

FRANKLIN

National Facility
Oceanographic Research Vessel

RESEARCH SUMMARY

CRUISE FR 2/94

Sailed	Sydney:	12:00 Hrs 19 January 1994
Arrived	Sydney:	12:00 Hrs 27 January 1994

COASTAL DYNAMICS AND ICHTHYOPLANKTON DISTRIBUTIONS IN THE SYDNEY REGION

Principal Investigators

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February 1994

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FRANKLIN is owned and operated by CSIRO

RV FRANKLIN
FR 2/94
RESEARCH SUMMARY

1. Itinerary

Depart Sydney 1200 Hrs, 19 January, 1994
Arrive Sydney 1200 Hrs, 27 January, 1994

2. Scientific Program

The main objectives of the cruise were to determine the baroclinic current structure of the coastal waters off Sydney, and the effects on the distribution of nutrients and planktonic fish. A second cruise (Fr 4/94) is to be undertaken in March and April to retrieve the moorings and repeat measurements to determine seasonal variability.

The program consisted of the deployment of current meter moorings, the acquisition of Conductivity, Temperature and Depth (CTD) data to determine water column profiles of temperature, salinity and fluorescence, water sampling for nutrients and nano-plankton, the acquisition of Acoustic Doppler Current Profiler (ADCP) data and the collection of phytoplankton and ichthyoplankton using the EZ net and surface nets. Particle concentrations were also measured from selected water samples. Concurrent ADCP sampling with two smaller vessels was also undertaken.

3. Principal Investigators

Professor Jason H Middleton and Dr Iain Suthers
Centre for Marine Science, University of New South Wales
and
Mr Peter M Tate
Environmental Management and Investigations Unit
Sydney Water Board

4. Results

In terms of the physical oceanography components of the cruise, all objectives were met. Three moorings were successfully deployed and are to be retrieved on Fr 4/92. The repeated CTD sections showed a changing balance in the near coastal ocean, with a strong upwelling favourable (southward flowing) nearshore current on the evening of the 19th, changing to a strongly northward flowing nearshore current by Saturday 22nd, after a strong southerly change brought 35-40kt winds on Friday night. The southward flowing current was then seen to re-establish later in the cruise. This data will provide excellent material for comparison against numerical models. The three vessel ADCP/CTD transects would also appear to have provided a unique data set, although it will be some time before all data sets will be analysed. Finally, the physical environment characteristics was used to provide information for the biological sampling program.

The EZ net performed flawlessly in support of the zooplankton and fish larvae sampling program, after initial minor electronic and mechanical problems. Over four nights and 1 day, 28 successful tows were made with a total of 30 deployments. Replicated surface neuston tows were made simultaneously with EZ tows resulting in a total of over 100 plankton samples. While our initial objective of sampling different surface water masses was not achieved (due to uniform T and S characteristics), we did sample a variety of deep water masses off Sydney from the nearshore to the continental slope. Horizontal, vertical and temporal variation in these samples was evident, although the samples have yet to be sorted. The relationship of the physical dynamics to the biological variability will be an exciting outcome of this project, with implications for environmental impact assessment and recruitment variability in fishes.

There appeared to be enormous diversity of larval fish in our samples, with no single taxon dominating. Size of larvae were generally small (< 12 mm) compared to impressive numbers of eel larvae and pelagic juvenile myctophids from our earlier Coral Sea cruises (Fr 8/92 and Fr 2/93). The abundance of particles from 2-60 μ m also showed marked variability horizontally and vertically, and may prove to be an important water mass characteristic.

We thank all scientific and ship's personnel, who undertook their tasks cheerfully and professionally throughout the cruise.

5. Cruise Narrative

In this narrative dates and times are expressed in Eastern Summer time, except where explicitly mentioned otherwise.

Wednesday, 19 January *Franklin* sailed at 1200, and once out of the heads an emergency drill was undertaken. The ship proceeded to the vicinity of the site to be used for mooring D, and conducted a survey of bottom topography to determine the exact location to deploy the mooring. Once this was completed, a short trip back towards the heads was made to rendezvous with a UNSW small boat to transfer additional flotation. *Franklin* then returned to the mooring D location, and the mooring was finally released at 1815 (0715 UTC) at 33°55.07'S, 151°25.04'E at a depth of 102 m. CTD 1 was then undertaken at 1833, after which the *Franklin* went farther offshore to the general region of mooring site E. The survey of this region was completed at 2030, and CTD 2 deployed. *Franklin* then headed to the south east to undertake a survey of Brown's Reef which was located at 34°02.11'S, 151°39.35'E. This reef rises to 390 m in about 500m of water, but is a very small pinnacle.

