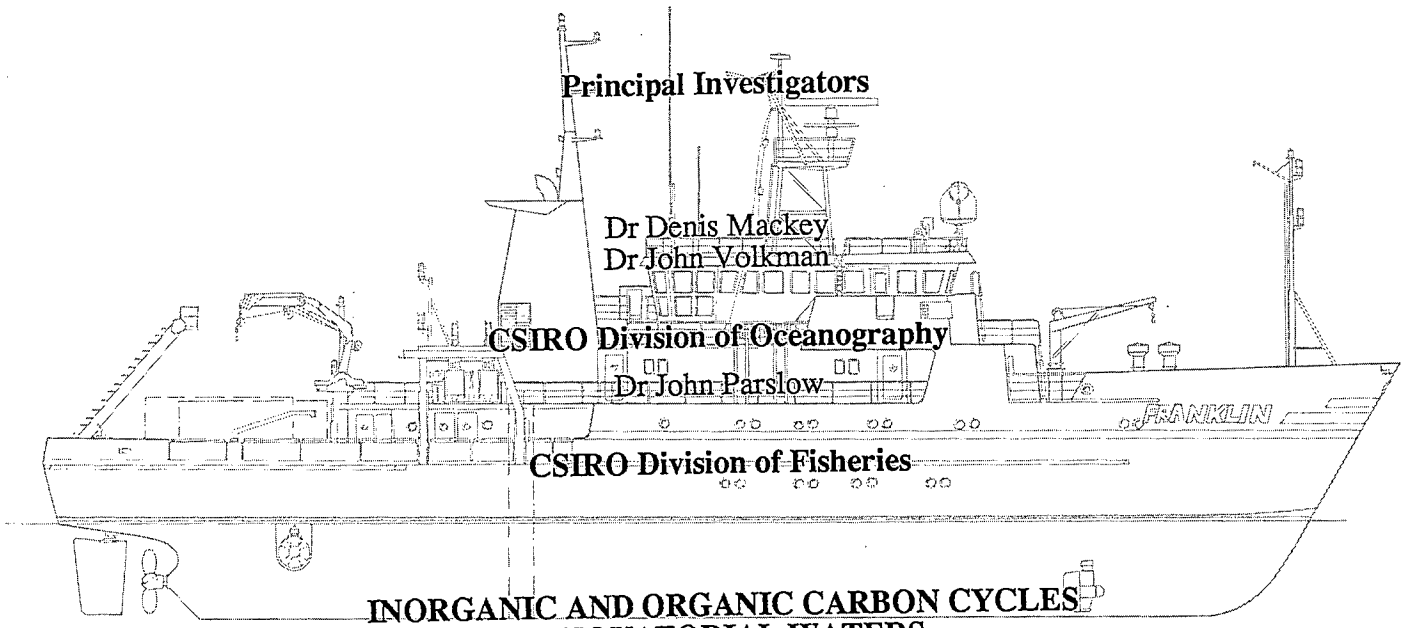
R.V. FRANKLIN

NATIONAL FACILITY
OCEANOGRAPHIC RESEARCH VESSEL

RESEARCH PLAN

CRUISE FR 08/90

Sail Rabaul 0800 Tuesday 2 October 1990
Arrive Townsville 1700 Wednesday 17 October 1990



Principal Investigators

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CSIRO Division of Oceanography

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INORGANIC AND ORGANIC CARBON CYCLES IN EQUATORIAL WATERS

For further information contact

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Telephone (002) 20 6222
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AUSTRALIA

R.V. FRANKLIN IS OWNED AND OPERATED BY CSIRO

CRUISE PLAN
R. V. FRANKLIN
FR 08/90

PROJECT

Inorganic and Organic Carbon Cycles in Equatorial Waters

ITINERARY

Depart Rabaul:	0800	Tuesday	02-October-1990
Arrive Townsville:	1700	Wednesday	17-October-1990

SCIENTIFIC PROGRAM

The Equatorial Pacific Ocean has higher biological productivity than the mid-ocean oligotrophic gyres. In the east, upwelled water brings nutrients to the euphotic zone but the productivity is lower than expected since elevated levels of nutrients remain in the euphotic zone. High productivity is confined to a narrow band near the equator. In the west, upwelling does not occur, surface nutrient concentrations are very low but increased productivity is observed over a broad band. The factors controlling the biological productivity of the Equatorial Pacific are not known. While the productivity is not particularly high, the huge area of the Equatorial Pacific ensures that it makes a significant contribution to the global carbon cycle.

SCOR has decided that the next major experiment to be conducted under the aegis of the Joint Global Ocean Flux Study (JGOFS) is to be a series of experiments in the Equatorial Pacific over the next five years. The experiments are based on transects across the equator from 10°N to 10°S at intervals of approximately 10 degrees of longitude. This cruise will effectively become a preliminary JGOFS cruise but, because of time constraints, we will only be sampling to 5°N. We aim to study the biological productivity, biomass, community structure and the carbon dioxide system in the Western Equatorial Pacific.

