R.V. FRANKLIN

NATIONAL FACILITY
OCEANOGRAPHIC RESEARCH VESSEL

RV FRANKLIN

RESEARCH PLAN

CRUISE FR 4/89

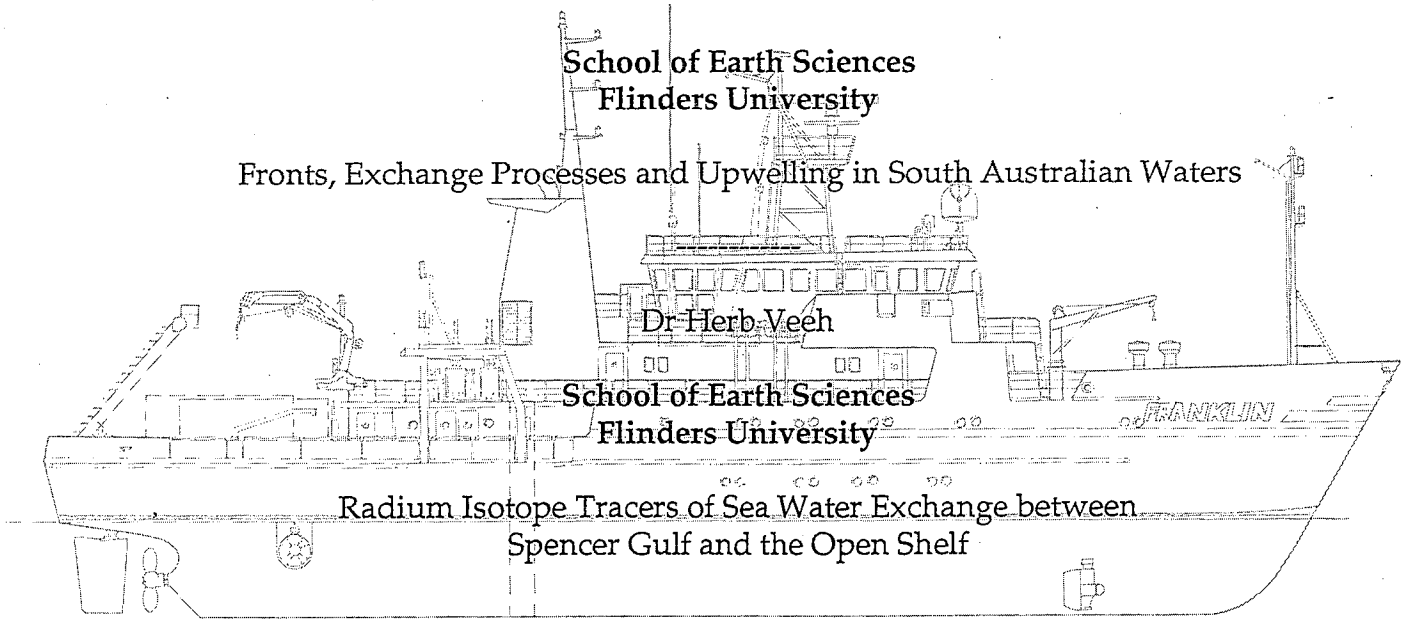
Sails Adelaide 0900 Thursday 23 March 1989
Arrives Melbourne 1600 Saturday 1 April 1989

Principal Investigators

Prof Geoff W. Lennon
&
Dr Richard Nunes Vaz

School of Earth Sciences
Flinders University

Fronts, Exchange Processes and Upwelling in South Australian Waters



Dr Herb Veeh

School of Earth Sciences
Flinders University

Radium Isotope Tracers of Sea Water Exchange between Spencer Gulf and the Open Shelf

November 1988

For further information contact

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AUSTRALIA

R.V. FRANKLIN IS OWNED AND OPERATED BY CSIRO

RV FRANKLIN
Research Plan
FR04/89

Itinerary

Sail Adelaide Thursday 23 March 1989
Arrive Melbourne Saturday 1 April 1989

Scientific programs

Investigation of frontal activity at the mouth of Spencer Gulf with the possible deployment of nine moorings at six sites. (*Lennon/Nunes*)

Survey of shelf waters to evaluate the extent of Bight and ocean water intrusion into the gulf/shelf zone, and the role played in local dynamics, and the possible recovery of two moorings located at two sites. (*Lennon/Nunes*)

Collection of water samples for trace element and isotope detection. (*Veeh*)

A possible final survey of the S.E. upwelling zone en route to Melbourne (*Lennon/Nunes*)

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The major objectives for this final stage of the project are the recovery of the nine Flinders' moorings (by the *Ngerin*), a re-examination of the frontal processes in Spencer Gulf (both *Franklin* and *Ngerin*) and a final survey of the upwelling zone along the SE coast (by the *Franklin*).

