

R.V. FRANKLIN

NATIONAL FACILITY OCEANOGRAPHIC RESEARCH VESSEL

RV FRANKLIN

RESEARCH PLAN

CRUISE FR 2/89

Sails Adelaide 0900 Tuesday 17 January 1989
Arrives Adelaide 1500 Wednesday 8 February 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
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Radium Isotope Tracers of Sea Water Exchange between
Spencer Gulf and the Open Shelf

November 1988

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R.V. FRANKLIN IS OWNED AND OPERATED BY CSIRO

PROJECT OVERVIEW

From December '88 to early April '89 the CSIRO research vessel *ORV Franklin* and the S.A. Department of Fisheries vessel *MRV Ngerin* will be engaged in a joint study of important oceanographic processes in South Australian waters.

The main investigations will be in (i) the frontal processes at the mouth of Spencer Gulf, (ii) the southwesterly advection of Bight water into the gulf region, and (iii) the upwelling along the S.E. coast.

There are several stages to the project which includes six separate cruises in this period, four by the *Ngerin*:

December 1-4
January 17 - February 8
February 22 -26
March 23 - April 1,

and two by the *Franklin*:

January 16 - February 8 (FR02/89)
March 23 - April 1 (FR04/89).

Unfortunately the *Ngerin* is not available for operation in the S.E. and will therefore concentrate upon large scale survey work in the gulf and shelf regions. Also, after discussions with CSIRO, it was recommended that the *Ngerin* might be more suitable for deploying the Flinders University current meter and thermistor chain moorings, and will most likely handle this part of the exercise. In total there are nine moorings to be deployed at six sites, two on the shelf in the December cruise, and the remaining seven at the mouth of Spencer Gulf in mid January. All moorings are to be recovered in the final cruise at the end of March. The deployment of the moorings is part of a long term study of this region by the Flinders University and is essential for the success of the project. It is hoped, therefore, that in the event that the *Ngerin* is unable to carry out this part of the exercise that the *Franklin* can be used in its place.

Several aspects of the project, such as the upwelling in the SE and the frontal activity at the mouth of Spencer Gulf, have unknown quantities - either in timing or in location and behaviour - and so a great deal of flexibility must be incorporated into the planning to ensure that advantage is taken of the most favourable conditions at the time of the cruises.

**RV FRANKLIN
Research Plan
FR02/89**

Itinerary

Sail Adelaide Tuesday 17 January 1989
Arrive Adelaide Wednesday 8 February 1989

Scientific programs

S.E. upwelling measurements and the retrieval of current meter moorings deployed by Hunter and Hearn. (*Lennon/Nunes*)

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

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 water intrusion into the gulf/shelf zone, and the role played in local dynamics. (*Lennon/Nunes*)

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CRUISE PROGRAM

A certain amount of flexibility must be incorporated into the cruise plan as a major component of the exercise is the investigation of upwelling activity in the S.E. region - something which only occurs with favourable winds and conditions that cannot be predicted.

As timing is less critical for the other activities these will be worked in around the times that the Franklin is engaged in the S.E. area.

Within this loose framework the following constraints and objectives must be met:

- 1 **Departure** from Adelaide on Tuesday 17 January 1989.
- 2 **Arrival** at Adelaide on Wednesday 8 February 1989.
- 3 **S.E. Coast** - A survey of the S.E. coast region between Beachport and Portland (Fig. 1) during an upwelling episode, and the recovery of two current meter moorings deployed at stations CM1 and CM2.
Transects will follow a similar path to the *Hunter* expedition (FR01/89) and with similar objectives - the gathering of data on the upwelling zone. There is a possibility to establish continuity with the *Hunter* cruise depending upon the incidence of upwelling events, and the proven success of the real time modelling.

Transect	Length (nm)	Transect Time (hr)	Total Time (hr)
8B-5A	44.8	7.5	7.5
5A-2B	46.8	7.8	15.3
2B-1B	19.0	3.2	18.5
1B-1A	37.0	6.2	24.7
1A-2A	13.5	2.2	26.9
2A-2B	23.7	3.9	30.8
2B-3B	13.5	2.2	33.0
3B-3A	24.8	4.1	37.1
3A-4A	13.5	2.2	39.3
4A-4B	20.6	3.4	42.7
4B-5B	13.5	2.2	44.9
5B-5A	14.7	2.4	47.3
5A-6A	13.5	2.2	49.5
6A-6B	11.4	1.9	51.4
6B-7B	13.5	2.2	53.6
7B-7A	13.7	2.3	55.9
7A-8A	13.5	2.2	58.1
8A-8B	19.3	3.2	61.3

It is desired that the vessel, towing the *seasoar* undulator at 6 kts., work to depths as shallow as 40 metres for this part of the cruise.

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.

- 4 **Mouth of Spencer Gulf** - 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 will be more suitable for this section because 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

Investigations are underway to examine techniques in transmitting NOAA satellite images via facsimile or radio from Flinders, which will be used to relate the sea surface temperature discontinuities (as indicated by the images) to the real underlying structure.