Thursday, 20 January The survey of Browns Reef was completed by 0100 and a set of CTD's were undertaken back towards Ben Buckler Headland on the northern end of Bondi Beach. CTD Stations 3-10 comprised this section, with each station having nutrient samples taken throughout the water column, and at the fluorescence maximum.

Franklin then headed out to the location of mooring E once more, and the mooring was subsequently released at 1048 sumertime (2348/19 UTC) at location 33°55.69'S, 151°28.48'E at a depth of 104 m. The *Franklin* then headed to the east-south east to continue to survey the area around Browns Reef. The site for mooring F was decided upon, and after a quick transit to the mooring E site to obtain additional ADCP data on the outer slope, mooring F was deployed at 1929 summertime (0829/20 UTC) at location 34° 01.15'S, 151°36.53'E at a depth of 333 m. This completed the deployment of moorings for the experiment with the first 3 moorings (A, B and C) deployed by the Water Board earlier in the week. The ship then began a second CTD/nutrient section, heading toward the Ben Buckler headland, beginning at Station 11, and finishing on Friday morning at Station 21.

Chlorophyll filtrations were made using GFF filters on 4 litre samples from one or two CTD bottles per Station, and on sporadic samples from the Turner fluorometer. In addition, HIAC particle counts using the 60 μ m sensor were made on three 10 ml subsamples from 3 to 5 bottles on Stations 2 to 15. CTD casts 15 and 16 were for taken for Yeokal SDL calibration.

Friday, 21 January The overnight CTD section was interrupted at 0800, and *Franklin* returned to the vicinity of The Gap to replace Greg Nippard with Brad Morris. Brad brought with him desperately sought after newspapers. Immediately after at 0911, CTD station 22 was undertaken, completing the section. *Franklin* then transited offshore to 1000m depth where CTD Station 23 was taken, and the first EZ net was deployed at 1430 at 34°03.75'S, 151°41.12'E to test the unit. Eric Madsen had to replace a card in the EZ net CTD, following which the net was loaded with 300 mm mesh nets with soft cod ends of 250m. On all tows three depth ranges were to be sampled, with the lowest being at the level of maximum chlorophyll. Following this the ship repositioned back to the coast where the first night EZ net was deployed at 2030 at EZ Station A. The wind had been rising since the late afternoon, and by 2100 had increased to 30kt, gusting to 40kt, so the EZ net was retrieved and *Franklin* hove-to for the night.

Saturday, 22 January With the morning the wind had abated somewhat, and by 1000 another CTD section was begun. This section was again taken on the line from Ben Buckler to Browns Reef, and comprised stations 24 to 34. No HIAC particle counts were taken here due to a blocked sensor. This section was completed by 1900 and *Franklin* returned to the coast. *Franklin* then repositioned at EZ Station A, with bar 10 tied as a result of damage on Friday evening, and began fishing at 2030 with three nets sampling intervals of 50 - 40m, 40 - 30m and 30 - 15m. Many ctenophors were found in the bottom net. Concurrent surface neuston tows were undertaken from the starboard side. An EZ Station was begun at Station B but the tow had to be cancelled due to a jammed camshaft on the net release mechanism. Two surface neuston tows were undertaken here. Redeploying at EZ Station B, the EZ net successfully sampled at depth bins of 70 - 60m, 60 - 40m and 40 - 15m. A tow at EZ Station C had to be aborted due to a net jam, but was finally completed successfully with the offending net bars tied out of the way. Depth bins sampled here were 120 - 80 m, 80 - 40m and 40 - 15m. Much zooplankton was found in the top bin. Stations D and E were then completed without further incident, sampling at depths identical to Station C. These were begun at 0315 and 0445 respectively.