CRUISE PROGRAM FR04/89

As with the plan for FR02/89 a large degree of flexibility must be included in the program. Certain aspects will depend upon the results from earlier cruises and the weather will also be an unknown, determining factor. However, with only a 6 - 7 day working period, the most must be made of the time available and, at this stage, it appears that priority will be given to work on frontal processes in the mouth of Spencer Gulf. If time allows and the conditions are conducive then a final survey of the SE upwelling region could be made on the return voyage to Melbourne.
Again it is requested that the *Franklin* be equipped and available for the recovery of the Flinders moorings in the event that the *Ngerin* is unavailable.

The major objectives and constraints for FR04/89 are:

1 **Departure** from Adelaide on Thursday 23rd March 1989.

2 **Arrival** at Melbourne on Saturday 1st April 1989.

3 **Mouth of Spencer Gulf** - A single survey of the area extending 34°30'S - 35°30'S and following a *H* pattern (Fig.2) to derive a synoptic picture of the temperature and salinity characteristics in the region.
The conventional Neil Brown CTD arrangement would be most suitable as water samples are required at regular intervals for chemical and nutrient analysis.
The *H* pattern covers approximately 220 nm. and, with a station separation of 5 nm., using an on-station time of 40 minutes and steaming at 11 kts. between stations, yields a total coverage time of about 49 hours.
A typical coverage would be:

Transect	Length (nm)	CTD Stations	Transect Time (hr)	Total Time (hr)
HE1-HE2	45	9	10.1	10.1
HE2-HN1	10	2	2.25	11.35
HN1-HM1	25	5	5.6	16.95
HM1-HM2	10	2	2.25	19.2
HM2-HN2	25	5	5.6	24.8
HN2-HW1	10	2	2.25	27.05
HW1-HW2	45	9	10.1	37.15
HW2-HS1	10	2	2.25	39.4
HS2-HM3	10	2	2.25	41.65
HM3-HM4	10	2	2.25	44.15
HM4-HS2	10	2	2.25	46.4
HS2-HE1	10	2	2.25	**48.65**

It is hoped that NOAA satellite images will be available via facsimile or radio from Flinders, to be used in relating the sea surface temperature discontinuities (as indicated by the images) to the real underlying structure.

4 **Microstructure of the Front** - Concentrating in an area 34°45'S - 35°05'S (the shaded area on Fig.2), there will be an intensive study of the frontal structure using a specially modified Applied Micro Systems CTD (ex Flinders) and the conventional Neil Brown CTD.
A measure of flexibility is needed as ideal conditions of tides and weather are required for investigations to proceed successfully. Also, the exact position of the front will be uncertain until the broader survey of the mouth area is completed.

5 **Shelf waters** - If time allows, a survey of the shelf waters adjacent to the mouth of Spencer Gulf and along two transects (*A* and *B* on Fig. 2) will be made to determine the extent of Bight and ocean water intrusion into this region and its role in determining the density, baroclinic forcing and mixing processes. As only limited chemical and nutrient analysis will be required the *seasoar*, working to depths of about 60 metres, will be most suitable.
Each transect is approximately 45 nm. and would be covered in about 7.5 hr. steaming at 6 kts..
In the event that the *seasoar* is unavailable the conventional Neil Brown CTD will be used with a station separation of 9 nm.. Using an on-station time of 40 min. this will yield an average speed of about 6 kts., keeping the coverage time as given above.

6 **S.E. Coast** - A final survey of the SE upwelling zone on the return leg to Melbourne. A single passage through the grid pattern towing the *seasoar* at 6 knts. or using the conventional CTD with 9 nm. separation between stations, giving a coverage time of about 43 hrs.. This will only be attempted with prevailing weather conditions.

