FRANK IN

National Facility
Oceanographic Research Vessel

RESEARCH SUMMARY
FR 05/96

Sail Fremantle 1100 Tuesday 7 May 1996
Arrive Dampier 0900 Friday 31 May 1996

Mixing and Circulation in the Perth Basin

Principal investigators

Dr Peter C. McIntosh CSIRO Division of Oceanography (Chief Scientist)
Dr Trevor J. McDougall CSIRO Division of Oceanography
and

Horizontal and Spatial Dynamics of Surface
Phytoplankton

Principal Investigator

Ms Esmee Van Wijk Flinders:Uhiversity (piggyback project).;

June.1996,

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Itinerary

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Arrived	Dampier	0900	Friday 31 May 1996

Principal Investigators

Dr Peter C. McIntosh, CSIRO Division of Oceanography (Chief Scientist)
Dr Trevor J. McDougall, CSIRO Division of Oceanography
Ms Esmee Van Wijk, Flinders University

Cruise Objectives

• To conduct a closely-spaced CTD survey around the perimeter of the Perth Basin so that the flows into and out of the basin at all depths can be estimated by inverse methods.

• To deduce the importance of mixing processes in the Perth Basin by examining the changes in water-mass properties as fluid flows through the basin and by using inverse methods on the hydrographic data from the perimeter of the Perth Basin.

•To investigate horizontal changes in chlorophyll a and phytoplankton species composition across hydrographic fronts.

• To correlate continuous chlorophyll a measurements with discrete samples of phytoplankton species composition.

Cruise Track

The actual voyage track is shown in Figure 1. It retraces the path of the 1987 Daxwin section along the southern leg of the box, passing over the deep current meter moorings of McDougall and Toole. It also duplicates the CTD's in this region conducted on Franklin Voyage FR6/95. The track then turns north, passing over Gulden Draak Knoll and Batavia Knoll, then turning northeastwards into the Cuvier Basin and closing the box over the ICM6 Tornczak and Church current meter moorings of Northwest Cape.

Cruise Narrative

Franklin departed Fremantle at 1100 on 7 May 1996, delayed one hour due to port traffic. We steamed down towards the first station of Cape Leeuwin with a moderate wind (15-20 knots) behind us. About midnight, 1 hour from the first station, the wind had swung to the NW and freshened to over 30 knots. We hove to, doing 2 knots to the NW. Some gusts reached 60 knots overnight. We were hove to all next day (8/5), and many people were feeling less than 100%, although a new influx of bean bags helped. The weather was caused by an unseasonably-late tropical cyclone ("Jenna") which travelled south. The morning of 9/5 we were about 50nm from first station, and steamed down there in a moderating wind (25-30 knots). Arrived about 10am and did the first station in 120m of water. The wind freshened again, and so we hove to rather than travel to the next station. Once the wind eased again, we travelled to the next station and did CTD #2 at about 1pm.

On Friday 10/5 the weather moderated and we got 3 stations done (#'s 3,4,5) in one watch. Then the fuel pump on the main engine broke about 9pm, and we drifted for about 4 hours while it was fixed. Luckily the seas were almost dead calm. The next morning we continued CTD's as planned. The voyage track was altered slightly to account for the lost time, reducing the number of CTD's to about 90, but still enclosing most of the original area. The major change was along the northern leg, where it was decided not to pass over the Wallaby Plateau, but stay in deep water to the south to avoid having to resolve deep and narrow boundary currents. We lost no further time due to bad weather.

On Sunday 12/5 we had a fire alarm, which turned out to be false. This is apparently quite rare, and no cause was found. Some of the scientific crew had trouble recognising the alarm as they had not heard it before.

Wednesday 15/5 we had a fire drill. Deepest cast of the voyage was here at station 27, with pressure of 5989db and 6150m of wire out. Started to notice a problem with the deep thermometers triggering at the next depth up (see equipment section below).

Saturday 18/5 the bridge noticed a loose strand of wire on the CTD cable about 800m from the CTD itself; the splice was beginning to unravel (see equipment section). We were now out of email range, somewhat later than anticipated.

Sunday 19/5 we celebrated Andreas's birthday with a formal (black tie) lunch, complete with birthday cake and a present from his wife (two Mr Bean videos).

The bathymetry in this region (around station 50, western-most section of loop) is different from the charts by up to 1000m. This prompted the question: What happens to bathymetry data from Franklin voyages?

Thursday 23/5 celebrated Dave's birthday with an informal (blue overalls) dinner, another birthday cake (thanks again cooks!) a lei made of sampling bottles and a highly edible present from friends.

Friday 24/4 we started to have trouble reaching the bottom because of the reducedwire length. Failed to reach the bottom on 3 stations altogether, one by about 400m. We were very lucky not to lose the wire earlier in the voyage. Not reaching the bottom in the region of the McDougall current meters would have reduced the value of the entire experiment considerably.