Sunday, 23 January *Franklin* repositioned back toward the coast to begin a multi-vessel ADCP section. Vessels *Wollamai* from the Water Board, combined with a UNSW chartered vessel and *Franklin*, and began the section at 0840. The smaller vessels made formation on *Franklin*, one either side at a distance of 1 cable (0.1 nm) with *Wollamai* to the north and the UNSW vessel to the south, and maintained 4 knots on a heading of 105° until 1137. A small gap in the small vessel ADCP transects occurred during 1030 and 1045 when the configuration files needed adjustment. The vessels then repositioned and made a return section back toward Ben Buckler beginning at 1215 and ending at 1455. A series of CTD Stations was then taken, again beginning near Ben Buckler, and heading out to the south east. Stations 36 to 44 were undertaken, finishing at 1900 These included samples for HIAC particle counts from 3 depths. From 2100 EZ net tows were taken again at Stations A to E, finishing at 0400. The net bar retaining bolts were loosened, and application of teflon tape between the trigger and the camshaft appeared to eliminate the jamming problems. Surface samples appeared remarkably uniform (as did the surface temperature and salinity), except that *Physalia* (bluebottles) were more common at C, D and E. Few larval fish appeared in the coastal stations A and B, despite a large biomass of zooplankton. Myctophids were found at C, D and E. As usual, two surface neuston tows were taken during each EZ deployment.

Monday, 24 January *Franklin* moved to position 33°56'S, 151°24'E where a set of CTD stations (Stations 45 to 69) were taken at 1/2 hour intervals through the day. The UNSW vessel undertook moored ADCP measurements throughout the day while *Wollamai* twice undertook ADCP transects from coast to the 120 m depth contour, and return. HIAC particle counts using the 60 µm sensor were made from both Niskin bottles on most CTD Stations.

Following completion of this survey *Franklin* moved north to the mouth of the Hawkesbury River, and began CTD Station 70 at EZ Station F, approximately 5 nm east of Barrenjoey Headland. An EZ net tow was then also undertaken at this location. The vessel then repositioned 1 nm off Barrenjoey and began a series of SDL casts and surface nets while moving slowly back to F. No horizontal gradients in temperature or salinity were observed, probably as a consequence of the low rainfall which has occurred in the area over the last month. The EZ net tow was repeated at 2321 as was the CTD cast (Station 71). Preliminary analyses show a relatively high biomass, with increased numbers of larval fish offshore at G and H. EZ Station I was then completed at 0445.

Tuesday, 25 January Returning to a position just 1 km off Bondi Beach, *Franklin* again met with the Water Board and UNSW vessels. The vessels moved in loose formation on a shore normal transect, with *Franklin* taking CTD's and nutrient samples every two miles. For each CTD cast, 2 Niskin bottle samples were collected, these being used for chlorophyll filtrations and salinity calibration. Five samples were also run through the HIAC particle counter. Concurrently *Wollamai* undertook Stations at much closer spacing of 1/4 nm, and the UNSW vessel took an ADCP transect at constant speed of 2.8 kt. This section was completed at location 34°00.92'S, 151°39.42'E at 1500 and the Water Board and UNSW vessels returned to Sydney harbour. *Franklin* continued the section out to the 500m contour, completing the section of CTD stations 72 - 80 before returning again to the coast to begin evening sampling using the EZ net. The first tow was taken at EZ Station A, and then tows were taken successively to Station E. The distribution of larval fish and zooplankton appeared to be radically different to the previous two nights, with greater abundance inshore at Stations A and B than offshore.

Wednesday, 26 January Australia Day was begun in the early hours with the vessel returning back toward Ben Buckler. To determine the near coastal structure for the days EZ tows, CTD Stations 81 to 85 were undertaken between 0435 and 0630. These Stations were at sites sampled on several previous days, so as to draw comparisons and establish the nearshore baroclinic structure. No chlorophyll or particle size measurements were made; with sampling undertaken only for salinity calibration. Following this *Franklin* again relocated at EZ Station A and undertook another set of EZ Stations from A to E with a repeat at Station D. In general, fewer zooplankton and fish larvae were found during the day compared to the night, but surprisingly, the majority was in the surface waters (as at night), and not near the level of chlorophyll maximum. Little zooplankton biomass was found at Station E, as observed the previous night. The cruise barbeque was held to celebrate Australia Day at 1700, following CTD Stations 87 to 97 through the night.

