

FRANKLIN

National Facility
Oceanographic Research Vessel

RESEARCH SUMMARY

Cruise FR 2/95

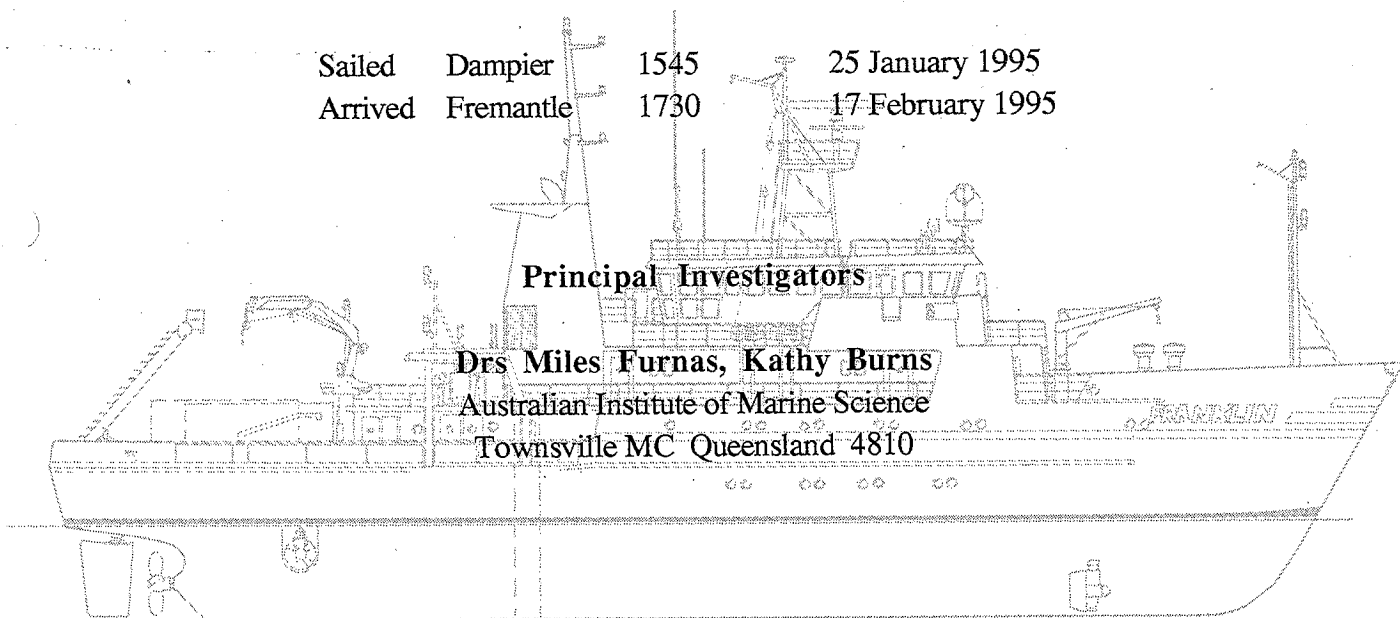
WESTERN GASPS

(Greater Australasian Shelf Productivity Study)

Sailed	Dampier	1545	25 January 1995
Arrived	Fremantle	1730	17 February 1995

Principal Investigators

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Cruise Report

FR02/95

Western GASPS (Greater Australasian Shelf Productivity Study)

Objectives:

1. Measure primary productivity and concurrent sedimentation of organic nutrients (CNP) at outer-shelf sites along the NW shelf under summer conditions.
2. Sample near-surface water column (dissolved, particulate) hydrocarbon concentrations and hydrocarbons in sedimenting particulate matter at outer-shelf sites along the NW shelf.
3. Service tide gauges and moorings at 3 sites along the NW shelf (Rowley Shoals, Scott Reef, Browse Shelf).
4. Measure nitrogen (NH_4 , NO_3) utilization by NW shelf phytoplankton.
5. Measure summer-time pelagic N_2 fixation rates by *Trichodesmium* and associated physiological processes.
6. Investigate physiochemical processes affecting speciation of iron in NW shelf waters under summer conditions.
7. Deploy a long-term pressure-temperature-salinity sensor at Ashmore Reef in support of Indonesian throughflow studies.

