

**CSIRO
Marine Laboratories**

REPORT 152

**Atlas of Operational, Environmental,
and Biological Data
from the Gulf of Carpentaria
Prawn Survey, 1963–65
Part 2. Survey Operations**

Ian S. R. Munro

1984

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION
MARINE LABORATORIES
P.O. BOX 21, CRONULLA, NSW 2230, AUSTRALIA

National Library of Australia Cataloguing-in-Publication Entry

Munro, Ian S. R. (Ian Stafford Ross), 1919-

Atlas of operational, environmental, and biological data from the Gulf of Carpentaria prawn survey, 1963-65. Part 2. Survey operations.

Bibliography.

ISBN 0 643 02981 8.

1. Shrimps—Carpentaria, Gulf of (N.T. and Qld.). 2. Shrimp fisheries—Carpentaria, Gulf of (N.T. and Qld.). 3. Fishery resources—Carpentaria, Gulf of (N.T. and Qld.). I. Commonwealth Scientific and Industrial Research Organization (Australia). Marine Laboratories. II. Title. (Series: Report (Commonwealth Scientific and Industrial Research Organization (Australia). Marine Laboratories); 152).

639'.543'0916475

© CSIRO Australia 1984. Printed by CSIRO, Melbourne

ATLAS OF OPERATIONAL, ENVIRONMENTAL, AND BIOLOGICAL DATA FROM THE GULF OF CARPENTARIA PRAWN SURVEY, 1963-65

PART 2. SURVEY OPERATIONS

Ian S.R. Munro

Division of Fisheries Research
CSIRO Marine Laboratories
P.O. Box 21, Cronulla, N.S.W. 2230

CSIRO Marine Laboratories Report No. 152 (1984)

Preface

During 1963-65 a survey was conducted jointly by the Queensland State and Australian Commonwealth Governments to examine the prawn resources of the south-eastern corner of the Gulf of Carpentaria.

The operation was requested by the Queensland Government, and its primary object was to determine the extent of prawn fishing opportunity in this relatively remote and unexamined area.

Field survey operations were conducted over a period of twenty four consecutive months using Karumba, a tiny settlement near the mouth of the Norman River, as shore base. A commercial prawn trawler was chartered to carry out experimental fishing and to collect biological and environmental data.

The survey was planned and conducted, as far as possible, along scientific lines and thus differed from earlier Australian prawn surveys which solely involved prospecting by an experienced trawler skipper. The survey area was defined as the waters of the south-eastern part of the Gulf south of 16°24'S latitude and east of 139°06'E longitude, but some operations were extended into the area bounded on the north by 15°48'S latitude and on the west by 138°54'E longitude. The survey vessel made 2324 experimental trawls within an area of approximately 25000 km². Biological and environmental data were collected in relation to all trawl stations. Juvenile prawns and planktonic larval stages were sampled in the lower reaches of the Norman River.

The conduct of the survey and the processing of data were the responsibilities of the then CSIRO Division of Fisheries and Oceanography. The direction of field operations and supervision of scientific investigations were the responsibilities of the author who served as Project Leader. Personnel comprising graduate zoologists and technical assistants were provided by CSIRO Division of Fisheries and Oceanography and the Queensland Department of Harbours and Marine.

The survey established the presence of stocks of small prawns (greentail, York, rainbow and juvenile banana) near river mouths during the summer monsoon, stocks of larger adult prawns (tiger, banana, Endeavour and blue-leg king) in deeper waters near the Wellesley Islands, and most importantly, large concentrations of banana prawns offshore from the Smithburne River during March to November.

Commercial fisheries were established almost immediately and spectacular catches of banana prawns attracted the attention of Australian and foreign prawn fishing interests. The survey led directly into the opening up of the Gulf of Carpentaria as a major prawn trawling area which now supports large fleets of trawlers which operate from a number of centres in both Queensland and Northern Territory. The Gulf now contributes a major part of the total Australian prawn landings.

The biological and environmental research conducted during the survey in 1963-65 are unique in that they relate to an area and stocks of organisms in virgin condition. They provide a base line most valuable for comparison in future studies of stock or environmental changes as may be required for management from time to time.

Part 1 of this Atlas describes background, arrangements and circumstances of the survey and the events which led to the establishment of the commercial fishery. Part 2 describes the vessel and fishing equipment, and provides details of fishing operations, station data and catch data. It also provides an analysis of time usage and the patterns in trawl sampling. The subsequent parts present the results of investigations on environment and prawns and other fauna.

Atlas is being published in five parts :-

1. Introduction
2. Survey Operations
3. Physical and Chemical Environment
4. Distribution and Biology of Penaeid Prawns
5. Distribution and Abundance of Associated Benthic Organisms

Part 1 was published as *CSIRO Marine Laboratories Report No. 151 (1983)*. Parts 3-5 will be published as *Reports No. 153-155* respectively.

CONTENTS

2.1 SURVEY VESSEL AND FISHING GEAR

2.1.1	VESSEL SPECIFICATIONS AND LAYOUT	5
(a)	Construction and layout	5
(b)	Size specifications of hull	5
(c)	Power supply	5
(d)	Wheelhouse equipment	5
(e)	Fish hold	5
(f)	Accommodation	5
2.1.2	FISHING GEAR SPECIFICATIONS	6
(a)	Standing gear	6
(b)	Running gear	6
(c)	Otter boards	6
(d)	Trawl nets	6

2.2 FISHING OPERATIONS

2.2.1	PLANNING.....	8
2.2.2	REVIEW OF TRAWLING OPERATIONS BY QUARTERS	13
(a)	First Quarter (29 July - 28 September 1963).....	13
(b)	Second Quarter (30 September - 28 December 1963).....	13
(c)	Third Quarter (2 January - 27 March 1964)	15
(d)	Fourth Quarter (30 March - 29 June 1964)	16
(e)	Fifth Quarter (1 July - 29 September 1964)	18
(f)	Sixth Quarter (3 October - 15 December 1964)	20
(g)	Seventh Quarter (15 January - 2 April 1965).....	23
(h)	Eighth Quarter (4 April - 29 July 1965)	26
2.2.3	TIME AND MOTION ANALYSIS	31
2.2.4	STATION POSITIONS	32
2.2.5	STATION LISTS AND PRAWN CATCH DATA	50
2.3	AREA OF OPERATIONS	
2.3.1	DEFINITION OF SURVEY AREA	76
2.3.2	IDENTIFICATION OF GRID SQUARES	76
2.4	SAMPLING PATTERN (STATIONS 1-2334)	
2.4.1	PATTERN BY AREA AS TRAWL NUMBERS PER GRID	80
2.4.2	PATTERN BY AREA AS TRAWL DURATIONS PER GRID	81
2.4.3	PATTERN BY TIME OF DAY BASED ON HOUR INTERVALS....	81
2.4.4	PATTERN BY AREA BY DAY/NIGHT BASED ON GRIDS	81
2.4.5	PATTERN BY SEASON BASED ON MONTH INTERVALS	83
2.4.6	PATTERN BY DEPTH BASED ON FATHOM INTERVALS - DISTIBUTION BY YEAR	83
2.4.7	PATTERN BY DEPTH BASED ON FATHOM INTERVALS - DISTRIBUTION BY QUARTER	83
2.4.8	PATTERN BY DEPTH BASED ON FATHOM INTERVALS - DISTRIBUTION BY MONTH	85

2.5	FISHING PATTERNS FOR ADULT BANANA PRAWNS	87
2.5.1	CATCH PATTERN ACCORDING TO AREA.....	95
2.5.2	SAMPLING AND CATCH PATTERNS ACCORDING TO STATE OF TIDE	95
2.5.3	SAMPLING AND CATCH PATTERNS ACCORDING TO PROGRESSION OF TIDAL CYCLE	98
2.5.4	SAMPLING AND CATCH PATTERNS ACCORDING TO AGE OF MOON.....	98
2.5.5	SAMPLING AND CATCH PATTERNS ACCORDING TO SOLAR AND LUNAR COMBINATIONS.....	98
2.5.6	DETECTION OF BANANA PRAWN SCHOOLS BY ECHO-SOUNDER	109

2.1 SURVEY VESSEL AND FISHING GEAR

The Queensland Government arranged the charter of a privately owned commercial prawn trawler *Rama* to function as government survey vessel. This newly built diesel powered vessel arrived at Karumba on 27 July 1963 and began trawling operations on 29 July. This same vessel was used continuously for survey purposes until 29 July 1965 with one change in fishing master and several changes in crew. Fishing procedures and net design were similar to those employed in normal commercial prawn trawling in Australia.

2.1.1 VESSEL SPECIFICATIONS AND LAYOUT

(a) Construction and layout

Rama was a flush-decked vessel of hardwood construction. The hull was carvel built and had a canoe stern. The engine and wheelhouse were aft, the fish hold midships, and crew accommodation forward below decks. The mast, derrick and sorting tray were situated immediately forward of the access hatch to the fish hold. The deck layout is illustrated in Figure 3.

(b) Size specifications of hull

Length overall : 14.6m (48 ft 0 in)
 Length at waterline : 13.7m (45 ft 0 in)
 Beam : 4.6m (15 ft 0 in)
 Draft : 1.7m (5 ft 9 in)

(c) Power supply

Propulsion power was provided by a single *Rolls-Royce* diesel motor which developed 102 kW (137 h.p.) at 1800 r.p.m., with 3:1 reduction to a single screw. This engine also provided power for winches and electricity generation. There was no auxillary motor or refrigeration.

(d) Wheelhouse equipment

The only navigation aids were a steering compass and a *Fumino* F-710 echounder. The compass had not been compensated but the vessel was swung and a correction table compiled for all headings. Communication between *Rama* and shore base and other vessels was by a *Marina* 62 two-way radio using standard operating frequencies. She lacked a chart table and other features which would have been valuable assets to the conduct of survey operations. It should be noted that radar equipment was not usually fitted to smaller fishing craft. Also radio direction finding proved to be useless because of absence of shore transmitters in this remote area. Neither fishing master was a qualified navigator and charts were inadequate. Consequently position fixing was difficult except in sight of land.

(e) Fish hold

The fish hold below decks measured approximately 4.6m x 4m x 1.8m (15 ft x 13 ft x 6 ft) with usable capacity of about 17 m³ (600 ft³). It was not refrigerated and cooling was achieved by the use of ice. Chilling and holding of prawns was by the brine method of mixing salt with flake ice. The hold was fitted with two 910-litre (200 gal) and two 445-litre (100-gal) brine tanks.

(f) Accommodation

Crew accommodation consisted of four bunks below decks forward and another in the wheelhouse. There was no toilet or wash facilities. Galley facilities comprised a small L.P.G. stove and stainless steel sink in one corner of the wheelhouse. Locker and cupboard space was limited. There was no refrigerator and no seating or table for serving meals. *Rama*, although having a cruising range of 1700 nautical miles, was designed primarily as a work vessel for

fishing trips of short duration not far distant from port. Consequently she lacked the space and comfort desirable for operating in this large remote area under tropical climatic conditions. Travelling distances often exceeded 150 km from base and made it necessary to remain at sea for weekly periods.

2.1.2 FISHING GEAR SPECIFICATIONS

In common with most Australian prawn trawlers of her size and period, *Rama* was rigged for the use of single gear which was manipulated by being shot directly over the stern and towed directly behind the vessel. During the survey experimental shots were standardized at 30 minutes duration but some were varied according to circumstances. Trawling time was often reduced to 15 minutes in shallow nearshore waters to avoid catching too much weight of jellyfish. Some durations were extended to 60 minutes to enable the crew to partake of a meal with limited interruptions. During tests for commercial yield of nocturnal species durations were extended to 90 or 120 minutes. When fishing for banana prawns the trawl was lifted immediately after it had passed through a detected school.

(a) Standing gear

Standing gear was of an overhead type with headroom below the gantries. The gantries were positioned at the forward end of the wheelhouse in line with the trawl winch which was located in a housing within the wheelhouse. The trawl winch was of the usual type incorporating power drive through an automobile truck-type differential and flat belt from the forward end of the engine. The drive shafts of the winch were extended through each side of the forward part of the wheelhouse. The warp drums were attached to the ends of these shafts on either side of the wheelhouse, and were controlled independently by separate clutches. Each drum had a capacity for

366m (1200 ft) of 29 mm (1.125 in) circumference steel wire rope. An independent 'niggerhead' was provided for warping in the cod-end and this was fitted to a shaft protruding through the forward end of the wheelhouse. All winch gear was controlled from within the wheelhouse.

(b) Running gear

The trawl rig was suitable for fishing in depths up to 90m (50 fathoms) using the conventional system of two warps. The warps were 29mm (1.125in) circumference 6/19's flexible steel wire rope. They were led vertically upwards from the drums to blocks directly above the drums and then outwards to the gallow blocks, thus leaving headroom below the warps. The gantries were fitted with 'fat-boy' type sheave blocks.

The trawl net was shot and hauled over the stern, the cod-end being dragged around the quarter and along the starboard side to the starboard gallows where the boom tackle was attached to the snotter. The cod-end was then lifted and emptied on to the sorting tray which was situated on the foredeck directly aft of the mast.

(c) Otter boards

Two sets of otter boards were used, one set having dimensions 1.8m x 0.9m (6 ft x 3 ft), and the other 1.8m x 0.8m (6 ft x 2 ft 9 in). Both sets were fitted with standard fixed brackets in which were five warp towing points, the centre point being three eighths of the length of the board aft of the leading edge. Net towing points were positioned one quarter of the length of the board forward from the trailing edge. The towing points used during most of the trawls were those on the trailing edge, and the warps were shackled into either the most forward point of the bracket or the one next to it.

(d) *Trawl nets*

Two types of nets were used by *Rama*. Initially she was equipped with two nets of the "Yankee Doodle" type because this kind of net was used commonly for the capture of banana prawns off the east coast of Queensland. She also carried two "Flat" type trawl nets because this kind of net was regarded as the most suitable for taking king prawns. The two kinds of nets differed essentially in their fishing characteristics. The "Flat" trawl was designed so that the foot rope remained on the sea floor throughout its length and the headline did not lift particularly high. Nets of the "Yankee Doodle" type have a wide opening characteristic in which the headline lifts high above the sea floor and the foot rope makes only limited contact with the sea floor. The "Yankee Doodle" design is thus a "balloon" type net which is better adapted for the capture of banana prawns because schools of these prawns, especially when in "balled-up" concentrations, tend to lift clear of the sea floor.

Throughout the two-year term of the survey particular nets were damaged beyond repair or wore out through continued use, and had to be replaced. Nets were allocated identification numbers for purposes of comparing catch rates and relative fishing power. Each of these numbers refer to the type of net rather than to a particular net, which in the course of time was repaired many times and eventually replaced by another net of virtually similar construction.

Unfortunately some information regarding numbering of nets has been lost and some confusion has arisen from numbers being designated differently by the two skippers. Some net specifications were documented in June 1964 by Mr P.D. Lorimer, a gear officer with the Fisheries Division, Department of Primary Industry. The net plans illustrated in Figures 4-7 were prepared

under his supervision but the numbers allocated by him to four nets are not consistent with numbers recorded in daily log sheets by the two skippers of *Rama*, H.S. McLaren (29 July - 18 December 1963) and N.J. Sykes (23 December 1963 - 31 July 1965).

All nets were constructed of 1.75-inch (44.5 mm) mesh 10/15 ply "Kuralon". They were hung on 6/19's flexible steel wire rope, the foot ropes being laid into 2-inch (51 mm) circumference coir rope before hanging. Approximately 10 lb (4.5 kg) of lead was used on the foot rope, and in most instances a 3-inch (76 mm) circumference coir mud rope was looped to it. Flotation of the headline was achieved by the use of three 8-inch (200 mm) diameter glass balls.

Nets of the "Yankee Doodle" type were used more extensively than those of the "Flat" trawl type, and two versions of this design (Net Nos. 1, 3, 4 and 5) were employed over different periods. Net No. 1 with a headline of 10 fathoms was the conventional "Yankee Doodle" favoured by Bundaberg fishermen. One No. 3 type net was constructed in May 1964 by Messrs Sykes and Lorimer and differed little from Net No. 1, but the bag was longer and the construction was simplified. Net No. 5 was constructed by Mr. Sykes in October 1964 and differed slightly from Net No. 3 in the method of cutting and joining.

The "Flat" type trawl originally used was Net No. 2 with a headline of 9 fathoms. It differed from the "Yankee Doodle" nets not only in being smaller generally, but in having a smaller bag and longer wings, and lacking the high opening characteristic. It was damaged beyond repair at Stn 1326 and replaced by Net No. 6, a "Flat" type trawl of equivalent dimensions constructed by Mr Sykes in October 1964. An unknown net of nylon netting was used at Stn 108 and 109, and this probably also was of the "Flat" type.

Table 1. Types of trawl nets used by *Rama*

Net No.	Trawl type	Headline length		Specification Illustrated
		Fathoms	Metres	
1	Yankee Doodle	10	18.3	Fig. 4
2	Flat trawl	9	16.5	Fig. 5
3	Yankee Doodle variant	10	18.3	Fig. 6
4	Yankee Doodle	10	18.3	
5	Yankee Doodle variant	10	18.3	
6	Flat trawl	9	16.3	Fig. 7
7	Flat trawl (?) (Nylon)	?	?	

Note - Headline lengths of nets 1, 3, 4 and 5 are also recorded as 12 or 13 fathoms in skipper's daily log sheets.

Four of the nets are illustrated (Figures 4-7). These diagrams give plan of the trawl (A), method of cutting out of various parts (B, also C-D in Figures 4-6, and E in Figures 4-5), and taper to be cut for each part (C in Figure 7, E in Figure 6 and F in Figures 4-5). The nets used with their identification numbers are listed above (Table 1). The stations at which the various nets were used is also listed together with the skipper's number as recorded in daily log sheets and the author's interpretation of net identification (Table 2).

2.2 FISHING OPERATIONS

2.2.1 PLANNING

During the two years of survey the guiding committee met at approximately quarterly intervals to review the progress and to plan for a further quarter. The survey proceeded via these quarterly intervals through various phases from an initial reconnaissance of the area and several series of fishing experiments finally to pilot-scale commercial fishing operations. Thus it is appropriate to review operations in blocks of quarterly

periods. The grouping of cruises herein agrees fairly closely with the dates of the quarterly divisions.

The general theoretical plan of approach to prospecting operations is outlined in 1.2.5 (a) and other sections above, but the practical achievement was rather different because of various circumstances and events. A major factor was the failure of the commercial trawlers under contract to the Mostyn company to participate in fishing operations in the southern part of the Gulf. This meant that the survey vessel had the initial task of reconnaissance of the whole area, and then had to conduct fishing experiments alone as well as collecting environmental and biological data. As the survey proceeded the vessel was required to follow up various leads and indications rather than to work systematically to a sampling pattern designed to satisfy desirable statistical requirements. Time was lost through mechanical breakdowns and adverse weather. During certain periods and under certain weather conditions the vessel was restricted to areas which would provide comfortable fishing conditions.

DECK PLAN OF RAMA.

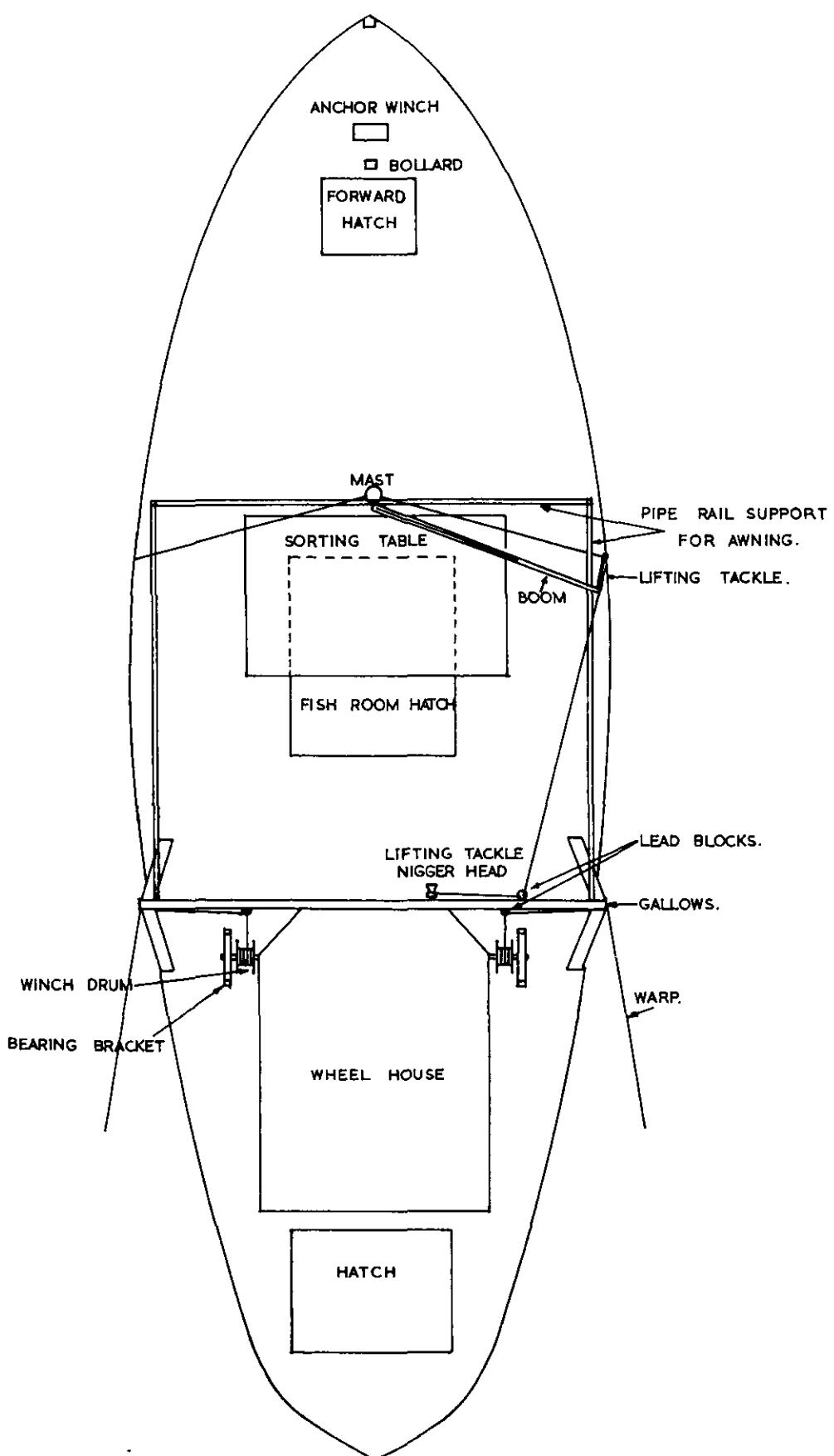


Figure 3

Deck layout of *Rama* showing arrangement of standing gear. Diagram prepared by Fisheries Division, Department of Primary Industry.

Fig. 4

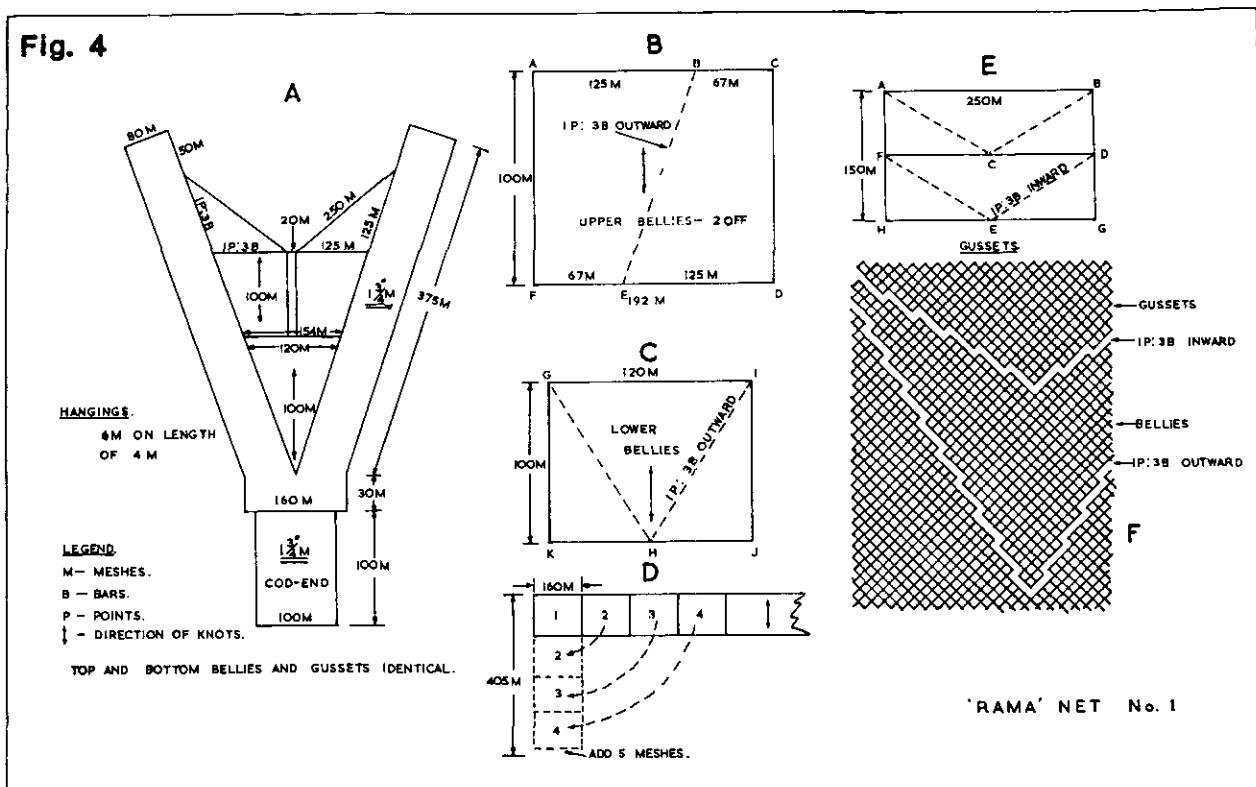
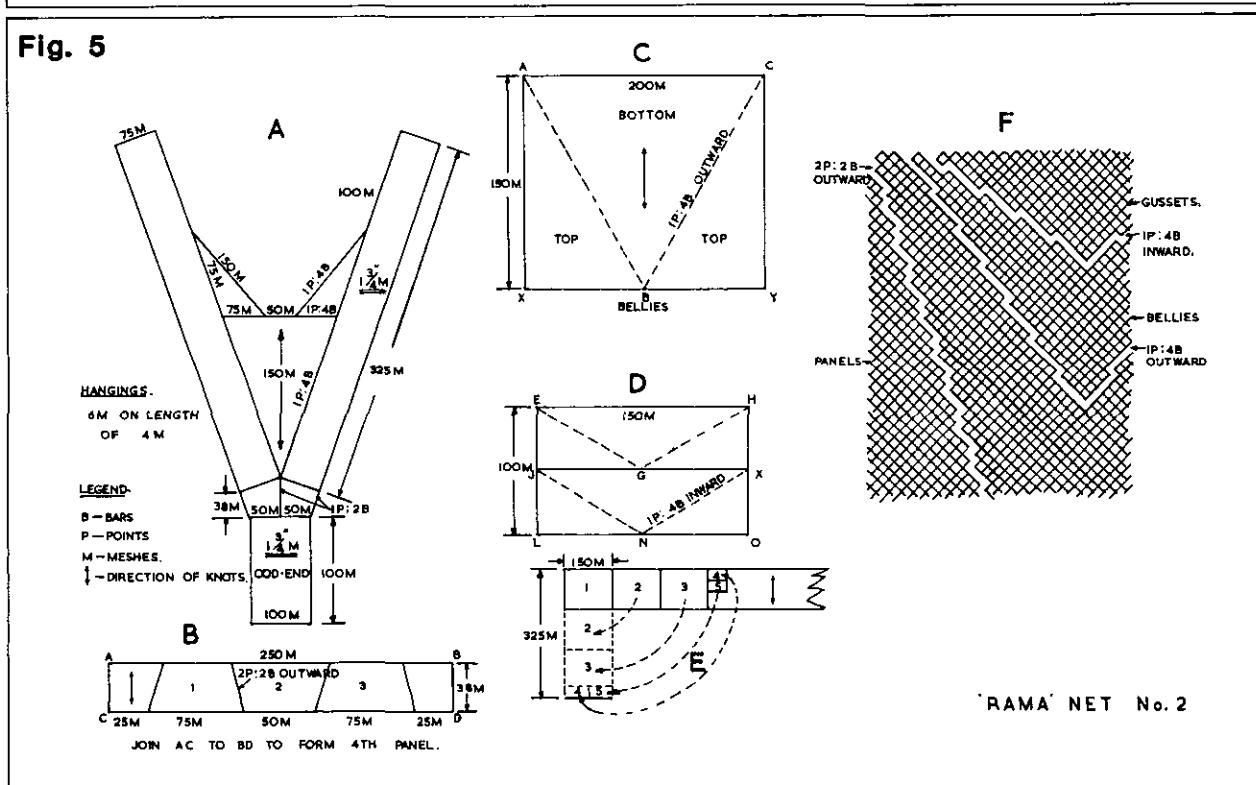


Fig. 5



Figures 4-7

Specifications of four trawl nets used by *Rama* and listed in Table 1. Figs 4 and 6 are of balloon nets of the "Yankee Doodle" type. Figs 5 and 7 are "Flat" trawl types.

