

R.V. FRANKLIN

NATIONAL FACILITY OCEANOGRAPHIC RESEARCH VESSEL

RV FRANKLIN

RESEARCH SUMMARY

CRUISE FR 8/89

Sailed Launceston 1100 Tuesday 4 July 1989

Arrived Hobart 2200 Friday 14 July 1989

Principal Investigator

Associate Professor Matthius Tomczak
Ocean Sciences Institute, The University of Sydney

Investigation of Mixing in the Bass Strait Water Cascade and the associated undercurrent along the eastern Australian continental slope.

Associate Investigators

Dr Lindsay Pender

CSIRO Division of Oceanography, Hobart

Test of the Bunyip micro-turbulence sensors of the microfish body

Dr David Close

South Australian Ornithological Association, Adelaide

Distribution of pelagic birds in relation to: surface zones, continental shelf, latitude and time of year.

26 July 1989

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R.V. FRANKLIN IS OWNED AND OPERATED BY CSIRO

RV FRANKLIN

RESEARCH SUMMARY

Cruise FR08/89

Itinerary

Sailed Launceston	1100 hrs Tuesday 4 July 1989
Arrived Hobart	2200 hrs Friday 14 July 1989

Scientific Programs

- 1 Investigation of mixing in the Bass Strait Water Cascade and the associated undercurrent along the eastern Australian continental slope.
- 2 Test of the micro-turbulence sensors on the *Bunyip* microfish towed body.
- 3 Distribution of pelagic birds in relation to surface zones, continental shelf, latitude and time of year.

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Hobart

Dr. David Close
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Results

The water mass characteristics of Bass Strait Water for July 1989 were established by performing CTD casts in the eastern part of Bass Strait. The structure of the Bass Strait Water undercurrent was surveyed with CTD and *Bunyip* sections between Bass Strait and Jervis Bay. A total of 45 CTD stations with between six and twelve Niskin bottles for nutrient analysis and CTD sensor calibration were completed. Three XBTs were launched when the weather did not allow CTD operation. Seven *Bunyip* tows of between 25 and 40 nautical miles length were completed. Of these, five tows covered the depth range between the surface and the bottom on the shelf, gradually shifting to the range 200-400m as bottom depth increased. The other two tows covered the range 200-400m and, by returning along the same track, the range 5-200m.

As part of ongoing trials of the *Bunyip* micro-structure towed body, an experiment was carried out for 2 hours on 13 July. The deployment and recovery were successful in the moderate seas. A considerable amount of data was collected to test the modifications made to the tow staff and micro-conductivity circuitry. Extensive analysis of the data in Hobart will be required before the success of the modifications can be judged.

There was continuous observation for on average eight hours on each of the ten days from 5th to 14th July, during which all birds seen were recorded, together with coordinates, ocean depth, and temperature and salinity of surface water. For ten minutes at fairly regular intervals (averaging two per hour) all birds visible in all directions from the ship were counted. Twenty-two oceanic species were recorded, including 16 species of procellariiformes.

Cruise narrative

R.V. *Franklin* left Launceston 11 am on Tuesday 4 July. A cruise track is supplied in Figure 1 of this report. After a few shallow CTD stations in southern Bass Strait and Banks Strait the Bunyip was towed from the shelf across the slope. An attempt to monitor the water mass structure over a 200m depth range just above the bottom by adjusting Bunyip cable length and flight path proved successful. It was decided to alternate between CTD sections from deep into shallow water and Bunyip sections from shallow into deep water. This pattern was followed until Thursday morning, with a last Bunyip tow past Kingfish B platform and the Southern Cross drilling rig. Bad weather from the west forced termination of the station and towing pattern. It was decided to seek the shelter of the mainland and continue work from Gabo Island. The normal pattern of sections across the continental slope was taken up from Gabo Island on Friday and continued until Monday 11 July, with the last section - a Bunyip profile - just north of Jervis Bay.

An unusual very intense low developed east of Gabo Island and intensified over the next two days to a central low pressure of 975 hPa. This forced suspension of all work from Monday 11 July 4pm to Wednesday 13 July 7pm. During these two days R.V. *Franklin* returned slowly south, against strong seas and increasing swell and winds of 40-60 knots. With ship's speeds not reaching 7 knots, it was impossible to perform a planned long Bunyip tow along the axis of the Bass Strait Water undercurrent above the 2000m bottom contour. Work did not resume until late Wednesday when the ship arrived south of Point Hicks (149°12'E). Another strong frontal system was at that time responsible for gale warnings in South Australia and forecasted to produce strong south-easterly winds and seas in the Tasman Sea during Friday 14 July. Under these circumstances the remaining time allocated to the cruise allowed only one more Bunyip profile through the Bass Strait Water Cascade near its origin, along 149°12'E from 38°S to 38°30'S.

