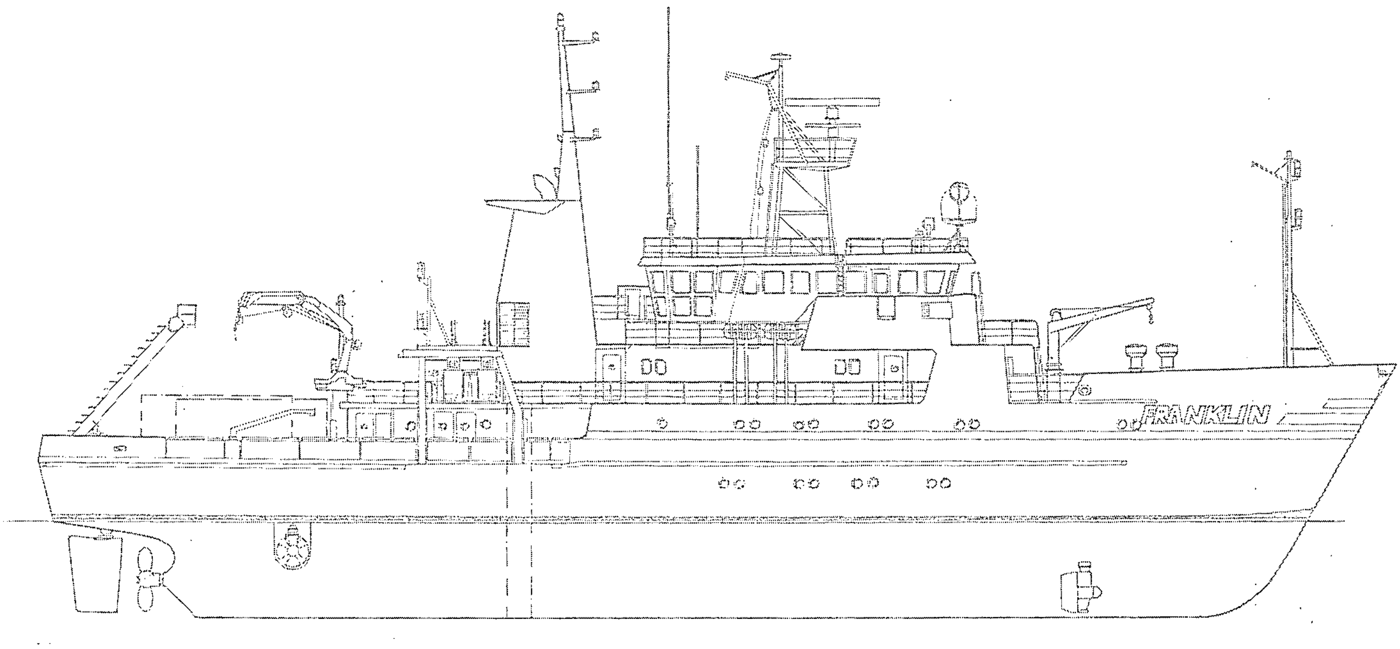
R.V. FRANKLIN

NATIONAL FACILITY
OCEANOGRAPHIC RESEARCH VESSEL

CRUISE SUMMARY

R.V. 'FRANKLIN'

FR 6/87



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R.V. FRANKLIN IS OWNED AND OPERATED BY CSIRO

CRUISE SUMMARY
RV FRANKLIN
FR 6/87

Scientific Program

Leeuwin Current Interdisciplinary Experiment:

(i) Microscale turbulence and the momentum and heat budgets,

(ii) Velocities and water properties in the Leeuwin Current : on the shelf; above the slope; in its offshoots and eddies.

Principal Investigators

(i) Trevor J. McDougall CSIRO, Division of Oceanography

(ii) George R. Cresswell CSIRO, Division of Oceanography

Cruise Objectives

(i) Hydrographic surveys in the region from Dongara to Albany at a time when the Leeuwin Current is strongest.

(ii) Sections of velocity with the Doppler Acoustic Profiler across the Current.

(iii) Detailed mapping of some eddies using BUNYIP and satellite-tracked buoys.

(iv) Estimating turbulent stresses in the Leeuwin Current using the microscale measurement capability of the microfish that is towed by BUNYIP's Sea-Soar vehicle.

(v) Determining the extent to which the Leeuwin Current flows on, and influences the waters of, the continental shelf.

(vi) Examining the interaction between the Leeuwin Current and its eddies and offshoots.

