RESEARCH SUMMARY

Cruise FR 7/93

Sailed	Hobart	0900	Saturday 11th September, 1993
Arrive	Nelson, New Zealand	1600	Sunday 19th September, 1993
Saile	Nelson	2030	Tuesday 21st September, 1993
Arrived	Townsville	0700	Tuesday 5th October, 1993

OCEAN TRANSPORT IN THE TASMAN SEA SEASONABLE VARIABILITY

Principal Investigators

Dr John Church
Dr Gary Meyers
CSIRO Division of Oceanography

Professor Matt Tomczak
FIAMS
Flinders University

November 1993

FRANKLIN

RESEARCH SUMMARY
CRUISE FR 7/93

1. Itinerary

Sailed Hobart	0900 Saturday 11th September, 1993
Arrived Nelson,New Zealand	1600 Sunday 19th September, 1993
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2. Scientific Program

OCEAN TRANSPORT IN THE TASMAN SEA
SEASONABLE VARIABILITY

To estimate the volume transport (and its time variability) of the EAC along the east Australian coast and in the Tasman Front using CTD, ADCP and current meter moorings.

To determine the large-scale general circulation of the Tasman Sea using patterns of tracers (temperature, salinity, oxygen and nutrients) and of the density to estimate geostrophic circulation

3. Principal Investigators

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4. Results

The 43°S section has now been repeated four times by *Franklin* and the western part once by the *Aurora Australis*. On all the sections, a thin layer of cold, high oxygen water is found at the base of the continental rise on the western side of the section, consistent with a weak deep western boundary current carrying deep water from the Southern Ocean northward into the Tasman Basin. At intermediate depths, a thermostad with a temperature

of about 8.5°C at depths of about 500 m marks the Subantarctic Mode Water. The Subantarctic Mode Water (SAMW) on this section is only found east of 153°E. Similarly, the salinity minimum of the Antarctic Intermediate Water (AAIW) is more intense east of 153°E. This suggests that the water at intermediate depths near the western end of the section is subtropical in origin, while the Southern Ocean influence is stronger to the east. In contrast, the first two sections in the series of repeats showed the SAMW and AAIW right up against the continental slope of Tasmania. The geostrophic shear on this section is generally weaker than found on previous occupations of this line. Near the coast of Tasmania the flow is weakly to the north, relative to a deeper level. The flow off the coast of Tasmania appears to be variable: on previous sections, flows both to the north and south have been found. In the summer sections the upper ocean is both warmer and much more saline. The large increase in salinity suggests that the seasonal changes are due in part to greater southward penetration of subtropical water in summer, as well as local warming by the atmosphere.

The 30°S section also nearly repeats a section previously occupied by *Franklin*, and more recently by the *Knorr*. As in the previous sections, the East Australia Current at this latitude is found over the continental shelf and slope. However, in contrast to the FR 10/89 section, the isotherms slope down away from the coast across the entire Tasman Basin, consistent with southward flow relative to a deeper level. Part of the water carried south by the EAC and the weaker southward flow in the interior of the Tasman Sea is returned to the north in a strong flow over the crest of the Lord Howe Rise. The remainder leaves the Tasman Sea to the east across the 172°E section north of New Zealand, mostly between 30°S and 32°S.

Very few oceanographic sections have been repeated in different seasons and different years. The repeat sections in the Tasman Sea will allow us for the first time to assess the seasonal and inter-annual variability in the western South Pacific. In addition to providing insight into the dynamics and circulation of the Tasman Sea, these sections will provide a valuable baseline against which future changes can be assessed.

5. Cruise narrative

All dates and times are local time - Australian Eastern Standard Time or New Zealand.

The ship sailed on time at 0900 on Saturday the 11th of September. This cruise was the first with the new computer system. While there had been some frantic preparation in the weeks leading up to the cruise some of the systems had not been fully tested. This was partly because of the near-impossibility of testing some of the systems in port. However, basic navigation and the CTD system were working at this stage. The first CTD station was reached at 2pm on the Saturday.