R.V. *Franklin* then headed south on a course to Hobart. The Bunyip micro-sensor fish was deployed off Flinders Island during the night from Thursday 13 July to Friday 14 July. Problems with the Bow Thruster were investigated during trials on Friday. Against all expectations, the strong frontal system dissipated before reaching the Tasman Sea during Friday, and R.V. *Franklin* could make much better speed than anticipated, arriving in Hobart on Friday 14 July at 10pm.

Summary

The summer of 1988/1989 and the following autumn were very unusual for eastern Australia. Months of heavy rainfall along the east coast occurred as a result of a strong anti-El Niño circulation in the tropics. An unusually strong East Australian Current advected large amounts of warm Coral Sea water southward. During July, 1989, the situation was returning to more normal conditions, but water temperatures in East Australian Current eddies were still very high for the season. A satellite image of the western Tasman Sea, transmitted to R.V. *Franklin* from the CSIRO Marine Laboratories on Monday 10 July and showing the situation on Friday 7 July, is shown in Figure 2 of this report. It shows an eddy with water warmer than 20°C east of Gabo Island. It is possible that this eddy contributed to the intensification of the unusual low

pressure system that developed in that area and produced the intense south-westerly to south-easterly winds.

The main aim of the cruise, a detailed investigation of the structure of the Bass Strait Water outflow, was achieved despite the adverse weather conditions, although not to the degree of data coverage originally anticipated. Bass Strait Water was present in all sections from 38°30'S to 35°S. As expected, no Bass Strait Water was found beyond the continental shelf south of 38°30'S where Bass Strait Water and Tasman Sea Water were separated by a well defined shallow sea front. In the mixing zone of the front the water was extremely well mixed vertically, to within $\frac{5}{1000}$ of one degree Celsius, and showed a very uniform horizontal gradient of about $\frac{3}{100}$ of one degree Celsius for every 2km.

The Bunyip towed CTD system proved of immense value to the program, particularly after initial restrictions to 250m operating depth because of problems with the fairing were overcome and the strategy of double coverage of sections (0-200m and 200-400m) was adopted. Connector problems in the towed body did not allow that strategy to come into full play until Monday 10 July, so only two Bunyip sections - at 35°S and along 149°12'E - were completed in this way. Overall the cruise produced valuable data with a level of detail not achieved before and has to be considered a success. A long Bunyip tow along the 2000m bottom contour from Jervis Bay to 39°S would have been of great value and should be included in a later winter cruise.

The conductivity sensor on the CTD showed large hysteresis during all stations before station 16 and occasionally during later stations

The trip provided a very informative transect of the birdlife of the western Tasman, in different oceanic zones. This type of ship possesses facilities which are perhaps unique for this type of project: the accessibility on the bridge of all relevant data about oceanic zones and climate, and the availability on the bridge of views in nearly all directions. From Bass Strait northwards it was possible to compare the birdlife within shelf waters (i.e. less than 150 m depth), over the shelfbreak (150 - 1000 m) and outside the shelf. It was also possible to compare the birdlife of the East Australian current with that of colder ocean masses. Many hours of observation were conducted within each of these zones.

