FRANKLIN

National Facility
Oceanographic Research Vessel

RESEARCH SUMMARY

Cruise FR 1/91

Sailed Hobart 0900 Sunday 6 January 1991
Arrived Adelaide 0930 Sunday 13 January 1991

BASS STRAIT INTERDISCIPLINARY STUDIES

Principal Investigators
Drs Peter Craig and Peter Nichols
CSIRO Division of Oceanography, Hobart

LOW FREQUENCY CIRCULATION AT THE WESTERN END OF BASS STRAIT

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19 February 1991

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Cruise Summary
RV *Franklin* FR 1/91

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

- Deploy five current meter moorings across each of the eastern and 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_2 of surface waters.

- Collect water and sediment samples at selected stations.

- Collect sediment samples off East Gippsland as part of collaborative studies with the School of Chemistry, University of Melbourne.

- Collect water samples for $\sum CO_2$ and titration alkalinity to investigate carbon cycling.

- Collect atmospheric gas samples for the CSIRO Division of Atmospheric Research for the analysis of CO_2 and other relatively important tracer gases.

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

- Six current meter moorings will be deployed on the shelf west of Bass Strait (see Table 1).

- CTD and ADCP measurements will be made at the mooring sites and across the shelf.

Cruise Summary

FR 1/91 was principally a deployment cruise. In all, 11 moorings were laid for the Bass Strait Interdisciplinary Study, and 5 for the University of NSW project, "low frequency circulation at the western end of Bass Strait". Details of the mooring locations are shown on Table 1 and Figure 1.

The only difficulty encountered was at the first UNSW mooring, M1. The UNSW Seastar acoustic releases were supplied with a plastic bracket to link the release hook to the anchor weight. The mooring buoyancy obviously exceeded the breaking strain of the bracket and, shortly after the uppermost float disappeared below the surface, the whole mooring bobbed back up, minus the anchor weight. The mooring was recovered and replaced, with a new anchor, and a loop of mooring wire substituted for the plastic link. Alternative linkages then had to be constructed for each of moorings M2, M4 and M5. The final proposed mooring, M6, was not deployed because we were an anchor weight short.

The period of the instrument deployments was planned to cover the time of summer stratification through to winter mixing. Over this cruise, we conducted 27 CTD stations (Fig 1). The majority of the Strait appeared, at the time of the cruise, to be well-mixed vertically down to about 50m. The Strait is horizontally stratified, with the warmest waters, around 17.6°, in the north-east, and the coolest in the southwest, at 15.3° C (Fig. 2).

There appears to be a pool of cold water in the deep central Strait where the depth exceeds 50m. The western end of the Strait, between King Island and Cape Otway is strongly stratified in the vertical (Fig.3). Our CTD sections do not resolve the north-western sector of the Strait in which the transition from strong to zero stratification occurs.

A full listing of chemical sampling undertaken along the north-east to South-west transect of Bass Strait is presented in Table 2.

Collection of Samples for CSIRO DAR was not undertaken during FR 1/91 as specialised sampling containers were not available. It is anticipated sample collection will be performed during FR 4/91.

Personnel

Peter Nichols	CSIRO-Oceanography	Chief Scientist
Rhys Leeming	"	
Mark Rayner	"	
Paul Boult	"	
Peter Craig	"	
Fred Boland	"	
Kevin Miller	"	
Danny McLaughlin	"	
Graham Symonds	ADFA	
Erik Madsen	CSIRO-ORV	
Jeff Dunn	"	Cruise Manager
Gary Critchley	"	

Acknowledgements

Particular thanks are due to the moorings group of Fred Boland, Kevin Miller and Danny McLaughlin for their skill with the deployments. Because of the closeness of the moorings, they were required to work even more unusual and extended hours than the rest of us.

We also extend our thanks to the Master and crew of the *"Franklin"* for their assistance and cooperation throughout the cruise.