- 5 **Microstructure of the Front** - Concentrating in an area $34^{\circ}45'S$ - $35^{\circ}05'S$ (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.
- 6 **Shelf waters** - 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, and it may also be possible to incorporate one or both of these transects on the forward and return journeys from the S.E..
Each transect is approximately 45 nm. and would be covered in about 7.5 hr. steaming at 6 kts..
- 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 Deployment** - In the event that *Ngerin* is unable to deploy the Flinders' moorings, the relevant equipment should be available on board the *Franklin* for this purpose. There are nine moorings to be located at six sites in the mouth of Spencer Gulf and the adjacent shelf areas (Fig. 3).

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

Deployment of the moorings would take priority over the other activities in the area (ie. 4,5,6 & 7 above) and, allowing 1.5 hr. station time and steaming at 11 kts. between sites, should be completed in about 24 hours.

- 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 - <i>HE1</i>	105 nm.	10.5 hrs.
<i>H</i> pattern	220 nm.	49 hrs. (with CTD stations)
<i>B</i> transect	45 nm.	7.5 hrs. (@ 6 kts..)
<i>B</i> - 8 <i>B</i> (SE coast)	210 nm.	19 hrs.
SE grid pattern	370 nm.	61.5 hrs. (@ 6 kts..)
8 <i>B</i> - <i>A</i>	250 nm.	23 hrs.
<i>A</i> transect	45 nm.	7.5 hrs. (@ 6 kts.)
Adelaide - 8 <i>B</i>	235 nm.	21.5 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 equipped 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 deployment 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
Jeff Smith		"
Paul Hutchinson		"
Robert Gardiner-Gaden		ADFA
Neil White	Cruise Manager	CSIRO - ORV
Phil Adams		"
Ron Plaschke		"
Mark Rayner		"

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



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CSIRO Division of Oceanography



D.H. Green
National Facility Steering Committee

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FIG.1.
S.E. COAST TRANSECTS
 (from Hunter FR01/89)