7 **Radium Isotope Tracers** (*Veeh*) - 20 litre water samples will be taken from gulf, shelf and frontal zones for radium isotope analysis. The station locations are not critical and can be incorporated with the other gulf and shelf activities.

8 **Mooring Recovery** - In the event that *Ngerin* is unable to recover the Flinders' moorings, the relevant equipment should be available on board the *Franklin* for this purpose. There are nine moorings located at six sites in the mouth of Spencer Gulf and the adjacent shelf areas (Fig. 3).

Name		Latitude	Longitude	Depth
north	(1)	34° 35'	136° 42'	37m
cancer	(2)	34° 49'	136° 33'	44m
capricorn	(2)	34° 57'	136° 32'	46m
south	(2)	35° 17'	136° 25'	80m
bight	(1)	35° 15'	135° 30'	105m
edge	(1)	35° 50'	136° 05'	130m

Recovery of the moorings could be done in conjunction with the final gulf and shelf surveys, adding about an hour (for every mooring) to the coverage time.

9 **Travelling Times** - Whilst it is impossible to produce a timetable for the activities at this stage, the following steaming times should be considered in the final planning:

Adelaide - *HE1*	105 nm.	10.5 hrs.
H pattern	220 nm.	49 hrs. (with CTD stations)
A transect	45 nm.	7.5 hrs. (@ 6 kts.)
B transect	45 nm.	7.5 hrs. (@ 6 kts..)
B - 8B (SE coast)	210 nm.	19 hrs.
SE grid pattern	260 nm.	43 hrs. (@ 6 kts..)
1B - Melbourne	190 nm.	18 hrs.

EQUIPMENT & DATA REQUIREMENTS

1 **CTD**
i) **Seasoar** undulator to work within 10 metres of the sea bottom. The rise and fall speed should be approximately 1m/sec and, with a towing speed of 6 kts., give a vertical and horizontal data spacing of 1 metre and 3 metres respectively. In-situ calibration of the *seasoar* CTD should be provided - possibly through simultaneous sampling of the CTD and a conventional bottle at some convenient point.
It is understood that the *seasoar* may not be available for the cruise and alternative plans, using the conventional CTD, have been made.
ii) **Conventional Neil Brown CTD** for use in the mouth of Spencer Gulf and other regions in the event of the unavailability of the *seasoar* system. The CTD should be equiped with the rosette sampler for calibration and nutrient sampling.
The output required from these samplings are:
a) vertical profiles of temperature, salinity and density.
b) contour maps of temperature/salinity/density as each section or transect is completed.
c) surface contours of temperature/salinity/density once a series of sections or transects have been made.
d) high resolution output is required from the microstructure work at the frontal zone.

2 **Auto-analyser Service** for sampling inorganic phosphate, nitrate, nitrite, silicate, oxygen, and salinity.

3 **Acoustic Doppler Current Profiler** providing instantaneous vertical profiles of velocity.

4 **Meteorological Instruments** for wind speed and direction, and surface heating measurements.

5 **Meteorological Charts** to be received via facsimile as required.

6 **NOAA Satellite Images** of sea surface temperature to be relayed from Flinders University via facsimile.

7 **Computing Equipment**
1) The CSIRO *compaq* personal computer (IBM PC/XT/AT compatible) for onboard CTD processing and other data analysis work. It may also be required, with a modem, for satellite image recovery.
2) VAX 11/750 for continuation of the real-time modelling of the upwelling on the SE coast - if this is attempted.

8 **Winch** - held in Hobart for mooring operations and should be fitted for the recovery of the Flinders' moorings in the event that the *MRV Ngerin* is unavailable.

Personnel

Rick Nunes Vaz	Chief Scientist	Flinders Uni/ADFA
Herb Veeh		Flinders University
James Gunson		"
Adam Clark		"
Mark Trenorden		"
Paul Chambers		"
Dave Vaudrey	Cruise Manager	CSIRO - ORV
Bruce Barker		"
Gary Critchley		"
Erik Madsen		"

This research plan is in accordance with the directions of the National Facility Steering Committee for the Oceanographic research vessel *Franklin*.

A.D.McEwan
CSIRO Division of Oceanography

D.H.Green
National Facility Steering Committee

November 1988

FIG 1.