Table 1

Mooring Locations

Bass Strait Interdisciplinary Studies

Mooring	Station	Latitude	Longitude	Depth	Instrumentation
1	2	40-39.45	148-08.2E	40	3cm
2	3	39-30	148-00.4	47	3cm 1tg
3	4	38.59.15	148-00.52	67	3cm
4	6	38-29.83	147.59.98	70	3cm
5	5	38-00.00	147-59.82	47	3cm 1tg
6	15	40-08.63	144-15.02	53	3cm 1 tg
7	16	40-18.35	144-28.89	71	3cm
8	21	39-23.64	143-49.74	102	ADCP
9	22	39-04.13	143-38.51	93	ADCP
9A		39-04.98	143-38.04	95	ts
10	23	38-54.73	143-32.55	64	3cm 1 tg

Low Frequency Circulation at the Western End of Bass Strait

Mooring	Station	Latitude	Longitude	Depth	Instrumentation
M1	17	40-50.23	144-08.50	95	1cm 1tg
M2	18	41-10.94	144-13.74	115	1cm 1tg
M3	19	41-13.35	144-05.87	496	1cm
M4	24	38-38.90	142-56.76	53	1cm 1tg
M5	25	38-54.11	142-43.89	79	1cm

cm - current meter
tg - tide gauge
ADCP - acoustic doppler current profiler
ts - thermistor string

Table 2: FR1/91 station locations and sampling details

CTD No.	Location lat. (S)	long. (E)	Date (UTC)	Time (UTC)	Water depth	Mooring No.	Sampling depths	Hydro.	AOX water	Pig. water	CHN water	Lipids water	DOC water	AOX sed.	Lipids sed.
1	43 08.04	148 18.80	6/1/91	408	171		900	Sal only							
2	40 39.05	148 08.28	6/1/91	2025	40	1	0,20,35	x							
3	39 30.01	148 00.01	7/1/91	542	47	2	0,20,40	x							
4	38 59.03	148 00.75	7/1/91	1024	69	3	0,30,60	x							
5	38 00.07	147 59.97	7/1/91	1736	44	5	0	x	220	x	x	x	1	x	x
							25	x		x	x	x	2		
							40	x	3108	x	x	x	3		
6	38 29.69	148 00.38	8/1/91	40	70	4	0,30,65	x							
7	38 22.04	147 40.35	8/1/91	321	54		0	x	49	x	x	x	4	x	x
					25		25	x		x	x	x	5		
							45	x	1255	x	x	x	6		
8	38 43.23	147 18.40	8/1/91	615	52		0	x	P38	x	x	x	7	x	x
							25	x		x	x	x	8		
							45	x	109	x	x	x	9		
9	39 04.05	146 56.66	8/1/91	900	62		0	x	1204	x	x	x	10	x	x
							25	x		x	x	x	11		
							50	x	1314	x	x	x	12		
10	39 24.89	146 34.69	8/1/91	1207	79		0	x	49	x	x	x	13	x	x
							35	x		x	x	x	14		
							70	x	2136	x	x	x	15		
11	39 33.98	146 07.51	8/1/91	1515	80		0	x	3125	x	x	x	16	x	x
							25	x		x	x	x	17		
							75	x	19	x	x	x	18		
12	39 42.51	145 39.51	8/1/91	1808	80		0	x	8	x	x	x	19	x	x
							60	x		x	x	x	20		
							75	x	X97	x	x	x	21		
13	39 51.45	145 11.60	8/1/91	2049	64		0	x	3052	x	x	x	22	x	x
							25	x		x	x	x	23		
							59	x	2534	x	x	x	24		

Table 2: (continued)