Itinerary

Depart Fremantle	1100	2 June 1987
Arrive Rottnest Island	1100	12 June 1987
Depart Rottnest Island	1230	12 June 1987
Arrive Rottnest Island	0715	13 June 1987
Depart Rottnest Island	0900	13 June 1987
Arrive Fremantle	1500	23 June 1987

Cruise Narrative

The need to retrieve a wandering meteorological buoy determined our strategy for the first three days of the cruise. This buoy was drifting south near Cape Leeuwin and on our way to the buoy we deployed BUNYIP together with the secondary vehicle (the 'microfish') which the Division of Oceanography has developed for the measurement of microscale turbulence. The Sea-Soar vehicle 'flew' very nicely, traversing the depth range from 50m to 190m at a climb rate of 1 m/s, and with only the 400 m of faired cable in the water. Vibration levels (as measured by the accelerometers) were a little less than on our previous cruise, and seemed to be down to acceptable levels. A major problem emerged with our circuitry for the turbulent shear probes, with electronic noise far outweighing the turbulence levels expected in the ocean: a problem that only occurred when immersed in salt water. After recovery of the vehicles, electronic diagnosis work continued while we began a CTD section across the Leeuwin Current along the Cape Mentelle line.

On 4 June we recovered the drifting buoy with its two current meters, after a dozen or more spectacular attempts to get a line to it in stormy seas, and then went back to complete the Cape Mentelle CTD section (see the cruise track of Figure 1, which has the dates marked on it). This section showed a healthy Leeuwin Current with a sea-surface temperature of 20.3°C, a width of about 55 nautical miles beyond the shelf break, and a mixed-layer depth at the shelf break of 220m. Leeuwin Current water spread across the shelf from top to bottom to within a few miles of the coast. GPS and the ADCP showed that the southward surface current was about 1 m/s on this section. Heading out to the 1000m position, we deployed BUNYIP a second time, only to have to bring it back on board in 30 knot winds as a front passed through. The next day and a half was spent steaming north in very trying conditions, dropping XBTs. Meal times were very thinly attended and at times there was a vacant look to the ship, like the Marie Celeste.

The bad weather abated when we reached the offshore station of the Dongara CTD section. We did a deep station to 4000 m and Ian Mann (Chief Engineer) endeavoured to pack the edges of the CTD drum in order to improve the spooling. This proved impossible. The CTD wire is spooling terribly. Each layer at about 5000 m scope is creating an extra 'hole' that is one half of the Lebus shell in circumference, and its effect is cumulative. The Dongara CTD section was completed, and we found that the Leeuwin Current there was only 25 nm wide (measured from the continental shelf break) with typical southward velocity of 0.5 m/s, a mixed layer teperature of 23.3°C and a mixed layer depth at the continental shelf of 200m.

The third Bunyip deployment, beginning early on the morning of 10 June, was timed to coincide with the availability of GPS data and we towed outwards from the 600 m contour off Green Head (30 nm south of the Dongara line). Having both the subsurface density data from Bunyip and the real-time velocity data from the GPS/ADCP combination was a real buzz, especially as this section proved to be quite anomalous. Bunyip's flight path was adjusted to keep its saw-tooth flight pattern just clipping into the mixed layer, and so we could map the density structure below. The sea-surface temperature suggested that we were in Leeuwin Current water but the potential isotherms dipped downwards from the coast, leveling off and eventually shoaling about 100 nm from the coast (see figure 2). The GPS/ADCP data lasted until the centre of the feature was reached and gave surface velocities of over 1 m/s towards the northeast. The temperature and current section suggested that we had traversed just north of the centre of a warm-core eddy. The next morning, we Bunyiped our way southwards from the centre of this warm eddy and encountered surface currents of 1 m/s to the ESE, confirming that this feature was an eddy with a well-formed bowl shaped structure to the potential isotherms. The following morning (12 June) an XBT section was run together with the GPS/ADCP data from the eddy centre towards Rottnest Island, so fleshing out the picture of the eddy.