Participants:

Dr. Miles Furnas (Chief Scientist)	Australian Institute of Marine Science
Dr. Kathy Burns	"
Ms. Sue Codi	"
Mr. Nicholas Crosbie	"
Mr. John Soles	"
Dr. Nancy Bray	Scripps Institute of Oceanography
Dr. Douglas Capone	University of Maryland
Ms. Genevieve Aldridge	"
Mr. Ronald Szymczak	Australian Nuclear Science and Technology Organization
Mr. Robert Beattie	Commonwealth Science and Industrial Research Organization (ORV Support)
Mr. Phillip Addams	"
Mr. Mark Rayner	"

Cruise Narrative:

Figure 1 illustrates the location of all CTD stations north of Northwest Cape.

The cruise departed Dampier at 15:45 on 25 January, approximately 8 hours late. The delay was related to necessary engine repairs and unplanned crew changes. At the time of sailing, one set of lithium batteries for the Scott and Mermaid Reef tide gauges had not been received and plans were made to pick these up in Broome during the cruise. Franklin proceeded to the vicinity of Rowley Shoals to carry out productivity experiments and sediment trap deployments.

Arriving in the vicinity of Rowley Shoals, three consecutive 24-hour deployments were made with the drifting sediment trap array set at 150 m (Stations 1-9). Two larval fish light traps and paired Infiltrix in-situ water samplers were incorporated into the surface portion of the drifting array. Daily primary production experiments were carried out at the trap site and numerous collections of *Trichodesmium* were made by net during the trap deployments. A 14-hour time series of CTD casts (Stations 13-38) was carried out to resolve temporal changes in the depth of density, temperature and fluorescence surfaces associated with internal wave activity. Following the three sediment trap deployments, an AIMS mooring near Mermaid Reef (17° 2.12'S 119° 38.78'E) with subsurface temperature-depth-recorders (TDR's) was recovered and re-deployed. Water samples were collected by clean techniques from the zodiac for iron analyses. The Franklin then proceeded toward Broome, occupying a line of hydrographic stations toward the coast (Stations 39-45), in order to pick up the tide gauge batteries and engine spares forwarded to Broome.

Franklin rendezvoused successfully with a launch off Broome to pick up the tide gauge batteries and engine spares. After occupying a primary production station off Broome, Franklin proceeded northward via the Lacepede Channel to a site west of Adele Island to begin a cross-shelf line of hydrographic stations (Stations 46-60). During the cross-shelf transect, an AIMS current meter mooring located at the shelfbreak (14° 38.74'S 122° 19.96'E) was recovered and re-deployed. An AIMS thermistor string mooring was also deployed adjacent to the current meter mooring.

While at Scott Reef, an AIMS TDR mooring adjacent (14° 5.51'S 121° 43.51'E) to the reef was recovered, serviced and re-deployed. Diving operations were carried out at North Scott Reef to recover and re-deploy an AIMS tide gauge. Larval fish were collected with floating light traps while Franklin was anchored overnight in the South Scott Reef lagoon.

Departing Scott Reef, Franklin returned to the AIMS mid-shelf mooring site and carried out a 16-hour time series of rapid CTD casts (Stations 61-87) to resolve internal wave dynamics in the vicinity of the moorings, then proceeded to Ashmore Reef.

The Scripps Institute of Oceanography pressure sensor was deployed at a sub-tidal location on the Ashmore Reef flat just east of the main anchorage entrance by small boat and divers (12° 12.85'S 122° 59.78'E). One overnight fish-trap deployment was conducted while Franklin was anchored on Marlin Bank, just north of Ashmore Reef. Franklin then moved to a site northwest of Ashmore Reef, where two 24-hour sediment trap/Infiltrix/fish trap deployments were carried out (Stations 88-92). During one deployment, a 16-hour time series of half-hourly CTD casts was conducted to sample internal wave activity (Stations 93-123)

After retrieving the second Ashmore sediment trap, Franklin proceeded back to Rowley Shoals, occupying CTD stations along the way (Stations 124-135). At Rowley Shoals, diving operations were carried out to retrieve and service the AIMS tide gauge at Mermaid Reef. The original tide gauge could not be replaced due to a leak in the pressure sensor and was replaced with another tide gauge.

