is too expensive.

#### INVENTORY

##### RECOVERED

Owner	Device	Serial No.	Mooring No.
CSIRO	PL24	1	1

"	SACM	47	1
"	RCM8	9326	1
"	RCM4	571	1
"	ACR	7	1
"	PL24	2	2
"	SACM	52	2
"	RCM8	7830	2
"	RCM4	7199	2
"	ACR	4	2
ADFA	WLR7	1232	2
CSIRO	SS37	2446	4
"	VACM	610	4
"	RCM8	7838	4
"	RCM5	6560	4
"	ACR	401107	4
"	PL24	3	5
"	SACM	13	5
"	RCM5S	7662	5
"	RCM4	1276	5
"	ACR	103001	5
ADFA	WLR7	1129	5
CSIRO	SS37	2442	6
"	SACM	14	6
"	RCM5S	7664	6
"	RCM5	7154	6
"	ACR	401007	6
"	ACR	400907	7
"	SS28	2448	#1
UNSW	RCM4S	6627	#1
CSIRO	SS28	801	#2
VIMS	RCM5S	7623	#2
ADFA	WLR7	1231	#2
ADFA	SEASTAR	14184	#2
CSIRO	SF45	1	8
"	ADCP	300	8
"	ACR	705205	8
"	SF32	1	9
"	ADCP	474	9
"	ACR	204403	9
"	SS37	2459	10
"	ACM2	1196	10
"	RCM5S	7839	10
"	RCM5	6167	10
"	AMTG	115	10
"	ACR	105602	10

MISSING

Owner	Device	Serial No.	Mooring No.
CSIRO	PL24	3	3
"	SACM	5	3
"	RCM5S	7663	3
"	RCM4	1733	3
"	ACR	6	3
"	AMTG	61	6
"	S4	10	7
"	RCM8	7659	7
"	RCM4	586	7
"	WLR7	1123	#1
"	SS28	1120	#3
"	ACR	5	#3
"	SS24	1	9(a)

"	TCH	754	9(a)
"	SEACAT	108	9(a)
"	SEASTAR	14156	9(a)
"	SS28	2451	#4
"	AMTG	60	#4
"	SS28	M369	#5
UNSW	SEASTAR	141857	#1
"	RCM4	6149	#3
"	RCM4S	8717	#4
"	SEASTAR	14158	#4
"	RCM4S	6148	#5
"	SEASTAR	14186	#5

Notes:

WLR7	1231	DSU No.	2183	Data words	31866	0004Z on 19/05/91
WLR7	1129	"	1119	"	32433	0000Z 19/05/91
WLR7	1232	"	1048	"	01539	flooded
RCM5	7623					0030Z 19/05/91

Fred Boland