We called into Rottnest Island on 12 June, putting off Mike Meerding (bound for Hobart), Jan Peterson and Ken Suber, to make room for the CSIRO Film Unit's crew of three. The afternoon of 12 June and the morning of 13 June was spent fulfilling our publicity obligations, while at the same time conducting research. The film crew were making a documentary on the Leeuwin Current that is presold to the ABC's Quantum show and will be screened later this year. We coordinated our observations with an airborne multispectral scanner survey conducted by Dr. Fred Prata of CSIRO at Floreat Park, WA. On our way back to Rottnest Island an XBT section showed that we passed through a cold feature with surface temperatures of only 18.5°C. The GPS/ADCP velocities of up to 1 m/s to the SSW were consistent with this interpretation. The cold front above the 150 m depth contour was rich in marine life that was both visible at the surface (seabirds, porpoises, pilchards) and on the echo sounder. Inshore of the front was a warm filament that extended as far as the 45 m contour. On the morning of 14 June we began what was to be a fourteen-hour Bunyip tow. Starting northwest of the centre of the cold feature, we towed to the edge of this cold water, whereupon we changed course (see the cruise track, Figure 1) towards Cape Naturaliste and mapped out a cross-section of the Leeuwin Current in as far as the 500m contour. This line was then completed with some CTDs.

On the night of 14/15 June we followed a zig-zag path (SE-SW-SE, etc.) along the shelf edge and slope from Cape Naturaliste to Cape Leeuwin to use the ADCP and XBTs to map the Leeuwin Current. It was this corridor of current that satellite drifters in the '70s had shown to accelerate southward. On June 15 the ADCP was used on bottom track to survey the Leeuwin Current on the shelf from Cape Leeuwin to Cliffy Head. A particularly flat section was used for calibration. The Cliffy Head section was started at dusk and the PDR suggested that we passed over what (romantically) appeared to be a shipwreck at 60m depth. The shelf dropped precipitously from 165 m to 260 m and it was along this cliff that we attempted to do a 240 m CTD station while moving over the ground at 3.2 knots (2.2 from current; 1 from windage). We were carried back up onto the shelf while (frantically) reeling in the CTD. The GPS came on at midnight and we steamed from the outer shelf and across the Leeuwin Current to the cold water beyond. The current peaked at 2 1/2 knots between the shelf break and the 1000 m contour (2 1/2 miles), and then fell away to near zero in 9 miles. We repeated the ADCP section back to the outer shelf and then did more calibration runs and finally continued the CTD section. The CTD section was completed on the evening of the 16th of June. We were about one cold core eddy radius offshelf so we steamed eastward and, fortuitously, came across the edge of such an eddy in less than an hour. An XBT section was started and continued when the GPS came on. We went across a strong Leeuwin Current offshoot jet, reached the eastern side and then turned northward to fully utilise the GPS "window". The results can be seen in Figure 3.

We continued eastward on the morning of 17 June, bottom tracking with the Doppler, towards Albany and then headed out to sea where a subsurface "meddy" was located and surveyed with the CTD. While this meddy was close to the continental shelf, it appeared to be isolated from it. This meddy was relatively warm and salty in comparison with its surroundings. When the GPS came on at midnight we started an XBT/ADCP run that took us all the way back into Albany where anchored for a short time.

Late in the afternoon of 18 June we steamed westward on the shelf towards the offshoot jet, intending to ride it out to sea to continue the survey of it. As it turned out the jet had both translated eastward some ten or so km and apparently pinched off. We were able to map its new configuration.

On the morning of the 19th, our intention was to map the pinched-off blob of warm water and we headed southwest. The weather deteriorated. We made 20 miles that night in, what was for most people, a straight survival exercise in either staying put in bed or on a chair. The morning of the 20th we ran with the wind and swell to the NNE for a few hours and then swung to the NNW to go to Cape Leeuwin and points north. An XBT section was done en route.

By the afternoon of the 21st June, we had entered the cool feature and deployed Bunyip at 1800 hrs for exploratory mapping. Early next morning we found a very energetic submesoscale vortex feature both in the depths of the isotherms from the Bunyip cross-section and also in the Doppler velocity vectors at 200 m, 250 m and 300 m (analysed by Jan Peterson after the cruise). By this time in the cruise, the electronics of the turbulence sensors had been improved sufficiently that the vibration of the probes themselves (as opposed to the vibration of the probe sting and microfish body) was indicated as our next limiting process towards further reducing the system's noise level. Some improvement in this direction was gained using a plastic restraint that Ian Mann machined for us.