CRUISE OBJECTIVES

1) To study the chemical and physical processes leading to increased biomass along the equator at the western boundary of the Pacific Ocean.
2) To measure vertical and horizontal profiles of pH, carbon dioxide and fluorescence in equatorial and near-equatorial waters characterised by elevated phytoplankton biomass.
3) To use chemical methods, particularly lipid and pigment analyses, for the characterisation of the community structure within different water masses.
4) To test new sensors for the *in situ* determination of oxygen, pH etc.

RESEARCH PLAN

There is a JAPACS (Japanese Pacific Climate Studies) line along 147°E and a joint Australia/Japan mooring on the equator at 147°E and so I propose that *Franklin* conduct two transects across the equator from about 2°S - 5°N along 147°E and from 5°N - 10°S along 155°E. Some slight detours will be necessary to avoid land masses. Wherever possible, stations will be occupied along the two transects at latitudes of 0, 0.5, 1, 2, 3, 4, 5 and 10 degrees.

In general, we will limit our CTD casts to 800 m so that the Variosens III can be fitted to the rosette sampler (500 m if the light meter is operational). Some casts will be made to 1500 m or to the bottom. ^{14}C productivity and particle size measurements will be made on samples collected at dawn.

High resolution measurements of the changes in the pCO_2 of equatorial waters should provide information on the uptake of CO_2 by the biota and, possibly, the exchange of CO_2 with the atmosphere. Some samples for trace metal analyses will also be collected on both transects across the equator. ^{14}C productivity measurements and biomass estimates will be compared with iron concentrations and copper/manganese free ion ratios. If possible, the Zodiac will be used to collect surface samples since this will eliminate contamination from the ship and the rosette sampler.

During the cruise, we will use a high performance liquid chromatograph fitted with a diode array detector to measure chemical markers for estimation of pigments and determining community structure. We will combine this information with measurements of trace element concentrations, trace element speciations and nutrient concentrations so that we can determine the relative importance of chemical and physical processes in controlling the community structure and total biomass.

We will use new instruments for the measurement of pH, dissolved oxygen, pCO_2, TCO_2 and alkalinity.

In addition to the intensive chemical sampling that will be carried out during this cruise, we will also be collecting standard hydrology data. Some of this data will be collected from the same area as in the cruise proposal by Lindstrom and Godfrey and along one of the JAPACS transects, and will thus provide additional information on the temporal variability within the Western Equatorial Pacific.

PRINCIPAL INVESTIGATORS

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CRUISE TRACK

We will steam from Rabaul to 147°E, just north of Manus Island and will begin our first transect to 5°N. We will then proceed to 5°N, 155°E to begin the second transect to 10°S. After completion of the second transect, we will proceed to Townsville. The track is shown on the enclosed sheet.

Time Estimate	HOURS
2940 nm @ 12 knots	245
25 CTD stations to 800 m	38
25 CTD stations (bulk samples)	38
12 'Dawn stations'	12
2 Intensive stations to 5000 m	40
Total	373 (15.5 days)

PERSONNEL

Dr. D. J. Mackey	CSIRO Division of Oceanography (Cruise Leader)
Dr. J. K. Volkman	CSIRO Division of Oceanography
Dr. E. C. V. Butler	CSIRO Division of Oceanography
Dr. B. Tilbrook	CSIRO Division of Oceanography
Mr. H. W. Higgins	CSIRO Division of Oceanography
Mr. F. B. Griffiths	CSIRO Division of Fisheries
Ms. J. E. O'Sullivan	CSIRO Division of Oceanography
Mr. D. Holdsworth	CSIRO Division of Oceanography
Mr. R. Beattie	CSIRO Division of Oceanography (Computing)
Mr. E. Madsen	CSIRO Division of Oceanography (Electronics)
Mr. R. Plaschke	CSIRO Division of Oceanography (Hydrology)
Mr. D. Terhell	CSIRO Division of Oceanography (Hydrology)

EQUIPMENT

Essential equipment requested from National Facility

CTD #4 (with 12 bottle rosette and altimeter)
CTD #1 (as reserve)
10 l Niskin bottles/5 l Niskin bottles
Variosens III fitted to CTD
Seatech fluorometer fitted to CTD
Light meter (PAR) fitted to CTD and to deck (both logged to VAX)
pH probe fitted to CTD

Oxygen probe fitted to CTD
Sacrificial anodes (removed from CTD for some casts)
SDL/battery pack/frame for use with Variosens III
ADCP
XBTs
Biological container
Clean container
Underway pH system
Underway Turner fluorescence system
Thermosalinograph
Salinity and dissolved oxygen determinations
Vax computer
Freezer (-40 and -20 °C) and refrigerator space
Liquid nitrogen dewar (filled with liquid N_2 in Townsville before FR07/90)
Autoanalyser (5 channels) for NO_3, PO_4, SiO_4, NO_2 and IO_3
Milli-Q water system
Uninterruptible power supply
Hydrology winch
Meteorological sensors and logging system
Scintillation counter
Centrifuge
Shimadzu UV-120-01 spectrophotometer
Dedicated use of an IBM-compatible (AT) personal computer
Amiga PC for reception of satellite imagery if possible