Thursday, 27 January Upon completion of the CTD transect at Station 96, a final ADCP survey was undertaken to the 500m contour and the vessel returned to Sydney Harbour Heads. The Pilot was picked up at 1100 and the vessel docked at No 17 Pyrmont at 1200.

Scientists

Jason Middleton	UNSW	Chief Scientist
Tim Dempster	UNSW	
Mark Gibbs	UNSW	
Brad Morris	UNSW	
Greg Nippard	UNSW	
Dave Rissik	UNSW	
Kim Smith	UNSW	
Iain Suthers	UNSW	
Linda Worland	UNSW	
Clive Holden	Water Board	
Dave Vaudrey	CSIRO - ORV	Cruise Manager
Bob Griffiths	CSIRO- ORV	
Eric Madsen	CSIRO- ORV	

Crew

Neil Cheshire (Captain)	Ian Menzies (First Mate)
Peter Warden (Second Mate)	John Scott (Chief Engineer)
Peter Harding (Second Engineer)	Don Roberts (Elec. Engineer)
Tony Bernardin (Greaser)	Jannick Hansen (Bosun)
Kris Hallen (AB)	Bluey Hughes (AB)
Jack Caldwell (AB)	Gary Hall (Chief Cook)
Bob Clayton (Second Cook)	Reg Purcell (Chief Steward)

CTD LOG FR 02/94

CTD No	TIME (UTC)	TIME (EST)	LATITUDE	LONGITUDE	DEP cast	DEP ocean
1	0733/19	1733/19	33 55.06	151 24.77	105	105
2	1017/19	1733/19	33 55.93	151 28.75	133	133
3	1340/19	2340/19	34 02.51	151 40.00	500	602
4	1504/19	0104/20	34 00.00	151 35.10	251	251
5	1641/19	0241/20	33 58.22	151 29.69	145	145
6	1803/19	0403/20	33 56.04	151 25.15	130	130
7	1914/19	0514/20	33 53.99	151 20.04	70	70
8	2019/19	0619/20	33 54.27	151 18.69	68	68
9	2118/19	0718/20	33 54.24	151 17.80	51	51
10	2203/19	0803/20	33 54.33	151 17.45	41	41
11	0910/20	1910/20	34 01.55	151 36.49	353	353
12	1029/20	2029/20	33 59.09	151 32.47	157	157
13	1144/20	2144/20	33 58.33	151 30.32	148	148
14	1317/20	2317/20	33 57.56	151 28.45	141	141
15	1423/20	0023/21	33 56.50	151 26.93	131	131
16	1449/20	0049/21	33 56.50	151 26.49	132	132
17	1505/20	0105/21	33 57.14	151 26.04	131	131
18	1621/20	0221/21	33 56.19	151 25.13	131	131
19	1747/20	0347/21	33 55.71	151 22.94	104	104
20	1855/20	0455/21	33 55.12	151 21.33	82	82
21?	2211/20	0811/21	33 53.91	151 17.81	50	50?
22	2211/20	0811/21	33 53.91	151 17.81	50	50
23	0155/21	1155/21	34 05.15	151 44.83	500	1112
24	2304/21	0904/22	33 54.58	151 18.39	67	67
25	2345/21	0945/22	33 54.48	151 19.52	68	68
26	0027/22	1027/22	33 55.05	151 21.32	83	83
27	0128/22	1128/22	33 55.67	151 22.99	105	105
28	0217/22	1217/22	33 56.14	151 24.91	129	129
29	0315/22	1315/22	33 56.90	151 26.63	131	131
30	0404/22	1404/22	33 57.61	151 28.49	142	142
31	0454/22	1454/22	33 58.23	151 30.31	148	148
32	0559/22	1559/22	33 58.97	151 31.82	154	154
33	0657/22	1657/22	33 59.75	151 33.74	196	196
34	0737/22	1737/22	34 00.43	151 35.31	277	277
35	0051/23	1051/23	33 58.28	151 31.33	149	149
36	0408/23	1408/23	33 53.73	151 17.91	50	50
37	0444/23	1444/23	33 54.53	151 19.35	68	68
38	0524/23	1524/23	33 55.12	151 21.30	82	82
39	0558/23	1558/23	33 55.69	151 22.96	104	104
40	0648/23	1648/23	33 56.26	151 24.84	129	129
41	0728/23	1728/23	33 56.89	151 26.55	131	131
42	0810/23	1810/23	33 57.63	151 28.42	141	141
43		There is no station 43				
44	0852/23	1852/23	33 59.06	151 31.95	155	155
45	1900/23	0500/24	33 56.00	151 24.00	114	114
46	1930/23	0530/24	33 56.00	151 24.00	114	114
47	2000/23	0600/24	33 56.00	151 24.00	114	114
48	2030/23	0630/24	33 56.00	151 24.00	114	114
49	2100/23	0700/24	33 56.00	151 24.00	114	114
50	2130/23	0730/24	33 56.00	151 24.00	114	114
51	2200/23	0800/24	33 56.00	151 24.00	114	114
52	2230/23	0830/24	33 56.00	151 24.00	114	114
53	2300/23	0900/24	33 56.00	151 24.00	114	114
54	2330/23	0930/24	33 56.00	151 24.00	114	114
55	2359/23	1000/24	33 56.00	151 24.00	114	114
56	0030/24	1030/24	33 56.00	151 24.00	114	114
57	0100/24	1100/24	33 56.00	151 24.00	114	114
58	0130/24	1130/24	33 56.00	151 24.00	114	114
59	0200/24	1200/24	33 56.00	151 24.00	114	114
60	0230/24	1230/24	33 56.00	151 24.00	114	114