On the 22nd of June we went into shallow water (30 m) off Guilderton just north of Perth. The swell was quite large. A line of CTD stations was done out across the shelf and slope. By not taking bottle samples, these stations were able to be done every 30 minutes and the Doppler was run on bottom track all the while. This enabled the filament of Leeuwin Current on the shelf to be accurately mapped. This pathway for the current was the same one that we had earlier observed off Rottnest. Further Bunyip tows were made on 22nd June and we returned to terra-firma at Fremantle on 23rd June.

By and large the scientific equipment of the ship worked very well. Many of the software programs are already quite user-friendly, and those that aren't are presumably being improved. Reports from electronics (Erik Madsen) and computing (Ken Suber) are attached.

Scientific Personell

Trevor McDougall	CSIRO Marine Laboratories
George Cresswell	" " "
Lindsay Pender	" " "
Ian Helmond	" " "
Paul Boult	" " "
Stuart Swan	" " "
Mike Meerding (2 June to 12 June)	" " "
Jan Peterson (excluding 12/13 June	" " "
Leigh Carter	" " "
Gary Critchley	" " "
Erik Madsen	" " "
Ken Suber (excluding 12/13 June)	" " "
3 CSIRO film crew (12/13 June only)	

Trevor J. McDougall George R. Cresswell

ELECTRONICS REPORT FRANKLIN 06/87

CTD SYSTEM

CTD #2 WAS MOUNTED IN ITS FRAME IN FREMANTLE PRIOR TO LEAVING PORT. APART FROM ONE MAJOR BREAK DOWN THE SYSTEM ONLY SUFFERED FROM THE USUAL FINGER PROBLEMS.
THE MAJOR BREAK DOWN WAS LATE IN THE CRUISE WHEN THE DECK UNIT DIED. THE CABLE VOLTAGE WENT DOWN TO 21 VOLT AND ALL BOSCHERT POWER LINES WENT DEAD. THE SEA CABLE FAULT WAS DUE TO AN O/C PRIMARY IN THE MAIN TRANSFORMER, THE BOSCHERT FAULT IS NOT CLEAR AS IT RESTARTED AS SOON AS I PUT A METER PROBE ON IT, I THEREFORE REPLACED IT WITH THE SPARE AND REPAIRED THE TRANSFORMER.

THE CTD WINCH SPOOLING HOWEVER IS IN A TERRIBLE STATE AND SHOULD BE FIXED ASAP. IAN MANN CONSIDERS IT NECESSARY TO DISMANTLE THE WINCH AND SEND THE DRUM TO HOBART WHERE THE HEC AND OUR OWN WORKSHOP HAS EXPERIENCE AND FACILITIES TO DO THE JOB.

XBT

I REPLACED THE HANDLAUNCHER CONNECTORS WITH THE R/S TYPES DURING THE CRUISE, WE DROPPED OVER 80 XBT'S AND DIDN'T ENCOUNTER ANY PROBLEMS.

IT WOULD HOWEVER BE ADVANTAGEOUS TO HAVE SOME SORT OF BRACKET WHICH CAN BE CLAMPED TO THE RAIL TO MOUNT THE HAND LAUNCHER IN DURING DROPS.

ADCP

THIS WORKED VERY WELL APART FROM A COUPLE OF LITTLE HIC UPS WHERE ERROR CODES 18,19,34,35,50 & 51 (ALL RELATING TO SPECTRUM WIDTH) KEPT FLASHING AT ABOUT TWICE THE NORMAL TRANSMISSION RATE, THE FIRST TWO TIMES IT RECTIFIED ITSELF WITHIN A MINUTE OR SO, BUT THE THIRD TIME A HARDWARE RESET WAS REQUIRED TO RESTORE TRANSMISSION.

MET.STATION

WIND SPEED, DIRECTION AND TEMPERATURE WORKED WELL, BAROMETRIC PRESSURE DOES VARY, BUT NOT SUFFICIENTLY AND THERE IS NO DISPLAY OF HUMIDITY OR IRRADIENCE.

GPS

DURING THE NIGHT OF 14 JUNE THE ACCURACY OF THE GPS GRADUALLY DETERIORATED TO SOME TEN MILES, ON TESTING IT THE FOLLOWING DAY I FOUND THE GPS TIME BEING CORRECT, THE DAY BEING 23 JUNE RATHER THAN 14 AND THE RECEIVER BEING BUSY GETTING INFO FROM SATELITES, ALMOST AS IF SOMEONE HAD RESET THE RECEIVER. APART FROM THAT NO PROBLEMS AT ALL.