A - Plan of net; B (all Figs), C and D (Figs 4-6) and E (Figs 4-5) - Method of cutting the various parts; C (Fig. 7), E (Fig. 6) and F (Figs 4-5) - Taper to be cut for each part.

Diagrams prepared by Fisheries Division, Department of Primary Industry.

Fig. 6

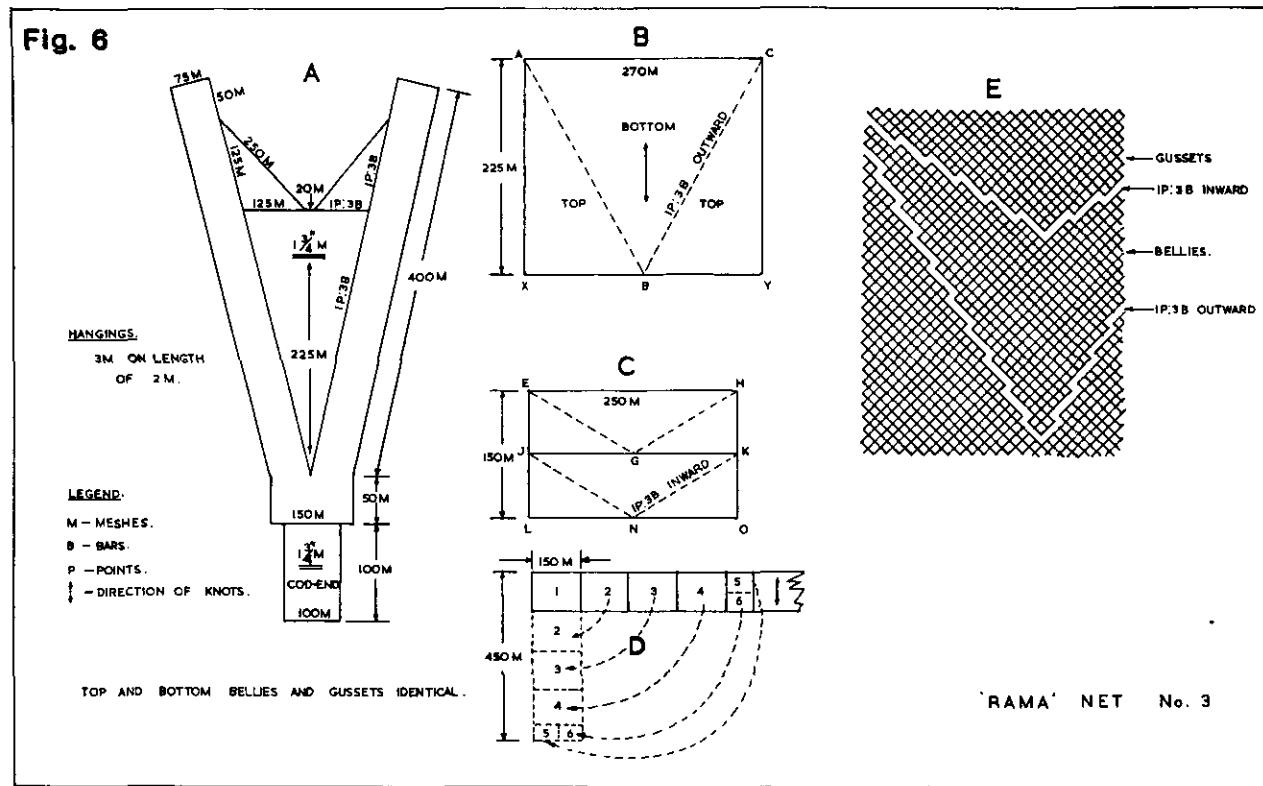


Fig. 7

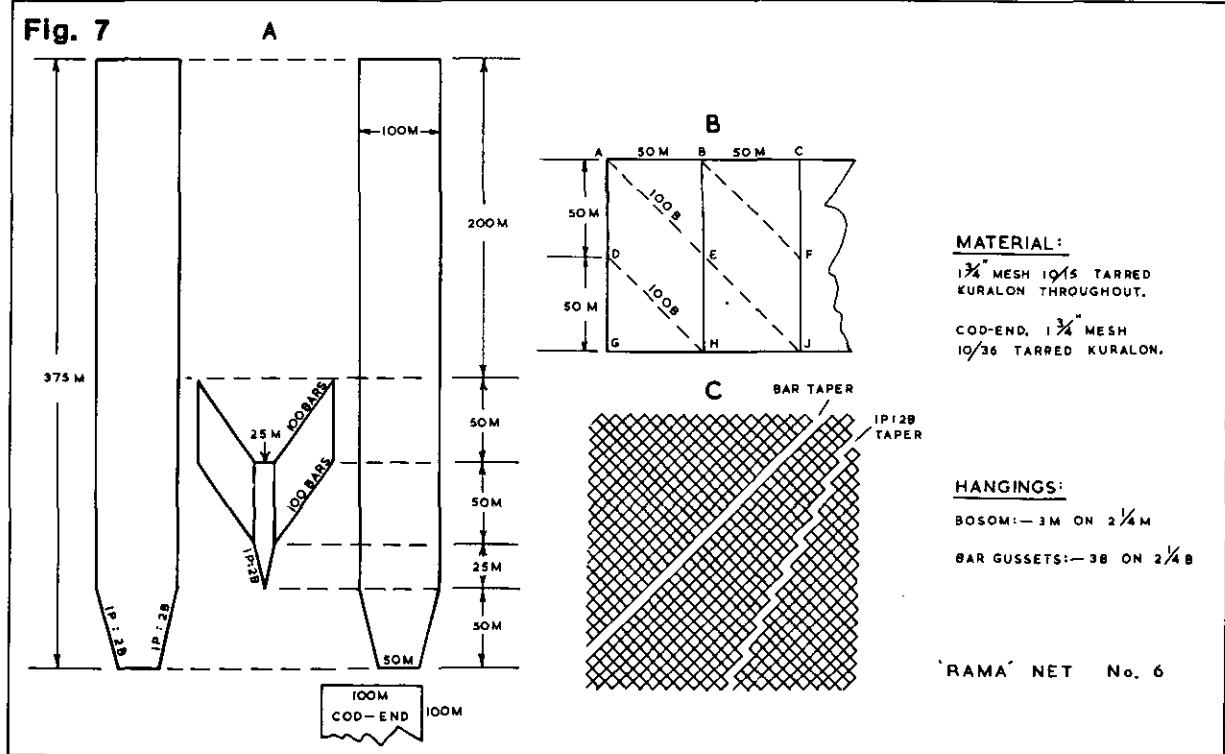


Table 2. Summary of use of trawl nets by *Rama* at Stations 1-2334

Net Number	Stations	Log Book Net Number
1	67-107, 110-178, 185-186, 249-250, 253-254, 258-259, 262-280, 283-284, 287, 290-304, 329-397, 454-482, 526-593, 858-885, 1212, 1237 1472-1501, 1524-1537, 1714-1736, 1741-1744, 1835-1853, 1866-1919, 1929-1934, 1937-1962, 1969-2043, 2055-2078, 2080-2082, 2084-2091, 2097-2197, 2183-2334	2
2	1-66, 187-248, 251-252, 255-257, 260-261, 281-282, 285-286, 288-289, 305-328, 398-453, 483-494, 495-525, 703-777, 996-1012, 1021-1211, 1238-1326	1
3	594-702, 778-857, 886-982, 2094-2096	3
4	1013-1020, 1327-1395	4
5	1396-1438	5
6	1440-1471, 1502-1523, 1538-1607, 1920-1928, 1935-1936, 1963-1968, 2044-2054, 2079, 2083, 2092-2093, 2180-2182 1608-1609 1610-1713, 1737-1740, 1745-1834, 1854-1865	6 7 X
7	108-109, 179-184	3
?1 or 3	983-985	Nil
? 5	1439	Nil

2.2.2 REVIEW OF TRAWLING OPERATIONS BY QUARTERS

(a) First Quarter (29 July - 28 September 1963)

Objectives: A general reconnaissance of the whole area to determine nature and location of prawning grounds, species and quantities of prawns, depth configuration, sediment composition and distribution, temperature and salinity patterns, and nature and abundance of benthos.

Strategy: Make one trawl in each grid square, its position as near as possible to the centre of the square, without regard to time of day, depth, or bottom characteristics.

Operational achievements: During the two months, 199 trawl stations were occupied during 16 cruises. Only 150 grid squares (70% of total) were sampled at one or more stations. Large deviations from planned course due to tide and navigational deficiencies had the effect of displacing trawl positions away from the centre of a planned grid square, even into an adjoining square, resulting in sampling being omitted from some squares and being duplicated in others. Navigational problems arose from lack of distinctive landmarks when in sight of the low-profile featureless coast, and lack of method for position fixing out of sight of land. The sampling provided a fairly comprehensive and representative coverage of the area.

Conclusions: This reconnaissance provided the first data on depth topography, sedimentation, and distribution and abundance of so-called trash organisms. The bottom over most of the area sloped gently from shore to seaward. The sediments were extremely monotonous, comprising blue-grey muds and muddy sands. They had higher lutite content nearest the shore line and changed to clean or almost clean sands along the northern part of the survey area. Broken shell in various sizes was a constant component but larger shell fragments and small pebbles were more characteristic of the

deeper areas to the north, and also near the islands. The area was generally poor in sedentary organisms. Sessile forms such as sponges, gorgonian fans and whips, and certain bivalves (*Spondylus*, *Ostrea*, *Malleus*) were characteristic of hard bottom comprising broken shell and bryozoan corals. Portions of the western sector were too foul for trawling. The trash comprised mainly vagile organisms, notably fish of many species, mantis shrimp and crabs. The swimming crabs *Charybdis callianassa* and *Portunus pelagicus* were very abundant.

This preview of the area confirmed that commercial species of prawns in the area comprised banana (*Penaeus merguiensis*), tiger (*P. esculentus*), blue-leg king (*P. latisulcatus*), red-spot king (*P. longistylus*), panda (*P. monodon*), Endeavour (*Metapenaeus endeavouri*), greentail (*M. insolitus*), York (*M. eboracensis*) and rainbow (*Parapenaeopsis sculptilis*). Non-commercial prawns included coral (*Parapenaeopsis cornutus*), go-home (*Atypopenaeus formosus*) and several species each of hardback (*Trachypenaeus* spp.) and New Guinea (*Metapenaeopsis* spp.). Small catch rates, varying from a few individuals to about 13 lb per 30 minutes, were not encouraging, but no trawling was done in depths exceeding 17 fathoms and fishing effort was strongly biased towards daylight (91%). The most promising area appeared to be that bounded by Mornington, Bountiful and Bentinck Islands where mixtures of banana, tiger, blue-leg king and Endeavour prawns were taken even in daylight. One catch of 7 lb of banana prawns in 8 fathoms seaward of Duck Creek (Stn 22) was probably an indication of schooling activity in the area later fished intensively for this species. Its significance was not appreciated at this time.

(b) Second Quarter (30 September - 28 December 1963)

Objectives: Three, in the following order of priority. (1) Examination in more detail of the area that showed most promise, placing greater emphasis on

night fishing, (2) re-examination of the area generally, particularly inshore as a check on seasonal changes in distribution and abundance, and (3) make tests to compare the fishing power of balloon and flat trawls in sampling prawns and trash organisms.

Strategy: Objective 1 was to be met by fishing in normal commercial fashion, adopting trawling durations of one or two hours, and making trawl paths continuous over restricted areas of favourable bottom. Fishing was to be mainly at night during the darker phases of the moon. Objective 2 would be attempted during less favourable fishing periods, with one 30-minute trawl per grid square principally in the band between shore and 30 miles seaward. Work would be brought closer inshore to provide shelter during adverse weather likely to be associated with the onset of the summer monsoon. Objective 3 was to be achieved at a time convenient to the other projects, adopting parallel trawls of 30-minutes duration at a selection of sites having different depths and bottom characteristics.

Operational achievements: During the three months, 322 trawls in 121 grids were made during 17 cruises. Cruises 17, 23, 24, 27 and parts of Cruises 21 and 29 were conducted in normal commercial style mainly within a radius of 12 miles from Sydney Island. 25 daylight and 8 night trawls were made towards full moon, 6 daylight and 21 night trawls between full moon and first quarter, 3 daylight and 17 night trawls between third quarter and new moon, and 9 daylight and 15 night trawls at new moon.

Cruises 18, 22, 25, 26, 28 and parts of Cruises 20, 21 and 29 were engaged with general reconnaissance, carrying out 30-minute daylight trawls at the rate of once or twice per grid square. Weather conditions became bad during Cruise 29 so the remaining portion of that cruise and the succeeding ones were worked close inshore along the coast between

the mouths of the Albert and Gilbert Rivers.

The fishing power tests on the balloon and flat trawl type nets were conducted during Cruises 19 and 20. Eleven pairs of 30-minute trawls were made by towing one type of net from a marked position and towing the other type net back to that position. These were made during daylight in depths of 3, 5, 6, 7 and 8 fathoms in grid squares 6695, 6696, 6607, 6610, 6794, 6893, 6894, 7294, 7206 and 7499.

Conclusions: Fishing tests in the area between Mornington, Bountiful and Bentinck Islands confirmed that this area showed most potential but catch rates were too low for profitable commercial exploitation. Catch rates of tiger prawns were 20 lb or less per hour in 93% of the trawl series, reaching 30 lb per hour on only two occasions and 50 lb per hour on two others. Tiger prawns were caught more consistently (92% of trawls) and in greater quantities than the other species. Combined catch rates of the other species amounted to about 5 lb or less per hour in over 90% of the trawls. Banana prawns were taken in 71% of the trawls and Endeavour prawns in 68% of the trawls, but catch rates of banana prawns were consistently higher than those of Endeavour prawns (trace to 20 lb per hour compared with trace to 8 lb per hour). Catch rates of banana prawns exceeded 5 lb per hour on eight occasions but catch rates of Endeavour prawns exceeded this amount on only two occasions. Blue-leg king prawns were rare, especially during daylight, only traces being taken in 15% of the trawl series. Catch rates improved at night especially in the tiger and banana prawn components. Some of the higher catch rates were during Cruise 21 even although the greater part of trawling effort was in daylight during full moon (12.4 lb per hour). Cruises 23, 24 and 27 all had high proportions of night trawls. Cruise 23 worked during last quarter to new moon (15.6 lb per hour) and Cruise 27 worked during full moon to first

quarter (11.9 lb per hour), gave marginally better results than Cruise 24 worked during the dark phase of the lunar cycle close to new moon (11.8 lb per hour).

A report on the results of tests comparing the fishing powers of two designs of trawl net has been prepared for publication elsewhere. Catches from ten pairs of parallel trawls were compared on the bases of total catch weight, number of species, and catch rates of individual organisms. The "flat" type net proved superior to the "balloon" type net for total organisms on all three bases. Samples comprised 123 species which were grouped in twelve categories. In terms of number of species, the nets performed equally only for ponyfish (Leiognathidae) and scyllarid lobsters (mainly *Thenus orientalis*), the "flat" trawl was equal to or slightly superior in catching sedentary invertebrates, swimming crabs, other crabs, mantis shrimp, bottom fish (flatfish and Platyccephalidae), leatherjackets (*Paramonacanthus*), other fish and cephalopods (squid and cuttlefish), and the "balloon" trawl was equal to or slightly superior in catching sessile invertebrates and penaeid prawns. In terms of catch rates of individuals, the nets performed equally only for cephalopods, the "balloon" trawl was equal or slightly superior in catching sessile invertebrates and scyllarid lobsters, and the "flat" trawl was always superior in catching larger numbers of the other nine categories of organisms listed above.

(c) *Third Quarter (2 January - 27 March 1964)*

Objectives

Because unstable working conditions, including cyclonic disturbances, were to be expected during the monsoon, the commercial style of fishing tests were to be suspended in favour of two other objectives: (1) Coverage of as much as possible of the whole area as seasonal repetition of sampling carried out during the early reconnaissance of the first

quarter; (2) Detailed investigation of shallow areas close inshore near river mouths where concentrations of smaller prawns (banana, greentail, York and rainbow) should be as a result of flushing from the rivers during the wet season.

Strategy

When weather permitted 5-day cruises were to be undertaken to make one trawl as near as possible to the centre of as many grid squares as possible. Shorter cruises were also to be made to areas close to port to sample in shallow areas off river mouths.

Operational achievements

During the three months, only 188 trawl stations were operated during 17 cruises. Foul weather conditions and various misadventures mitigated against the objectives being achieved. *Rama* caught fire on 6 January and time was lost in repair of after deck and wheelhouse. She had to shelter in the Albert River during cyclone "Little Audrey" early in Cruise 35. Time was lost training a replacement for an assistant who was hospitalized. Early in Cruise 38 *Rama* broke down at Pisonia Island with electrical faults and no radio contact. She was located by aerial search and towed back to port. The first ten days of February were too rough to work during cyclone "Dora". On 8 February *Rama* was struck by lightning which destroyed the radio and compass and magnetized metal structures and machinery causing excessive deviation of compass headings. Further delay was caused by replacement of metal parts and recovery of a new compass which went astray in delivery necessitating a charter flight to Mt Isa over flood-bound countryside. Overcast weather delayed swinging the new compass on azimuths. *Rama* was fully functional again by March 15. Despite lost time sampling was achieved in 107 grid squares (50% of total). Many of these grids were close inshore and excellent coverage was made with respect to the second objective.

This coverage was sufficiently extensive to give reasonable assessment of the potential of the areas adjacent to river mouths during the months January to March.

Conclusions

The weather was too unstable during the summer monsoon, including cyclonic disturbances and rough seas, for vessels to operate satisfactorily or venture very far from shelter.

Stations that were worked in depths of 8-18 fathoms during Cruises 38 (near Mornington Island in daylight), 44 (northern central area at night), 48 (south-west of Bountiful Island in daylight) and 50 (western sector of the eastern half wide of Gilbert and Smithburne Rivers partly at night) showed presence of banana, tiger, Endeavour and blue-leg king prawns. Being of nocturnal habit, larger numbers showed at night but even tigers were not sufficiently abundant to attract commercial interest. Banana prawns started to show in depths of 8 fathoms or more in the eastern part of the area late in March.

Smaller prawns taken close inshore in depths of 6 fathoms or less, particularly in depths of 3 fathoms or less, comprised four species of possible commercial interest, namely juvenile banana, green-tail, York and rainbow. The four species were taken together fairly consistently along most of the mainland shore and quantities in some areas were sufficiently large to attract commercial interest, e.g. catch rates per 30 minutes of 40 lb (Staaten River), 50, 80, 115 and 270 lb (Duck Creek), 50 lb (Van Diemen Inlet, Smithburne River) and 60 and 90 lb (Albert River). These were available during daylight fishing but night fishing would be difficult because of shallow depths and lack of fishing landmarks. Another problem was the abundance of jellyfish which made nets too heavy to land and the prawn catch too hard to separate. Jellyfish sometimes were taken at rates up to 15 baskets per 30 minutes. Counts per pound were

respectively 14-100 for banana, 20-100 for rainbow, 50-150 for York and 70-330 for greentail. For the majority of samples (70-75 %) these counts were respectively 25-80 for banana, 40-70 for rainbow, 90-100 for York and 200-300 for greentail. Some of the rainbow prawns had an iodine taint making them unsuitable for marketing.

(d) *Fourth Quarter (30 March - 29 June 1964)*

Objectives: Four, with priority to the location of commercially payable quantities of larger prawns suitable for the export trade. (1) Attempt to re-examine the survey area as a whole to determine seasonal differences between the post-monsoon period and that before the monsoon when the original reconnaissance was made. (2) Devote particular attention to deeper water in the hope of locating larger quantities of nocturnal species such as tiger prawns. (3) Investigate inshore shallows to determine post-monsoon status of abundance, schooling behaviour and growth of adolescent banana prawns and associated smaller species, and to follow their migrations from river mouths into deeper water. (4) Carry out some gear research with a view to improving the effectiveness of nets and fishing power generally.

Strategy: Make at least one trawl in as many grid squares as possible and so obtain a reasonably comprehensive coverage by area. Devote some cruises to daylight trawling in the inshore fringe of shallow water along the mainland coast between the Nicholson and Staaten Rivers. Devote remaining time to trawling at night in the deeper parts towards the centre of the survey area, and also possibly extend operations north of Mornington Island to obtain access to a wider area of deeper water. A gear technologist from the Department of Primary Industry would accompany one or more cruises to advise on search and trawling techniques, and the most efficient rigging and use of gear.

Operational achievements: During the three months elapsed, 331 stations were occupied during 17 cruises. Only 138 grid squares were visited within the survey area (64% of total) but nine just outside the northern boundary were also sampled. The grid squares not sampled were mainly those in the south-west corner (hard unproductive bottom) and reefy unworkable areas adjacent to Mornington Island.

Cruises 51-56 during April (Stns 710-857, comprising a relatively high proportion of night trawls) provided the general coverage. At the end of this tenth month of survey there was sufficient data for the plotting of preliminary depth contour and sediment distribution charts, and these proved to be extremely useful in planning all future operations.

During May Cruises 57-61 (Stns 858-946, all in daylight) provided comprehensive coverage of the inshore zone comprising depths less than 5 fathoms. Only small numbers of the several species of smaller prawns were caught indicating the concentrations present during and immediately after monsoonal rains had dispersed, but jellyfish were still extremely abundant.

A gear technologist accompanied Cruise 62 and supervised the working of 15 daylight and 21 night stations along a suspected migration path of banana prawns from Albert River towards Sweers Island and thence eastwards towards the centre of the survey area. On two consecutive nights (24-25 May) while trawling in 11-13 fathoms, a few promising lifts of tiger prawns (6-70 lb per 30 minutes) preceded the detection by echo sounder of a large concentration of banana prawns in "balled-up" formation. 600 lb of banana prawns were taken out of the school during the last few minutes of Stn 981. The following trawl lifted 80 lb each of banana and tiger prawns.

After unworkable weather during the first half of June, Cruises 65-68 searched for further concentrations of banana prawns with 29 daylight and 39 night

trawls in 10-13 fathoms. This search was in the centre of the survey area and a suspected migration path from Duck Creek westward towards the centre of the survey area. There were a few lifts of 10-25 lb of tiger and banana prawns per 30 minutes. At Stn 991 a concentration of banana prawns yielded 280 lb per 30 minutes in 12 fathoms during early afternoon.

Conclusions: Location and capture on two occasions of adult banana prawns in "balled-up" concentrations, and some improved catch rates for tiger prawns (up to 80 lb per 30 minutes) were the first encouraging signs during the first eleven months of trawling, that the Gulf was likely to have sufficient potential to encourage commercial exploitation.

That a completely new approach to search for banana prawns was needed was evident from size distribution observations during the third and forth quarters and the discovery of place and time of "balled-up" adult concentrations. Experience of Bundaberg trawermen since 1954 had indicated that the "balls" and associated "mud boils" were in quite shallow depths within a few kilometres of river mouths, but this was not so in the Gulf. Schools of juveniles occurred in coastal shallows (3 fathoms or less) during the wet season and 75% of these were of 25-80 count (per lb) and half of the remainder of 80-100 count. By early May numbers were reduced to scattered individuals and those of 80-100 count had disappeared. Those of 25-80 count had become scattered widely from the shore to 10 fathoms, and those of 10-25 count equally widely distributed but extending to 13 fathoms. This inferred that the coastal shallows and river mouths served as nursery grounds during summer but after the wet season banana prawns grow and migrate to deeper waters where adults form up into large dense schools. The three large catches comprised individuals averaging 14 count. The schools were in 11.5-12 fathoms in grids 6901 and 6902 situated near the centre of the survey area and about 80 km from river nursery grounds along the southern and eastern mainland shores.

The preliminary depth contour chart compiled in June 1964 was based on limited data (Stns 522-982), and although grossly simplified, it provided a basis for directing operations until a revised version (Stns 1-1050) was compiled. An important feature was a tongue-shaped area of gutter between the 10 fathom and 11 fathom contours projecting through grids 6901 and 6902 north-east into grid 6802. The stations where the 'balled-up' concentrations of banana prawns occurred were located in this gutter, Stn 991 north of the 10-fathom tongue-shaped contour, and Stns 981 and 982 south of it (see Figure 8 in which this feature is marked with an enclosing circle).

One such concentration was at about midnight at tidal LW on tidal cycle day neap +1, and the other during early afternoon close to tidal HW on tidal cycle day neap -3, suggesting that such schooling might occur at times of least tidal movement. On this basis, search for large concentrations of banana prawns which might be detected by echo-sounder, should be carried out during periods from several days before the neaps ("double tides") to several days after the neaps. Also such search might be most profitable during periods of several hours around times of tidal HW and LW. Such times would be during daylight and night respectively according to the tidal cycle pattern (diurnal tides) at this season of the year.

(e) Fifth Quarter (1 July - 29 September 1964)

Objectives: The primary objective was to fish systematically in likely places at likely times in an endeavour to catch commercially payable quantities of the more important species such as banana and tiger prawns. However, some effort was to be devoted to more generalized reconnaissance in selected areas within the survey area, and perhaps outside it, and to monitor trends in habitats from which considerable data had been collected already.

Strategy: Trawling effort was to be concentrated in the deeper more open central sector of the survey area where experience had indicated best promise of yields of banana and tiger prawns in commercial quantities. Use would be made of depth contour and sediment configurations and tidal information in searching for these species. Large schools of banana prawns would be tracked by systematic sampling at close intervals in selected areas and along suspected migration paths from shallower water. Search for banana prawns would be conducted during daylight and at night and the echo-sounder would be used extensively to detect schools in 'balled-up' condition.

Operation achievements: During the three months, 377 stations were worked during 13 cruises. Only 109 grid squares were visited and 24 of these were outside the survey area. In order to examine the bottom and check productivity of the north-east extension of the survey area one cruise (Cruise 70 comprising 35 daylight and 8 night trawls) made four east-west traverses up to about 60 km seaward of the coast between the Staaten and Nassau Rivers.

Little attention was paid to inshore waters less than 4 fathoms, namely only seven stations within the survey area and another eight north of the Staaten River.

The central and northern parts of the survey area was sampled much more intensively than during the previous eleven months. Twenty trawls were made in the sector between Bountiful Island, Sydney Island and Cape Van Diemen, and bad weather prevented more extensive trawling in that area. The remainder of time was spent mostly east of 139°54'E longitude and between the sandy northern stretches and 17°12'S latitude. Eleven cruises were devoted to searching and trawling in this area.

A depth contour chart compiled in June 1964 from limited data (Stns 522-982) served as a basis for directing

operations. The tongue-shaped area of gutter between the 10 and 11 fathom contours where "balled-up" schools of banana prawns that had been found (Figure 8, in circle) became a focal point in the search for further concentrations of banana prawns. During all cruises except 70 and 76 all or most of the trawling was carried out within a radius of about 40km of this tongue. Three of these cruises followed possible migratory paths through various depth ranges from the eastern shore into the central circle.