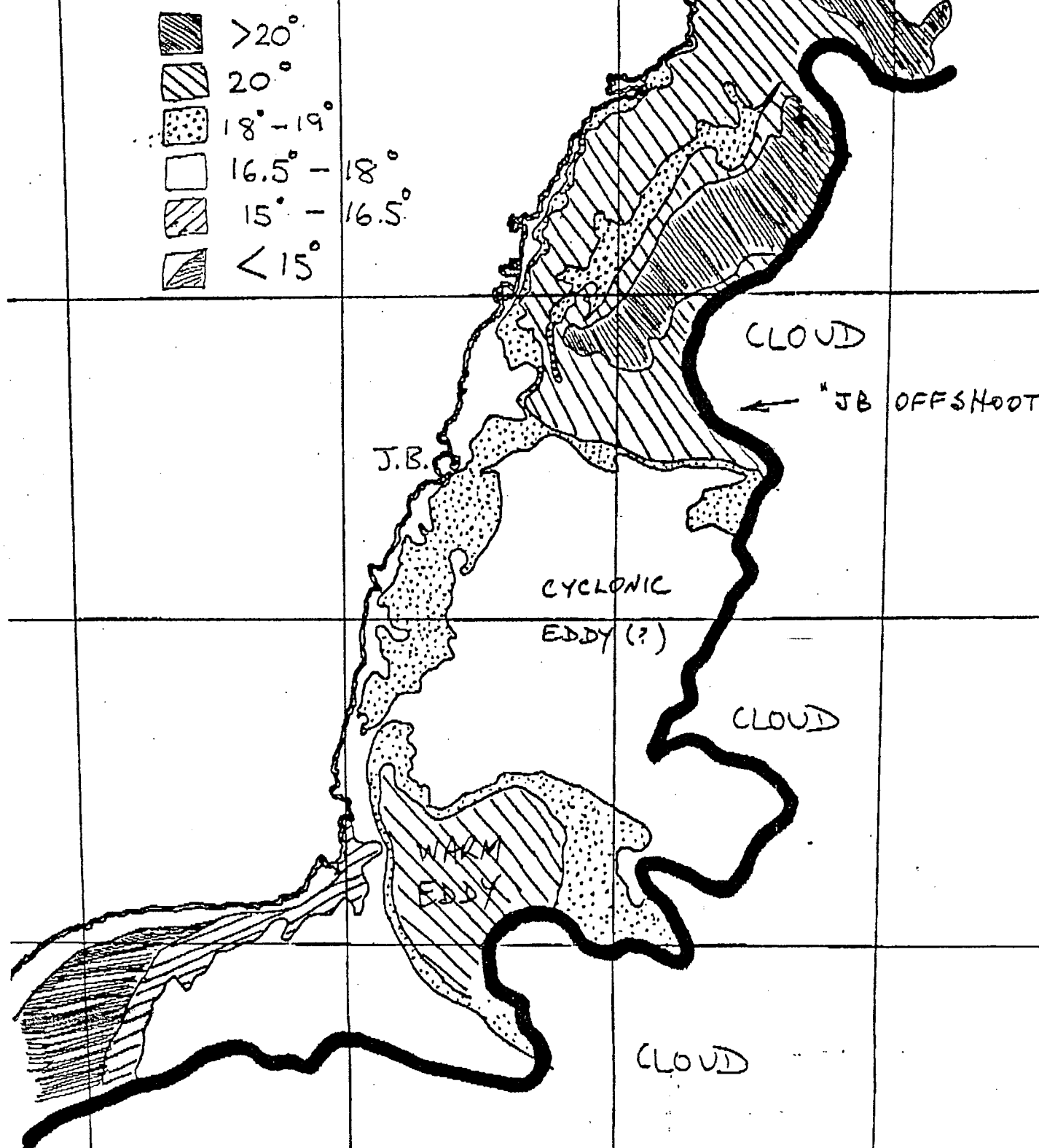
One unexpected discovery was that north of 35 degrees 16 minutes Providence Petrels *Pterodroma solandri* were quite common outside the shelf, more so than Great-winged Petrels *Pterodroma macroptera*. It was also interesting to record Yellow-nosed Albatrosses *Diomedea chlororhynchus* frequently at these latitudes. Certain species of Shearwater genus *Puffinus* were extremely rare throughout the trip, so reinforcing existing evidence about their seasonality. Further findings of significance are expected when the data have been fully analysed.

The requirements of ornithology and those of oceanography were not of course always compatible; thus the ship sometimes spent long periods in areas where birds were scarce, or conversely passed rapidly through areas where birds were plentiful. A noteworthy instance of the latter was a front between ocean masses where several hundred albatrosses and several thousand prions were concentrated. Another familiar obstacle was calm weather on certain days (the 5th and 14th) which caused procellariiformes such as albatrosses to sit on the sea instead of approaching the ship to be counted. East of the Tasmania, most of the cruise was within shelf waters; so that it was not possible to make a full comparison of these with other zones.

Personnel

Matthias Tomczak	The University of Sydney	Chief Scientist
Mathew England	The University of Sydney	
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Randall Lee	The University of Sydney	
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David Terhell	CSIRO - ORV	

Figure 2



7 JULY 89

CRUISE FR08/89

Figure 1

A U S T R A L I A

30°

Cruise track
summary

— Bunyip
— CTD

BRISBANE

SYDNEY

140°

150°

EDEN

MELBOURNE

40°

TASMANIA

HOBART