CTD No.	Location lat. (S)	long. (E)	Date (UTC)	Time (UTC)	Water depth	Mooring No.		Sampling depths	Hydro.	AOX water	Pig. water	CHN water	Lipids water	DOC water	AOX sed.	Lipids sed.
14	40 00.16	144 44.12	8/1/91	2316	52			0	x	3079	x	x	x	25	x	x
								25	x		x	x	x	26		
								45	x	1187	x	x	x	27		
15	40 09.12	144 14.82	9/1/91	149	53	6		0	x	5	x	x	x	28	x	x
								25	x		x	x	x	29		
								50	x	X233	x	x	x	30		
16	40 18.90	144 28.64	9/1/91	413	70	7		0,30,60	x							
17	40 50.47	144 08.95	9/1/91	826	95	M1		0,60,90	x							
18	41 11.56	144 13.74	9/1/91	1345	118	M2		0,60,106	x							
19	41 13.69	144 06.69	9/1/91	1607	489	M3		0,110,480	x							
20	41 20.96	143 49.87	9/1/91	1815	2060			0,25,50,100	x							
								250,500,750								
								1000,1500,2000								
21	39 23.69	143 49.75	10/1/91		644	101	8	0,50,100	x							
22	39 04.11	143 38.54	10/1/91		912	93	9	0,40,85	x							
23	38 54.44	143 33.09	10/1/91		1226	75	10	0,25,60	x							
24	38 40.88	142 56.50	10/1/91		1950	61	M4	0,25,55	x							
25	38 53.99	142 44.26	11/1/91		14	77	M5	0,35,73	x							
26	39 07.41	142 32.15	11/1/91		231	508		0,50,175	x							
								350,500								
27	39 14.47	142 25.83	11/1/91		406	1311		0,25,50,100	x							
								200,400,600								
								800,1000,1300								

Numbers for AOX and DOC water samples indicate bottle numbers

Station location do not indicate precise mooring locations

x Indicates sample taken for analysis specified

RV FRANKLIN ELECTRONICS REPORT
CRUISE FR01/91
S.E.MADSEN 13th January 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 AND ROSETTE SYSTEM

Towards the end of the cruise, spiking in the oxygen data caused me to tighten the oxygen sensor assembly, but after a further few ctd stations the oxygen sensor failed altogether, it was replaced en route to Adelaide.

RAYTHEON SOUNDER.

The 3.5Khz system, borrowed from the navy, was installed in the electronics lab. and tested prior to departure. The tow cable was re-spooled to the mooring groups winch before we got to Adelaide.

SIMRAD SOUNDER.

A faulty recorder amplifier board prevented the paper recorder from operating at start up, this was replaced with the spare board. Repairs to the faulty board could not be affected as suitable replacement transistors were not available.

EG & G SEALINK RANGER.

This blew a power amplifier mos fet to pieces on power up, as no spares were onboard, repairs could not be affected.

MET STATION

Tests were done on the pressure interface card to determine the cause of frequent PLL unlock, however, until the last day of the cruise it did not loose lock for periods long enough for diagnostics, after which the frequency would vary from 10Khz to 3.5Mhz with blocked input to the digiquartz.

COMPUTERS, PRINTERS AND SOFT WARE.

MICRO1

Modifications to the Navigation software during the last port period interfered with the met. software, such that all met. parameters were either 99.00 or -99.00, this was over come by starting the met program first.

MICRO2

This crashed once due to overheating in the rack, I suspect this was caused by insufficient air extraction, it was fixed by removing the rack back cover.

MICRO3

This micro was gaining excessive time from start up, on investigation it was found that the external time reference was missing, a new time reference, made from the electronics spares was fitted. This micro also crashed a few times due to suspected over heating in the rack, after removal of the rack rear door this problem did not recur.

Report on the Ph and Turner Fluorometer as used on FR 01/91

One of the objects of the cruise was to ascertain the status of the Ph and Turner Fluorometer data collection.

Over the past 7 days these two systems have been observed to function continuously and transfer there data to the data logging programs in the operations room. The weather over this period has been moderate with no really bad weather.

Observations made on the Ph Meter.