S.E. COAST TRANSECTS

(from Hunter FR Ø1/89)

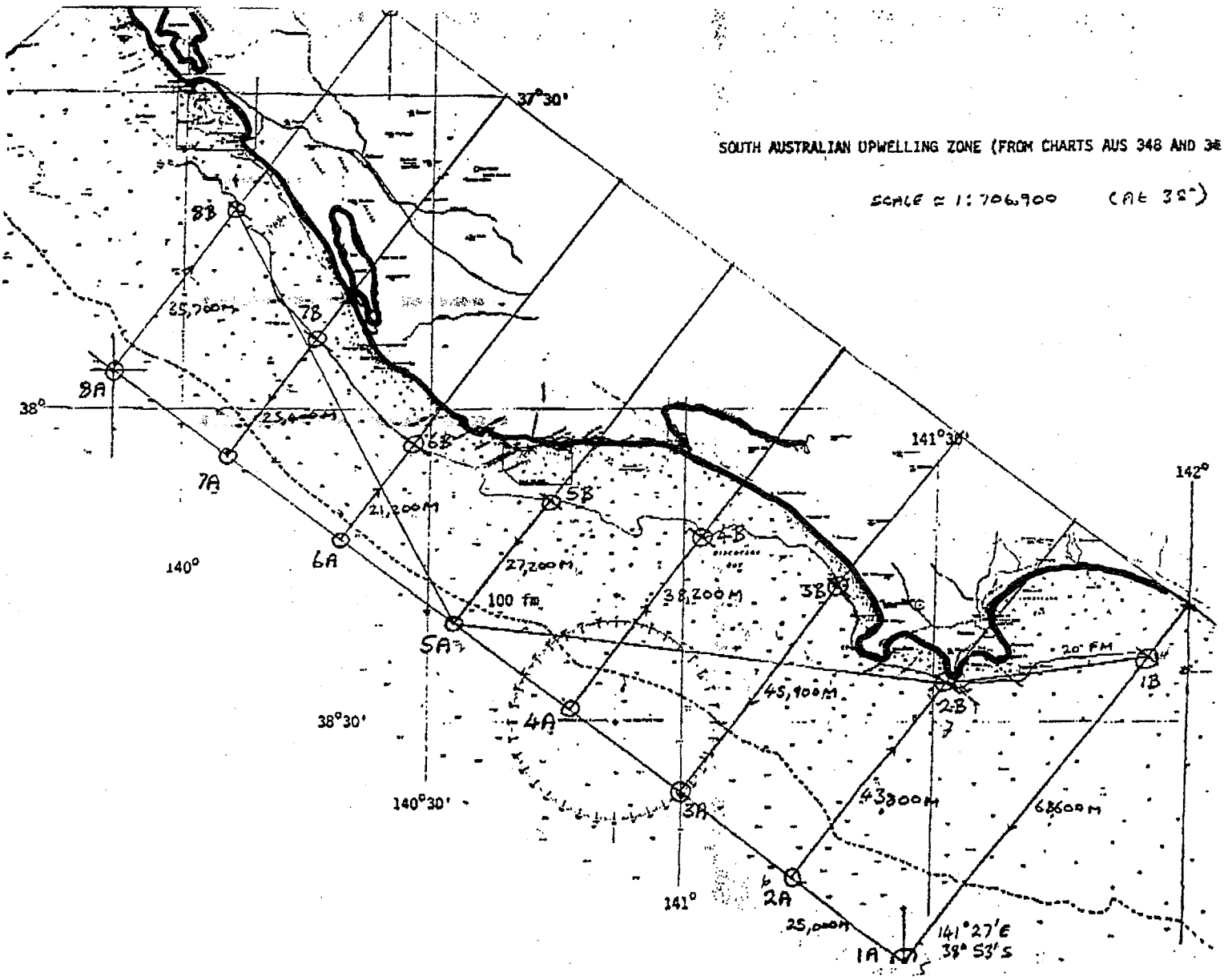


FIG 2.