During July banana prawns were taken consistently during both daylight and night during Cruises 69 and 71. Catches up to 10.5 lb per 30 minutes were made in daylight and up to 21 lb per 30 minutes in association with tiger and Endeavour prawns at night during Cruise 69 in 7-12 fathoms. On two consecutive nights during Cruise 71 in the area between the 10-11 fathom tongue and the 18 fathom gutter off Bountiful Island, banana prawns were taken in quantities up to 30 lb per 30 minutes along with tiger and Endeavour prawns. A catch of 40 lb per 30 minutes was taken in daylight at Stn 1168 in grid 6701.

Promising quantities of banana prawns were taken again in August in association with tiger and Endeavour prawns during Cruises 72, 73 and 74. The only good showing of banana prawns during Cruises 72 and 74 were within the area between the 10-11 fathom tongue and the 18-fathom gutter. Cruise 73 which had consistent consecutive showings was confined to that area. During Cruise 72 two consecutive trawls yielded 40 lb and 10lb of banana prawns per 30 minutes at night in 10-12 fathoms (Stns 1208-1209). During Cruise 73, banana prawns showed consistently in 10-14 fathoms during both daylight and night, the best catches being 25 lb per 30 minutes just after dark (Stn 1219 in grid 6800) and 200 lb per 30 minutes in mid-afternoon (Stn 1223, also in grid 6800), both in 11 fathoms. Cruise 75, which worked daylight stations, caught virtually nothing.

During September small numbers of banana prawns were taken along with tiger and Endeavour prawns at night between Sydney and Bountiful Islands but not at the stations worked in the central area also during Cruise 77. During Cruise 78 a "ball" was found in daylight in 8 fathoms (Stn 1346 in grid 7103) during a traverse from Brannigan's Creek towards the 10-11 fathom tongue. It yielded a catch of 300 lb per 30 minutes. *Rama* was joined by the Mostyn Company trawler *Toowoon Bay* and the area around this station was worked intensively during Cruise 79, but only small numbers of banana prawns showed and these were consistent only at night. The best lifts were 6 and 10 lb per 30 minutes in 8-9 fathoms at night in grid 7001. During Cruise 80 a catch of 140 lb of banana prawns per 30 minutes was taken at night in 8 fathoms (Stn 1393 in grid 7002). During this and the following night, a little to the east of this position, banana prawns showed in consecutive trawls, yielding 6-14 lb per 30 minutes.

Tiger and Endeavour prawns were usually taken along with the banana prawns during night trawling. Tiger prawns were caught at the rate of a few individuals up to about 10 lb per 30 minutes until Cruise 80 which yielded 9 to 50 lb through seven consecutive 60 minute trawls in 11-12 fathoms. The same series of trawls provided a few better catches of Endeavour prawns, 10 to 30 lb per 60 minutes, being in contrast with catch rates of a few individuals to about 3.5 lb per 30 minutes for the rest of the quarter. Counts per pound were mainly in the ranges 11-15 for banana, 12-14 for tiger, and 11-17 for Endeavour prawns.

Conclusions: The few trawls made in coastal shallows that caught few or no small prawns seemed to indicate that there were no large concentrations of greentail, York, rainbow or juvenile banana prawns in that environment during July to September.

Cruise 70, which worked the area seaward of the Staaten to Nassau Rivers adjacent to the north-east part of the survey area, demonstrated that the bottom was of hard sand and shell with areas of coarse shell and small pebbles, and reef outcrops. It appeared to be an extension of similar bottom which stretches across the northern part of the survey area from the Gilbert River towards the 18-fathom gutter off Bountiful Island. It appeared to be unproductive and generally unsuitable for trawling.

Investigations during this fifth quarter substantiated conclusions on distribution and probable abundance of the principal species of commercial size prawns. The area selected for detailed investigation on the results of the first year of general reconnaissance was a good choice, and the catch rates achieved by *Rama* and *Toowoon Bay* gave further encouragement for commercial exploitation.

Tiger prawns continued to show fairly consistently in most night trawls with catch rates per 30 minutes of 21-25 lb (1 station), 11-20 lb (2 stations), 6-10 lb (15 stations), and 1-5 lb (66 stations).

Continuing sporadic good lifts of banana prawns indicated that there must be reasonably large populations resident in the area at this season of the year. Catch rates per 30 minutes of 21-40 lb (5 stations), 11-20 lb (6 stations), 6-10 lb (14 stations), and 1-5 lb (43 stations) were evidence of general presence in the area, and possibly some indication of schooling activity at times. The large catches of respectively 140, 200 and 300 lb were evidence that 'balled-up' concentrations were still in the area. The eight larger catches (21-300 lb per 30 minutes) came from grids 6701, 6703, 6800, 6801, 6802, 7002 and 7103, three of the stations being associated with the 10-11 fathom tongue, three a little north of it and two a little south of it. Three catches were in daylight and five at night. Six were made within 1-3 hours of tidal LW and two 3-4 hours after HW.

Also four were 2-3 days before or after neap tides and four were 5 days before or after neap tides. These observations tended to confirm the theory that schooling activity of banana prawns was associated with periods of low water movement namely slack water (HW or LW) within a few days of neap tides, and that 'balling-up' was in areas with particular bottom configuration.

(f) *Sixth Quarter (3 October - 15 December 1964)*

Objectives: The main objective was to continue to search systematically through a wide range of depths, and particularly in several selected areas, for the two main commercial size prawns, namely tiger and banana prawns. Some time would be devoted to closer examination of the area between the grounds worked in the fifth quarter and the grounds between Bountiful and Sydney Islands. Some investigation would also be made of the extreme south-west corner of the survey area.

Strategy: Survey trends had changed during the fifth quarter from general reconnaissance to commercial style fishing search. Commercial style fishing had become easier with the support of a commercial trawler *Toowoon Bay* which would work side by side with the survey vessel. Both vessels would work systematically during day and night. Operations would include trawling along traverses across the survey area from base towards Bountiful and Bentinck Islands, and fishing in the central area, the sector between Bountiful and Sydney Islands, and between Bentinck Island the mainland. This would provide a greater proportion of trawling in depths less than those worked during the previous quarter. Work would not be carried out in the shallow coastal fringes of the east and south mainland shores unless monsoonal weather prevented trawling elsewhere.

Operational achievements: During the three months only 180 stations were

worked during 11 cruises. Sixty-five grid squares within the survey area were visited and virtually no sampling was carried out along the coastal fringe from the Nicholson River to the Staaten River. Of the 11 cruises undertaken, only one (Cruise 84) accomplished a full six-day operation away from port. Cruises 88 and 89 were operated on a day basis from port because of unsettled weather. All others were curtailed to some degree because of unworkable weather conditions and mechanical breakdowns. No work was done during Cruise 91 due to the bad weather associated with cyclone "Flora", and both vessels sustained damage and loss of gear in returning to the shelter of port on 5 December. The survey vessel *Rama* was immobilized until 15 January due to damage to her motor and the subsequent fitting of a new one.

Some trawling was carried out in the area between the 18-fathom gutter off Bountiful Island and positions south of the 10-11 fathom tongue, working in depths of 8-15 fathoms. This was done in October (Cruise 82 and Cruise 84 part, Stns 1510-1518) and November (Cruises 85, 86 and Cruise 90 part, Stns 1600-1607). During Cruises 82, 85 and 86 and part of Cruise 84 (Stns 1514-1518) trawling was at night and tiger and Endeavour prawns showed to some extent fairly consistently through each series but banana prawns were extremely sparse. The largest catch of banana prawns was 3 lb in 30 minutes at Stn 1535 and was of the order of about 0.5 lb per 30 minutes at four others. Tiger prawns were taken at the rate of 1-9 lb and Endeavour prawns at the rate 1-4 lb per 60 minutes during Cruise 82 and were present in every haul. They were far less consistent in the night trawls of the other cruises, the largest catch being 16 lb of tiger prawns and 3 lb of Endeavour prawns per 60 minutes at Stn 1526. There were no significant catches during daylight.

Late in October (Cruise 84 part, Stns 1472-1491 and 1519-1523) and through November (Cruises 87, 88, 89 and Cruise 90 part, Stns 1562-1568) the shallower areas in the 1-9 fathom depth range were investigated in the hope of locating banana prawns which may have moved out of the rivers after early rain. It was considered that this zone would be worth monitoring through the whole duration of the wet season. These five traverses radiated from the mouth of the Norman River from north to west but failed to find significant quantities of prawns. A few small tiger, Endeavour and banana prawns were taken mainly at night in 6-8 fathoms in October. The only catch worth mention was from Stn 1555 where 0.6 lb banana, 3 lb greentail and York and 4 lb of rainbow prawns were taken in 4 fathoms in daylight during 30 minutes trawling near the mouth of the Norman River.

The general area between Bountiful, Sydney and Bentinck Islands had been worked with some success during this season in 1963. It comprises a basin with muddy bottom, divided by raised banks and characterized by strong tidal flow. It was trawled in October (Cruises 81, 83 and Cruise 84 part, Stns 1501-1509) and again in November (Cruise 90 part, Stns 1589-1599). During the three visits in October, 41 stations were worked at night and the remaining four in daylight. Twenty-four stations were worked around full moon (bright period) and 12 at new moon and 5 in the last quarter (dark periods). Consecutive series of trawls at night during the three cruises in October consistently took tiger prawns. Endeavour prawns were caught less frequently and in lesser quantities. Very few banana prawns appeared in the catches. Day trawling produced almost nothing. Tiger prawns were caught in quantities in the ranges of 2-35 (mean 10) lb, 1-13 (mean 4) lb, and 2-6 (mean 5) lb per 60 minutes respectively during the three series of night trawls. Endeavour

prawns, when present, were taken at rates of only 1-4 lb per 60 minutes. Banana prawns were taken in quantities of 1-9 lb per 60 minutes at only eleven stations.

The commercial trawler *Toowoon Bay* accompanied the survey vessel on eight cruises and worked close by in the central parts of the survey area and in the sector bounded by Bountiful, Bentinck and Sydney Islands. Her gear was adjusted to fish more heavily than that of *Rama*. During the period 3 October to 10 November she fished only at night in depths of 6-13 fathoms. During 15 nights she made 64 shots occupying 81.5 hours. It is estimated that she caught a total of 554 lb comprising 380 lb of tiger, 86 lb of banana, 78 lb of Endeavour and 10 lb of blue-leg king prawns. During the same period in the same area *Rama*, in addition to day work, during 13 nights made 74 shots occupying 63.5 hours. It is estimated that her catch was 404 lb comprising 301 lb of tiger, 32 lb of banana, 60 lb of Endeavour and 11 lb of blue-leg king prawns. Both catches were much lower than those obtained by *Toowoon Bay* during 17-28 September when over 7 nights she made 42 shots occupying 42 hours and landed an estimated 780 lb comprising 487 lb of tiger, 130 lb of banana, 153 lb of Endeavour and 10 lb of blue-leg king prawns.

The area in the south-west corner between Bentinck Island and the mainland coast between Point Parker and the Nicholson River had received little attention during previous quarters. This was visited twice mainly to obtain size and distribution data on smaller tiger, Endeavour and blue-leg king prawns. In October (Cruise 84 part, Stns 1492-1500) night trawling in 2-4 fathoms obtained small numbers of juvenile tiger, Endeavour and blue-leg king prawns of count per pound respectively of 57-91, 70-122 and 57-113. A longer series of stations in 2-5 fathoms were worked in daylight during November (Cruise 90 part Stns 1569-1588). Tiger prawns of count

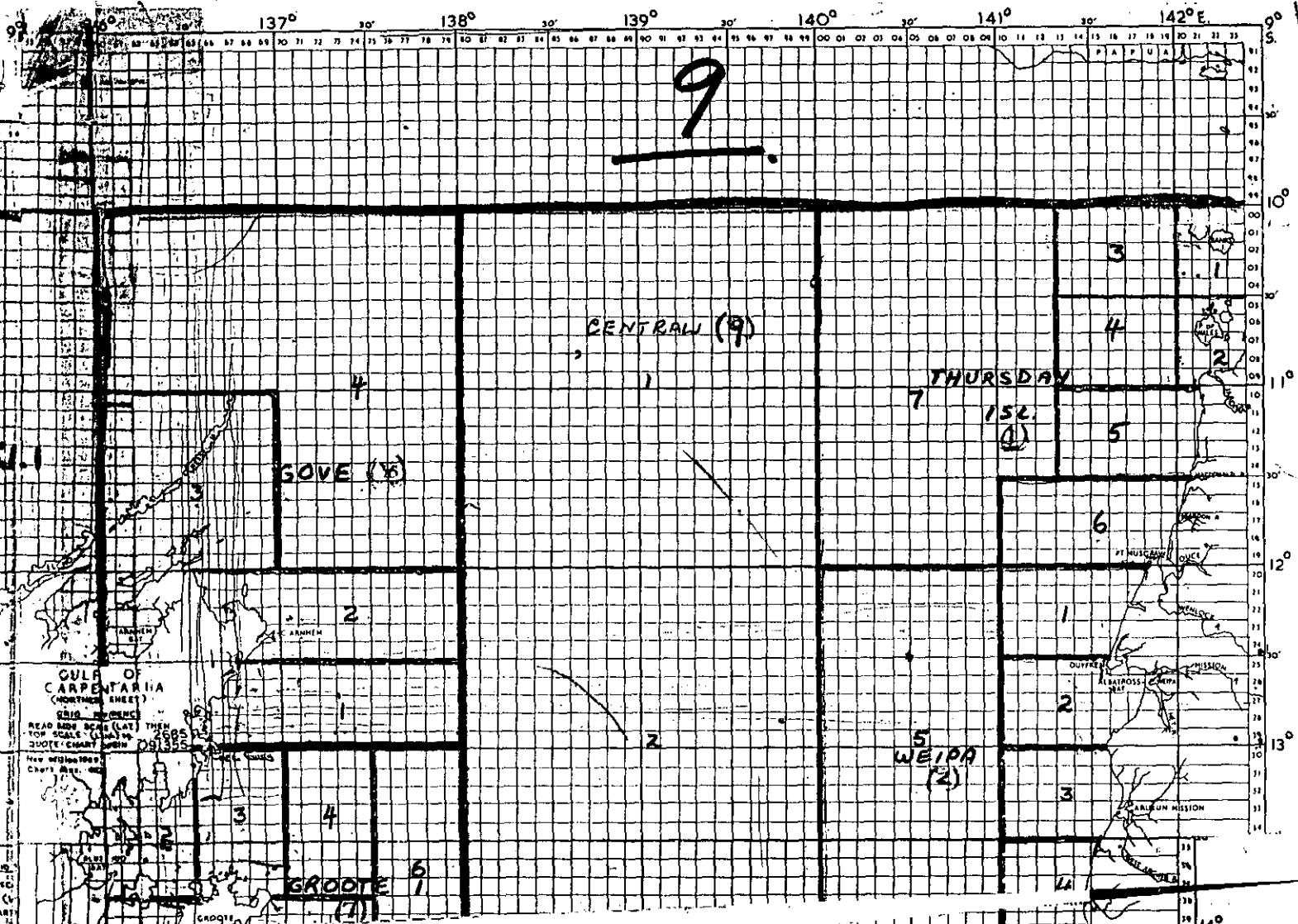
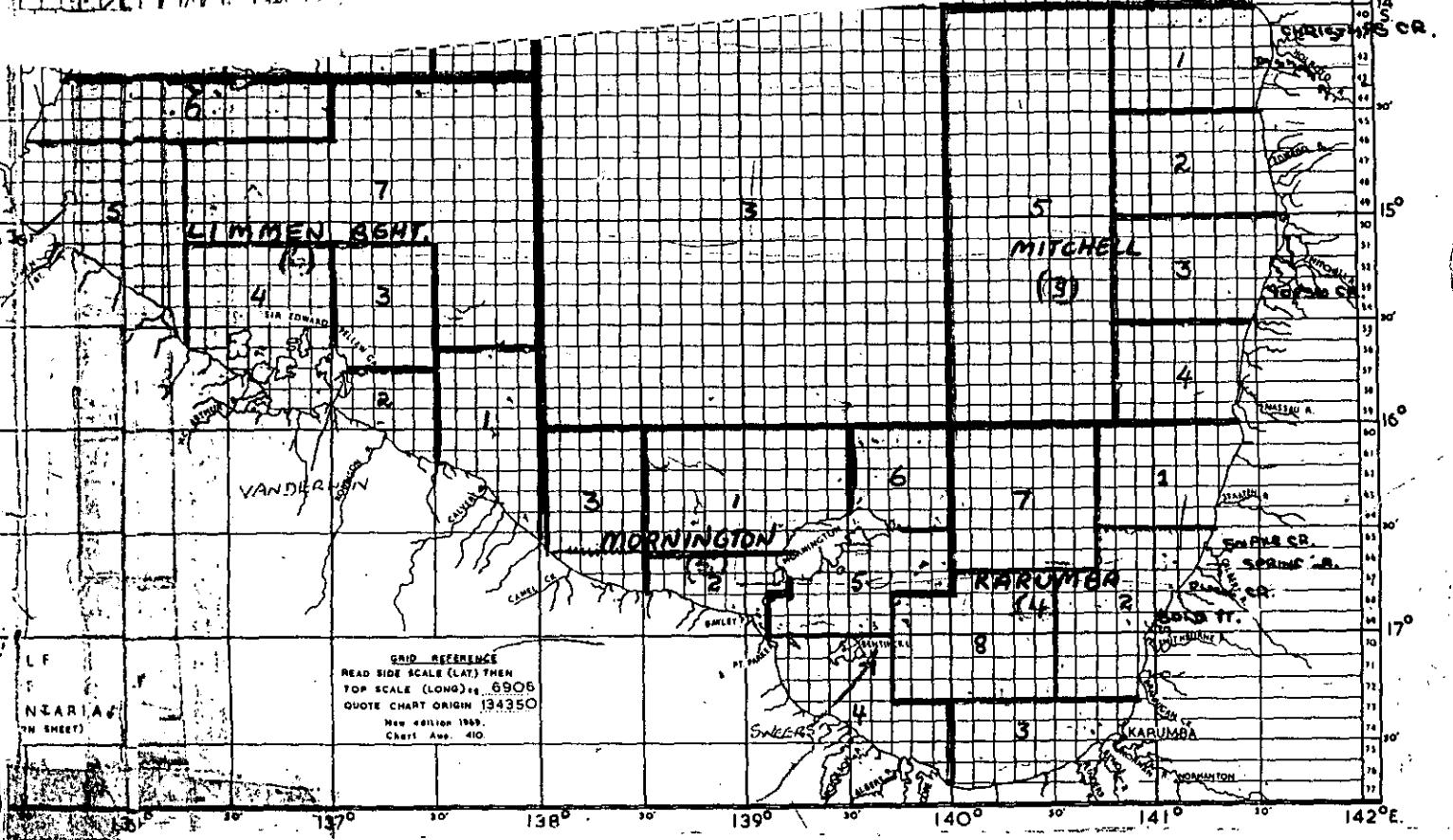
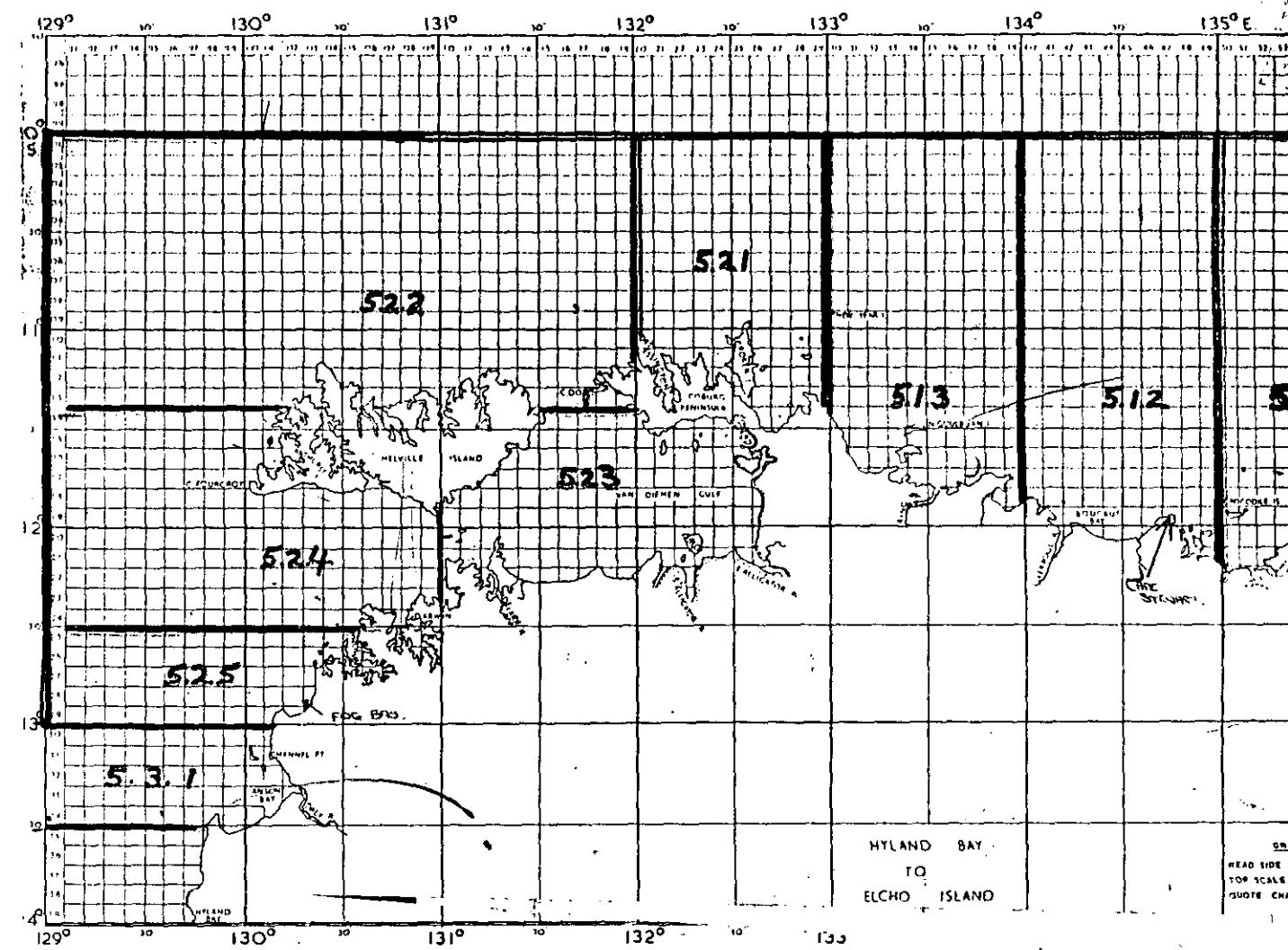
35-76 were taken at seven stations and *Endeavour* prawns of count 45 were taken only twice. Very few banana prawns were noted in this area.

Conclusions: Trawling results were most disappointing especially in view of encouraging catch rates obtained during the fifth quarter. Even in the most productive areas found to date the catches were lower than in the previous quarter, and for all species combined *Rama* averaged only 6.4 and *Toowoon Bay* averaged only 6.7 pounds per 60 minutes respectively.

Banana prawns had become very scarce, the largest individual catches per 60 minutes were 9 lb for *Rama* and 15 lb and 24 lb for *Toowoon Bay*. These low amounts suggested that the big schools had dispersed or migrated elsewhere, perhaps into deeper water outside the survey area.

Tiger prawns continued to show consistently during night trawling but at this season were scarcely abundant enough to support commercial trawling. The largest individual catches per 60 minutes by *Rama* were 16 lb and 35 lb respectively from grounds east and west of Bountiful Island. *Toowoon Bay* never took more than 15 lb of this species per 60 minutes.

As in previous quarters it was noted that catch rates of tiger and Endeavour prawns improved at depths greater than 8 fathoms but this depth range combined with suitable bottom did not constitute the major part of the survey area. At this stage it was concluded that the main reservoir of stocks of these species might well be in the deeper waters outside the survey area. The fringes of these populations which came into the survey area might also be seasonal and account for diminished catches during the current quarters. It seemed desirable to extend operations at least to the north of Mornington Island to explore the potential of these species in the hope of finding a steady non-seasonal commercial sized resource.



Catching of small prawns off the mouth of the Norman River later in November indicated that juvenile banana prawns and greentail, York and rainbow prawns were again schooling in coastal shallows.

Juvenile tiger, Endeavour and blue-leg king prawns occur in the shallow waters of the south-west corner adjacent to the islands.

(g) *Seventh Quarter (15 January - 2 April 1965)*

Objectives: Emphasis was again placed on continuing survey operations with commercial style search and fishing methods and support of commercial vessels, with two definite objectives. (1) Extend operations into deeper waters immediately outside the survey area in search of non-seasonal commercial-size stocks of tiger, Endeavour and blue-leg king prawns. (2) Work within the main basin of the survey area during and immediately after river floodings to ascertain whether banana prawns congregate in schools as on the east coast of Queensland, and whether such schools could support a short intensive seasonal fishery.

Strategy: An operational plan to meet both objectives was agreed to by CSIRO and the Mostyn Company based on a 30-day cycle during which 24 days would be worked at sea and the remainder at Karumba. The refrigerated mother ship *Laakanuki* would serve as base for the trawlers either at Bountiful Island or Mornington Island Mission. The trawlers would search for banana prawns in the 3-7 fathom zone between the Flinders and Gilbert Rivers and thence in the 8-14 fathom area south-east of Bountiful Island, and in the 6-9 fathom basin between Bountiful and Sydney Islands. Also 7-10 days would be utilized in exploration of new areas exceeding 20 fathoms to the north of Mornington Island in search of tiger and Endeavour prawns. Priority would be given to intensive fishing for banana prawns if schools were detected in either of the major depth zones of the survey area.

Operational achievements: During the three months 329 stations were worked during nine cruises. Trawling was carried out in only 86 grid squares including ten outside the survey area to the north and west of Mornington Island. Because the search was confined to several restricted areas some grid squares were sampled many times, 6909 being sampled 17 times, 6804 13 times, 7097 and 7197 each 11 times.

The survey vessel was immobilized at Karumba until 15 January when she put to sea in company with *Toowoon Bay* and *Laakanuki* on the first of two 24-day cruises.

During the first 24-day period (Cruises 92 and 93) 8 days were lost through bad weather including storms and high winds, and no trawling was accomplished outside the survey area to the north of Mornington Island. Twenty five stations were worked in 3-6 fathoms between Bynoe River and Van Diemen Inlet, and a further 14 through 4-11 fathoms from Karumba to the central tongue. The remaining 98 were in a band south of 16°42'S latitude between Denham Island, Bentinck Island and the central tongue, and in an area off Bentinck and Sweers Islands east to 139°54'E longitude and south to 17°18'S latitude. Daylight trawls in the shallower waters of the eastern half of the survey area were totally unrewarding but a few traces of banana, York and rainbow prawns were noted in depths less than 5 fathoms. About 2-3 lb of tiger and Endeavour prawns were taken at each of two of the nine night trawls made between the 18-fathom gutter and the central tongue. During six nights of trawling in the general area between Mornington, Bountiful and Sweers Islands and the central tongue tiger and Endeavour prawns were caught fairly consistently but in disappointingly small numbers. Small numbers of banana and blue-leg king prawns also occurred in some of these trawls but total catch rates were well under 10 lb per 30 minutes. Tiger prawns were taken at rates of 5-7.5 lb per 30 minutes in only 6 trawls and

Endeavour prawns at 1-3.5 lb per 30 minutes in most of the trawls. Small numbers of banana prawns were caught during daylight and night in the areas to the south and south-east of Sweers Island, and were accompanied by Endeavour, greentail, York and rainbow prawns. During 33 trawls banana prawns were taken at the rate of 1-5 lb per 30 minutes in 10 trawls and Endeavour prawns at 1-1.5 lb per 30 minutes in only 4 trawls. Counts per pound were mainly 12-20, 15-40 and 11-25 respectively for tiger, Endeavour and banana prawns.