Equipment provided by applicants

Microscope
Particle size analyser
Filtration apparatus
Plankton nets
Incubation apparatus for productivity experiments
Plankton centrifuge
High performance liquid chromatograph with diode array detector and autosampler
Turner Fluorometer for batch chlorophyll measurements
Clean Niskin bottles and other equipment for trace metal sampling
Additional single channel autoanalyser, FIA or spectrophotometer
Equipment for determining pCO_2, TCO_2 and alkalinity

Special requirements

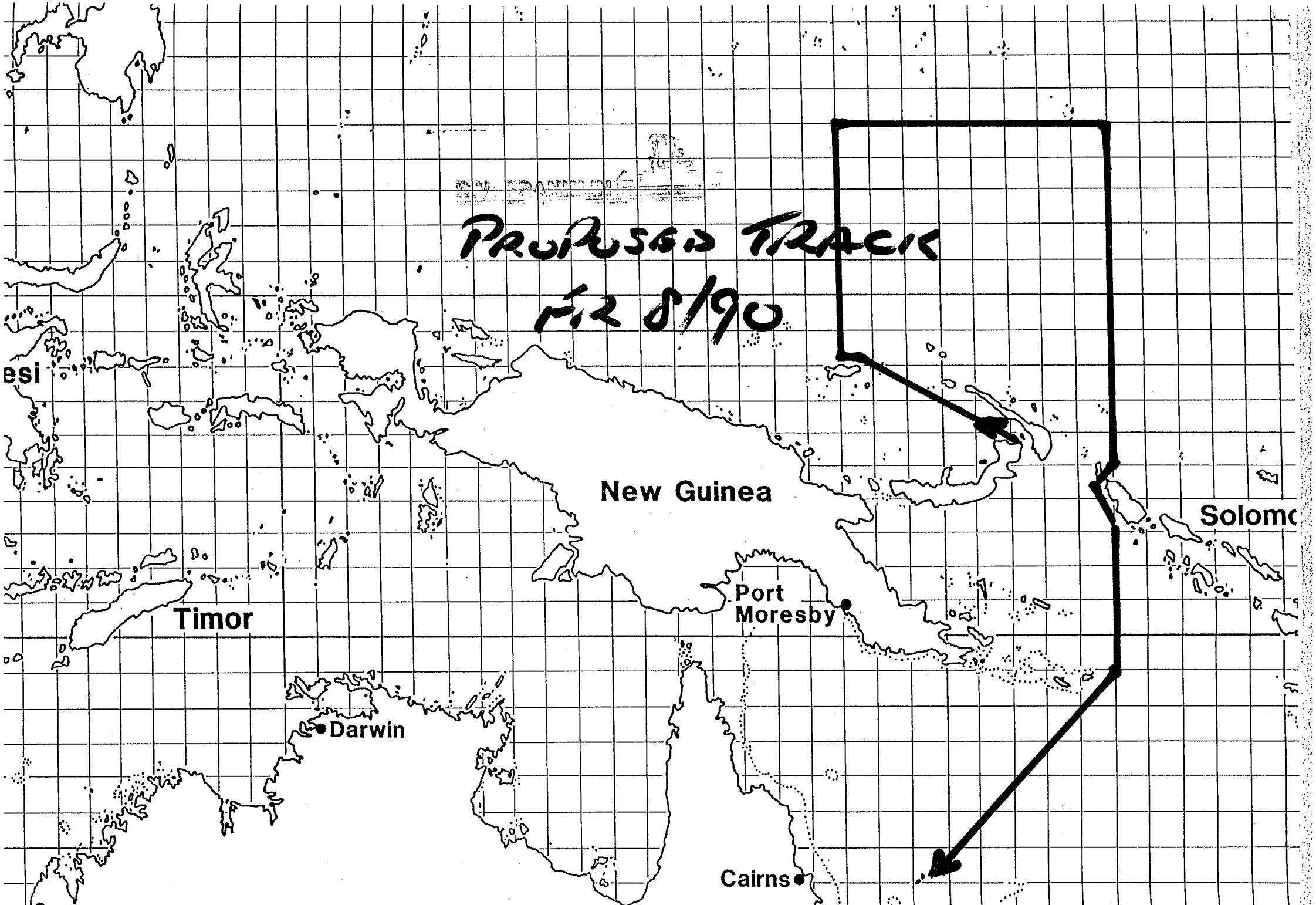
Access to all bench space in all laboratories
Use of fire hydrant water system for air conditioning of clean container
Improved air conditioning in biological container
We require the following data sets from the instruments on RV Franklin
CTD - including pH, fluorescence, oxygen and turbidity
Thermosalinograph
Underway pH
Underway Turner fluorescence
ADCP
Navigation
Bridge and event logs

Nutrients
Salinity
Dissolved oxygen

This Cruise Plan is in accordance with the directions of the National Facility Steering Committee for the oceanographic research vessel *RV Franklin.*

A. D. McEwan
CSIRO Division of Oceanography

D. H. Green
National facility Steering Committee


PROPOSED TRACK
MR 8/90
New Guinea
Timor
Port
Moresby
Darwin
Cairns
esi
Solomo