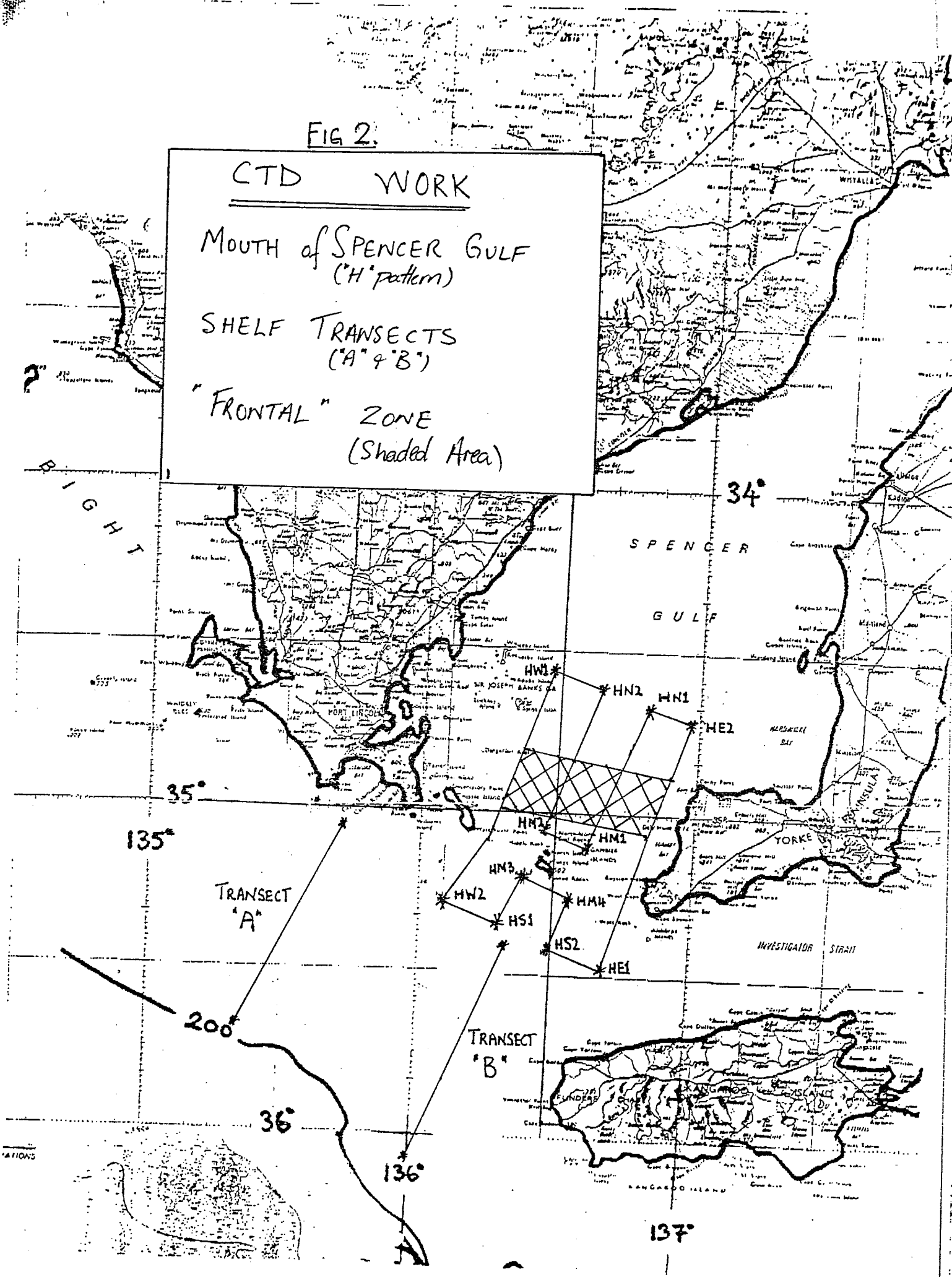
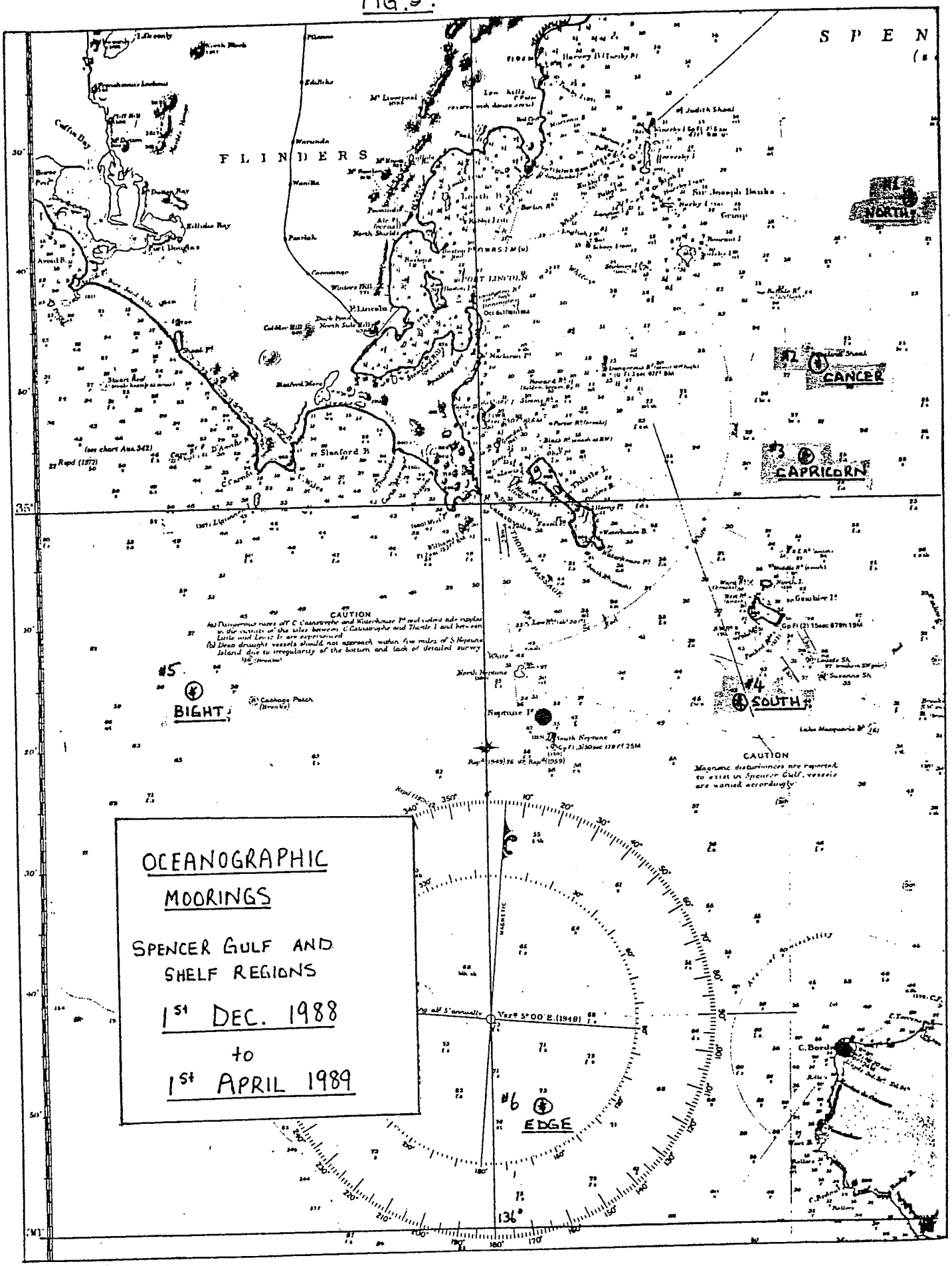

CTD WORK
MOUTH of SPENCER GULF
("H" pattern)
SHELF TRANSECTS
("A" & "B")
"FRONTAL" ZONE
(Shaded Area)
BIGHT
SPENCER
GULF
34°
35°
135°
136°
137°
HW1
HN2
HN1
HE2
HM2
HM1
HM3
HW2
HM4
HS1
HS2
HE1
TRANSECT "A"
TRANSECT "B"
YORKE
INVESTIGATOR STRAIT
KANGAROO ISLAND

FIG. 3.


FLINDERS
SPEN
#1 NORTH
#2 CANCER
#3 CAPRICORN
#4 SOUTH
#5 BIGHT
#6 EDGE
CAUTION
CAUTION
OCEANOGRAPHIC
MOORINGS
SPENCER GULF AND
SHELF REGIONS
1ST DEC. 1988
to
1ST APRIL 1989