

FRANKLIN

National Facility
Oceanographic Research Vessel

RESEARCH SUMMARY

Cruise FR 07/94

Sailed Port Adelaide	1215	Wednesday 6 July 1994
Arrived Albany	1030	Sunday 24 July 1994
Sailed Albany	1130	Sunday 24 July 1994
Arrived Fremantle	0900	Wednesday 27 July 1994

SOUTHERN SHELF EXCHANGE AND CIRCULATION

Dr John Bye and Dr Peter Petrusevics

School of Earth Sciences

Flinders University of South Australia

PILCHARD ECOLOGY OFF THE SOUTH COAST OF WA

AND THE GREAT AUSTRALIAN BIGHT

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1. Itenary

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2. Scientific Program

SOUTHERN SHELF EXCHANGE, CIRCULATION AND PILCHARD ECOLOGY OFF THE SOUTH COAST OF WA AND THE GREAT AUSTRALIAN BIGHT

.To observe the current structure of the Great Australian Bight, its relation to the Leeuwin Current, and its exchange with the southern ocean.

.To determine the distribution and abundance of pilchard eggs and larvae across the south coast of Western Australia and the Great Australian Bight in relation to the Leeuwin Current.

3. Principal Investigators

Dr John Bye and Dr Peter Petrusevics
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Flinders University of South Australia
GPO Box 2100 Adelaide South Australia 5001

Dr Rick Fletcher
WA Marine Research Labs
PO Box 20 North Beach Western Australia

4. Results

1. Great Australian Bight Outflow

CTD data from shelf and near off-shelf stations indicated the existence of a salinity dominated outflow, originating at the head of the Great Australian Bight. Outflow is a gravity current which flows in an easterly direction with a maximum surface to bottom salinity stratification of about 0.5. The eastward flowing current was observed to flow off the shelf at a number of stations in the eastern part of the GAB at depth of about 200 metres. Weaker, but persistent, salinity stratification was also observed at a number of stations along the shelf west of the head of the GAB as far as the Archipelago of the Recherche.

In the region of the shelf data suggest the existence of salinity stratified bottom lenses as a possible mechanism of salt release.

2. Mesoscale Structure

The deep ocean stations reveal the details of a cross-shelf structure similar to that suggested by bottle sampling of 25 years ago in which a pattern of onshore and offshore geostrophical motions extending down to about 2000 metres which characterise the Flinders Current was observed. Further west this structure is replaced by an alongshelf dynamic topography in which the eastward Leeuwin Current occurs in the upper levels, but a westward transport exists at depth. The ADCP data will provide valuable new insights into these systems.

3. South Australian Basin Water

The Central Indian Deep water was found to have a diffuse maximum in the range 3000-3500 metres below which the bottom water of the South Australian Basin was well defined.

4. Plankton Sampling

The plankton sampling section of the cruise was highly successful. Approximately 130 vertical tows, 100 surface tows, 20 oblique and 30 EZ net samples were collected during the cruise. Given the most favourable weather conditions more stations were completed than originally planned.

Preliminary observations indicate a high degree of temperature dependence on the distribution of pilchard eggs and larvae. Larvae were found in shelf waters of about 17 degrees whereas pilchard eggs were not found until the water temperature had exceeded 17.5 degrees. Thus no pilchard eggs were seen in the area east of Caiguna. Culturing experiments carried out onboard confirmed the development times as found in other studies of approximately two days to hatching at 18 degrees.

A large amount of information on other fish larval species, including Australian salmon and for invertebrates will also be available following examination of the collected material

5. Cruise Narrative

All dates and times are local

Ship departure was delayed until 1215 hrs Wednesday 6 July . During the afternoon test runs were carried with the vertical bongo (300, 500 micron), surface (1000 micron) and the EZ net (360 micron), all worked satisfactorily. CTD and larval sampling began Thursday morning south of Kangaroo Island and followed the route showed in the cruise track. To avoid damage to the CTD cable and avoid possible fouling of the prop oblique net tows were arranged to be made from the aft deck. This arrangement, made early in the cruise, worked satisfactorily throughout the cruise. By this stage the CTD, ADCP, thermosalinograph, sounder acquisition system, the underway fluorometer and profiling fluorometer were operational although some problems with communicating with WOCE CTD No 8 were experienced. At this stage the dissolved oxygen and profiling fluorometer output was not calibrated. It was noted that the CTD salinity values were about 2.1 high in relation to bottle

data.

During Saturday 9 July about midday, after station 11, repairs were carried out to the ship's main engine. This required the ship to drift for about 6 hours during which period opportunistic plankton tows were made with the 500 micron bongo net.

During Monday 11 July winds up to 30 knots and gusting 35-40 knots forced abandonment of deep water CTD cast and larval sampling at station 20. During this period the ship was forced to hove away from line of stations. Approximately 10 hours of time were lost. Due to frequent damage to the codend in the oblique (500 micron) tow the method of retrieval was modified by leaving the aft A-frame fully extended until the net was back on deck.