CTD work continued smoothly for the first part of the 43°S section (see map - figure 1). Some problems were experienced with the ADCP software but this was going in an effective manner after about a day and a half. By this stage the ADCP, CTD, Trimble GPS, Navtrak GPS, thermosalinograph and sounder acquisition systems were all operational. The main problem with the computer system for the next week or so was an annoying problem with the winch monitor software (which provided the CTD pressure readout for the winch driver) hanging. This was exacerbated by the fact that the stand-alone PC version (which only provided wire out) could not be used safely because some of the magnets on the pulley had become ineffective leading to incorrect readings.

At about 1900 on Friday the 17th September a problem with the pitch control gear for the main propeller was discovered. One of the castings in the hydraulic control system had developed a crack and squirted hydraulic oil up to 5 feet when the propeller pitch was changed. It would also squirt oil a lesser distance at other times. As it was not possible to repair at sea and there was no guarantee that it would not become worse (possibly rendering the main drive inoperative) the only option was to head for port. Bluff was considered but was decided against because going into the head sea to Bluff would have put extra strain on the CPP gear. Unfortunately this also had the effect of making it virtually impossible to complete the 43°S section.

We arrived in Nelson, New Zealand at 1600 (NZ time) on Sunday the 19th. Howard Smiths had already started chasing a replacement part and the only spare to be found was at the LIPS factory in Holland. Arrangements were made for the part to be flown out. A repair was also attempted on the existing part. Eventually the repair was passed by the Lloyds surveyor, Max Cameron (Chief Engineer) and Bruce Maroc (HSI). The spare part was still shipped out from Holland and was installed during the following port period.

We left the ship repair dock at 1530 on Tuesday the 21st as we would have been blocked in if we hadn't. We moved to a vacant wharf while installation of the repair was completed and finally left Nelson at about 2030 on the 21st.

We did a test cast with the new small diameter bottles on the way north to Cape Reinga. One bottle was lost completely and the analyses showed that most of the bottles had performed much better than on the previous cruise. There were still a couple of obvious leakers, though.

We began the 173°E section in marginal conditions and behind time. We thinned out the CTD sections as much as we reasonably could and would still have been able to reach Townsville on the 4th if we had had a few days reasonable weather after leaving Nelson. This was not to be - head seas and high winds led to very slow progress even

though some stations were missed. XBTs were dropped at these locations.

The stop in Nelson had, in effect, used up all our bad weather allowance so there was no option at this stage but to ask for an extra day to get enough of the scientific program completed for the cruise to be worthwhile. This day was granted and the arrival date in Townsville changed to the 5th of October. Eventually the weather improved and the slightly cut down CTD program was completed without further incident. The last CTD station was completed at about 0400 on the 2nd of October. This was followed by a gyro test to compare the ship's heading received through the Navtrak GPS navigator and through the new synchro-digital converter in the ADCP deck unit. This showed a heading-dependant difference with an amplitude of about 2 degrees. This will be pursued later.

The Trimble 4000A GPS is on its last legs. Despite recent servicing it insists on hanging on to satellites which are well below its elevation mask leading to poor quality and very patchy data. I recommend that this unit (which is 7 years old) be replaced as soon as possible as this has a very detrimental effect on the ADCP data quality.

The new computer system worked well and the new ops room layout is a big improvement.

7(a) Scientific personnel

Neil White	CSIRO DO	Chief Scientist
Steve Rintoul	CSIRO DO	
Tony Woods	CSIRO DO	
Andrew Fiedler	FIAMS	
Rob Radcliffe	FIAMS	
Bernadette Heaney	CSIRO ORV	
Val Latham	CSIRO ORV	
Ruth Eriksen	Antarctic CRC	
Bob Beattie	CSIRO ORV	
Erik Madsen	CSIRO ORV	

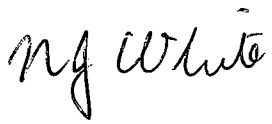
7(b) Crew

Neil Cheshire	Master	Dick Dougal	Mate
Ian Menzies	Second Mate	Max Cameron	Chief Engineer
Ian Hayward-Bryant	Second Engineer	Don Roberts	Electrical Engineer
Tony Bernardin	Greaser	Jannik Hansen	Bosun
Wayne Browning	AB	Bluey Hughes	AB
Kris Hallen	AB	Gary Hall	Chief Cook
Bob Clayton	Second Cook	Reg Purcell	Chief Steward
Wendy Doran	Deck Cadet		

Acknowledgements

As always, acknowledgements and thanks to all of the ship's officers and crew for their very professional and helpful approach.