The first area which needs to be corrected is the earthing of the Ph probe. At present there is an earth attached to the ships earth through a mains socket and a alligator clip. This should be replaced with a more reliable system such as a soldered connection with a lead into a terminal block. This would make the system more reliable as it would decrease the probability of accidental disconnection of this earth.

The second area which needs to be changed is the water detector. At present the water detector is only held onto the tray by tape which in a humid environment would lift . So it is suggested that the detector itself is attached by a more robust means, as this again would ensure greater reliability.

The water detector works well in itself but the alarm should be modified. At present when the alarm is triggered it emits a high pitched tone in the GP lab which , if the person was not waiting for, is quit a shock. It would be better if this was replaced by a worrible and a flashing light as this would penetrate the noisy environment yet it could be at a lower sound level. Also as the GP lab is not always manned a repeater should be placed in the Op's room to ensure that any malfunction causing a leak would be picked up quickly. This could be placed in the Port rear rack as this has a Eurocard 19" rack subsystem in it. The wiring could be brought up via a communication duct at the port stern end of the GP lab.

It has been noticed that as the weather increases an the boat starts to move around then the noise on the chart recorder increases. It can be duplicated by raising the outlet pipe in the sink. This tends to suggest that there is some back pressure problem with the measuring system.

The final comment on the Ph system is one of finish. The system although working well looks thrown together. After talking with Gary Critchely, we believe that the tray with the pump and sensors needs to be on a sliding tray which can be locked in the extended mode. This would enable the chemistry tech.to work on the system with greater ease (this would entail the cabling to be extended). The electronics packages used for this system are in three different boxes, this should be change so that there is a proper box made which again should be on sliders. The Ph meter requires a switch to be change when calibrating the system, this should be duplicated on the front of the box so that it is easily accessible. (See diag. at back)

As far as spares for the system, then I feel after talking to Gary Critchley that there should be :

1 a set of Valves
2 enough tubing to replumb the system
3 extra Ph and Temperature probes possible 2
4 a spare sensor holder for the probes and a spare grounding container

As for spares for the Ph meter itself I dont feel that there is much you can keep on board other that a whole Ph meter.

While some of the above suggestions involve ascetics it is also true that if a system is well constructed then the reliability for that system will increase.

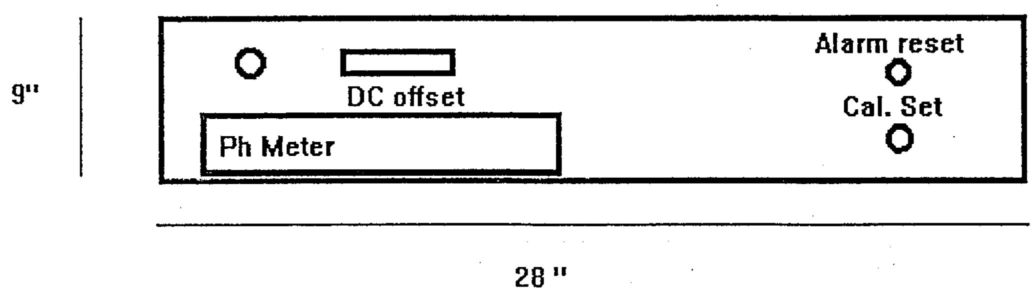
Observations on the Turner Fluorometer

There is not that much that can be said about the Fluorometer apart from that there should be some uV glasses made available for the tech. when he changes the silica gel. Because although the instructions say to turn off the unit to change the gel there will be times when this is not done.

As far a spares are concerned the main part which should be duplicated is the interface to the PDP 11 computers ie the A/D converter board(which I understand is kept on board). Apart from that there is not much in the way of spares which can be kept on board.