61	0300/24	1300/24	33 56.00	151 24.00	114	114
62	0330/24	1330/24	33 56.00	151 24.00	114	114
63	0400/24	1400/24	33 56.00	151 24.00	114	114
64	0430/24	1430/24	33 56.00	151 24.00	114	114
65	0500/24	1500/24	33 56.00	151 24.00	114	114
66	0530/24	1530/24	33 56.00	151 24.00	114	114
67	0600/24	1600/24	33 56.00	151 24.00	114	114
68	0630/24	1630/24	33 56.00	151 24.00	114	114
69	0700/24	1700/24	33 56.00	151 24.00	114	114
70	0933/24	1933/24	33 34.99	151 25.05	48	48
71	1302/24	2302/24	33 33.14	151 25.05	48	48
72	2105/24	0705/25	33 53.82	151 17.80	49	49
73	2220/24	0820/25	33 54.78	151 20.67	82	82
74	2333/24	0933/25	33 55.82	151 23.41	111	111
75	0103/25	1103/25	33 56.69	151 26.11	129	129
76	0221/25	1221/25	33 57.76	151 28.77	143	143
77	0333/25	1333/25	33 58.28	151 31.04	149	149
78	0453/25	1453/25	33 59.14	151 33.78	188	188
79	0604/25	1604/25	34 00.15	151 36.61	317	317
80	0719/25	1719/25	34 00.92	151 39.31	496	496
81	1735/25	0335/26	33 56.88	151 26.48	132	132
82	1802/25	0402/26	33 56.33	151 24.87	130	130
83	1827/25	0427/26	33 55.75	151 23.01	105	105
84	1850/25	0450/26	33 55.14	151 21.34	84	84
85	1913/25	0513/26	33 54.51	151 19.63	69	69
86	1935/25	0535/26	33 53.49	151 17.92	52	52
87	0812/26	1812/26	33 53.77	151 18.02	50	50
88	0912/26	1912/26	34 03.07	151 22.05	120	130
89	1032/26	2132/26	34 08.94	151 29.81	295	298
90	1146/26	2146/26	34 11.84	151 38.17	500	1058
91	1301/26	2301/26	34 05.06	151 39.90	500	728
92	1422/26	0022/27	33 58.11	151 42.08	495	495
93	1538/26	0138/27	33 51.07	151 43.90	300	336
94	1639/26	0239/27	33 47.87	151 36.01	140	140
95	1757/26	0357/27	33 45.04	151 28.09	120	120
96	1852/26	0452/27	33 41.96	151 20.46	43	43