SATNAV'S

RAY PETTY DELIVERED THE SHIPMATE ON THE MORNING OF DEPARTURE,UNFORTUNATELY HE WAS TO QUICK FOR ME TO CATCH HIM. AS SOON AS WE CAST OFF IT WAS OBVIOUS THAT THE AUTO HEADING DID NOT WORK AND WE COULD NOT GET ANY INFORMATION FROM THE RS232 PORT. I WAS RELUCTANT TO DISMANTLE IT IN VEIW OF THE STATE OF THE INTECH.

THE INTECH WAS IN ITS RANDOM VIDEO MODE WHEN SWITCHED ON, AND NOTHING THAT I COULD DO COULD PERSUADE IT OTHERWISE, I HENCE LEFT IT OFF FOR TWO DAYS, AFTER WHICH IT WORKED LIKE A CHARM, EXCEPT FOR A SLOW CLOCK ERROR ONCE WHICH CAUSED THE LOGGING NETWORK TO REJECT THE DATA AS OUT OF DATE.

FREEZER ALARM

A SMALL MALFUNCTIONING IN THE METERING PART AND THE FACT THAT THE CHEMLAB FRIDGE GETS ABOVE ZERO BETWEEN FREEZING CYCLES WAS THE ONLY COMPLAINT OVER THIS INSTRUMENT.

D.E.L.P COMPAQ

THE COMPAQ WAS INSTALLED IN THE SHIPS OFFICE WITH WIRING RUN TO THE REMOTE DISPLAY ON THE BRIDGE AND TO THE DELP DISPLAY IN RACK 7 IN THE OPS. ROOM, THIS WORKS QUITE WELL AND WILL BE EVEN BETTER AS SOON AS THE GPS IS CONNECTED TO DELP.

COMPUTING REPORT, FR6/87 K. Suber

Hardware:

The computers operated throughout the cruise with no significant H/W problems. A DZV11 interface was successfully installed in Micro2, which now has support for TT0: thru TT11:. All attempts to install a second RD51 disk drive in Micro2 failed (the MOUNT command returned a DEVICE OFFLINE error).

The ADCP deck unit indicated BIT errors several times during the cruise. These corresponded to Spectral Width and Doppler Frequency errors for various beams (BIT error codes 17, 18, 19, 34, 35, 50, & 66 - see Table 5-2 of the ADCP H/W manual). Sometimes it disappeared by itself after a minute or sc Terminating the S/W and powering down the deck unit stopped the problem, but it needs looking into in detail. The problem occurred at least three times on this cruise, and has occurred on previous cruises.

The Intech broke down near the start of the cruise; NAV logging was switched to the Shipmate. The Shipmate version of the NAV program did not log any data. After investigation, it was determined that the output circuit of the Shipmate was at fault. The Intech problem soon disappeared, and NAV logging was switched back to the Intech for the remainder of the cruise. At about 14:30 GMT on 17 June, the NAV display on the DELP screen indicated NAV down. The Intech display showed a time that was 4 minutes behind the correct time, and since NAV uses the time from the Intech in NAV.DIS, the data was considered old. Resetting the time on the Intech worked temporarily, but within a couple of minutes, its time was 3 minutes fast. During all of this, the Shipmate was keeping correct time, so the error must be in the Intech H/W, rather than in any of the transit satellites. (There is a note on setting up the Intech's RS232 output format, for use by the Franklin officers; a similar note should be prepared on the Shipmate.)

The GPS firmware appears to be different from our latest documentation "Activity messages" are not displayed as in the past; in the activity message mode, the display only shows SV numbers, sometimes with full stops after each digit (e.g., 0.6. for SV #6). This seems to be when the receiver is locked on to the SV. (This is not a problem with GPS; just a comment for the informatio of users.)

The power on indicator lamp in the Micro1 tape drive power switch doesn't work.

Software:

The GEN (general data - T/S, pH) logging system was modified to make the time tags more accurately reflect the time at which the data was actually collected. An additional task, MSYNC, gives a synchronizing signal at the beginning of each minute, by setting a group-global event flag. The scheme for keeping all the micros synchronized with Micro6 can cause small "hiccoughs" (should be only a second or two at the most) when the system time of a micro is reset, which is done every two hours.

The VAX DUA0 disk fills up rather too quickly, partly due to old data. MTSPOL could (optionally?) copy files to DUA1, which has lots of space.