The second 30-day joint cruise was abandoned on March 17 after 16½ days were lost due to heavy seas and high winds. During Cruise 94 *Rama* made 17 daylight trawls in 2-5 fathoms between Accident Inlet and Duck Creek and two further seaward to the west. She then proceeded to Mornington Island Mission anchorage and worked 22 night stations outside the survey area with one traverse to the north and three to the west of Mornington Island. Also three daylight trawls were made to the south-east of Sweers Island. Several good catches were made in 2-4 fathoms while working in daylight between Accident Inlet and Duck Creek. Catch rates of small banana, greentail and York, and rainbow prawns per 30 minutes were respectively 7, 10, 30, 45 and 80 lb, 10 and 35 lb, and 7, 20, 25 and 60 lb. The night trawling to the north and west of Mornington Island was very disappointing. Tiger and Endeavour prawns showed fairly consistently but only in small numbers. The best catch was 11 lb comprising 1.5, 7 and 2.5 lb respectively of banana, tiger and Endeavour prawns per 60 minutes.

Three daylight cruises were worked in conjunction with *Toowoon Bay* mainly in depths of 1.5-5 fathoms to monitor distribution, growth and movements of small banana prawns. Small banana prawns had been observed to be very abundant in the Norman River during early March and appeared to be migrating away from their summer nursery grounds in that river. Cruises 95 and 97 worked 42 stations along the coast

between Accident Inlet and Duck Creek and Cruise 96 worked 23 stations off the mouths of the Norman, Bynoe and Flinders Rivers. The majority of these trawls took reasonable quantities of small banana prawns mixed with greentail, York and rainbow prawns. Banana prawns, greentail and York prawns and rainbow prawns were taken at rates per 30 minutes of up to 7 lb, 10 lb and 25 lb respectively. The catches were generally better along the coast north of Accident Inlet. Concentrations of jellyfish interfered with fishing.

A more refined depth contour chart incorporating data from Stns 1-1050 was now available as a guide to operations. A most noticeable feature of configuration was that the fathom interval contour lines were indented coastwise opposite all the river mouths, suggesting seaward continuation of the rivers across the gulf floor (see Figure 8). The large catches from "balled-up" concentrations of banana prawns during 1964 had been associated with these gutter-like depressions, and it was now thought that they may serve as migration paths for banana prawns moving from river nurseries into deeper water. In late March Cruise 98 was designed to test this theory. It operated as a north-west traverse through 7-10 fathoms towards the central tongue and then through 10-11 fathoms to an area centering on grid square 6804. Most of the trawling was at night and good commercial size banana prawns (13-15 count per pound) began to show well during the second night where consecutive 30-minute trawls in 10.5 fathoms yielded 20, 55, 170 and 45 lb between 2000 and 0200 hr. Two trawls during the same time interval on the third night yielded 25 and 35 lb. *Toowoon Bay* working around the same marker buoy made catches of 30 and 150 lb per hour on the second night and 150, 25, 8, 5 and 35 lb per hour on the third night. Tiger prawns also showed consistently on these nights ranging from a few individuals to 5 lb per 30 minutes. The cruise was cut short by logistic problems but both vessels returned to the same position for Cruise 99 but, after

working seven night stations to midnight, were driven back to port by bad weather. Tiger prawns and blue-leg king prawns showed at rates of 1-4 lb and a few individuals respectively per 30 minutes, while a total of only 4 banana prawns were landed.

The first part of Cruise 100 comprised three series of night trawls in 6-11 fathoms in an area bounded by grid squares 7296 and 7297 (south-east of Sweers Island), Bountiful Island, and a gutter in grid square 6800. The fourth night was spent in 9-11.5 fathoms along the central tongue, and the fifth night in 9-10 fathoms in the area between the central tongue and the Smithburne River where good catches of banana prawns were taken during Cruise 98.

During the three nights working west of 140°E longitude catches comprised a mixture of tiger, banana, Endeavour and blue-leg king prawns, totalling only 40-170 individual prawns per 30 minutes in half of the total trawls made, the best being 5 lb of banana prawns per 30 minutes. Throughout this series the banana prawns were small, counts being 20-45 per pound. The tiger prawns also were small, mainly with 18-65 count, and only a few catches reached 2 lb per 30 minutes. Trawling near the central tongue produced similar poor catches, and the catches were even worse in the 9-10 fathom area seaward of the Smithburne River, but banana prawns showed at all but the first station, and were of 13-16 count mainly. Indications improved by midnight when 7 lb of banana prawns per 60 minutes were taken but the weather changed and the cruise had to be abandoned.

Conclusions: Persistent bad weather particularly in the western sector during the first half of the quarter caused much loss of time, and seemed to indicate that trawling was unlikely to be a profitable operation at this season of the year.

The search for non-seasonal stocks of nocturnal prawns which might support commercial operations was a failure.

While tiger prawns, and to a lesser extent Endeavour prawns, showed fairly consistently in deeper water trawling at night both within and outside the survey area, catch rates were far too low to attract commercial operations.

Trawling tests in areas to the north and west of Mornington Island were not encouraging, yields being only comparable with those of the deeper parts of the survey area. Areas visited to the north and north-west of Mornington Island included large tracts of rough, reefy and untrawlable bottom. Areas to the west of Mornington Island Mission anchorage had much sand although there were patches of sandy mud similar to that within the survey area.

During this quarter several studies on banana prawns in the Norman River had been in progress. Size and sex composition studies on juveniles had confirmed that the lower reaches of this river had served as a nursery during the duration of summer and that there were no changes in size composition throughout this period. Studies on juveniles penned in floating cages demonstrated rapid growth and uniformity in size composition. Plankton collections had shown that there had been a continuous influx of larval stages into the river. These observations, supported by studies on gonad development in maturing and adult prawns, seemed to indicate that banana prawns had a prolonged spawning period. There appeared to be continuous recruitment of larvae to juvenile stocks in nurseries and continuous recruitment of adolescents seaward to fishable stocks through summer. Studies on river juveniles and fishing tests off the mouths of most of the rivers flowing into the area indicated that nursery areas were extensive and populations of juveniles and adolescents extremely large. Small prawns disappeared from the coastal fringes by the end of summer, and appeared to migrate into deeper water to mature and spawn. Isolated large catches had been made from compact schools in gutters within the 9-11 fathom zone from May through to September

1964. The good catches obtained wide of the Smithburne River during March of this quarter suggested that recruits, perhaps from early in this summer, had matured and were already schooling up in deeper water. Large concentrations of mature banana prawns were now known to occur in a particular sector of the survey area over a prolonged period of the year. Indications were that concentrations were already in this area and that future search for large schools might profit by working the gutter extensions of rivers, particularly the eastern rivers, into depths where previous catches had been made. It seemed likely from present indications that banana prawns could be caught in large quantities over a much longer season than was formerly expected.

(h) Eighth Quarter (4 April - 29 July 1965)

Objectives: Efforts were to be concentrated entirely in the search for, and the fishing in a commercial manner for, concentrations of adult banana prawns in the gutter systems offshore from the coast between the Smithburne and Gilbert Rivers. The quarter comprised the normal three-month period plus the month of July so that the survey would cover a full 24-month period.

Strategy: To search with echo-sounders along the gutter systems seaward of Smithburne River, Van Diemen Inlet, Duck Creek and Gilbert River, mainly in depths of 7-11 fathoms. Trawling effort would be divided between daylight and night, and concentrated during periods of slack water accompanying HW and LW and especially during periods of neap tides. On detection of schools by echo-sounder traces or mud boils marker buoys would be placed for reference. Toowoon Bay would work side by side with the survey vessel, and two other commercial trawlers sponsored by the Mostyn company were to join the fleet during the second half of this quarter.

Operational achievements: Trawling operations were confined to the north-east quadrant of the survey area between 16°30' and 17°12'S latitudes, and between 140°06'E longitude and the eastern shore of the mainland. *Rama* worked 398 stations during 22 cruises. Only 40 grid squares were trawled in, although search patterns covered others. The bulk of trawling was concentrated in seven central grid squares as follows 6706 (35), 6707 (29), 6806 (84), 6807 (21), 6905 (20), 6906 (66) and 6907 (18). *Toowoon Bay* working in conjunction with and in sight of *Rama* made 214 trawls during the period 4 April - 22 June. As in the two previous quarters operations were hampered by weather unsuitable for fishing. *Toowoon Bay* suffered several mechanical breakdowns.

The search for banana prawns began at Cruise 101 during which *Rama* made 46 trawls during five consecutive nights mainly in 9-10 fathoms in the gutter systems around marked positions in grids 6905 and 6906. Banana prawns showed consistently over four nights totalling about 210 lb, four consecutive trawls on the first night yielding 20-30 lb each per 30 minutes. *Toowoon Bay* took about 268 lb in 30 trawls, the largest catch being 40 lb per 30 minutes.

During Cruise 102 three consecutive nights were worked in the gutter systems seaward of Van Diemen Inlet and the Gilbert River, mainly in grids 6706 and 6806 in depths of 9-10 fathoms. During the second night the search was extended northwards through 10-11 fathoms and then eastwards into 8 fathoms off the Gilbert River, returning to grid 6706 for the third night. Banana prawns showed only in very small quantities in the catches of *Rama* (best being 7 lb per 60 minutes). *Toowoon Bay* took only 35, 3 and 23 lb respectively during the three nights. On the morning of the fourth day banana prawns were located in payable quantities in grid 6806. The first good show was between moonset and first

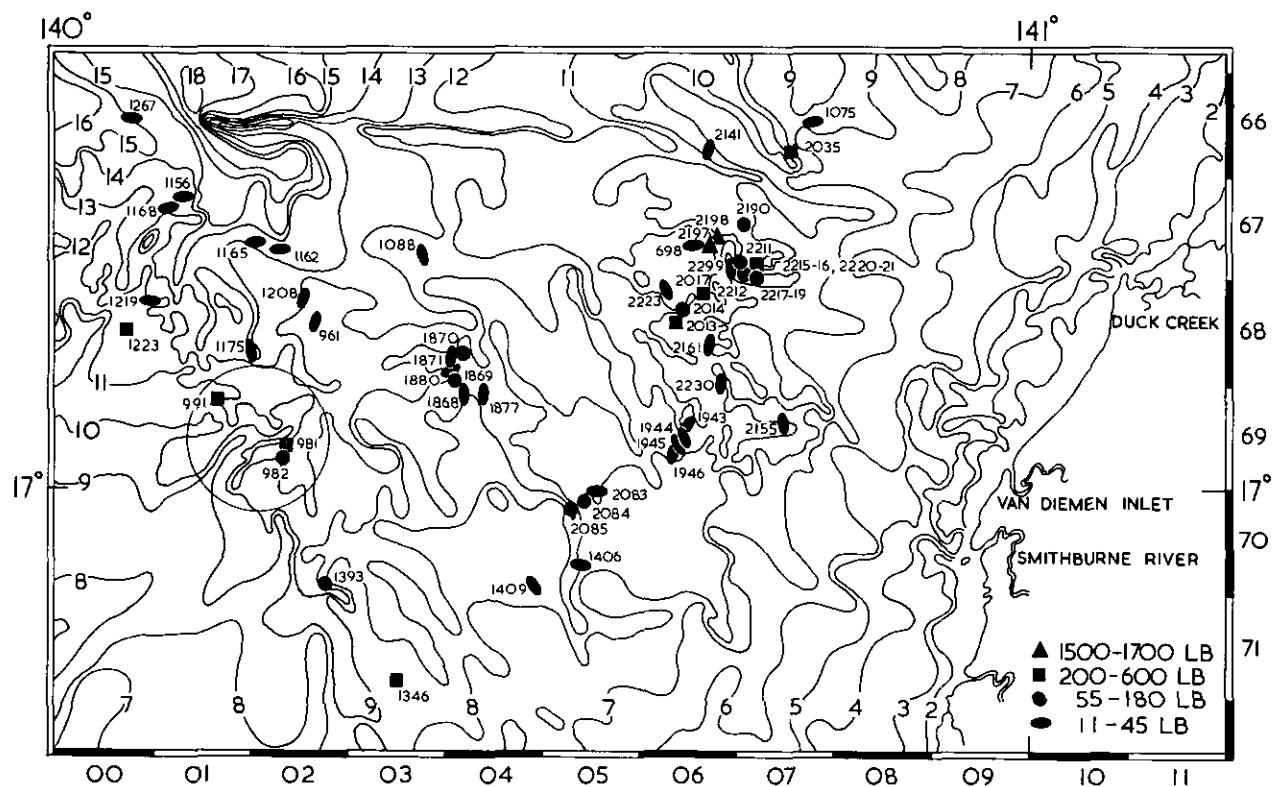


Figure 8

The gutter system seaward of the coast between Duck Creek and Brannigan's Creek (eastern shore) and station positions where *Rama* caught significant quantities of mature banana prawns. The depth contours are in fathoms. Station positions are numbered and the size of catch indicated according to the accompanying legend. Catches are total lifts, not catch rates per 30 minutes. The central tongue is circled. Part of the 18-fathom gutter off Bountiful Island is shown in the upper left hand corner.

light and good commercial size catches were made by both vessels until about noon. *Rama* made consecutive lifts of 370, 65, 8 and 550 lb per 30 minutes (total 993 lb). *Toowoon Bay* made consecutive lifts of 340, 80, 130, 100 and 80 lb per 30-60 minutes (total 730 lb). It was estimated that both vessels lost equivalent quantities through gear breakage and net damage from sharks.

Cruises 103-105 produced disappointing results and were interrupted and curtailed by strong winds. *Toowoon Bay* did not participate in the second cruise and abandoned the third on the second day. During Cruise 103 both vessels worked two nights around a marked position in 9-10 fathoms within the gutter systems of grid 6806 and moved closer inshore to 6-8 fathoms (mainly grid 6807) on the third night. Catches of both vessels were only 2-12 lb of banana prawns per night.

During Cruise 104 *Rama* worked mainly during daylight between the Smithburne River and 40 km seaward. A few mixed greentail, York, rainbow and small banana prawns were taken in 3-4 fathoms close inshore.

Cruise 105 was concentrated in a narrow strip between Van Diemen Inlet and grid 6905, mainly in 8-10 fathoms within the gutter systems of grids 6905 and 6906 for two nights, and a systematic search during daylight through 3 to 10 fathoms. Small numbers of banana prawns were taken at very few stations, the most being 4 lb per 30 minutes.

During Cruise 106 in early May both vessels trawled for two nights in 8-9 fathoms within the gutter systems seaward of the Smithburne River (mainly grids 7005 and 7006). Both vessels took banana prawns consistently each night, the best catches being after midnight on the first night when *Rama* lifted 25, 100 and 75 lb in consecutive 30-minute trawls. *Toowoon Bay* made catches of 1-30 lb per 30 minutes on the first night and 3-30 lb per 60 minutes on the second night. Strong winds on the third day terminated work.

Cruise 107 was planned to investigate banana prawns in deeper waters around the central tongue and south-east of Bountiful Island. Both vessels worked for two nights between grids 7103 and 6801 but results were disappointing, the best catches being 10-13 lb of tiger prawns per 60 minutes for both vessels in grid 6802. Operations were transferred to 9-10 fathoms seaward of Van Diemen Inlet to Duck Creek, trawling for three nights in different gutter systems. Few banana prawns showed in this area and each vessel took 7 lb per 60 minutes once in grid 6706.

During Cruise 108 both vessels trawled for two nights around markers in the two more northerly gutters investigated during the previous cruise (grids 6806 and 6606-6607). *Toowoon Bay* had to return to port on the third day and *Rama* trawled through the afternoon and early evening but got swept north by strong ebb tide to unfavourable sandy bottom. She then fished for a further night in the southerly gutters (grids 6906-6907) before being forced to abandon work because of strong winds. Results were disappointing again, the best catches being banana prawns at 15 lb per 60 minutes in grid 6606 and 12 lb per 30 minutes in grid 6907. *Toowoon Bay* made one lift of 30 lb per 60 minutes in grid 6806.

During Cruise 109 both vessels trawled for three consecutive nights in the gutters seaward of Van Diemen Inlet and Duck Creek, principally in grid 6806. Banana prawns showed consistently in small numbers and *Rama* made one lift of 25 lb per 30 minutes and *Toowoon Bay* lifted 30 lb and 20 lb respectively in consecutive trawls of 45 and 30 minutes between 2000 and 2100 hr on the first night. Operations were again curtailed by strong winds.

Both vessels returned to the same general area for Cruise 110 trawling mainly in grids 6806 and 6706 the first night with only shows of a few individual banana prawns. *Rama* took 180 lb in 30 minutes about noon the following day in

grid 6707 and *Toowoon Bay* made two consecutive lifts of 25 lb per 60 minutes between 2100 and 2300 hr. *Toowoon Bay* was returning to port with a sick crew man on the third day when *Rama* detected a large school of banana prawns in "balled-up" condition in grid 6706 between 0900 and 1000 hr, lifting 1700 and 1500 lb respectively in consecutive trawls of 30 and 8 minutes. *Toowoon Bay* immediately returned to the position and lifted 25 and 1500 lb respectively in consecutive trawls of 15 and 20 minutes. As both vessels were not refrigerated they had to return to port immediately to discharge their spectacular catches. These catches corresponded with a period of reduced tidal flow being a few hours after slack tide HW on day neap tide +2.

On 2-3 June, as Cruise 111, both vessels systematically searched around the marker left in position in grid 6706 during the previous cruise. No actual trawling was done during the first night. On the following day *Rama* trawled through daylight and *Toowoon Bay* through afternoon and evening. The best show was only 12 lb of banana prawns per 30 minutes. Strong wind conditions terminated this cruise.

Cruise 112 began on 6 June when *Rama* returned to the gutter systems in grid 6806 but caught only a few individual banana prawns in two late afternoon trawls. The commercial trawlers *Lottami* and *Avis* had arrived in the Gulf. *Rama* had to seek shelter on the second day because of strong winds but *Avis* detected a school and had lifted between 1000 and 1300 lb of banana prawns. Most of this catch was lost through gear breakage. The vessels returned to the gutters at the southern end of the ground on the third day but strong winds again prevented trawling.

Cruise 113 proved most successful and the four vessels between them landed a total of about 5 tonnes of

banana prawns from two afternoons of trawling. Systematic searching was begun by *Lottami* and *Avis* on 9 June and they were joined by *Toowoon Bay* on 10 June and by *Rama* on 11 June. The commercial vessels worked around the marker left in the southern gutter system during the previous cruise. On 11 June a new marker was placed in 10 fathoms in the middle gutter (grid 6707). During the afternoon *Rama* lifted 9, 150 and 150 lb respectively in consecutive trawls of 15, 23 and 15 minutes. *Toowoon Bay* lifted 35, 300, 15 and 320 lb in consecutive trawls of 25 to 37 minutes. *Lottami* lifted about 700 lb. On June 12 all vessels worked close to this same marker during the afternoon. *Rama* landed 2050 lb in seven lifts (300, 500, 100, 150, 150, 250 and 600 lb per 10-35 minutes). *Toowoon Bay* landed 2320 lb in six lifts (1100, 60, 160, 200, 300 and 500 lb per 15-45 minutes). *Lottami* took over 2000 lb in two or three lifts and *Avis* about 1500 lb. It was significant that 11 June was day neap tide ±0 and 12 June was day neap tide +1. On the first day the catches were 1-2 hours after HW slack tide, and on the second day 5-8 hours before LW slack tide.

Lottami and *Avis* worked with *Rama* during Cruise 114 in the middle and southern gutter systems but strong winds prevented fishing during two of the four days absent from port. On the second day which was worked in the middle gutter (grid 8606) the best catches of banana prawns were 20 lb by *Rama*, 70 and 80 lb by *Lottami*, and 265 and 500 lb by *Avis*. On the fourth day *Rama* trawled alone during afternoon and night in the southern gutters but landed only a total of 25 lb.

Rama trawled during daylight on three consecutive days between grids 6907 and 6703 during Cruise 115 but only traces of banana prawns were noted for some of the stations. *Toowoon Bay* trawled mainly in 10-12 fathoms taking mixed catches of banana, tiger, Endeavour and king prawns, the best catch being 150 lb

near the central tongue. The other vessels caught 25-30 lb of greentail, York, rainbow and small banana prawns in shallow waters. Strong winds again curtailed operations on this cruise.

Cruise 116 produced no results. Strong winds forced *Rama* to work the first day close inshore between Smithburne River and Duck Creek where she took small quantities of mixed small prawns. On the second day she was joined by *Lottami* and *Avis* in daylight search for banana prawns in the middle gutters. On the third day all three vessels joined in daylight search in the southern gutters and were joined by *Toowoon Bay* that night. *Toowoon Bay* experienced engine trouble and had to be towed to port by *Rama*. Only small traces of banana prawns were noted at a few stations in the gutter systems.

Cruise 117, involving trawling on five consecutive days, began on 1 July when *Rama* worked the middle gutters in daylight. On the second day she worked the southern gutters to midday and again at night to midnight when she made two consecutive lifts of 5 lb of banana prawns. She was joined by *Lottami* which took 600 lb in several lifts and *Avis* who made consecutive lifts of 60, 15 and 120 lb around midnight. On the third day *Rama* worked in grid 6707 to noon and again at night to midnight. As on previous nights banana prawns showed consistently but her best catch was only 15 lb. *Avis* caught 150 lb that night. *Rama* worked in grids 6707 and 6607 to the same time schedule on the fourth day, and during the morning she made one lift of 400 lb while *Avis* caught 450 lb. The total landings for the three vessels was about 2500 lb.

Rama resumed search for banana prawns in the southern gutter system in the afternoon of the first day of Cruise 118 (7 July) and was joined by *Lottami* and *Avis* on the following afternoon. A large marker buoy was placed at 16°54.7'S latitude 140°40'E longitude as a permanent reference mark in the

southern gutter system. Strong winds curtailed fishing in the area so *Rama* made six trawls in coastal shallows between the Smithburne River and Van Diemen Inlet on the third day and returned to port on the fourth after attempting to fish around the buoy. *Lottami* and *Avis* worked around the buoy on the following day. *Rama* caught about 1 lb of banana prawns on two occasions in the gutter system of grid 6906.

No stations were worked during Cruises 119, 120 and 121. During the first of these strong winds forced all three vessels back to port. On the next cruise they were accompanied by *Toowoon Bay* but that vessel broke down and had to be towed to port by *Rama*. *Laakanuki* accompanied the other trawlers to the buoy but could not locate it. Gale force winds scattered the fleet and the larger vessels had to run before the weather. On 21 July all vessels in the area and an RAAF Neptune bomber participated in an air-sea search for *Lottami* which had been missing for four days. The search was called off when the missing vessel reported from Yirrkala Mission in Arnhem Land. *Avis* then commenced trawling near the buoy. *Rama* attempted another cruise (Cruise 122) on 27 July. Bad weather prevented her making more than one trawl near the buoy on the first day and another in gutters further north on the second day. *Avis* attempted to join her but sustained mechanical problems after running aground. *Rama* returned to the buoy on the third day but her echo-sounder failed. This proved to be the last cruise as the charter contract expired on 31 July.

Conclusions: Operations during this final quarter amounted to a commercial pilot-scale banana prawn fishing exercise within a restricted area by a fleet of four trawlers in more or less coordinated effort. The area had been established from earlier prospecting and was characterized by a bottom configuration of gutter systems in which banana prawns tended to form large compact schools under certain tidal or lunar conditions.

This joint operation proved most successful despite disruptions to fishing due to bad weather conditions and some mechanical breakdowns. A number of excellent catches including lifts in excess of 1000 lb of good sized banana prawns confirmed the presence of large compact schools, and that these schools could be located by systematic searching in particular areas at particular times, and using echo-sounders for their detection.

The results indicated the reality of a very attractive commercial catch potential, the extent of which would have to be tested by full scale commercial exploitation over the years to come. They showed that commercial quantities of export sized banana prawns were available seasonally in the south-east corner of the Gulf of Carpentaria, and the period of availability was probably from March to September. The stocks of banana prawns in the area were probably sufficient in themselves to support a prawn trawl fishery based on the port Karumba. However it had been shown that there were also stocks of nocturnal species such as tiger, blue-leg king and Endeavour prawns in the central and western parts of the study area. These might support at least subsistence level fishing outside the season when adult banana prawns were available in large compact schools.

The pattern of catching in the study area seemed to confirm that this type of mass schooling was periodic and appeared to be associated with periods of minimal water movement. Such conditions occur at slack tide either at high or low water, and especially during or close to the days of neap tide which occur during the transition between successive fortnightly periods. During this transition the normal diurnal oscillation tends to become semi-diurnal for one or more days producing what is locally known as 'double tides'. As will be shown in Part 3 of this Atlas the tides are lunar and thus there is close linkage in tidal and lunar

events. An examination is made of banana prawn abundance in relation to sun, moon and tide in Section 2.5 which follows. The theory of schooling at minimum water movement was used in predicting during this quarter and again for commercial fleet operations during 1966, the first year that tidal prediction tables were available for the port of Karumba.

The success in trawling for banana prawns during the eighth quarter of the survey was actually the true beginning of all large scale trawling operations in the Gulf, initially based on Karumba and quickly spreading to Weipa, Groote Eylandt and other centres.

The Gulf Prawn Survey, which had gathered considerable environmental and biological knowledge during the first seven quarters, had until now raised only very limited hopes for exploitation of prawn stocks in the Gulf. It was clear from an early date during investigations that the large populations of juvenile banana prawns in river nurseries must contribute to extensive adult populations. The eventual tracking down of these adult populations when concentrated in compact schools with high fishable yield characteristics, in terms of time and place, was the ultimate achievement of the whole survey exercise. Admittedly these schools could have been stumbled over by chance during speculative prospecting by any commercial trawler. The fact remains that they were actually tracked by studies of bottom configuration, and of the biology and behaviour of the particular organism, a process which took the greater part of two years research effort.

2.2.3 TIME AND MOTION ANALYSIS

In drawing up the charter agreement with the owners of the prawn trawler *Rama* which was hired as survey vessel, The Queensland Government provided for a normal working period of twenty four working days in each four-week period.

Financial adjustments were provided for the working of days extra to the twenty four if required, and for days within each twenty-four day period which could not be worked due to adverse weather conditions, mechanical breakdowns and other unscheduled eventualities.

A working day was defined as any day on which the vessel spent twelve hours or more steaming or fishing as instructed by the supervising officer, or on work such as discharging catch, refuelling, loading with stores and ice, etc. It was provided that working days in port should not exceed four days in each four-week period. In effect on a seven-day basis this allowed for five working days away from port, one unloading and loading service day in port, and one day of rest for the crew.

While in consideration to crew and other sea-going personnel, this arrangement was adhered to as far as possible, it did not contribute to the most effective economical utilization of elapsed time. A great problem with the particular area was its large size and lack of sheltered anchorages as havens during spells of bad weather which included tropical cyclones and high winds. Bountiful Island was used frequently as a base when operating in the north-western and central sectors of the survey area, necessitating a full day travel each way between that base and port. Also during the early phases of the operation, when general reconnaissance was conducted by making a single trawl in the centre of each grid square, at least six nautical miles had to be steamed between positions, in addition to travel to and from some anchorage. Such operations resulted in uneconomical ratios of trawling to travelling time.

At the beginning of the survey, ice was not available and the vessel could remain away from base for less than two days because of putrefaction of samples in the high ambient temperatures. This situation restricted operations to relatively short distances from Karumba.

In the analysis of how time was utilized during the two-year period (Figures 9-11) it will be noted that by far the greatest proportion of time was spent in port or at anchor away from port sheltering from adverse weather or engaging in normal diurnal off-duty rest. These diagrams show that considerable blocks of time were utilized in resting at anchor away from port during certain cruises.