In particular, many thanks to the engineering crew for their efforts and *very* long hours working on the repair to the CPP casting.



Neil White
Chief Scientist

November 1993

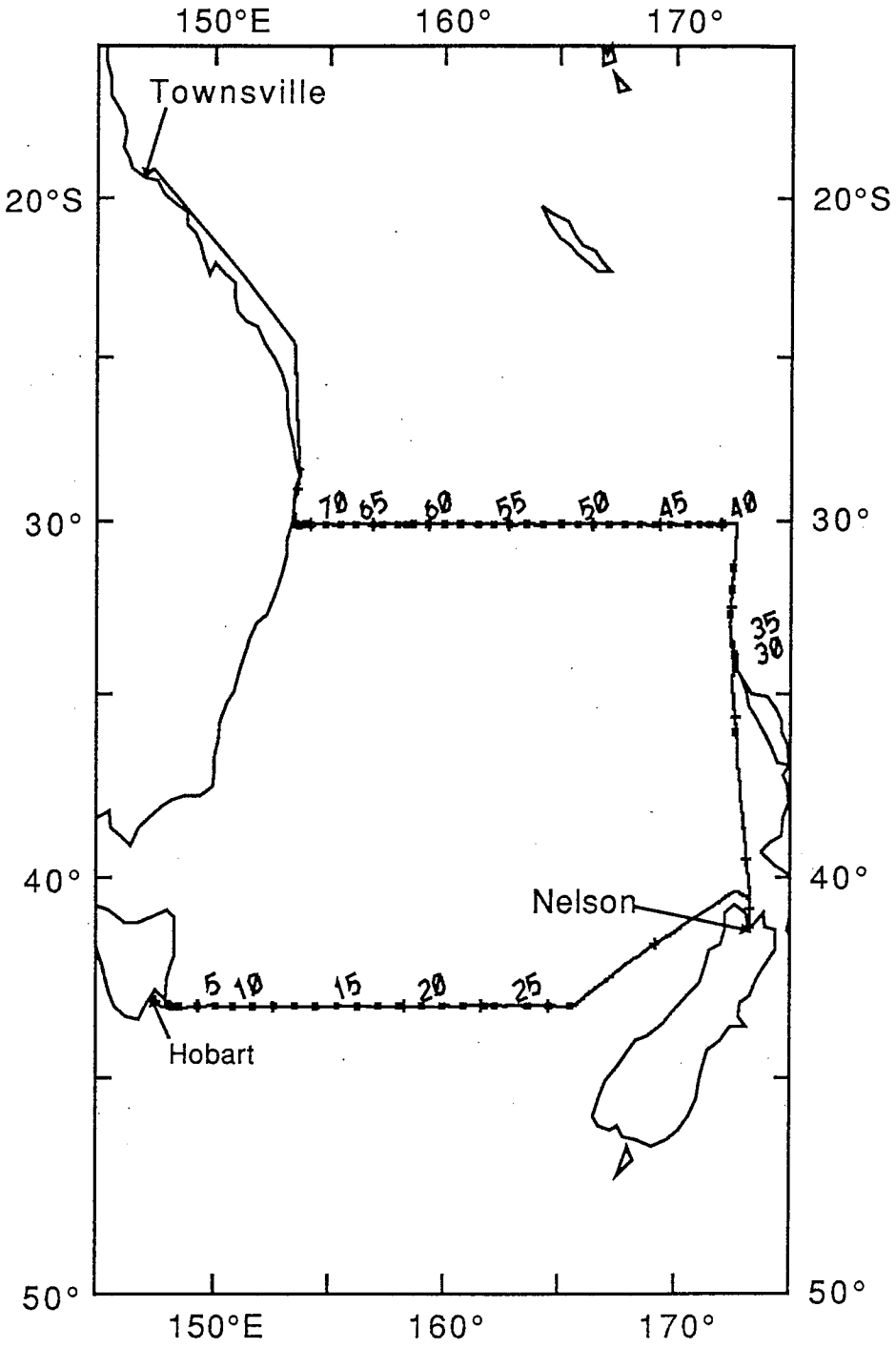


Fig 1. Cruise track for Fr 7/93 with CTD stations