There is a problem with the ADCP/GPS interface; the GPS data used by the ADCP appears to lag behind by about 1 hour after 6 hours. The problem with the ADCP/GPS interface task "hanging" has been fixed with the revision by B. Beattie, which was installed at the start of the cruise.

DELP (the display and event log program) had some trouble. It reports NAV as down when a fix is being processed; NAV should update its .DIS file during processing of fixes. At about 20:15 GMT on 20 June, DU0 on Micro2 filled up, causing Turner logging to exit, and causing DELP to give a long series of error messages. Making more space on the disk did not fix the problem; renaming the DELP log file and the current Turner data files started things going again. The accumulation of data files indicates that there was probably a problem with MTSPOL; however, MTSPOL was reported as UP by DELP.

MTSPOL was in fact "hung" at PC = 053610; selecting option 3 with MTR (stop MTSPOL) had no effect. MTSPOL was manually aborted, then restarted. After replying YES to the query "Tape mounted by another user; dismount it?", MTSPOL began taping, and cleaned up the data files that had accumulated.

Several instruments were turned off at the end of the cruise, but before the logging programs were stopped. To prevent possible loss of data, and to make cruise ending go smoothly, instruments should be turned off after the cruise ending procedure has completed.

Cruise track (June 1987 local time)

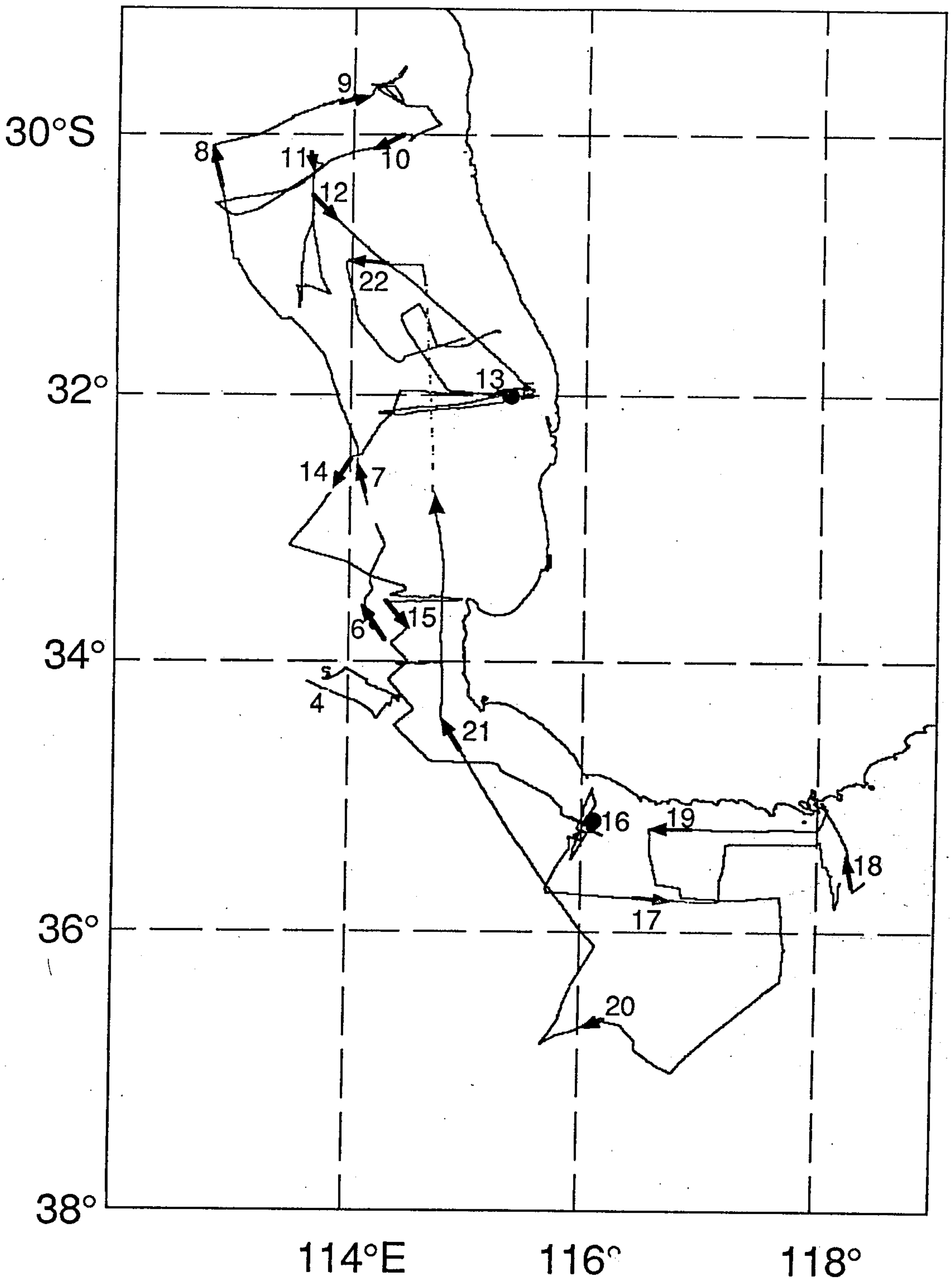

Figure 1

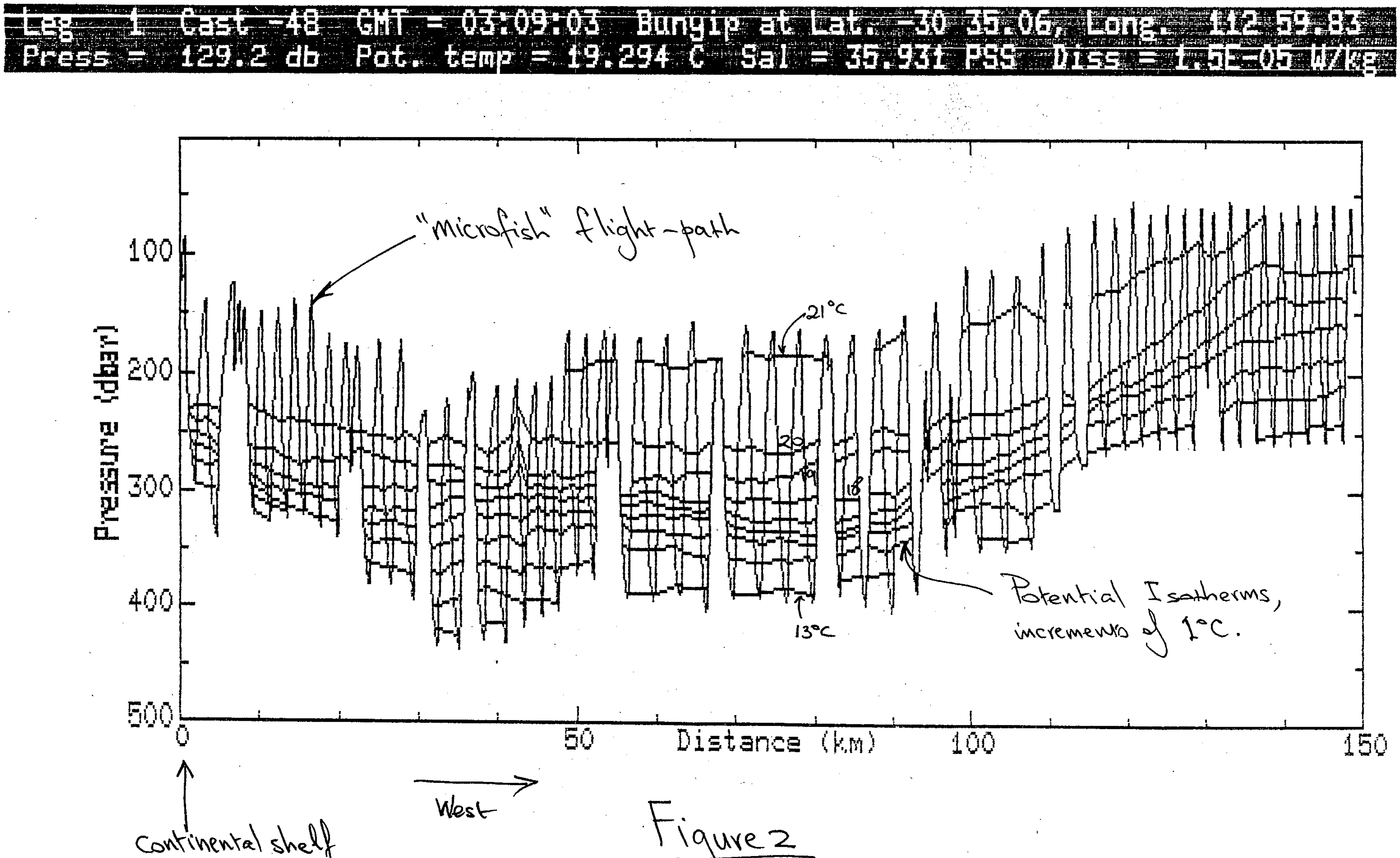
Leg 1 Cast -48 GMT = 03:09:03 Bungip at Lat. -30 35.06, Long. 112 59.83
Press = 129.2 db Pot. temp = 19.294 C Sal = 35.931 PSS Diss = 1.5E-05 W/kg
"Microfish" flight-path
21°C
20
19
18
13°C
Potential Isotherms, increments of 1°C.
Pressure (dbar)
100
200
300
400
500
0
50
100
150
Distance (km)
West
Continental shelf