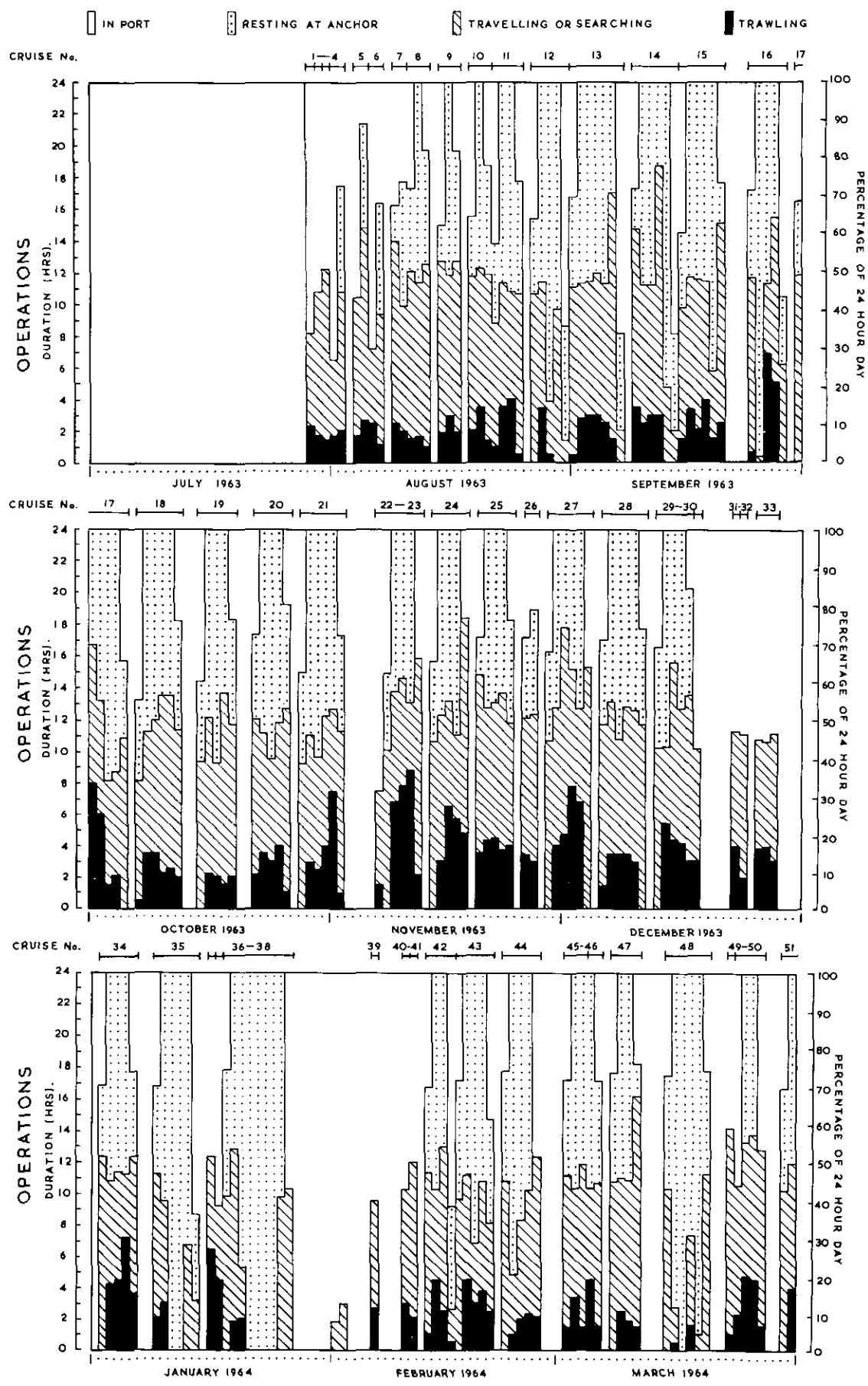
One case is Cruise 38 in January 1964 when the motor could not be started at Pisonia Island and the vessel had to be located by air search and await rescue. This was followed by a period mainly in port awaiting repairs and sheltering from Cyclone 'Dora' with associated monsoonal bad weather and flooding. During this event the vessel was struck by lightning, producing magnetic problems which restricted operations to the coastal shallows until mid-March.

During June 1964 Cruises 63 and 64 were abortive with the vessel weatherbound at Bountiful and Sweers Islands. Again in September 1964 the vessel became weatherbound in port for eight days. Cruise 91 in December 1964 was curtailed by Cyclone 'Flora' and the vessel sustained mechanical and other damage which put her out of action until mid-January. Much time was lost again during Cruises 93 and 94 by persistent bad weather while based in the western sector for prolonged joint fleet operations from mid-January to early March 1965. Bad weather again seriously reduced fishing effort from Cruise 118 onwards during July 1965.

2.2.4 STATION POSITIONS

A total of 2324 trawls were made by *Rama* in the south-east corner of the Gulf of Carpentaria. They are identified by station numbers 1-889 and 900-2334. Ten numbers in the series are omitted because of a field recording error.

The respective masters of the vessel were practical fishermen and their navigational skill relied on time and



Figures 9-11

Analysis of utilization of elapsed time by the survey vessel *Rama* between 29 July 1963 and 31 July 1965. Proportional time in four categories is examined on a daily basis arranged according to cruises and grouped in quarterly blocks.

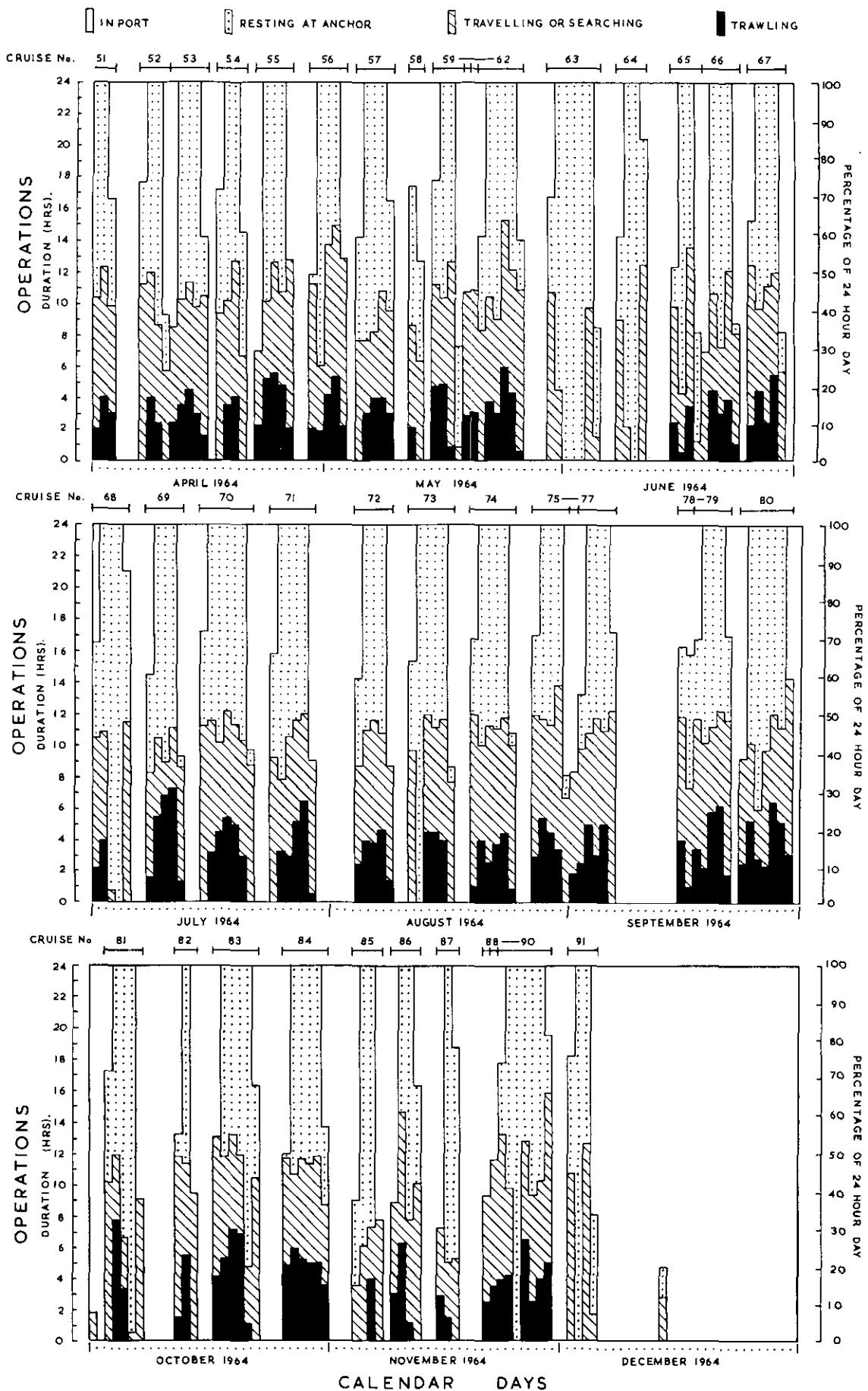


Figure 10

See caption to Fig. 9.

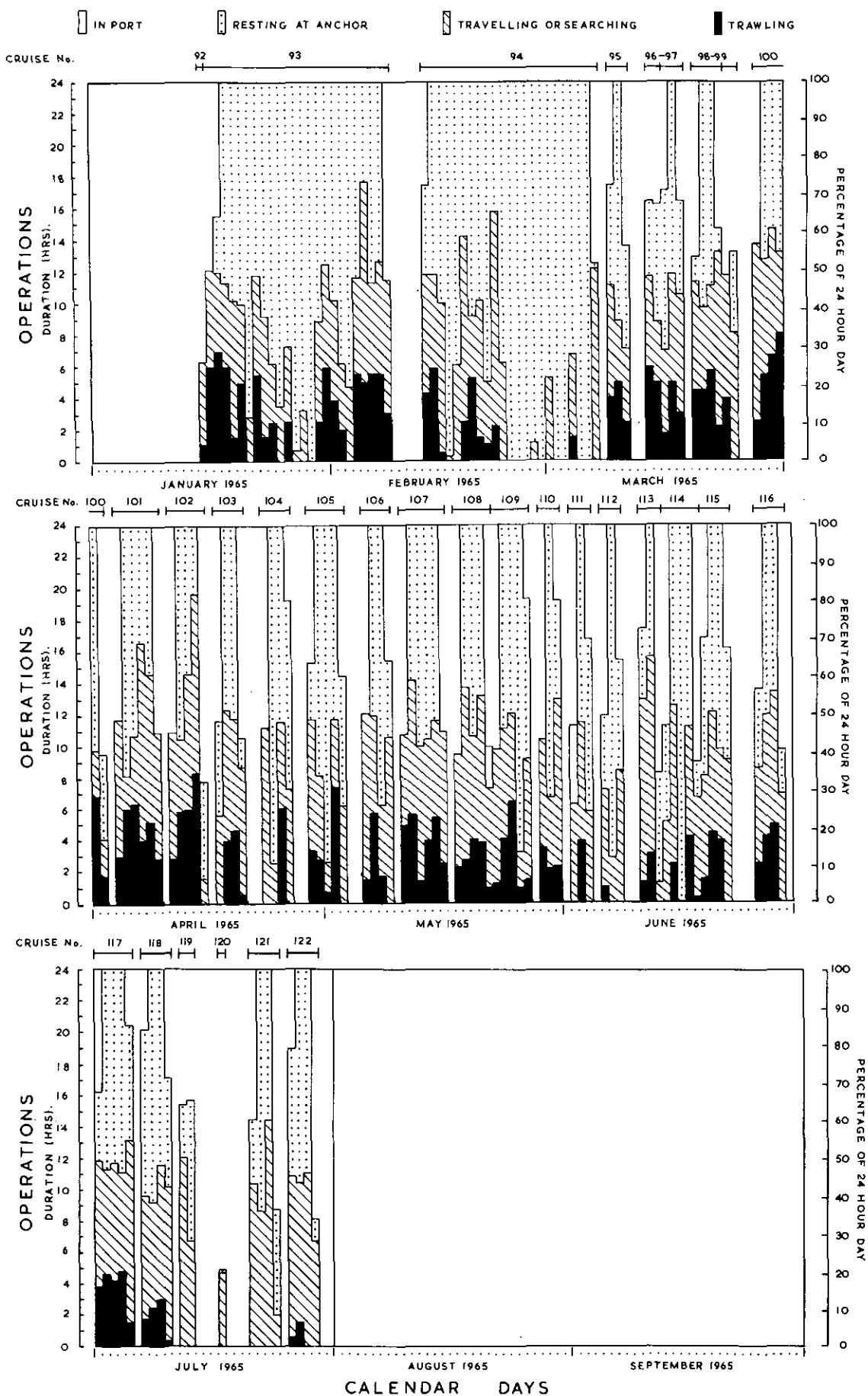


Figure 11

See caption to Fig. 9.

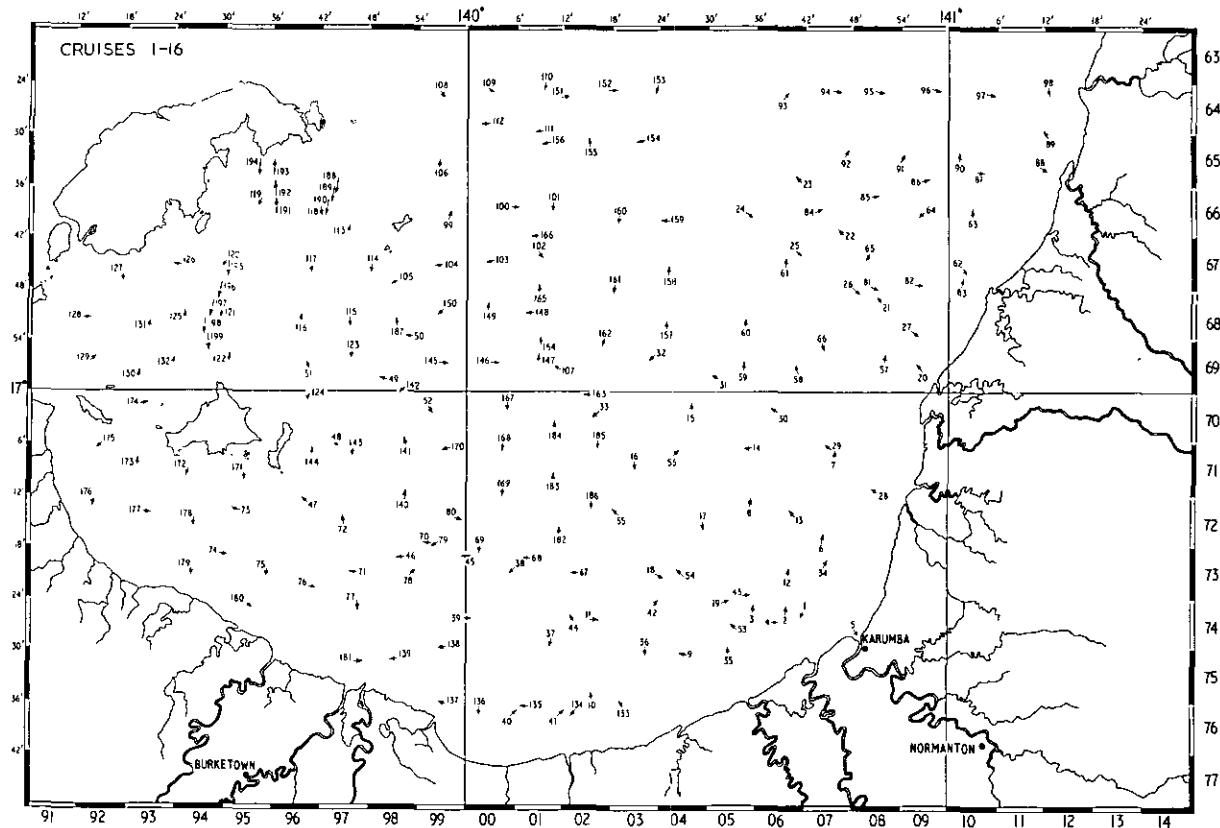


Figure 12

Figures 12-37 are charts with insets showing estimated positions of 2324 trawl positions occupied by *Rama* in the south-east corner of the Gulf of Carpentaria, with reference to coastal outlines, latitude and longitude, and grid square network.

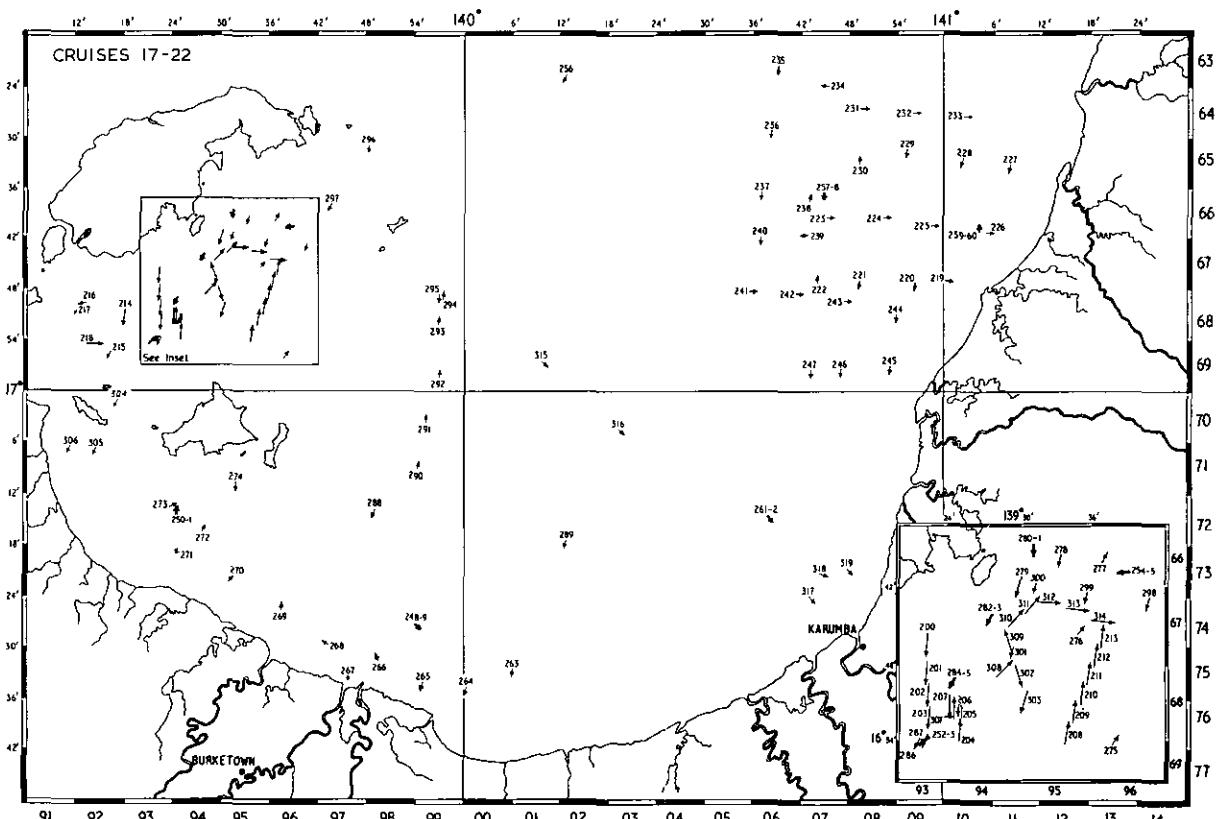


Figure 13

See caption to Fig. 12.

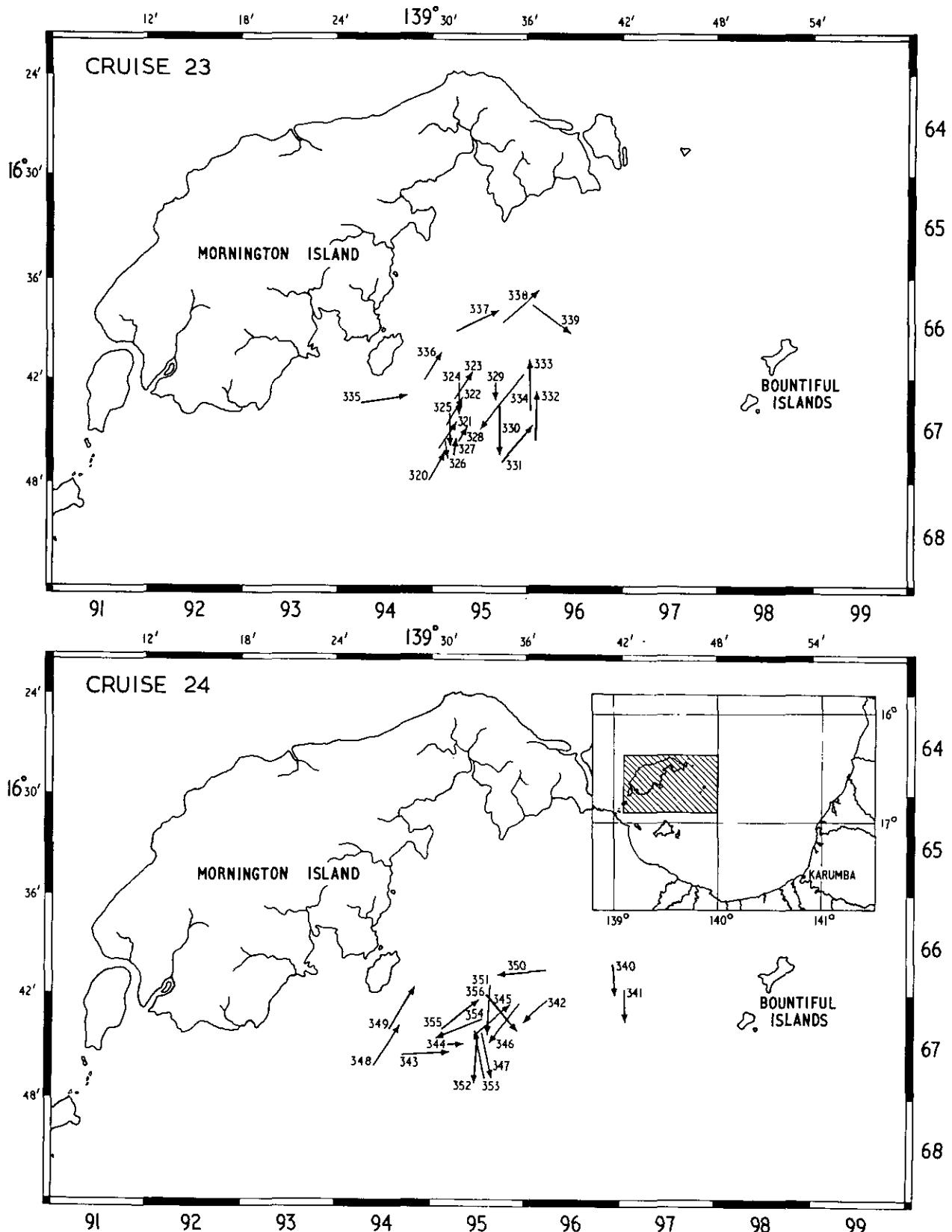
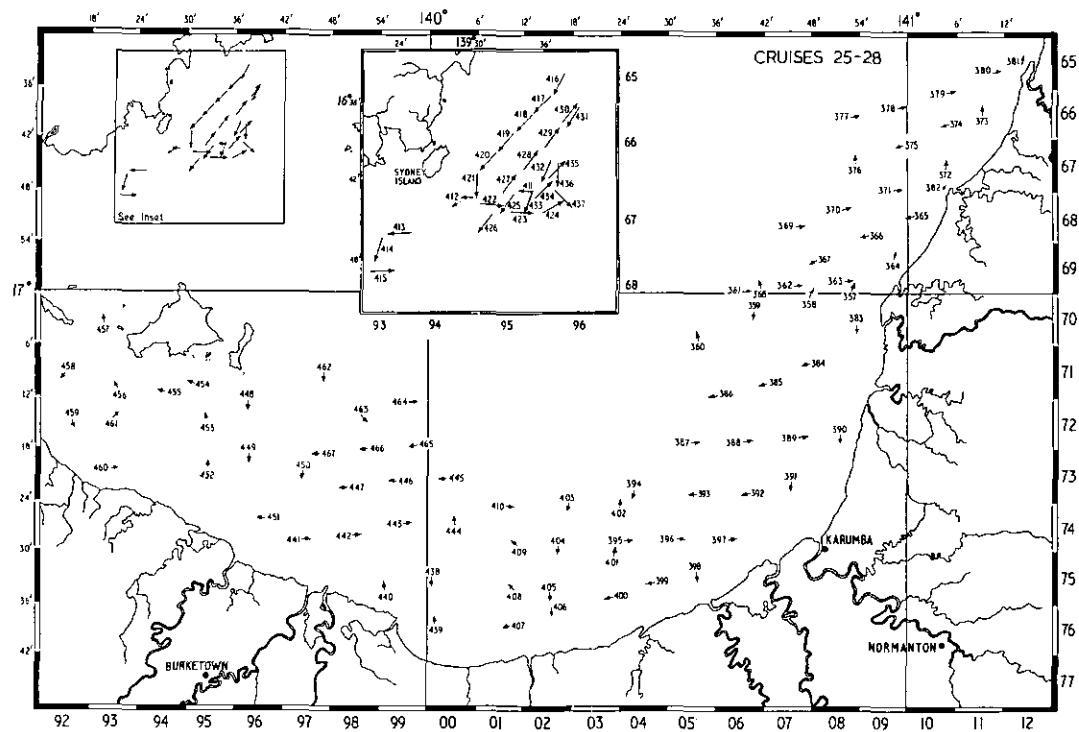


Figure 14

See caption to Fig. 12.



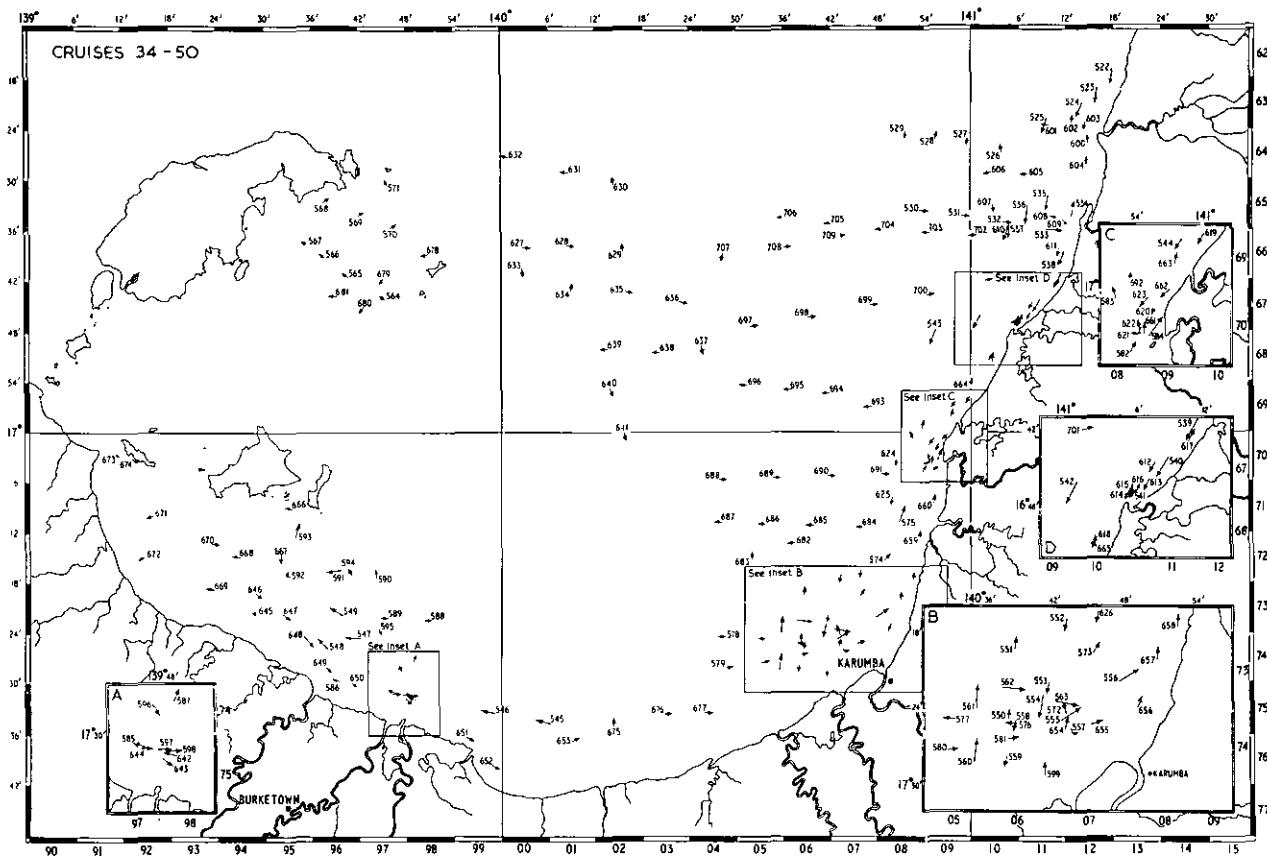


Figure 17

See caption to Fig. 12.