EZ LOG FR 02/94

Station	Latitude	Longitude	Depth
A	33 56.7	151 17.5	67
B	33 57.5	151 20.0	83
C	33 57.0	151 26.5	130
D	34 00.0	151 35.0	250
E	34 02.5	151 40.0	600
F	33 35.0	151 25.0	50
G	33 35.0	151 31.0	70
H	33 35.0	151 39.0	130
I	33 35.0	151 45.0	300

adcp9bin6

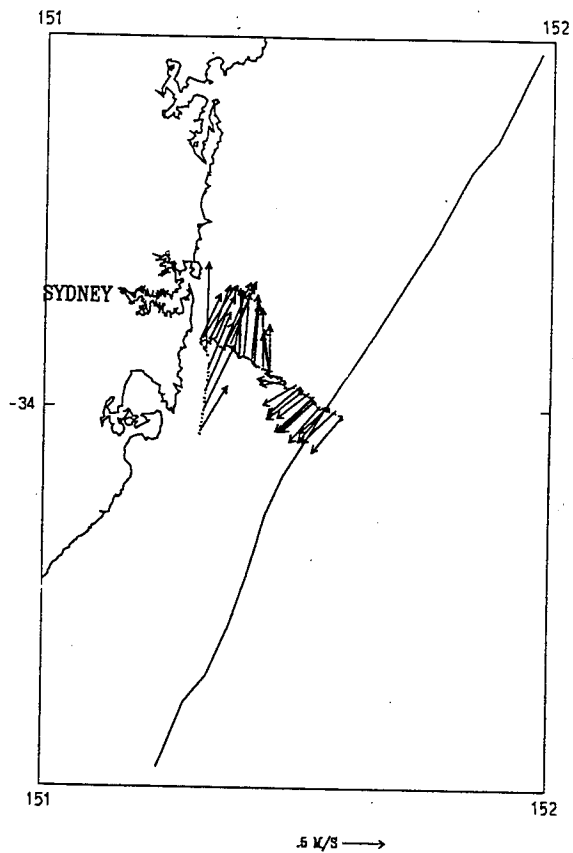


Fig 1.

ctd2f-37

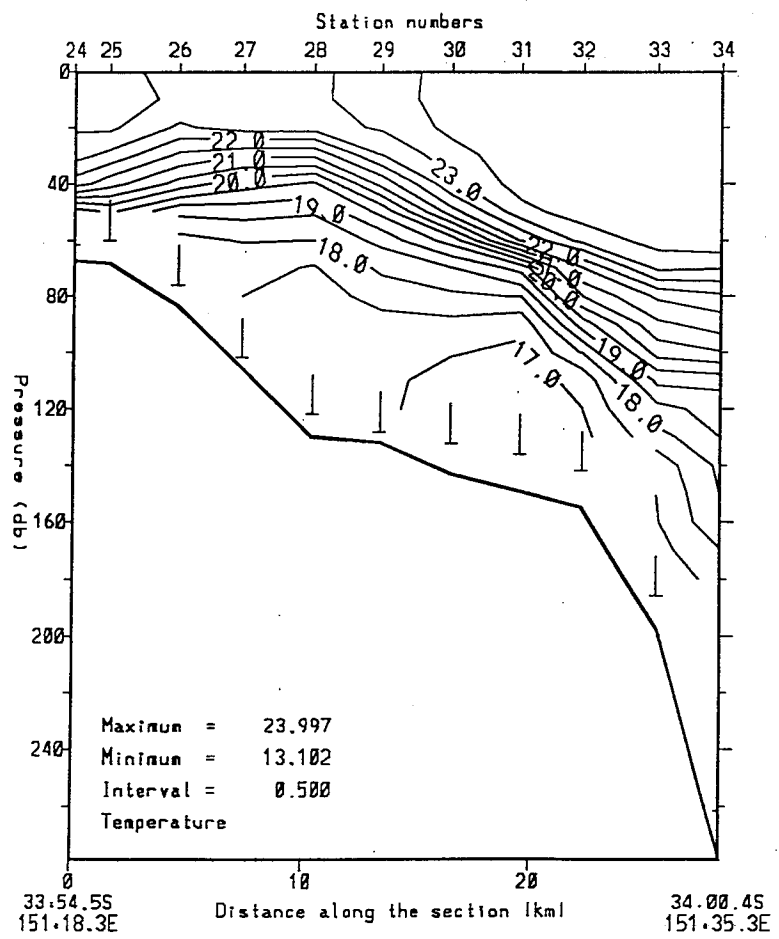


Fig 2

Franklin cruise 2/94