P.R.Boult

Proposed layout for the Ph system



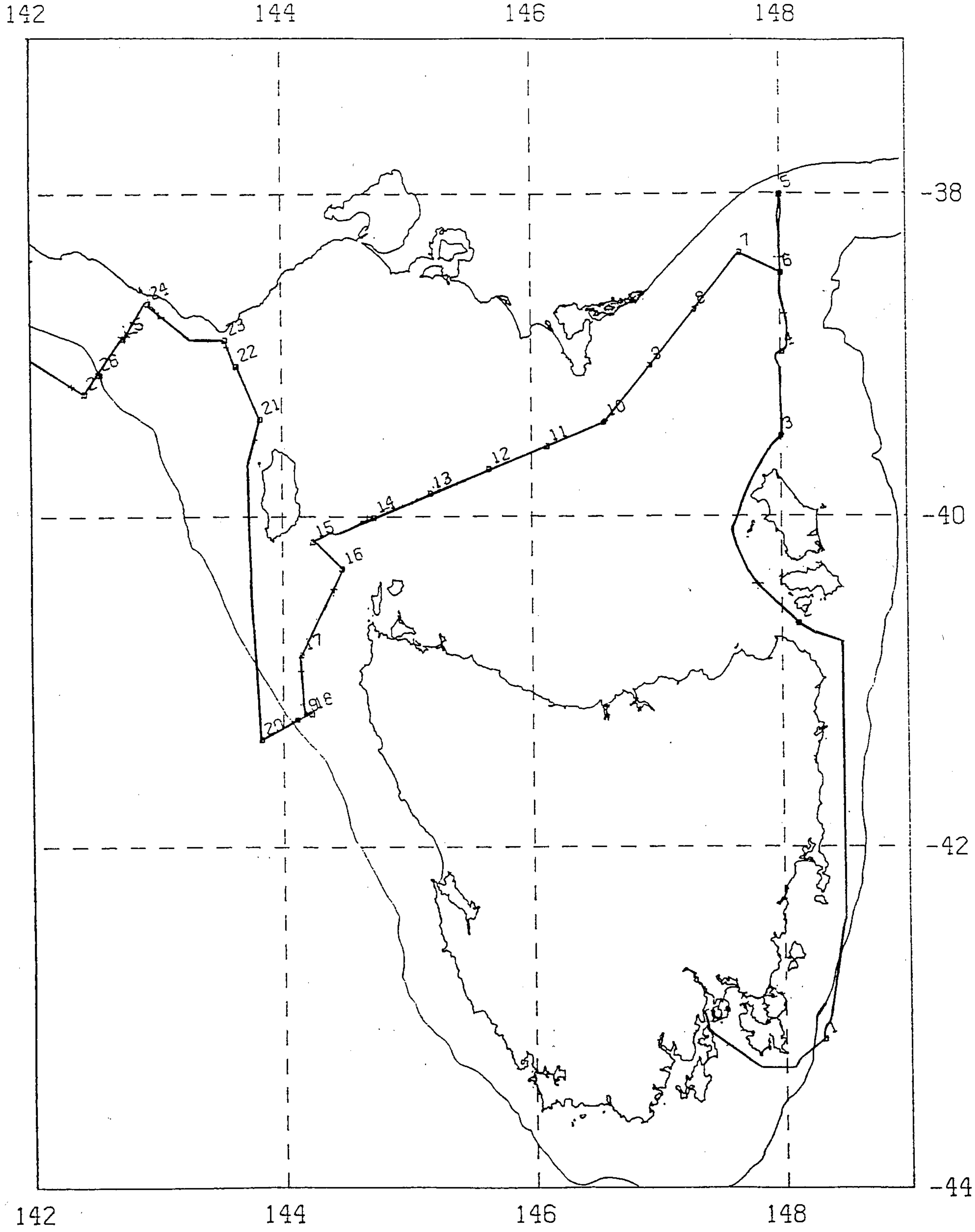


Fig. 1 Cruise track, FR 1/91