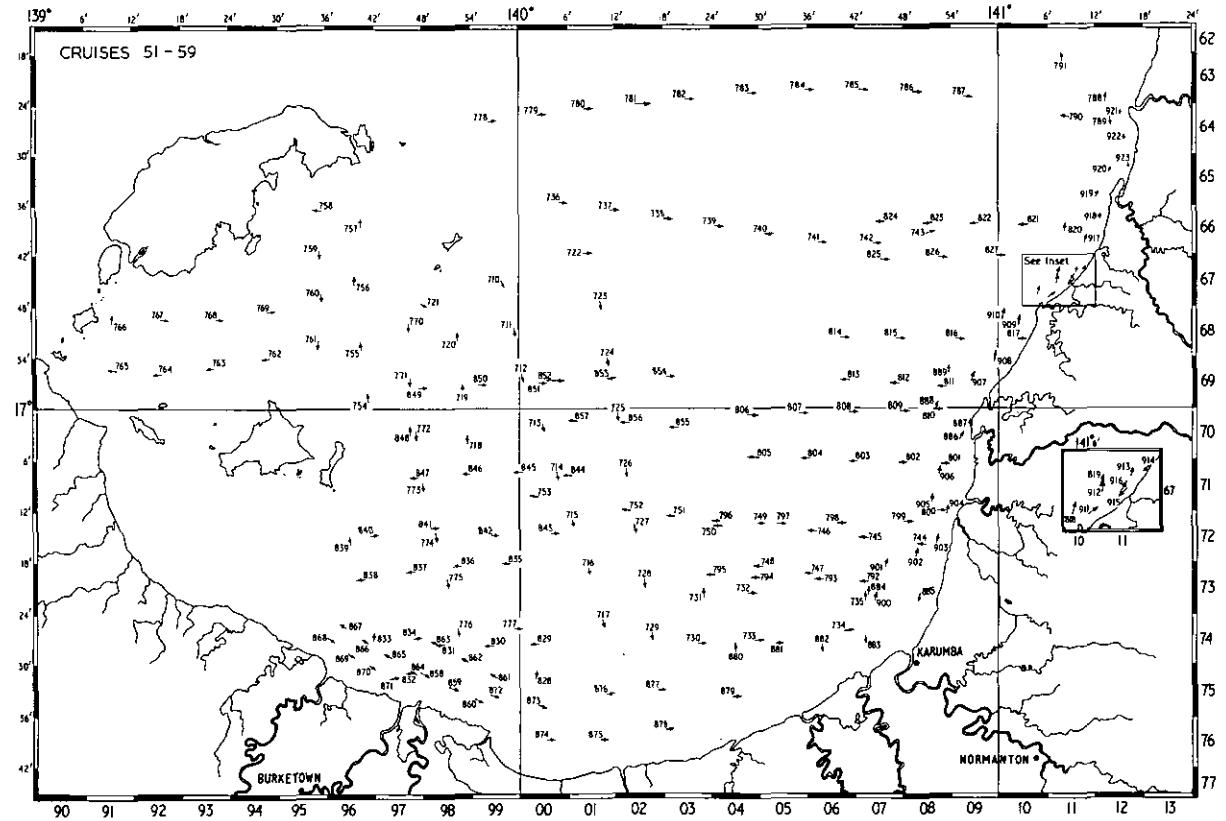


Figure 18

See caption to Fig. 12.

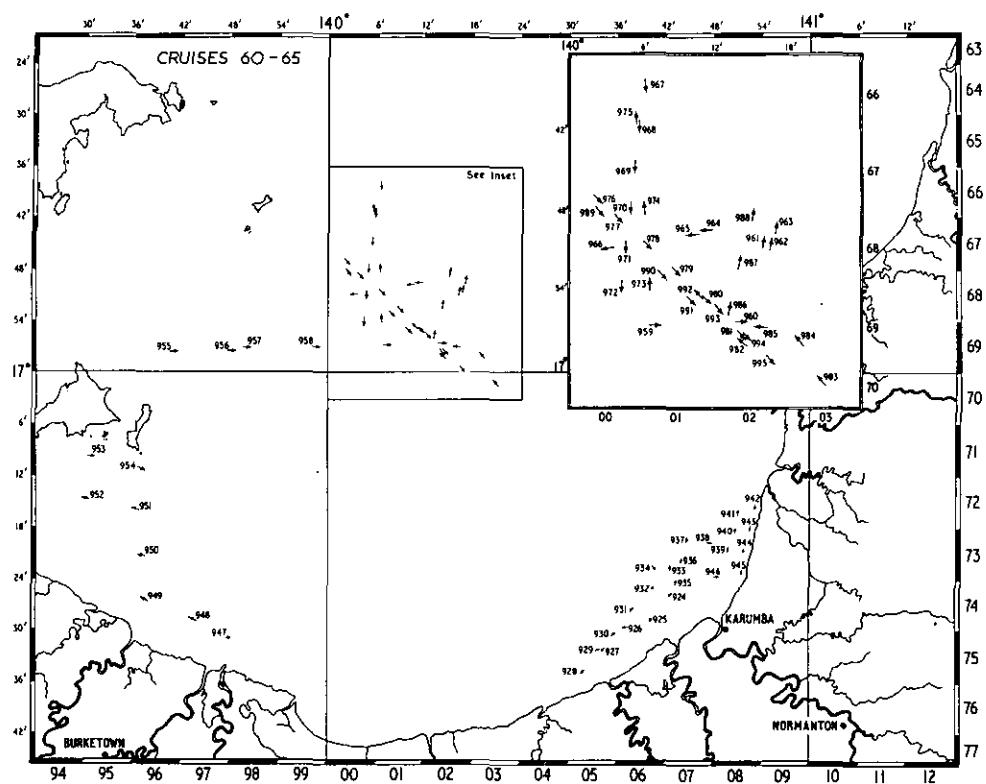


Figure 19 See caption to Fig. 12.

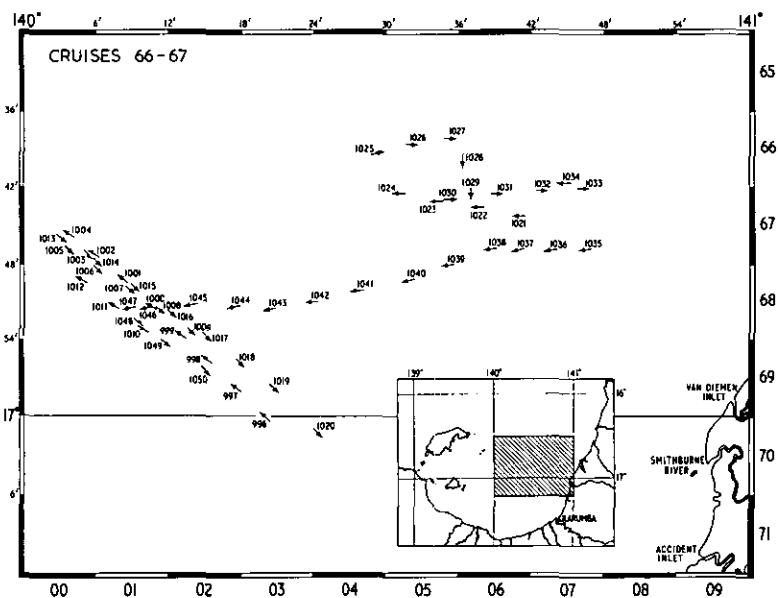


Figure 20 See caption to Fig. 12.

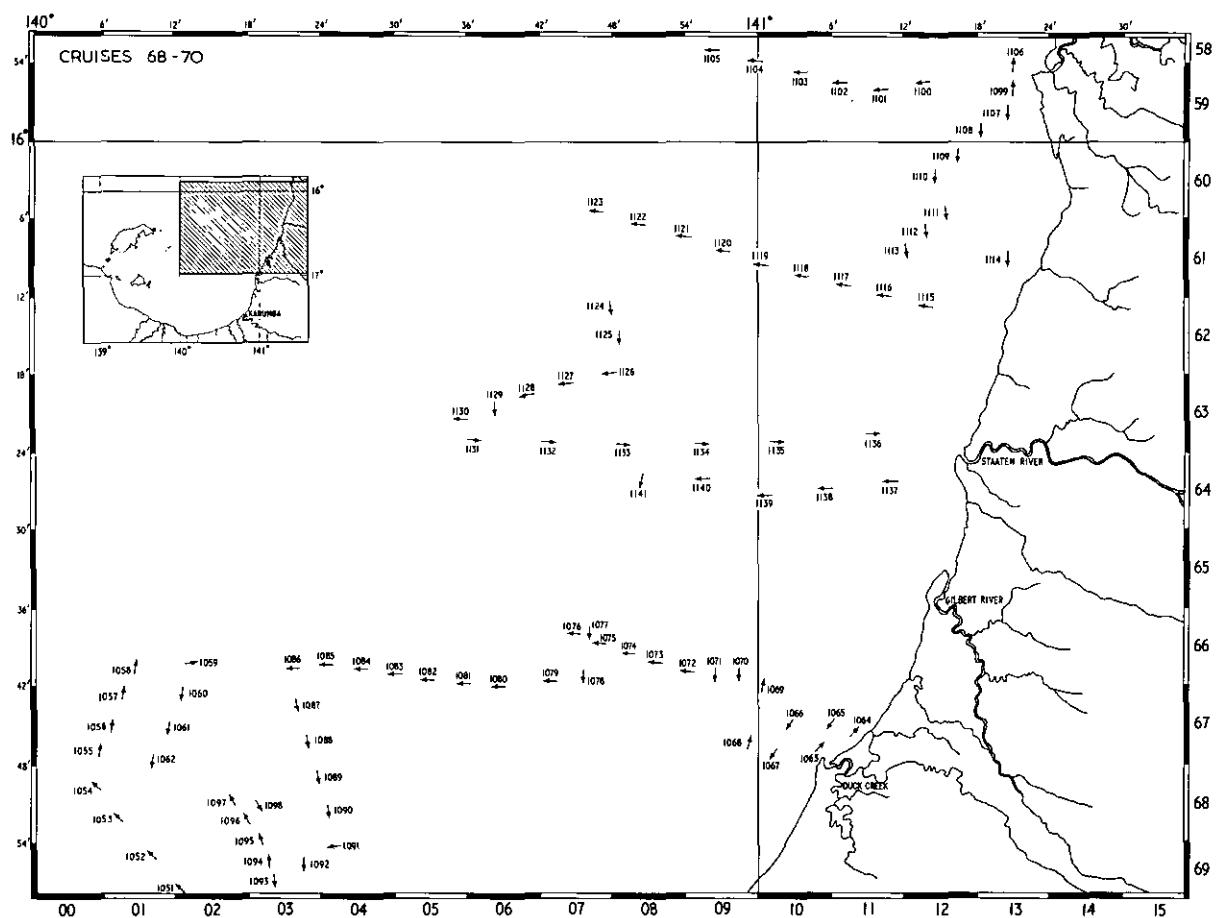


Figure 21 See caption to Fig. 12.

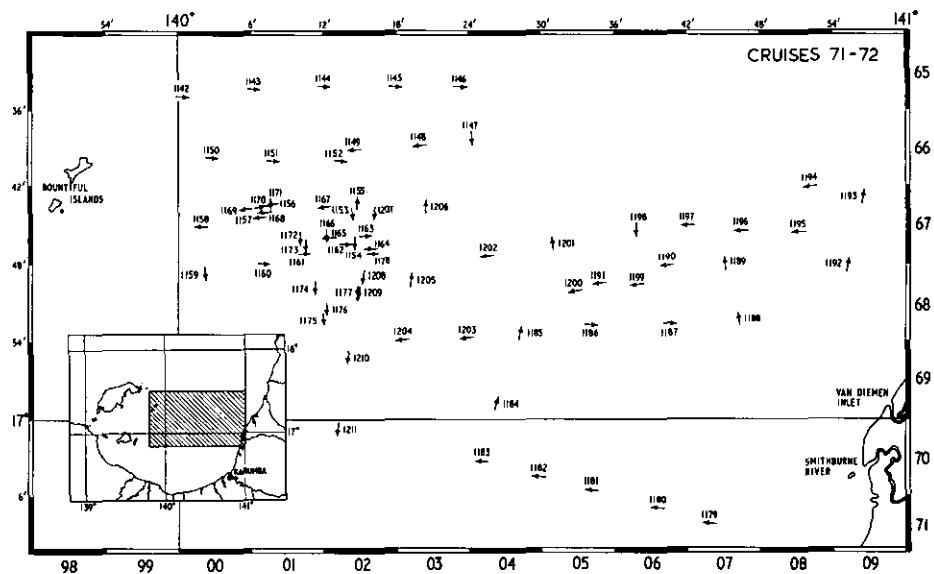


Figure 22 See caption to Fig. 12.

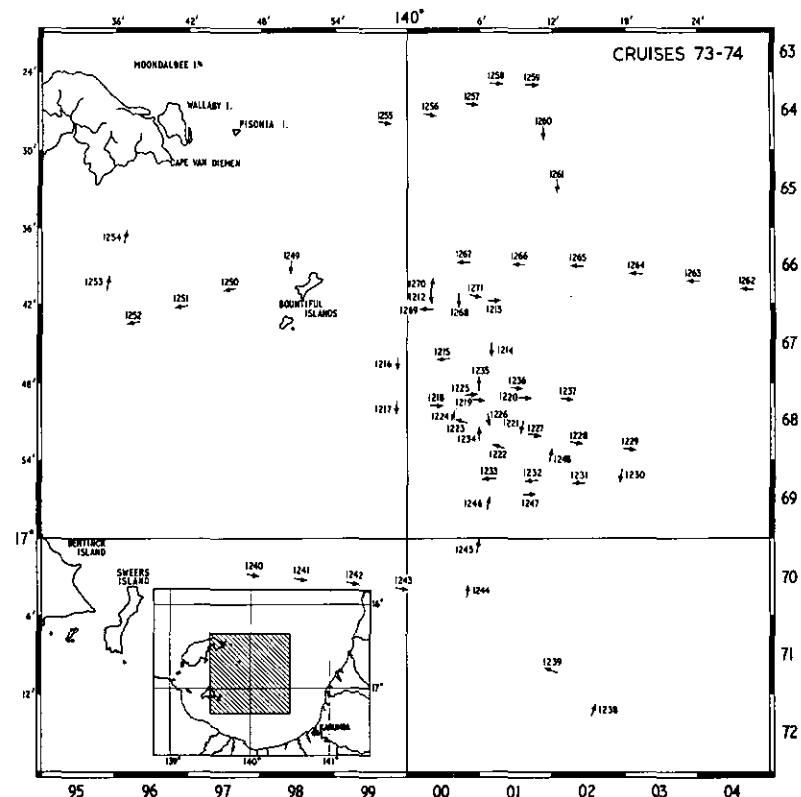


Figure 23 See caption to Fig. 12.

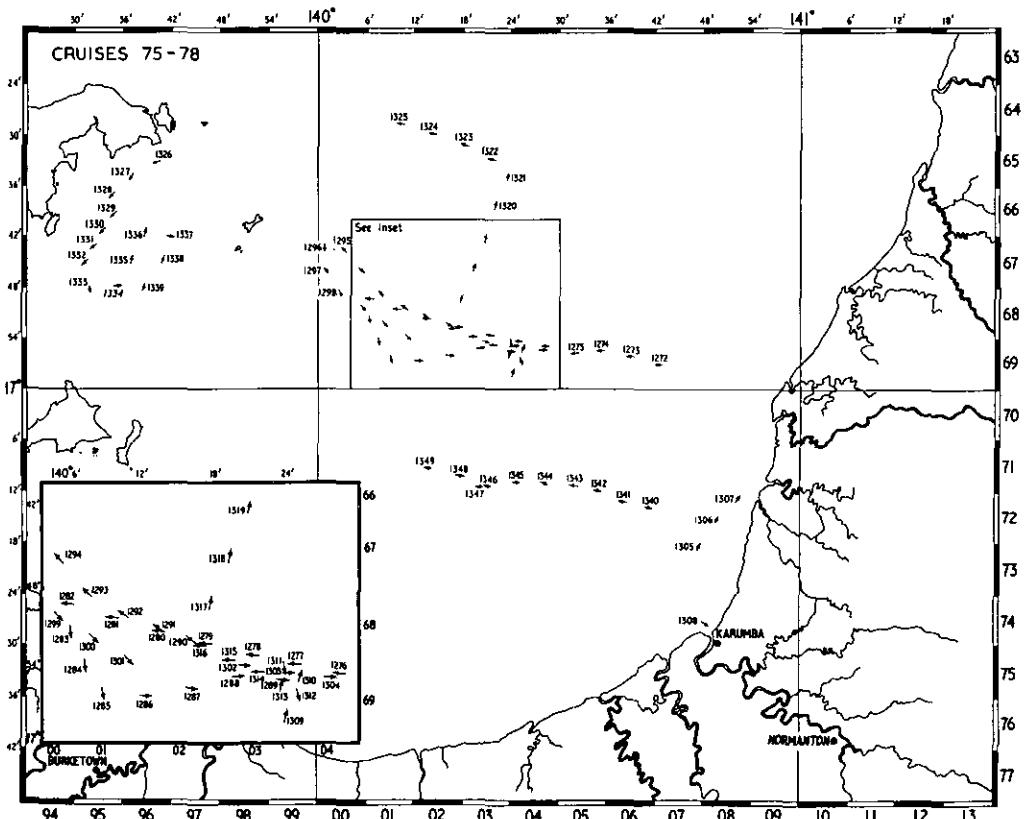


Figure 24 See caption to Fig. 12.

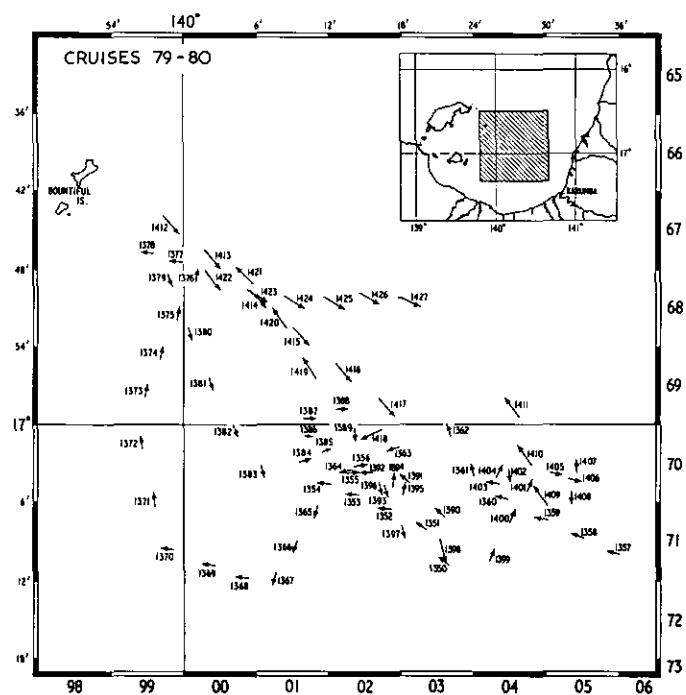


Figure 25

See caption to Fig. 12.

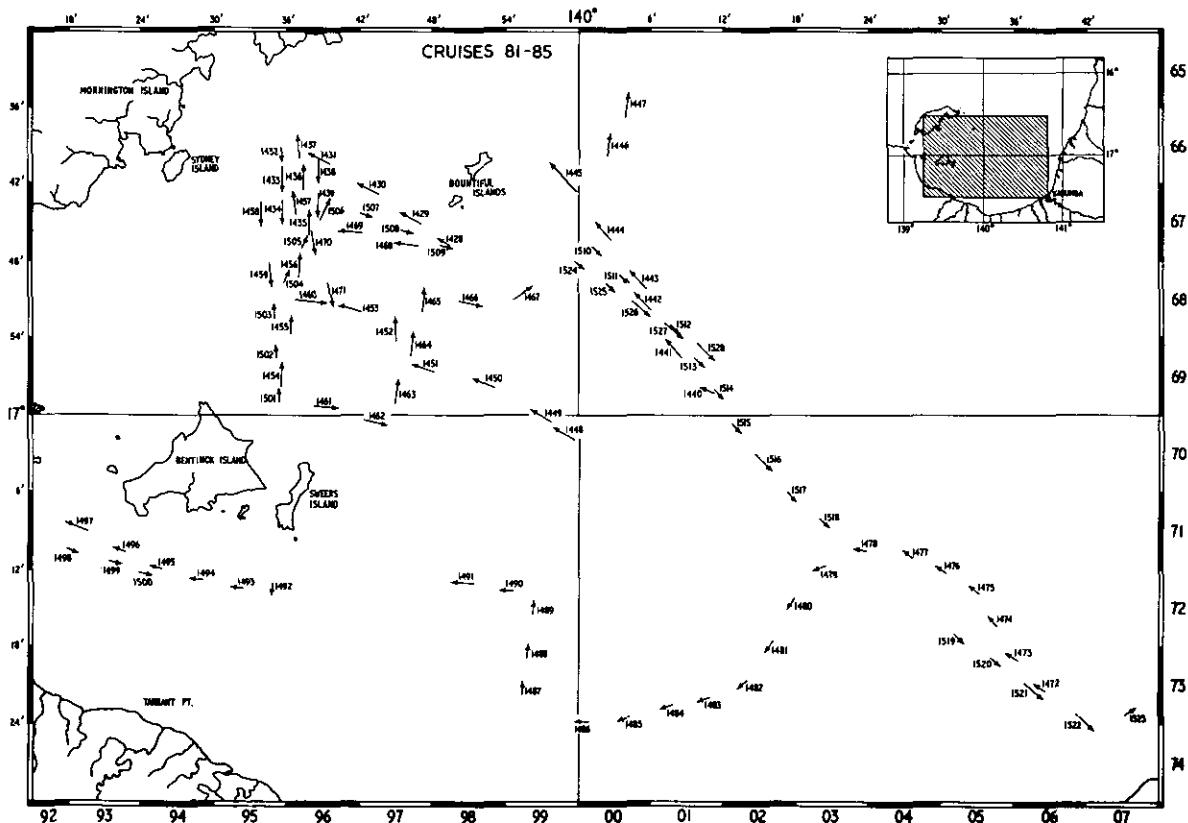


Figure 26

See caption to Fig. 12.

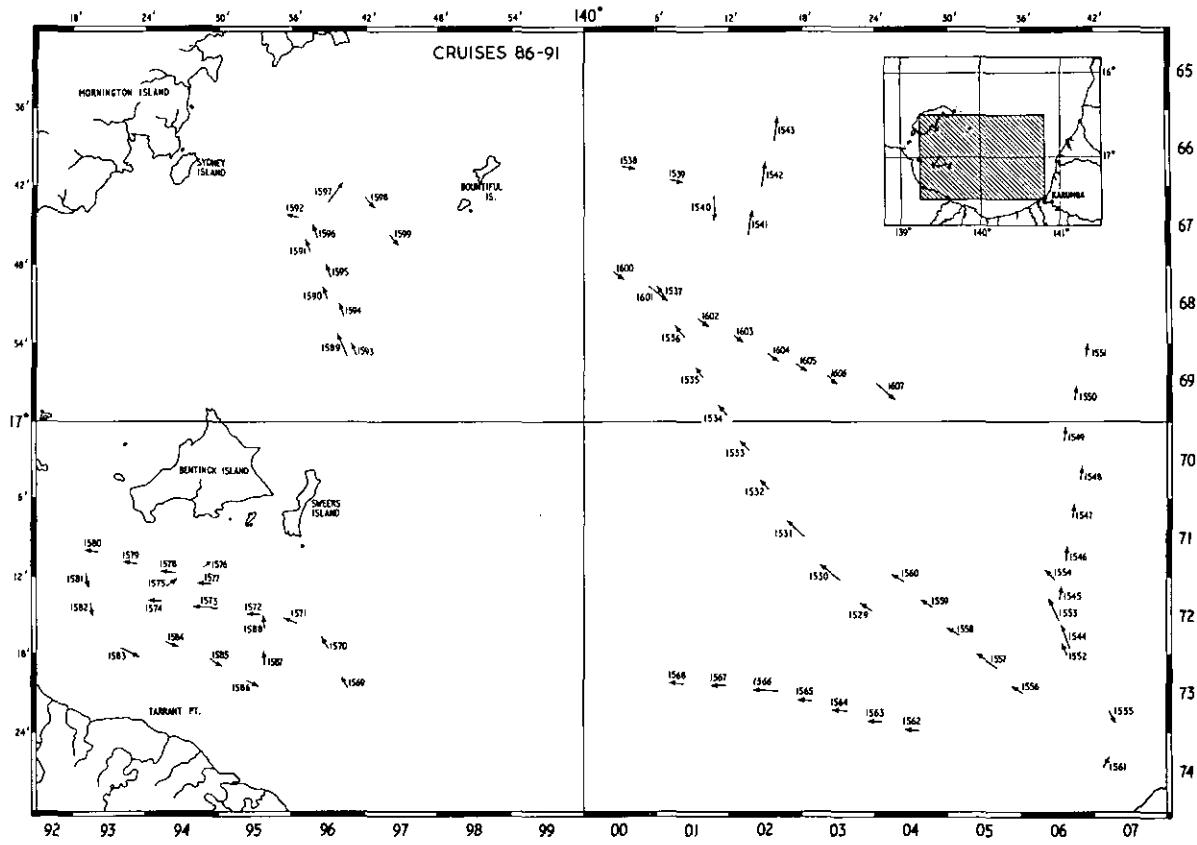


Figure 27 See caption to Fig. 12.

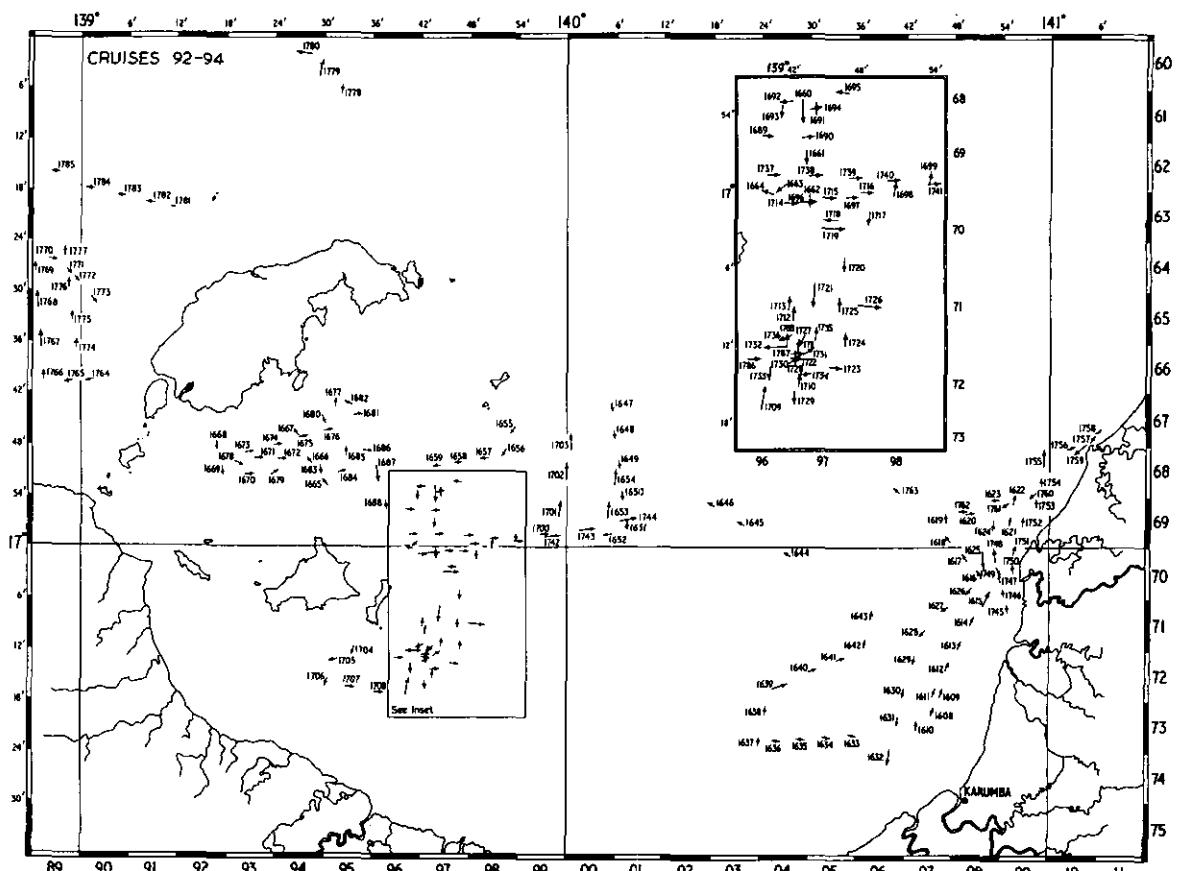


Figure 28 See caption to Fig. 12.