Once the casts became shallower than 3000m we mounted the fluorometer on the CTD so that Esmee could get vertical profiles. We also devoted spare Niskin bottles to collecting a large volume of water from the chlorophyll maximum to provide phytoplankton samples.

Wednesday 29/5 finished the last CTD, giving us plenty of time to steam to Dampier. On the way we spent a number of hours practising picking up current meters for the benefit of Ian Moss, who will be master on the voyage to retrieve the McDougall current meters.

Equipment

The 1.7l Niskin bottles worked well, and there were no major problems. We lost one bottle on Monday 20/5 - it was simply missing when the CTD came out of the water. No idea what happened.

We had a continual problem for the first half of the voyage with two deep bottles apparently triggering at the same depth. This was eventually tracked down to a slight alignment problem in the rosette, which Erik fixed, and we had no further problems. The backup rosette had problems operating at depths around 5000m or deeper, and we only used this for a few casts.

On Saturday 18/5 the splice in the CTD wire started to unravel, and we had to cut off 835m of cable and re-terminate it. This took about 3 hours. The cable length was now estimated to be 5675m. This meant our maximum wire out for subsequent casts was about 5555m. There were three casts where we couldn't reach the bottom after this time. If this had happened earlier in the voyage, so that we couldn't reach the bottom in the region of the McDougall current meters, it would have reduced the value of the entire experiment considerably. I suggest that if another splice is used, that the number of times it goes over the sheaves is logged, and consideration be given to a backup strategy for intensive deep CTD voyages when the splice nears the end of its expected working life.

About halfway through the voyage we received the news that CSIRO was considering buying new Guildline salinometers. This caused some consternation among the OMS people because they had not been consulted. Aren't they the local experts?

For this voyage we had been given specific guidelines concerning CTD wire tension. We monitored this carefully, and logged all casts fully. Wire tension was always below the absolute limit of 1.3 tonnes, but did occasionally exceed 1.2 tonnes. The major factor was ship roll when the CTD was below 5000m. The next important factor was the winch acceleration, and the winch drivers were careful to start the winch slowly. We found it made no appreciable difference to ascend at half the usual speed while at depth, suggesting the drag of the CTD package is not important.

It quickly became clear that deep CTD's were taking about 30 minutes longer than estimated. We eventually established that the wire-speed readout was reading high by about 10%, although the wire-out readout was accurate. From 17/5 we ran the winch at an indicated 65m/min.

The colour printer was installed via Appletalk - it could not be made to work directly on the ethernet.

Two new cuvette caps for the fluorometer were purchased for this voyage, but they had the wrong thread size. The old one was adequate until the engineers managed to machine one of the new caps to fit. The other new cap has not been touched.

We were only without email for about 4 days. This was an important facility, allowing faster communication, and reducing the isolation. I suggest that consideration be given to improving this facility, so that it is always available. It might also be a good idea to arrange for some form of regular news service to be sent by email.

I found out that most of the crew phone home about once a week. It is important that this is as easy and cheap as possible - it might save some relationships! At the moment it is both expensive and bad quality. I recommend this be fixed as soon as possible.

Conclusion

This was a very successful voyage in terms of the data collected. A large section of ocean was fully enclosed with deep CTD's, which will allow the construction of an inverse model to study mixing processes and property fluxes in this region. In addition, a large amount of surface data on chlorophyll and phytoplankton was collected in the region of a number of surface fronts. There were very few problems on this voyage, and everybody seemed to get along very well. With the exception of the first three days, the weather was also kind.

Acknowledgements

Thank you to the two CTD watches, and to the chemists, for working hard and caring about the quality of the data. Thank you to Esmee for helping with the CTD's when needed. A special thank you to the ship's crew for their hard work, dedication and generosity. And thanks to everyone for also making the voyage enjoyable.

Ships Crew

Neil Cheshire Master
lan Moss Mate
Ian Menzies 2nd Mate
Mike Culpepper Chief Engineer

Lindsay Cale 1st Engineer
Don Roberts Electrical Engineer
Yannick Hansen Bosun
Norm Marsh AB
Peter Genge AB
Wayne Golding AB
Phil French Greaser
John Tilley Chief Steward
Lindsay Ballinger Chief Cook
Peter Dux 2nd Cook

Science Crew

Peter McIntosh	CSIRO Oceanography	Chief Scientist
Andreas Schiller	CSIRO Oceanography	
Yukio Masumoto	University of Tokyo	
Esmee Van Wijk	Flinders University	(piggyback project)

Neil White	CSIRO-ORV	Cruise Manager
Erik Madsen	CSIRO-ORV	
Helen Beggs	CSIRO-ORV	
Dave Terhell.	CSIRO-ORV	
Val Latham	CSIRO-ORV	
Kate Berry	CSIRO-DF (on loan)	