On Tuesday 12 July at station 25 the CTD cable was "kinked" which required repairs involving cutting and rejoining. Approximately 3 hours of time was lost. At this stage some modifications to the cruise track (essentially cutting corners) was made to make up for lost time and in anticipation of possible stormy conditions. After water sample analysis and CTD data were compared by Flinders University scientists a scaling factor of 0.94275 was coded into the CTD calibration which allowed some onboard first-cut analysis of CTD data to be made.

During the course of the week the reversing thermometer data were analysed. This showed a discrepancy of about 0.13 degrees between the thermometer and CTD data. This offset was subsequently coded into the CTD calibration data. CTD and larval sampling continued satisfactorily throughout the first week with good progress made with time due to unusually calm weather.

During the second week a bottle test cast was carried out at station 44. Salinity analyses showed that the bottles were not leaking (maximum deviation for 11 bottles was .008)

On Tuesday 19 July CTD #8 was replaced by CTD #2 as a result of noting a further shift in salinity values of 0.01 in CTD #8 between stations 54 and 55. Fluorescence data was lost since CTD #2 could not support the profiling fluorometer.

On Wednesday 20 July were advised that due to problems with spooling of the CTD cable on the winch there was concern that damage may result to cable and possibly the CTD. As a result, from station 91 onwards all CTD casts were limited to about 100 metres which effectively eliminated any further deep water casts. Later in the day, after station 92 near Bremer Bay, it was decided to proceed to a 5000 metre station in an attempt to rectify the CTD winch spooling problem. At this station separate casts with CTD #2 and #8 were made to compare performance. The re-spooling exercise improved CTD cable takeup marginally but not sufficiently to guarantee satisfactory operation in deepwater stations. During the final leg back to the shelf south of Albany two deepwater casts were made. For the remainder of the cruise CTD casts were limited to about 100 metres.

From about Bremer Bay (station 92) westwards the main thrust of the cruise was focussed on plankton trawls including a number of closely spaced EZ trawls. After a brief delay near Albany due to rough weather further plankton trawls were conducted before sailing in to King George Sound where the scientists from the Western Australian Marine Labs were picked up by the "Karen E" at about 1030 hrs on Sunday 24 July. The Franklin then proceeded to Fremantle

conducting an ADCP survey of the Leeuwin current interface en-route. The ship docked at Fremantle at 0900 hrs 27 July 1994. Considering the problems encountered early in the cruise and the difficulty with some of the equipment the cruise was highly successful from a joint oceanography and plankton sampling point of view. The success is largely due to the interdisciplinary spirit of co-operation shown between the oceanographers and biologists and support and long hours spent by both CSIRO and Flinders University scientists to resolve calibration problems with equipment.

Specific points to be highlighted are

1. Lack of calibration of CTD #8

This proved a challenge to Dr John Bye and Jodie Hammat in comparing the evolving CTD data with extensive Nansen bottle data from the South Australian section of the cruise collected approximately 25 years ago.

2. Performance of the underway (Turner) fluorometer

The underway fluorometer ran well for the first week after which numerous problems were experienced. This included a blown globe, blocked pipe and excessive gain which caused loss of sensitivity and meaningless Turner values. After 14 July the response of the instrument was very low thus casting doubts on the integrity of the data.

3. The CTD cable spooling became sufficiently irregular that the planned CTD program had to be abandoned after station 91. The effect was that deep ocean exchange could not be monitored over the latter third of the cruise as 100 metres was considered as the maximum wire-out length.

4. The surface 1000 micron net was deployed very successfully throughout the cruise and an interesting and varied collection of marine species was obtained.

6. Scientific personnel

Peter Petrushevics	FIAMS Chief Scientist
John Bye	FIAMS
Vanessa Fahlbusch	FIAMS
Jodie Hammat	FIAMS
Esmee Van Wijk	FIAMS
Rick Fletcher	WA Marine Research Lab
Stuart Blight	WA Marine Research Lab
Rob Tregonning	WA Marine Research Lab
Jeff Dunn	CSIRO ORV Cruise Manager
Erik Madsen	CSIRO ORV
Mark Rayner	CSIRO ORV
Dave Wright	CSIRO ORV

7. Crew personnel

Neil Chesire	Master
Ian Seddon	Mate
Ian Menzies	Second Mate
Max Cameron	Chief Engineer
Peter Harding	Second Engineer
Don Roberts	Electrical Engineer
Ron Carr	Bosun
Bluey Hughes	AB
Joel Haigh	AB
Mick Barton	AB
Phil French	Greaser
Gary Hall	Chief Cook
Nat Dall	Second Cook
Reg Purcell	Chief Steward

Acknowledgments

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Peter Petrusevics
Chief Scientist

July 1994

Franklin cruise 7/94