Figure 2

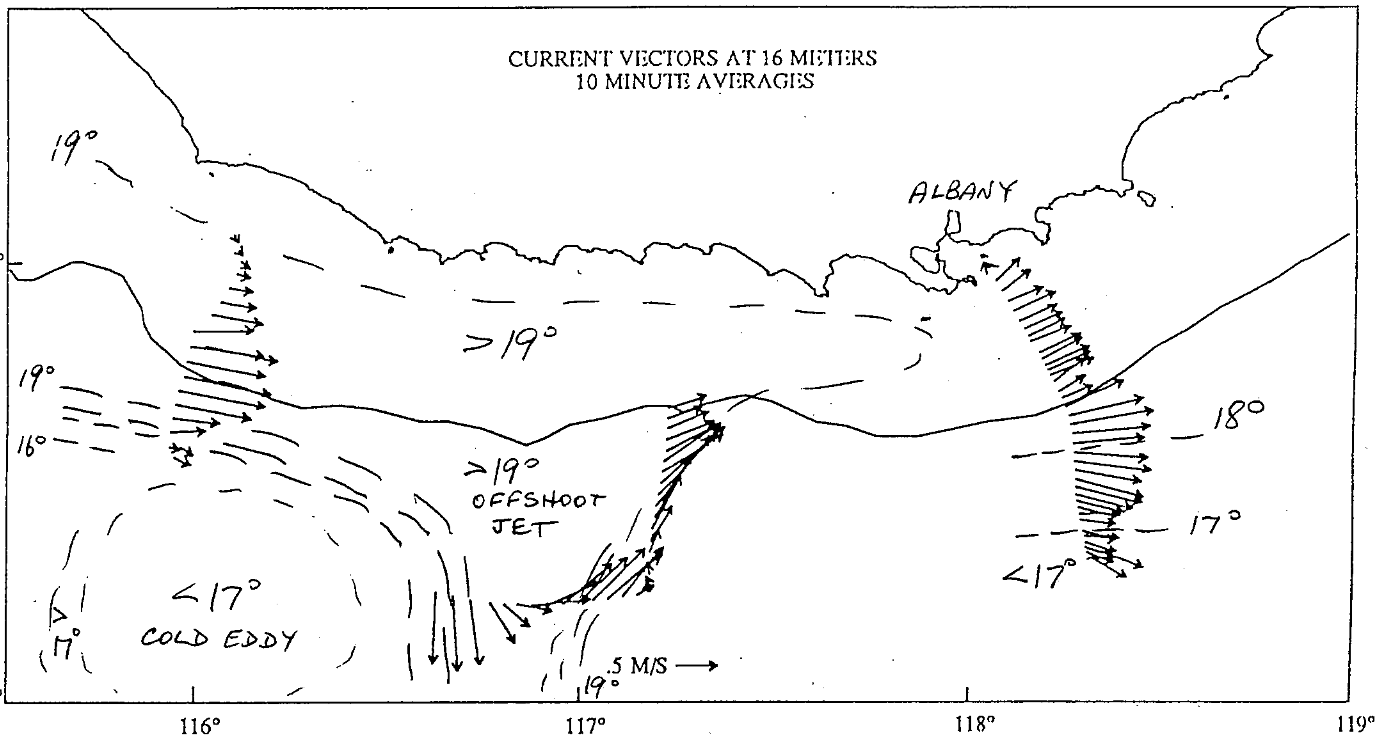
CURRENT VECTORS AT 16 METERS
10 MINUTE AVERAGES
ALBANY
19°
>19°
19°
16°
18°
>19°
OFFSHOOT
JET
17°
<17°
<17°
COLD EDDY
.5 M/S
19°
35°
36°
116°
117°
118°
119°

Figure 3.