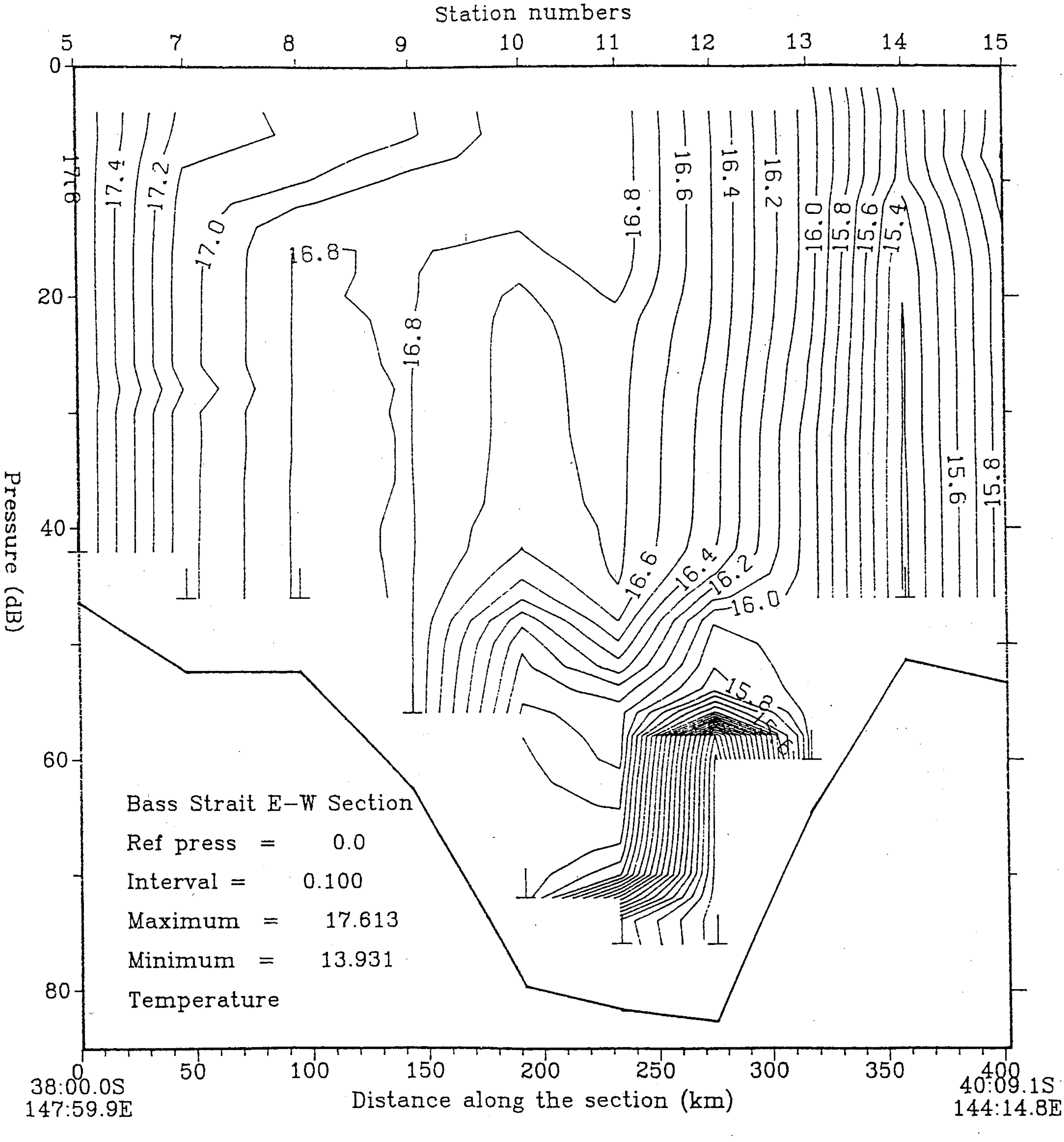


Fig. 2 **Temperature section across Bass Strait, stations 5 to 15, 8 Jan. 1991**