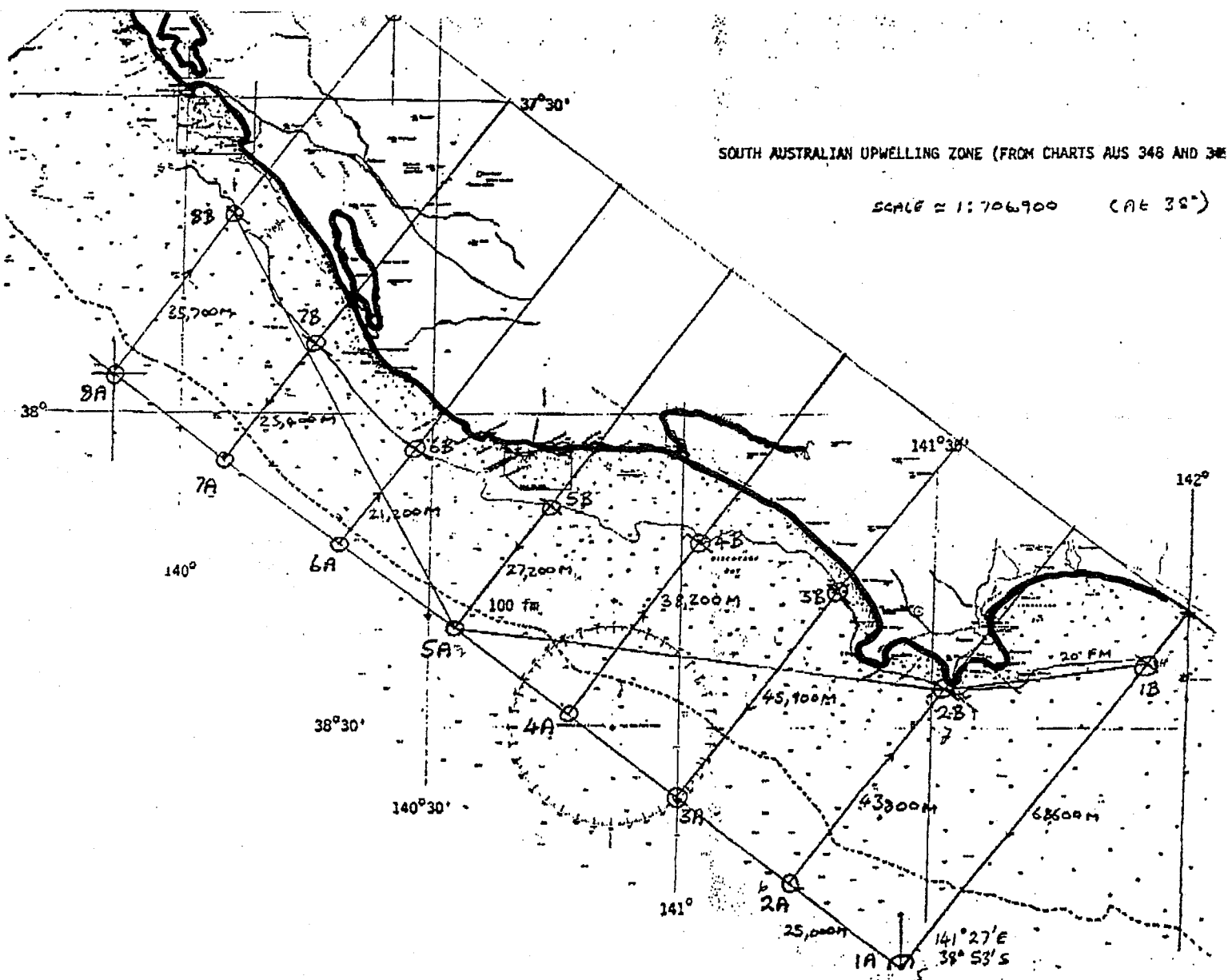


FIG. 2

CTD WORK

MOUTH of SPENCER GULF
(H* pattern)

SHELF TRANSECTS
(A* & B*)

"FRONTAL" ZONE
(Shaded Area)

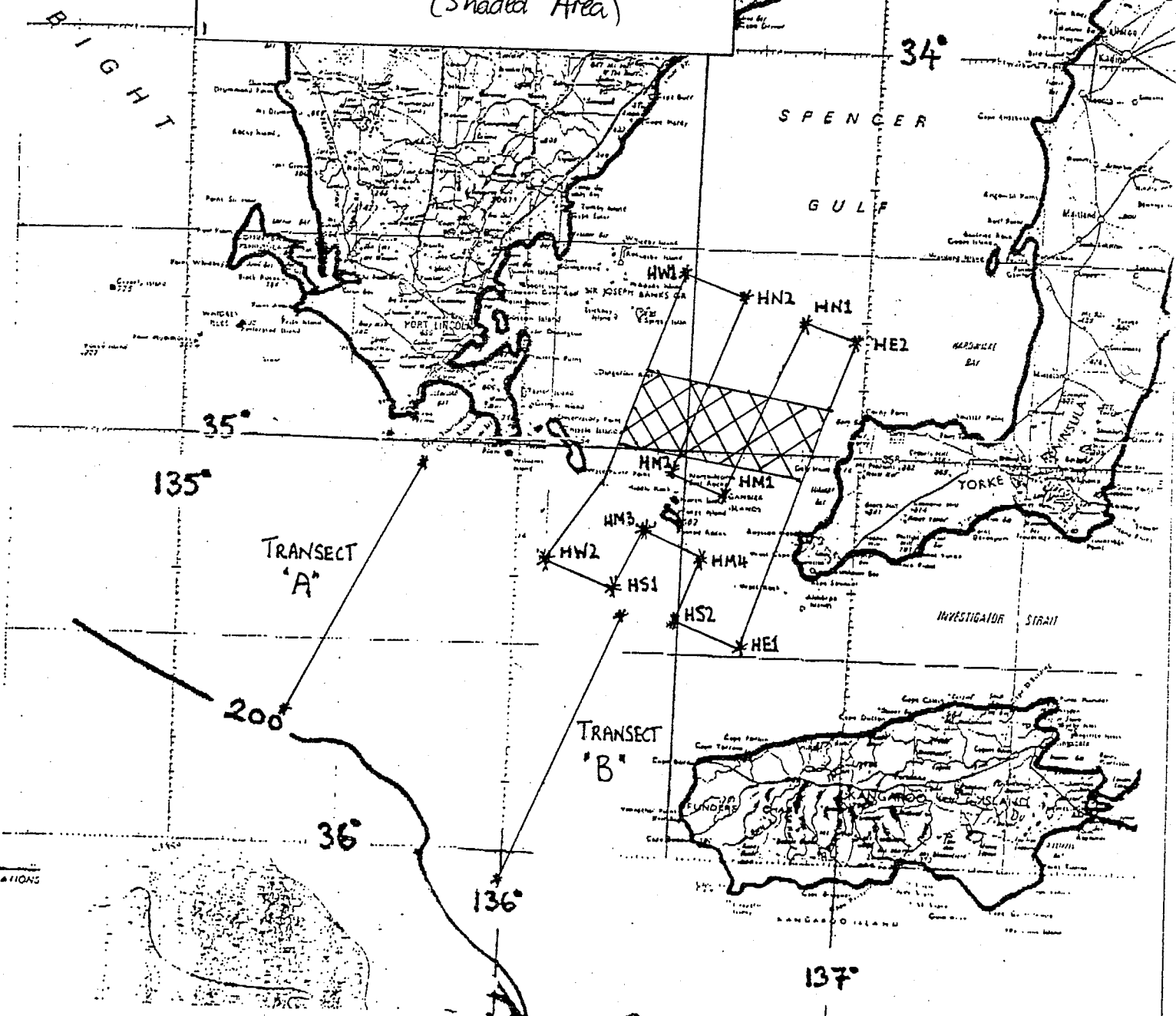


FIG. 3.