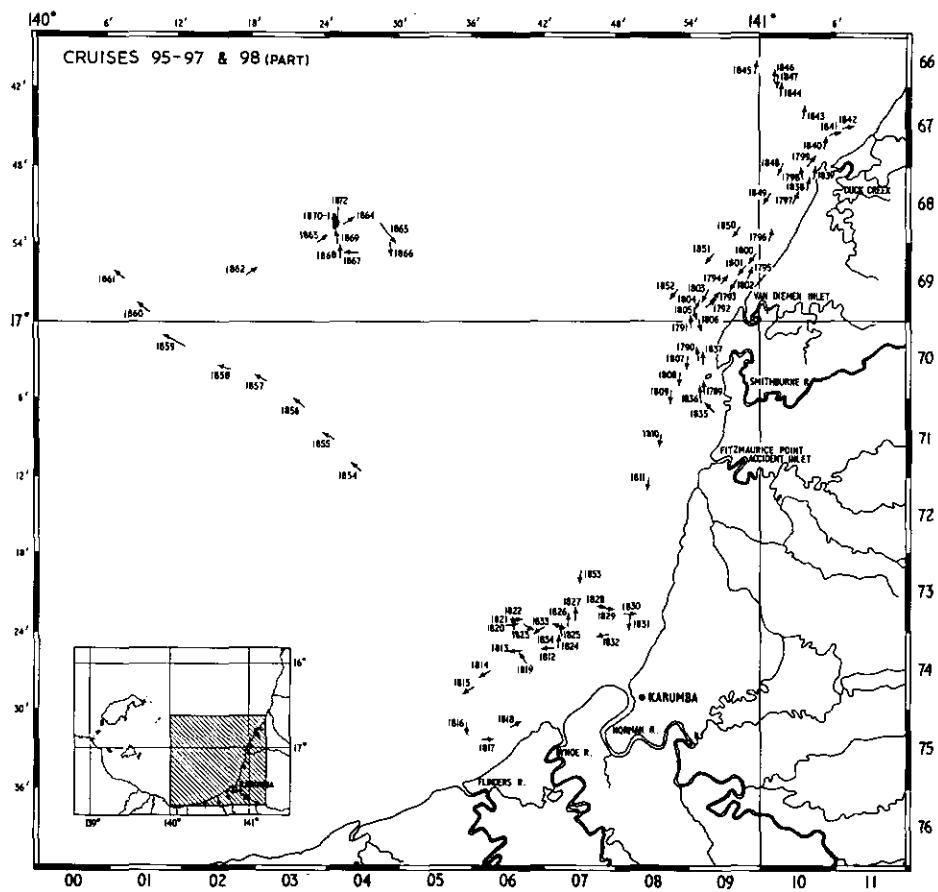


Figure 29

See caption to Fig. 12.

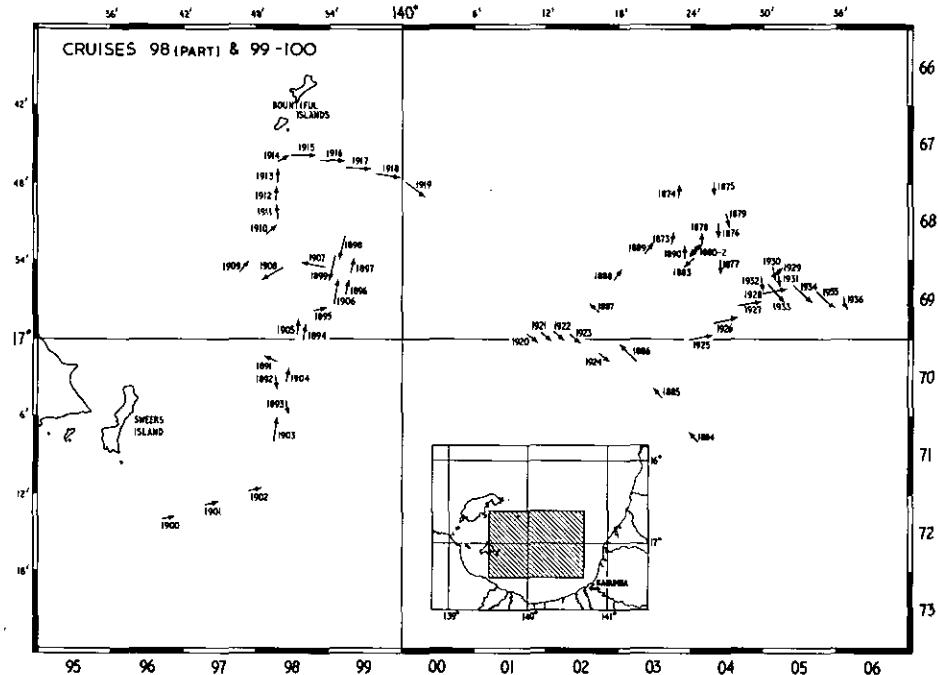


Figure 30

See caption to Fig. 12.

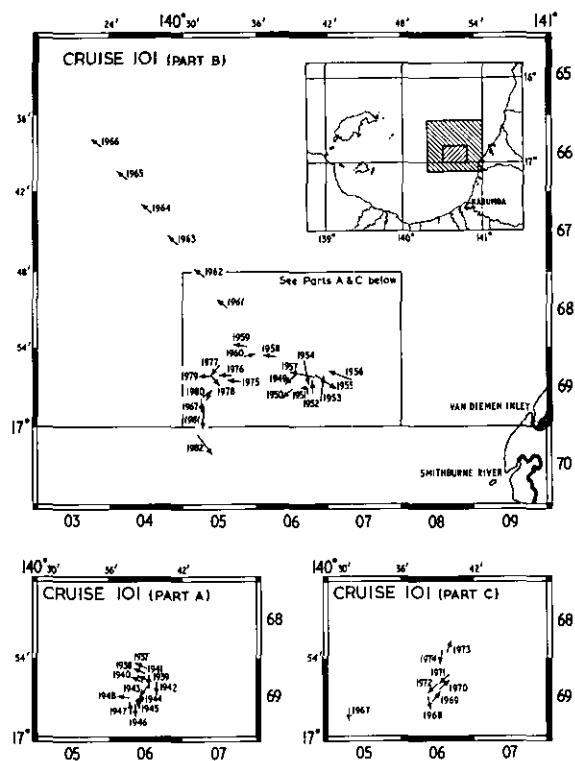


Figure 31

See caption to Fig. 12.

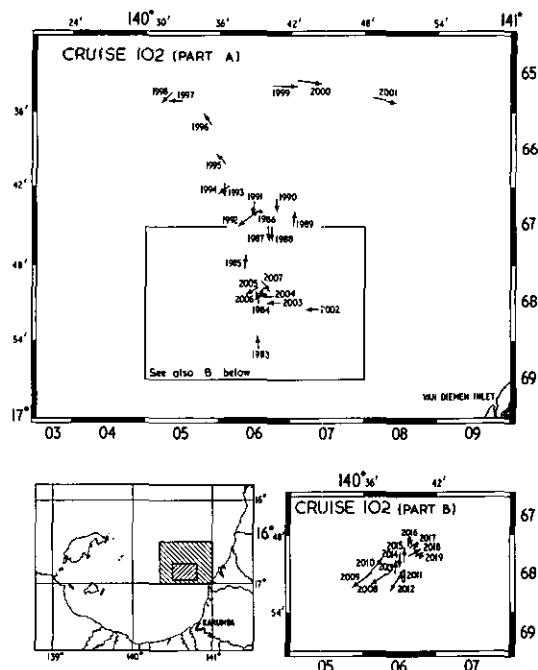


Figure 32

See caption to Fig. 12.

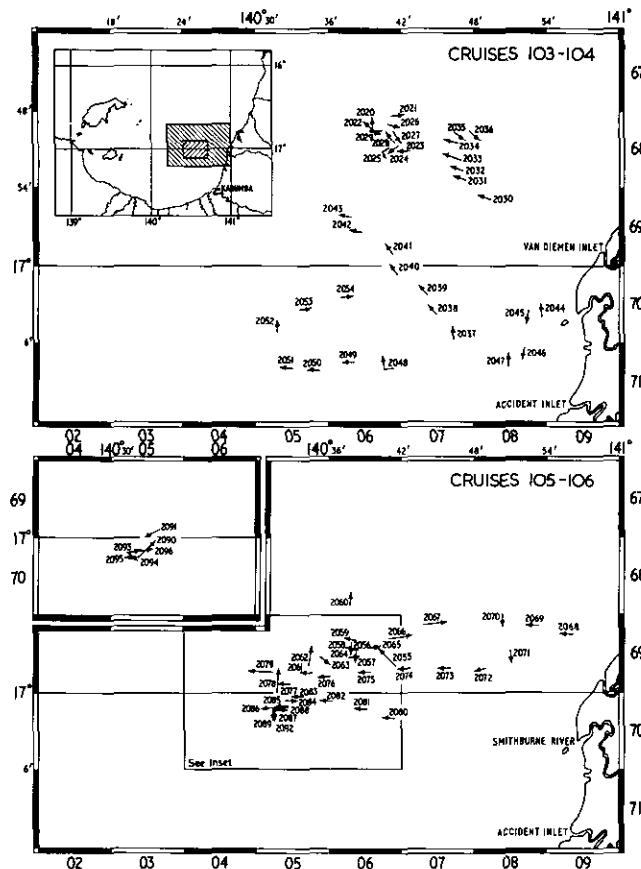


Figure 33

See caption to Fig. 12.

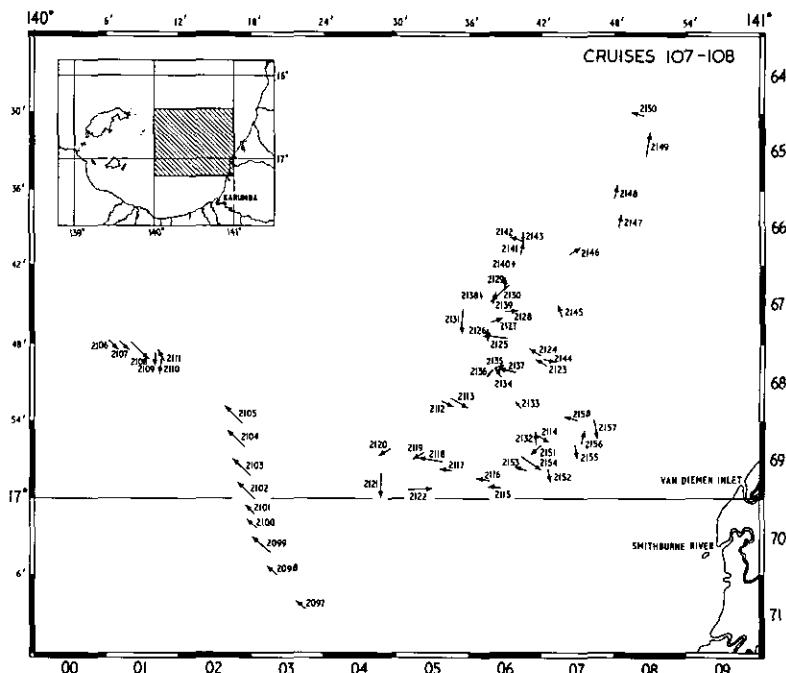


Figure 34

See caption to Fig. 12.

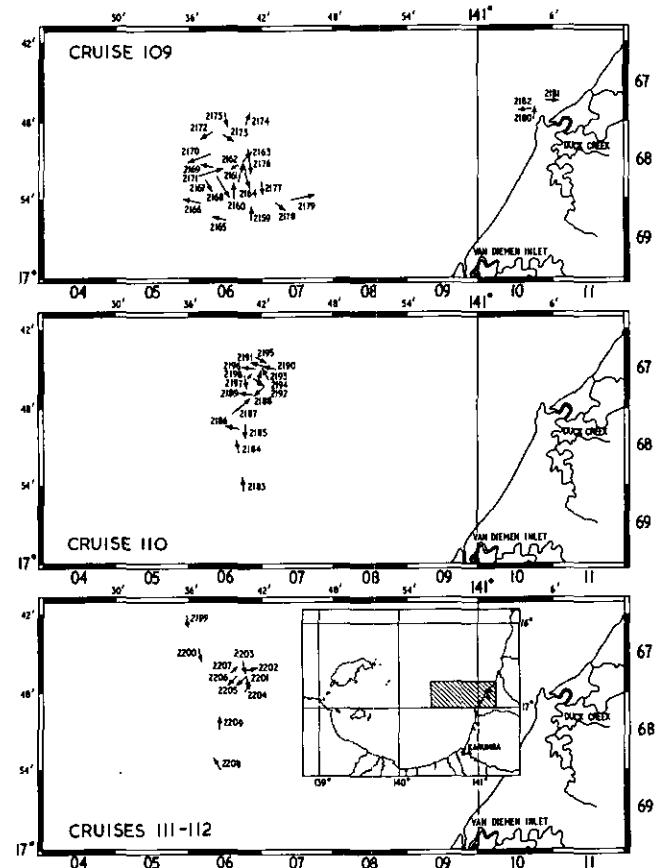


Figure 35 See caption to Fig. 12.

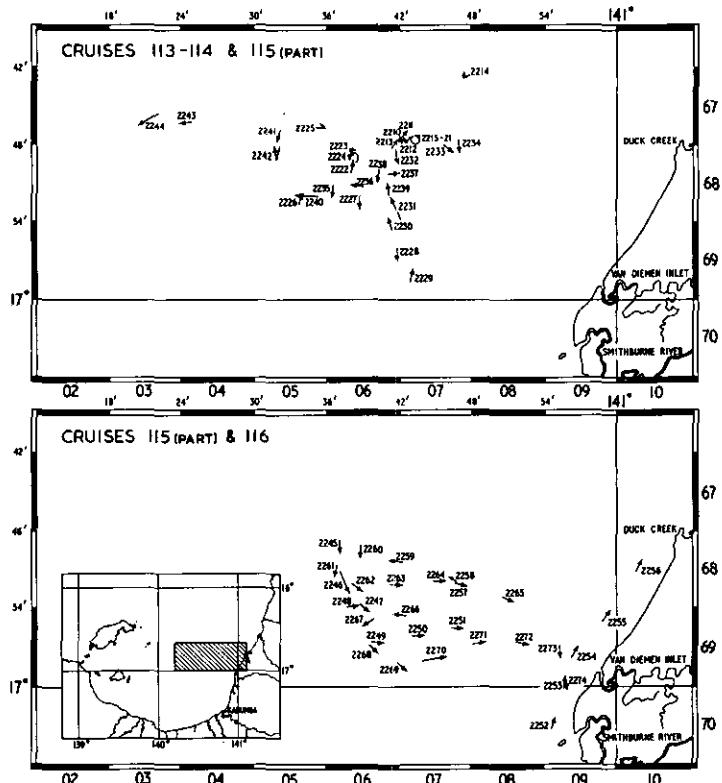


Figure 36

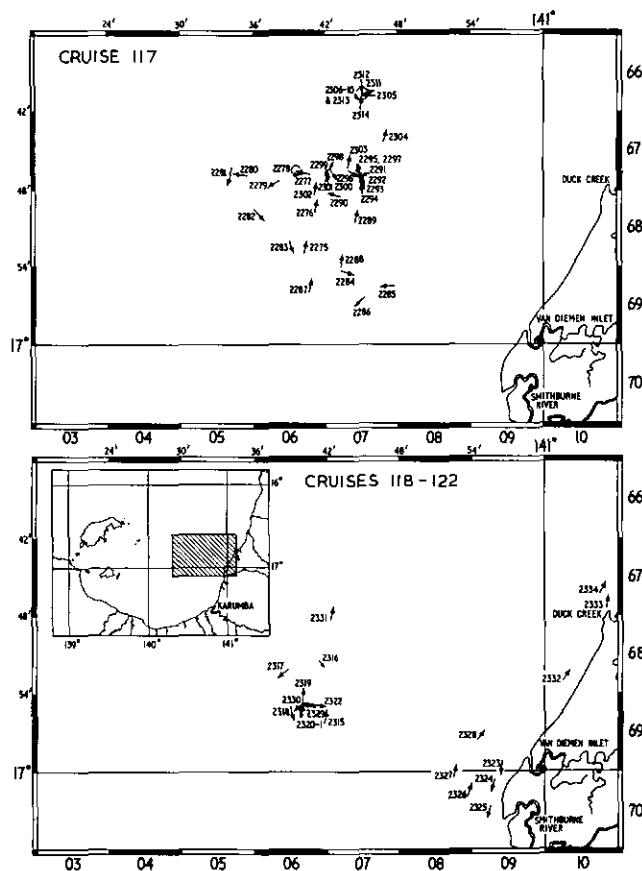


Figure 37

See caption to Fig. 12.

direction, drift from winds and currents, and reference to landmarks in making landfalls and positioning the vessel. Navigational aids comprised an unadjusted steering compass, alarm clock and echo-sounder. Charts provided little detail and had been updated little since originally compiled by Matthew Flinders.

For survey purposes the positions of stations were estimated at the end of each cruise by the author using information provided by the master of the vessel and taking into consideration observations on wind and currents. The positions thus were determined by the method of dead reckoning, using cross bearings on landmarks where available, and working to a system of best fit for data. The original steering compass and its replacement were swung and a compass heading correction table compiled to aid the setting of courses and plotting of cruise tracks. Distances were based on speeds of respectively eight knots while cruising and two knots while trawling. A handbearing compass was used to obtain cross-bearing from landmarks.

The estimated positions and directions of course for each station is indicated by a numbered arrow in the accompanying set of charts (Figures 12-37). These charts are marked with degrees and minutes of longitude along the upper margin of the frame and with degrees and minutes of latitude along the left hand margin of the frame. Grid square ordinates are indicated along the right hand and bottom margins of the frame. Stations are displayed in groups of cruises. Where stations are too densely packed to provide adequate clarity in identification, the groups are also shown in insets either with enlarged scale or divided into smaller sets.

2.2.5 STATION LISTS AND PRAWN CATCH DATA

In the accompanying 47 sets of tabulated data (Table 4) in computer line printer output format, selected station data and prawn catch data for all 2324 numbered trawl stations are summarized. These data are restricted to those items of interest to prawn trawlers, namely (a) date, time of day and haul duration, (b) depth and grid-square (see Section 2.3.2 for grid square identification) and bottom sediment (see Section 3.2 in Part 3 of this Atlas), (c) bottom temperature, (d) quantity of trash organisms, and (e) prawn catch in terms of species, and in the case of commercial species count per pound (heads on).

Prawn catch quantities are stated either as weight as estimated in pounds (larger lifts) or numbers as actually counted (smaller lifts). Counts per pound are mean count for the sample taken for detailed laboratory examination, usually 50 individuals comprising a mixture of male and females taken at random from the total catch. The scientific and common names of the prawn species are listed in Section 4.1.1 of Part 4 of this Atlas. A series of code symbols is used in the extreme right hand column to qualify certain catches of prawns. Details are given below (Table 3).

Also in column 10, Trash Quantity, some values are qualified by another set of code symbols. These qualify both the catches of trash organisms and catches of prawns in terms of gear breakage. In some cases where little or no trash was lifted, the qualification is that the net was fishing normally and that productivity in the area was extremely low, and that organisms had not been lost through net damage or maladjustment of gear. Details of these codes are also given below (Table 3).

Table 3. Details of symbols used to qualify catches of prawns and trash organisms in the Station List and Prawn Catch Rate data (Table 4).

Data group	Symbol	Qualification
Gear breakage (See column 10, "Trash Quantity")	✓	Net fishing normally
	✗	Net lost
	*	Net torn
	†	Cod-end untied
	¶	Net muddled up
	Δ	Net not fishing efficiently (weather conditions)
	Λ	Net not fishing efficiently (mechanical reasons)
	∅	Net not fishing efficiently (other reasons)
	‡	Catch discarded because of large quantities of jellyfish
	§	Course changed during trawl
Catch Control (See extreme right hand column "Other Prawns")	∅	Number or weights in "Other Prawns" refer to unidentified species
	⊖	Numbers in "Banana", "Greentail & York" and "Rainbow" are probably minimum numbers (i.e. laboratory samples in cases where no record was kept of total catch of each species). Weight or number enclosed in brackets in "Other Prawns" is total weight of these components combined.
	Π	Apparently more non-commercial prawns were caught than listed under "Coral", "Hardback", "Go-home" and "New Guinea"
	ψ	Weights in "Other Prawns" refer to non- commercial species
	⊜	Weights or numbers in "Other Prawns" refer to a mixture of "Greentail & York", "Rainbow" and some "Non-commercial Species", either an unsorted catch or residue after laboratory samples were taken.
	Ω	Weights and numbers listed under "Rainbow" were recorded as "Coral" but are almost certainly "Rainbow"
	▽	Estimated numbers based on 175 individuals = 1 lb under "Hardback" and "Go-home"
Species Presence (See columns under "Commercial Prawns" and "Non-commercial Prawns")	⊕	Under any species indicates that that species was observed in the catch but no other details were recorded except perhaps total catch under "Other Prawns"

Table 4. Basic trawl data and prawn catch data of interest to trawlersmen for 2324 trawl stations occupied by *Rama* in the south-east corner of the Gulf of Carpentaria between 29 July 1963 and 27 July 1965. See Table 3 for explanation of code symbols.

STATION NUMBER	DEPTH (m)	GRID REFERENCE	DATE	TIME OF DAY	HAUL DURATION (min)	BOTTOM TEMPERATURE (deg C)	SEDIMENT CODE	TRASH QUANTITY (banded)	COMMERCIAL				PRAWNS				NON-COMMERCIAL PRAWNS (Nos.)			OTHER PRAWNS No./M.				
									BANANA		TIGER		ENDEAVOUR		GREENTAIL & YORK		RAINBOW		BLUE LEG KING		PANDA (Nos.)			
									No./M.	Count per lb.	No./M.	Count per lb.	No./M.	Count per lb.	No./M.	Count per lb.	No./M.	Count per lb.	CORAL	HARDBACK	GO-HOME	NEW GUINEA		
1	2	7486	29/ 7/63	1148	34	18.6		0.5	28	23												1	0	
2	4	7486	29/ 7/63	1357	39	18.3																9	0	
3	5	7485	29/ 7/63	1512	32	1.0																1LB	0	
4	1	7486	29/ 7/63	1655	26	0.15			14	38														
5	3	7488	29/ 7/63	1753	30	2.5																		
6	4	7287	30/ 7/63	1138	35	18.4		17																
7	5	7187	30/ 7/63	1325	38	18.6		59														2	0	
8	6	7285	30/ 7/63	1600	30	19.2		58														0		
9	3	7584	31/ 7/63	1643	30	17.2		36	0.3															
10	2	7582	31/ 7/63	1301	30	17.2		82	0.1															
11	4	7482	31/ 7/63	1438	30	17.9		64	1.0															
12	4	7386	1/ 8/63	1908	32	18.5		15	0.3															
13	5	7226	1/ 8/63	2024	30	19.9		17	0.5												7	1		
14	7	7185	1/ 8/63	2213	30	19.5		51	0.5	1	15									11	2	3		
15	8	7084	1/ 8/63	2352	30	19.5		51	1.0											1	17			
16	9	7183	2/ 8/63	0816	32	18.6		51	0.5												1LB	0		
17	7	7204	2/ 8/63	1820	32	19.0		51	0.3												1LB	0		
18	6	7383	2/ 8/63	1210	30	18.6		51	0.5															
19	5	7485	2/ 8/63	1345	32	20.5		51	0.5												1	0		
20	8	6989	2/ 8/63	1628	37	21.7		17	1.5	A														
21	7	6868	4/ 8/63	0825	30	20.5		50	2.0											1	32	5		
22	8	6867	4/ 8/63	2226	30	20.7		126	1.5											1	2	2		
23	10	6586	5/ 8/63	0622	32	20.6		126	1.5											2LB	0	2LB		
24	10	6865	5/ 8/63	0553	30	21.0		93	0.3															
25	9	6786	5/ 8/63	1827	31	20.5		51	1.0															
26	7	6788	5/ 8/63	1286	30	20.6		51	1.5															
27	6	6589	5/ 8/63	1347	38	20.0	P	10	1.5															
28	3	7188	6/ 8/63	1652	30	20.4		18	0.5															
29	6	7187	6/ 8/63	1627	30	20.4		51	1.0															
30	8	7286	6/ 8/63	2080	30	20.4		49	1.0															
31	9	6985	6/ 8/63	2150	30	20.2		49	2.0											2	14			
32	9	6983	6/ 8/63	2327	32	20.4		65	5.0											2	28			
33	10	7082	7/ 8/63	0630	32	21.0		58	0.5												1			
34	3	7387	7/ 8/63	0800	30	20.2		18	0.3															
35	2	7505	9/ 8/63	1120	30	18.0		4	0.3												1	0		
36	5	7483	9/ 8/63	1336	30	18.2		113	0.5															
37	4	7481	9/ 8/63	1545	30	18.2		16	0.5												1	0		
38	6	7388	9/ 8/63	1743	30	18.6		51	1.0															
39	4	7489	9/ 8/63	1926	30	17.8		49	1.5															
40	2	7688	10/ 8/63	0625	30	17.6		18	0.1															
41	2	7681	10/ 8/63	0945	30	17.0		18	0.2											45	51			
42	5	7483	10/ 8/63	1232	30	18.2		41	0.3															
43	5	7385	10/ 8/63	1433	30	19.2		10	0.3															
44	5	7482	11/ 8/63	1158	30	18.4		49	1.5															
45	5	7380	11/ 8/63	1450	30	18.6		50	0.3															
46	6	7298	12/ 8/63	1620	30	18.8		51	0.5															
47	6	7296	12/ 8/63	0808	32	19.2		48	8.2															
48	7	7197	12/ 8/63	1159	6	19.2		2	0.0															
49	8	6988	12/ 8/63	1346	30	19.4		49	0.5															
50	8	6698	12/ 8/63	1527	30	19.6		93	1.5												1			
								6	11	5	12	2	16											
STATION NUMBER	DEPTH (m)	GRID REFERENCE	DATE	TIME OF DAY	HAUL DURATION (min)	BOTTOM TEMPERATURE (deg C)	SEDIMENT CODE	TRASH QUANTITY (banded)	COMMERCIAL				PRAWNS				NON-COMMERCIAL PRAWNS (Nos.)			OTHER PRAWNS No./M.				
									BANANA		TIGER		ENDEAVOUR		GREENTAIL & YORK		RAINBOW		BLUE LEG KING		PANDA (Nos.)			
									No./M.	Count per lb.	No./M.	Count per lb.	No./M.	Count per lb.	No./M.	Count per lb.	No./M.	Count per lb.	No./M.		Count per lb.	CORAL	HARDBACK	GO-HOME
51	7	6986	13/ 8/63	0815	30	19.4	116	B,5																
52	6	6849	13/ 8/63	1055	30	19.6	51	3.0																
53	7	7485	15/ 8/63	1318	30	19.3	18	H,4																
54	6	7384	14/ 8/63	1296	30	19.3	51	0.4																
55	7	7283	15/ 8/63	1515	30	20.1	51	0.4																
56	7	7184	15/ 8/63	1643	29	20.8	51	1.8																
57	6	6988	16/ 8/63	0742	28	20.3	14	1.0																
58	10	6986	16/ 8/63	0958	30	20.4	49	2.5																
59	9	6985	16/ 8/63	1141	31	20.4	53	1.0																
60	10	6885	16/ 8/63	1256	30	20.9	51	0.5																
61	10	6736	16/ 8/63	1451	32	21.1		0.5																
62	3	6710	16/ 8/63	1832	30	21.0	51	0.5																
63	4	6610	17/ 8/63	0734	30	21.2	51	0.5																
64	7	6689	17/ 8/63	0947	31	21.0	61	1.0																
65	9	6788	17/ 8/63	1046	28	22.2	51	1.0																
66	6	6987	17/ 8/63	1358	30	20.4	50	0.5																
67	7	7382	18/ 8/63	1309	30	21.1	51	0.3																
68	7	7381	19/ 8/63	1338	30	20.8	55	0.3																
69	7	7282	19/ 8/63	1556	30	20.6	51	0.5																
70	6	7289	19/ 8/63	0627	30	20.2	51	1.4		</														