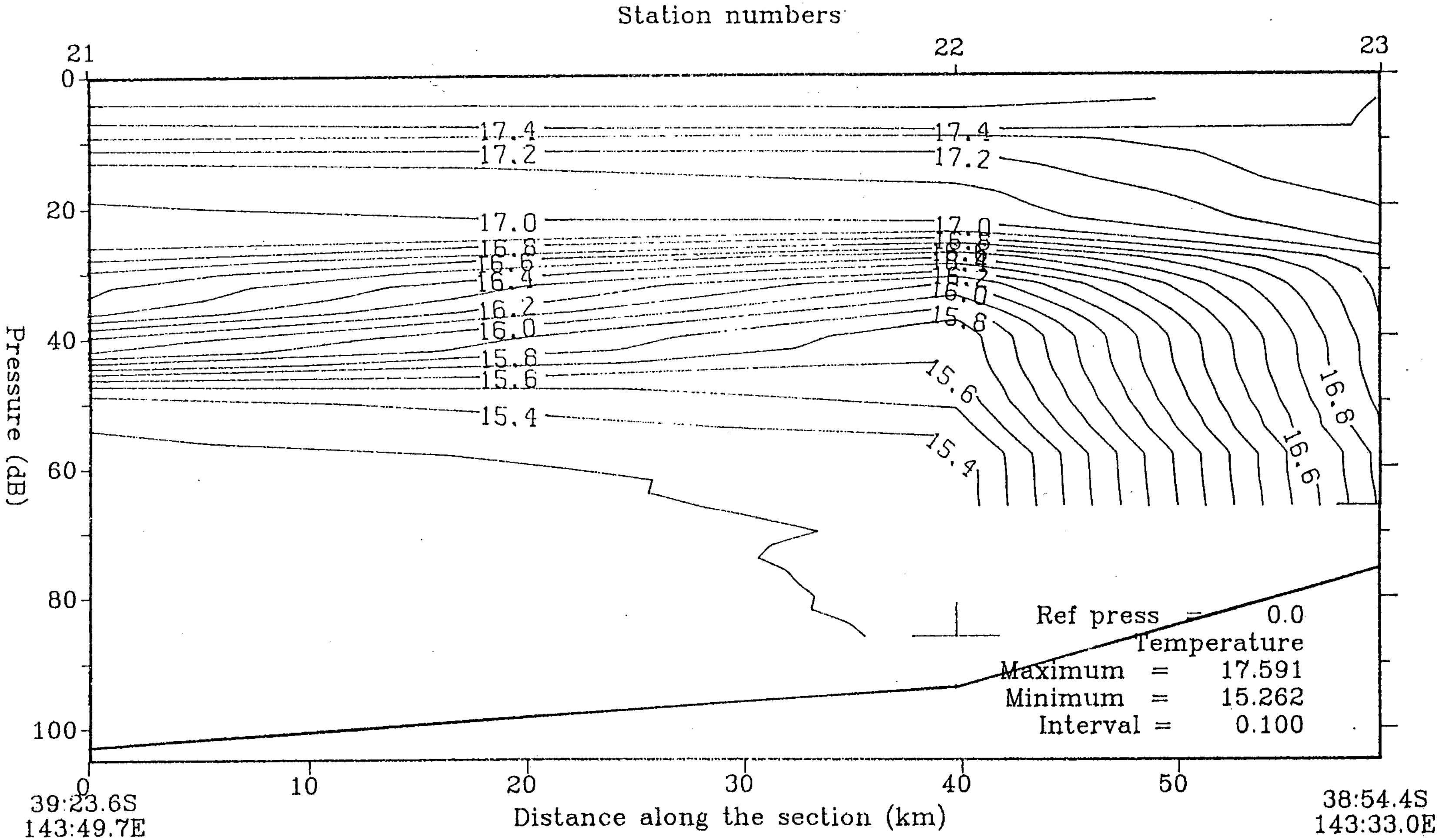


Fig. 3 **Temperature section between King Island and Cape Otway, 10 Jan. 1991**