Franklin then proceeded to a site approximately 20 nm NW of the Rankin gas production platform, where three sequential 24-hour sediment trap/fish trap/Infiltrix sampler deployments were carried out (Stations 136-148). At the completion of the third deployment, Franklin then sailed southward to a site off Ningaloo Reef to try for one more 24-hour sediment trap/fish trap/Infiltrix sampler deployment. This deployment could not be undertaken due to rough seas and Franklin proceeded southward to Fremantle. One final hydrographic station (151) was occupied for productivity experiments off Carnarvon.

Throughout the cruise, a hydrographic station was occupied daily at approx. 08:30 local time for primary production (^{14}C) and nitrogen (^{15}N) uptake experiments. As daily operations and sea state permitted, numerous surface and near-surface horizontal net tows were made to collect *Trichodesmium* for nitrogen fixation and primary production experiments. Phytoplankton growth rates and associated grazing rates on picoplankton ($<2\ \mu\text{m}$ fraction) were measured using diffusion culture methods.

Wind and sea-state conditions permitting, water collections were made from the zodiac for near-surface iron (Fe^{+2} , Fe^{+3} , total Fe, complex Fe, particulate Fe) and trace metal (Ag, Al, Cd, Co, Cu, Cr, Mn, Ni, Pb, Ni: dissolved, particulate) determinations. Water and plankton samples were collected for analyses of naturally occurring uranium series radioisotope concentrations.

General Comments

Apart from the disruption caused by the need to collect the tide gauge batteries at Broome, almost all major cruise objectives were met. The only objective not met in entirety were the the sediment trap deployments near Scott Reef. Two individual trap deployments (Ashmore Reef, Ningaloo Reef) were not attempted due to rough weather conditions at the time. *Trichodesmium* proved to be elusive in outer shelf waters, but enough was obtained for a reasonable number of nitrogen fixation experiments.

As expected, sedimentation fluxes of particulate matter were low at all offshore sites. The measurements made will complement sedimentation flux measurements made with AIMS research vessels and the Franklin in 1992 (FR03/92). A considerable number of P vs I experiments were carried out to resolve phytoplankton responses to vertical displacements during internal waves.

Internal wave activity was observed at all of the time series stations occupied with wave amplitudes ranging between 20 and 40 m. These observations will complement ongoing internal wave studies carried out on the southern NW shelf (e.g. FR01/95).

Along- and cross-shelf hydrographic sections revealed complex layering of water masses and distinct N-S breaks in water properties along the northern NW shelf. Further synoptic hydrographic sampling throughout the shelf will be required to resolve sources and volumes of shelf waters.

The Chief Scientist and scientific party commend the ship's crew and O.R.V. support staff for their able and enthusiastic assistance.

Diving Operations

SCUBA dives were made at Scott Reef (2 February: M. Furnas, J. Soles, R. Szymczak, D. Capone), Ashmore Reef (5 February: M. Furnas, J. Soles) and Rowley Shoals (9 February: J. Soles, R. Szymczak, M. Furnas). Dives were carried out from the AIMS zodiac and the Franklin tinny without incident.

Date	Location	Divers	Max Depth	Duration
2-2-95	Scott Rf	J. Soles	17 m	15, 20 min
		M. Furnas	17 m	10,10 min
		R. Szymczak	17 m	15 min
		D. Capone	17 m	20 min
2-5-95	Ashmore Rf	J. Soles	4 m	40 min
		M. Furnas	4 m	40 min
2-9-95	Mermaid Rf.	J. Soles	15 m	45 min
		M. Furnas	15 m	5, 30 min
		R. Szymczak	15 m	45, 30 min

Heavy Engineering

The ship's engineering staff assisted Dr. Nan Bray with great enthusiasm and ingenuity in the construction of the mooring for the pressure sensor deployed at Ashmore Reef. The mooring design was altered to ease installation and an improved lightering flotation system was devised using "native materials" flotation found aboard the vessel. The engineers are to be commended for their assistance.

Accomplishments:

CTD stations	151
Primary Production Measurements/P vs I experiments	23
Phytoplankton growth/grazing experiments	6
Hydrocarbon samples collected (dissolved&solids)	8
Nitrogen Uptake Experiments	23
Nitrogen fixation experiments with <i>Trichodesmium</i>	17
Water samples for iron and trace metal analyses	16
Sediment trap deployments (CNP, hydrocarbons)	8
Fish light trap deployments	10
Tide gauge deployments	3
Moorings deployed or serviced	4
Ask the skipper (Ian) about his fish.....	

Other matters:

Phenol and phume cupboards - The external lab trailer proved totally unsuitable for working with phenol as the exhaust fan was inadequate. Ammonia analyses were shifted to the fume cupboard in the GP lab which proved excellent. No persistent phenol fumes were detected in the GP lab. To be recommended, but engineering help was required to start the fume cupboard suction fan.

Laboratory container - Improved in layout and air conditioning over the older container. The air conditioner dripped and leaked large volumes (litres per day) of moisture continuously throughout the cruise, making the lab bench underneath it largely useless for anything but working storage for plasticware. It is unclear what proportion of the water dripping is condensate and what proportion seawater getting in through the external vents on the end and side due to overflows from water baths on the container

roof. The water both dripped from the corner of the A/C housing, ran down the walls under the housing and ran down the power cord (!!!!!). The A/C unit and shroud need to be fitted with effective, roll-proof, drip trays and drains. Removable awnings or shrouds over the vents would help keep rain out as well. A removable awning over the door would also be very helpful in keeping water out of the container during wet conditions. Addition of some small, movable/removable shelves (say, 8-12 inches wide, with a 1-2 inch edge fence) over the lab benches would provide additional useful space in the container. The container roof remains the best spot for seawater incubations and the seawater supply to the afterdeck is considerably improved in volume and reduced temperature.

Light Logging - Great to have it. At the next chance for an upgrade, I would suggest a switch to Biospherical sensors (QSR-240 for the masthead and QSP-200 for the CTD would be desirable). The current Licor sensors are only 2pi in geometry and are less sensitive to scattered light (underwater) and more prone to low surface light readings due to ship's roll (masthead). The 4pi biospherical sensors are roll-proof and give a better underwater view of the available light from a plankter's point of view. It would also be desirable to have surface light available as an on-line variable during CTD casts so as to be able to correct changes in U/W light for clouds.

Life Belts - Only 6 inflatable life belts were available on board during the cruise and three were accidentally inflated, two of those during small boat operations. The present vests cannot be reset at sea, leaving us with only three operational vests for the duration of the cruise. More spares are needed, though only 6 need be available at one time.

Computing/Ops Room - Bravo!

Outboard motors - The 25 hp motor used on the zodiac needs servicing badly. The transmission/clutch proved very difficult to operate and the motor refused to run at slow or idle throttle settings. It got a bit dicey at times trying to pick up a surface float near the surf zone on Rowley Shoals or come alongside in choppy seas. The fuel lines on both the zodiac and tinny kept popping off the fuel tanks for no apparent reason. The 40 hp motor on the tinny also tended to stall occasionally.

Scintillation Counter - The scintillation counter ran beautifully for the duration of the cruise, with over 2000 samples counted. With the demise of the VAX-based ship's data system, the routine to log scintillation counter data also disappeared. Given the low level of usage, it might be more time effective to give an old laptop computer with a communications program like CrossTALK a home as an on-line data capturer. The laptop would be useful aboard the Franklin as a dog's body PC for other projects as needed. It is probably not worth the time programming the scintillation counter data capture into the SUN based data system.



Miles J. Furnas
Chief Scientist

FRANKLIN 02/95 Station locations (1-151)