STATION NUMBER	DEPTH (m)	GRID REFERENCE	DATE	TIME OF DAY	HAUL DURATION (min)	BOTTOM TEMPERATURE (deg C)	SEDIMENT CODE	TRASH QUANTITY (bars)	COMMERCIAL PRAWNS						NON-COMMERCIAL PRAWNS (No.)										
									BANANA		TIGER		ENDEAVOUR		GREENTAIL & YORK		RAINBOW		BLUE LEG KING	RED SPOT KING (No.)	PANDA (No.)	CORAL	HARDBACK	GO-HOME	NEW GUINEA
									No./Wt.	COUNT per lb.	No./Wt.	COUNT per lb.	No./Wt.	COUNT per lb.	No./Wt.	COUNT per lb.	No./Wt.	COUNT per lb.	No./Wt.						
181	16	6681	28/ 8/63	1030	30	22.4	50	1.0																	
182	15	6781	24/ 8/63	1227	30	22.6	51	0.8																	
183	11	6786	26/ 8/63	1354	30	22.1	45	0.8																	
184	14	6794	28/ 8/63	1528	30	21.6	115	1.5																	
185	8	6798	28/ 8/63	1656	30	22.4	89	0.8																	
186	18	6594	29/ 8/63	0612	30	21.6	111	2.0																	
187	8	6981	1/ 9/63	1317	30	21.1	51	3.6																	
188	17	6499	2/ 9/63	1148	30	22.2	39	0.3																	
189	17	6499	2/ 9/63	1395	30	22.2	68	2.5																	
190	17	6491	2/ 9/63	1439	30	22.2	61	0.3																	
191	15	6491	2/ 9/63	1681	30	21.8	49	1.5																	
192	15	6499	2/ 9/63	1729	30	21.8	130	1.3																	
193	8	6697	3/ 9/63	0850	30	22.2	133	1.0																	
194	7	6798	3/ 9/63	1036	30	22.0	116	0.3																	
195	3	6697	3/ 9/63	1215	30	22.2	51	1.6																	
196	7	6696	3/ 9/63	1343	30	22.2	51	2.9																	
197	7	6796	1/ 9/63	1597	30	22.2	94	2.6																	
198	11	6697	3/ 9/63	1647	30	22.2	51	1.0																	
199	8	6695	4/ 9/63	0912	30	22.0	55	2.0																	
200	7	6798	4/ 9/63	1058	30	22.0	51	2.8																	
201	6	6695	4/ 9/63	1210	30	22.0	51	3.0																	
202	5	6495	4/ 9/63	1333	30	22.2	49	2.5																	
203	2	7696	4/ 9/63	1733	30	22.2	96	1.0																	
204	5	6694	5/ 9/63	0955	30	22.2	51	2.6																	
205	1	6694	5/ 9/63	1126	30	22.0	49	1.0																	
206	5	6792	5/ 9/63	1247	30	22.0	49	1.0																	
207	5	6592	5/ 9/63	1502	30	22.0	51	1.0																	
208	3	6592	5/ 9/63	1634	30	23.0	49	0.5																	
209	3	6593	5/ 9/63	1756	30	22.4	48	0.3																	
210	5	6593	6/ 9/63	0923	30	22.4	51	2.0																	
211	3	6593	6/ 9/63	1148	30	22.6	51	0.5																	
212	2	7693	6/ 9/63	1148	30	20.9	31	6.3																	
213	4	7692	6/ 9/63	1228	30	22.0	39	1.5																	
214	2	7692	6/ 9/63	1352	30	20.8	17	0.0																	
215	3	7190	7/ 9/63	1611	30	20.9	23	0.5																	
216	3	7190	7/ 9/63	1734	30	21.6	17	0.5																	
217	2	7598	9/ 9/63	1844	30	21.0	25	0.3																	
218	6	7295	10/ 9/63	1075	30	21.6	51	0.3																	
219	6	7146	10/ 9/63	1124	30	21.8	51	1.0																	
220	7	6598	10/ 9/63	1256	30	21.8	51	1.0																	
221	7	7197	10/ 9/63	1453	30	21.8	51	1.5																	
222	7	7198	10/ 9/63	1620	30	22.0	69	0.8																	
223	9	6599	11/ 9/63	0916	30	22.0	58	1.5																	
224	9	6598	11/ 9/63	1038	30	21.6	51	0.5																	
225	10	6591	11/ 9/63	1213	30	22.0	50	2.5																	
226	11	6591	11/ 9/63	1301	30	22.0	130	1.6																	
227	9	6598	11/ 9/63	1585	30	22.0	51	1.5																	
228	9	6599	11/ 9/63	1630	30	22.0	91	1.0																	

STATION NUMBER	DEPTH (m)	GRID REFERENCE	DATE	TIME OF DAY	HAUL DURATION (min)	BOTTOM TEMPERATURE (deg C)	SEDIMENT CODE	TRASH QUANTITY (bars)	COMMERCIAL PRAWNS						NON-COMMERCIAL PRAWNS (No.)										
									BANANA		TIGER		ENDEAVOUR		GREENTAIL & YORK		RAINBOW		BLUE LEG KING	RED SPOT KING (No.)	PANDA (No.)	CORAL	HARDBACK	GO-HOME	NEW GUINEA
									No./Wt.	COUNT per lb.	No./Wt.	COUNT per lb.	No./Wt.	COUNT per lb.	No./Wt.	COUNT per lb.	No./Wt.	COUNT per lb.	No./Wt.						
151	13	6492	12/ 9/63	0833	30	22.6	59	0.5																	
152	13	6492	12/ 9/63	0957	30	22.6	66	0.5																	
153	12	6495	12/ 9/63	1124	30	22.6	66	0.3																	
154	11	6593	12/ 9/63	1246	30	22.6	66	0.3																	
155	12	6592	12/ 9/63	1410	30	22.6	129	1.0																	
156	14	6591	12/ 9/63	1513	30	22.4																			
157	12	6592	12/ 9/63	1513	30	23.0	59	1.0																	
158	10	6592	12/ 9/63	1640	30	23.0	43	1.5																	
159	12	6593	12/ 9/63	1759	30	23.0	53	0.5																	
160	12	6703	12/ 9/63	0829	30	23.0	93	1.5																	
161	12	6592	12/ 9/63	0949	30	22.8	4																		

STATION NUMBER	DEPTH (fm)	GRID REFERENCE	DATE	TIME OF DAY	HAUL DURATION (min)	BOTTOM TEMPERATURE (deg. C)	SEDIMENT CODE	TRASH QUANTITY (Basket)	COMMERCIAL				PRAWNS				NON-COMMERCIAL PRAWNS (No.)				OTHER PRAWNS No./Wt.		
									BANANA		TIGER		ENDEAVOUR		GREENTAIL & YORK		RAINBOW		BLUE LEG KING		RED SPOT KING (No.) PANDA (No.)		
									No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.			
281	7	6793	1/10/63	0943	60	25.4	51	1.0	5	13	23	11	1	18									
282	6	6893	1/10/63	1054	60	25.3	51	5.6	38	15	14	15	1	17									
283	5	6893	1/10/63	1207	60	25.3	51	4.8	48	13	12	11											
284	5	6894	1/10/63	1057	60	25.4	50	5.4	64	14	86	14	4	22									
285	5	6894	1/10/63	2009	60	25.4	51	- +															
286	6	6894	1/10/63	2128	60	26.0	115	5.0	19	18	311	15	15									62	12
287	5	6894	1/10/63	2244	60	25.3	51	4.0	46	155													
288	6	6895	2/10/63	1412	60	26.0	18	1.5														1	
289	6	6895	2/10/63	1548	60	25.6	51	1.0															
290	6	6895	2/10/63	1651	60	24.4	50	1.5															
291	6	6895	2/10/63	1884	60	24.4	51	8.0															
292	7	6895	2/10/63	1925	60	24.4	51	9.0	1	14	121	9	6	19									
293	7	6795	3/10/63	1526	60	26.8	51	1.0	6	18	281	18	18	18									
294	5	6893	3/10/63	1712	30	26.6	49	0.1	53	15	15	12	1	38									
295	5	6894	3/10/63	1712	30	26.6	49	0.1															
296	5	6892	4/10/63	1023	42	26.9	101	0.3															
297	3	6892	4/10/63	1123	42	25.8	51	0.3															
298	5	6892	4/10/63	1222	40	25.8	51	7.0															
299	4	6718	7/10/63	1738	30	26.2	18	1.5															
300	5	6793	8/10/63	0828	50	25.6	51	1.0															
301	6	6793	8/10/63	0958	30	25.6	51	0.5	1	18													
302	7	6787	8/10/63	1125	30	26.4	51	1.0															
303	7	6627	8/10/63	1303	36	26.8	84	1.5															
304	7	6888	8/10/63	1427	30	25.6	51	2.0															
305	6	6888	8/10/63	1507	30	25.8	72	2.0	3	12													
306	6	6810	9/10/63	1707	30	26.6	39	0.5															
307	3	6511	9/10/63	0644	30	25.6	41	0.5															
308	5	6511	9/10/63	0931	30	25.6	38	2.0															
309	6	6509	9/10/63	1194	30	25.6	70	2.0															
310	7	6509	9/10/63	1226	30	26.2	68	2.0															
311	8	6488	9/10/63	1358	30	25.8	117	1.0															
312	6	6489	9/10/63	1517	30	25.8	103	1.0															
313	5	6419	9/10/63	1637	30	25.8	69	1.0															
314	9	6387	10/10/63	1013	30	26.6	79	1.0															
315	10	6388	10/10/63	1132	30	25.6	68	2.0															
316	9	6406	10/10/63	1392	20	26.6	129	2.0	*														
317	8	6686	10/10/63	1417	30	25.6	84	0.1															
318	6	6687	10/10/63	1546	30	25.8	122	1.0															
319	8	6687	11/10/63	1217	30	25.6	93	1.0															
320	9	6688	11/10/63	1337	30	26.4	84	1.0	1	11													
321	8	6685	11/10/63	1502	30	25.8	89	0.5															
322	6	6886	11/10/63	1622	30	25.6	51	0.3															
323	7	6887	11/10/63	1737	30	25.6	51	0.3	3	13													
324	5	6888	12/10/63	0753	30	25.6	51	1.0															
325	4	6985	12/10/63	0920	30	26.0	17	1.5															
326	6	6987	12/10/63	1047	30	25.8	10	20.0	4	13													
327	7	6987	12/10/63	1293	30	25.8	10	0.0															
328	3	7499	16/10/63	0826	32	25.2	18	0.3	16	29													
329	3	7499	16/10/63	1817	34	25.2	18	0.3	17	27	1	51	12										
330	3	7294	16/10/63	1421	32	26.0	51	1.0	2	21	5	53	11	64									

STATION NUMBER	DEPTH (fm)	GRID REFERENCE	DATE	TIME OF DAY	HAUL DURATION (min)	BOTTOM TEMPERATURE (deg. C)	SEDIMENT CODE	TRASH QUANTITY (Basket)	COMMERCIAL				PRAWNS				NON-COMMERCIAL PRAWNS (No.)				OTHER PRAWNS No./Wt.		
									BANANA		TIGER		ENDEAVOUR		GREENTAIL & YORK		RAINBOW		BLUE LEG KING		RED SPOT KING (No.) PANDA (No.)		
									No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.			
231	3	7294	16/10/63	1518	30	26.0	51	1.0	1	25	5	48	16	48					2	113	15		
232	6	6893	17/10/63	0957	30	27.0	51	0.5	1	14	4	11											
233	6	6893	17/10/63	0832	30	26.8	51	0.8	6	13	6	19											
234	7	6696	17/10/63	1154	30	26.1	51	1.0					4	14									
235	7	6696	17/10/63	1249	31	26.8	51	1.5					1	6	11								
236	13	6382	16/10/63	0953	30	26.0	18	1.3					1	10	10								
237	6	6687	18/10/63	1505	30	26.1	51	1.0															
238	6	6687	19/10/63	0815	30	27.0	51	1.3					1	17									
239	6	7204	19/10/63	1415	30	26.2	51	1.3															
240	7	7500	22/10/63	1244	30	26.8	18	1.0	1	19												9	
241	8	7500	22/10/63	1407	30	27.2	4	1.0			26	29										26	
242	2	7599	22/10/63	1502	30	27.2	4	0.3	3	34	</												

STATION NUMBER	DEPTH (m)	GRID REFERENCE	DATE	TIME OF DAY	HAUL DURATION (min)	BOTTOM TEMPERATURE (deg C)	SEDIMENT CODE	TRASH QUANTITY (Buckets)	COMMERCIAL				PRAWNS				NON-COMMERCIAL PRAWNS (No.)				OTHER PRAWNS No./Pkt.				
									BANANA		TIGER		ENDEAVOUR		GREENTAIL & YORK		RAINBOW		BLUE LEG KING		RED SPOT KING (No.)		PANDA (No.)		
									No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.			
381	8	6794	31/10/63	0405	36	27.6	S1	1.6	5	18	25Lb	16	9	27									2	0	
382	7	6794	31/10/63	0409	60	27.6	S1	1.5	0	16	20Lb	16	32	29											
383	6	6895	31/10/63	0402	60	27.6	S1	3.0	1	16	83	14													
384	4	7092	31/10/63	0425	30	28.6	S1	1.6																	
385	2	7192	31/10/63	1149	30	28.6	S1	2.0																	
386	2	7191	31/10/63	1259	30	28.6	S1	0.1																	
387	5	6893	1/11/63	0635	30	28.6	S1	0.1																	
388	6	6894	1/11/63	0702	60	27.6	S1	4.6	23	18	64	16	2	29											
389	6	6794	1/11/63	0654	60	27.6	S1	2.0	27	17	40	16													
390	7	6794	1/11/63	1055	60	27.6	S1	2.6	13	139	16														
391	8	6795	1/11/63	1115	60	27.6	S1	2.0	16	14	14Lb	16													
392	8	6795	1/11/63	1225	60	27.6	S1	0.6	105	13	3H2	16													
393	7	6795	1/11/63	1335	60	27.6	S1	0.6	25	14	64	17													
394	6	6796	1/11/63	1457	60	27.6	S1	1.6	3	15	9	19	1	18											
395	9	6981	2/11/63	0911	30	27.6	S1	0.5		5	18														
396	8	7083	2/11/63	1129	30	27.6	S1	0.5																	
397	1	7487	7/11/63	1442	30	29.6	S4	4.5	20	31															
398	3	7397	7/11/63	1609	30	29.6	S4	0.5	18	30															
399	2	7397	7/11/63	1702	30	29.6	S4	1.6	13	23															
400	5	6795	9/11/63	1546	60	28.6	S1	0.5	28	16	2	23	1	227											
401	6	6795	9/11/63	1655	60	28.6	S1	3.0	233	6															
402	7	6795	9/11/63	1899	60	28.6	S1	5.0	126	14	136	18													
403	2	6795	9/11/63	1929	60	28.6	S1	4.6	16	14	219	18	4	23											
404	2	6795	9/11/63	2046	55	28.6	S1	2.5	43	13	264	17	16	23											
405	4	6795	9/11/63	2155	60	28.6	S1	2.6	162	14	232	18	25	26											
406	7	6795	9/11/63	2307	60	28.6	S1	4.6	50	16	419	20	40	40											
407	6	6795	10/11/63	0059	60	28.6	S1	4.6	69	17	49Lb	18	43	36											
408	7	6795	10/11/63	0233	60	28.6	S4	4.0	254	15	3H0	19	17	27											
409	8	6795	10/11/63	1058	60	28.6	S4	2.0	52	15	15Lb	17	3	21											
410	7	6795	10/11/63	2008	60	28.6	S4	1.5	23	16	240	17	12	21											
411	3	6795	10/11/63	2156	60	28.6	S4	1.5	6	15	226	13	9	19											
412	6	6796	10/11/63	2301	60	28.6	S1	1.5	12	13	234	16	5	19											
413	7	6796	11/11/63	0123	120	28.6	S1	0.6	10Lb	15	30Lb	18	7	22											
414	8	6695	11/11/63	0322	120	28.6	S1	4.0	19Lb	14	20Lb	15	7	23											
415	6	6799	11/11/63	1855	60	28.6	S1	1.0	66	18	10	19	16												
416	3	6794	11/11/63	2055	50	28.6	S1	0.5	11	11	4	21													
417	7	6695	11/11/63	2335	90	28.6	S1	0.6	9	16	15Lb	15	9	26											
418	7	6695	12/11/63	0018	90	28.6	S1	0.6	5	16	380	19	64	31											
419	7	6696	12/11/63	0158	90	28.6	S1	0.6	9	15	330	19	12	27											
420	8	6696	12/11/63	0334	90	28.6	S1	1.0	5	9															
421	7	6697	12/11/63	0945	60	28.7	S1	1.5																	
422	6	6797	12/11/63	1133	60	28.7	S1	0.5	8	12															
423	7	6794	12/11/63	1939	60	28.7	S1	1.5	5Lb	15	25Lb	13	128	23											
424	8	6795	12/11/63	2113	30	24.9	S1	1.0	18Lb	15	25Lb	15	37	27											
425	7	6795	12/11/63	2315	30	29.9	S1	0.6	1	16	12Lb	16	11	17											
426	7	6795	12/11/63	0056	80		S1	0.5			19Lb	14	9	17											
427	6	6795	12/11/63	0408	80		S1	0.5	4	14	6Lb	17	4	25											
428	7	6794	12/11/63	1955	80	28.6	S1	4.6	67	17	5Lb	16	73	28											
429	9	6794	12/11/63	2051	90	28.6	S1	0.6	1	14	177	12	42	46											
430	7	6696	12/11/63	1756	90	28.6	S1	5.0	12	16	12Lb	13	80	24											
431	8	6794	2/11/63	1101	30	28.3	S1	0.1																	
432	7	6795	2/11/63	1222	30	28.4	S4	1.0																	
433	7	6887	2/11/63	1495	30	28.4	S3	0.5	2	25															
434	6	6982	2/11/63	2031	30	28.6	S1	0.5	3	22															
435	6	6982	2/11/63	2153	30	28.6	S1	0.5	1	22															
436	5	6889	2/11/63	1545	30	28.6	S1	0.5																	
437	5	6889	2/11/63	1523	30	28.4	S1	0.5																	
438	7	6889	2/11/63	1555	30	28.4	S1	0.5																	
439	3	6810	2/11/63	0615	30	28.6	S1	0.1																	
440	6	6889	2/11/63	0934	30	28.6	S1	0.1																	
441	3	6811	2/11/63	0729	30	28.7	S1	0.5	6	15															
442	7	6811	2/11/63	0729	30	28.7	S1	0.5	33	26															
443	7	6798	22/11/63	1115	30	28.5	S1	0.5																	
444	5	7197	22/11/63	1248	30	28.5	S1	0.5																	
445	5	7197	22/11/63	1556	30	28.5	S1	0.5																	
446	5	7197	22/11/63	1512	30	28.5	S1	0.5	</																

STATION NUMBER	DEPTH (m)	GRID REFERENCE	DATE	TIME OF DAY	HAUL DURATION (min)	BOTTOM TEMPERATURE (deg C)	SEDIMENT CODE	TRASH QUANTITY (Buckets)	COMMERCIAL						PRAWNS						NON-COMMERCIAL PRAWNS (Nos.)							
									BANANA		TIGER		ENDEAVOUR		GREENTAIL & YORK		RAINBOW		BLUE LEG KING		RED SPOT KING (No.)		PANDA (Nos.)	CORAL	HARDBACK	GO-HOME	NEW GUINEA	
									No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.			
491	3	7583	26/11/63	1338	30	28.2	39	2.0																				
492	5	7404	26/11/63	1457	30	28.2	49	0.5																				
493	5	7492	26/11/63	1624	30	28.0	38	0.3																				
494	4	7492	26/11/63	1743	30	28.7		1.0																				
495	3	7582	27/11/63	0436	30	28.9	115	0.3	3	1																		
496	1	7602	27/11/63	0757	30	29.7	120	1.0	36	53	1																	
497	1	7601	27/11/63	0915	30	28.9	49	1.6			28	51																
498	3	7501	27/11/63	1832	30	28.7	39	0.8	1	28	1	151																
499	4	7401	27/11/63	1146	30	28.6	39	2.0	7	23	3	76																
500	3	7401	27/11/63	1306	30	28.4		1.0	4	17																		
501	6	6795	30/11/63	0842	30	28.8	51	0.3																				
502	6	6794	30/11/63	1120	30	28.8	46	0.4			20	23																
503	7	6794	30/11/63	1231	30	28.8	37	0.0	3	14	39	12	1	35														
504	6	6793	30/11/63	1346	30	28.8	34	0.8			7	11																
505	6	6693	30/11/63	1455	30	29.2		5.0	4	15	15	14	2	22														
506	6	6596	1/12/63	1826	30	28.8	51	1.0			25	11																
507	6	6596	1/12/63	1936	30	28.8	51	1.5			222	14	40	18														
508	6	6695	1/12/63	2047	30	28.8	51	1.5			284	17	40	21														
509	6	6695	1/12/63	2281	30	28.8	49	0.8	2	14	16LB	15	93	29														
510	6	6695	1/12/63	2313	30	28.8	49	0.8	44		16LB	15	170	21														
511	8	6695	2/12/63	0027	30	29.0	51	5.0	93	14	25LB	16	84	26														
512	9	6795	2/12/63	0140	30	29.0	53	4.8	61	13	15LB	17	30	28														
513	7	6795	2/12/63	0252	30	29.0	51	2.0			196	15	11	10														
514	7	6795	2/12/63	0404	30	28.8	51	2.0			52	13	6	14														
515	8	6795	2/12/63	0516	30	29.0	51	1.5			60	13	44	28														
516	9	6795	2/12/63	0628	30	29.0	51	1.5			56	13	31	27														
517	8	6696	3/12/63	0032	30	29.0	96	1.0			10	14	8LB	16	118	61												
518	8	6696	3/12/63	0119	30	29.0	55	3.0	10	14	8LB	16	118	61														
519	6	6795	3/12/63	0234	30	29.0	55	0.3	11	15	52		66	34														
520	6	6696	3/12/63	0323	30	29.0	55	0.3	11	15	6LB	16	15	26														
521	7	6696	3/12/63	0450	30	29.0	1.5		13	14	16LB	17	49	24														
522	8	6696	3/12/63	0502	30	29.0	55	0.3			6	13	44	28														
523	7	6796	4/12/63	0158	30	29.0	55	0.5	2	16	1	76		9														
524	7	6796	4/12/63	0259	30	29.0	51	2.5	3	14	98	12	12	15														
525	3	7395	6/12/63	1385	30	38.1	51	0.2	18	24					58		5											
526	1	7088	6/12/63	1421	30	38.0	58	1.0			25LB	53	1	113		90		8										
527	2	7599	6/12/63	1683	30	38.4	58	0.3	4	23					13		16											
528	3	7497	7/12/63	0738	30	29.9	18	0.3	1	30					2		1											
529	3	7498	7/12/63	0846	30	29.9	49	0.8	3	14	1	91																
530	4	7499	7/12/63	1000	30	29.7	50	0.5	6	21					6		1											
531	4	7498	7/12/63	1110	30	29.7	50	1.0	1																			
532	5	7388	7/12/63	1233	30	29.5	49	1.0																				
533	4	7399	7/12/63	1345	30	29.6	49	1.0																				
534	5	7398	7/12/63	1457	30	29.4	49	1.0																				
535	6	7397	14/12/63	1651	30	29.4	51	4.0			68	15	TLB	15														
536	7	6795	14/12/63	1816	30	29.0	51	0.0	1	15	51		15															
537	6	6695	14/12/63	1841	30	29.6	51	0.5	1	27	2	40																
538	6	6799	18/12/63	1208	30	29.6	51	0.8	1	27	4	50	1	35														
539	5	7299	18/12/63	1326	30	29.1	49	0.5	1	16																		
540	5	7293	18/12/63	1423	30	29.7	51	0.5	2	24																		
541	6	7293	18/12/63	1547	30	29.5	23	0.3	3	25																		
542	6	6795	14/12/63	1683	30	29.6	51	2.5			7LB	32					49	24	48									
543	7	6795	14/12/63	1805	30	29.5	50	1.3	1	15	39	15					43	91	54									
544	7	6795	14/12/63	1832	30	29.5	50	1.3			7LB	36	1	41			41	98	55									
545	8	6795	14/12/63	1841	30	29.6	51	0.3	10	14	172	16	19	23			48	66	65									
546	7	6795	14/12/63	1941	30	29.6	51	0.1	28	15	125	16	3	18			21	113	56									
547	7	6795	17/12/63	0120	30	38.5	51	0.5			2	24						47	81	112								
548	7	6795	17/12/63	0216	30	38.9	84	1.0			8LB	41					42	98	260									
549	7	6795	17/12/63	0312	30	38.2	36	1.0	135	36						49	24	145	350									
550	7	6795	17/12/63	0413	30	38.2	40	0.8	105							46	168	260										
551	8	6795	17/12/63	0504	30	38.5	18	1.0	17	65								52	120									
552	8	6795	17/12/63	0511	30	38.8	18	0.3	17	65				</														

STATION NUMBER	DEPTH (m)	GRID REFERENCE	DATE	TIME OF DAY	HAUL DURATION (min)	BOTTOM TEMPERATURE (deg. C)	SEGMENT CODE	TRASH QUANTITY (Buckets)	COMMERCIAL				PRAWNS				NON-COMMERCIAL PRAWNS (No.)					
									BANANA		TIGER		ENDEAVOUR		GREENTAIL & YORK		RAINBOW		BLUE LEG KING		RED SPOT KING (No.)	
									No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.
881	3	7198	21/ 4/64	1935	38	18	0.3										7	151	1			
882	6	7198	21/ 4/64	2050	38	54	0.3		1	22												
883	7	7197	23/ 4/64	2110	38	51	1.0		3	54	1	27					5	107				
884	8	7196	23/ 4/64	2325	38	34	2.0					5	17									
885	9	7304	23/ 4/64	2043	38	51	3.0															
886	9	7304	24/ 4/64	2209	38	48	3.0															
887	7	7305	24/ 4/64	2325	38	45	1.0*															
888	7	7308	24/ 4/64	0449	38	54	0.1		2	24												
889	6	7307	24/ 4/64	0625	38	51	0.3		3	23												
890	6	7328	24/ 4/64	1830	38	18	T															
891	5	6988	24/ 4/64	1925	38	18	1.0		2	38												
892	7	6988	24/ 4/64	2045	38	31	3.0		2	24	8	17										
893	9	6989	24/ 4/64	2203	38	34	3.0		4	22	10	13										
894	9	6986	24/ 4/64	2325	38	51	3.0		4	22	1	5										
895	7	6987	24/ 4/64	2040	38	52	1.5															
896	5	6980	24/ 4/64	2025	38	51	1.0		2	25												
897	2	6810	25/ 4/64	0332	38	51	0.5		5	74							14	113	10	48		
898	6	6711	25/ 4/64	0435	38	17	1.0		1	41							1					
899	2	6711	25/ 4/64	1813	38	4	0.1		1	52												
900	3	6611	25/ 4/64	1930	38	18	0.5															
901	9	6612	25/ 4/64	2050	38	23	0.5															
902	7	6610	25/ 4/64	2211	38	64	1.0															
903	7	6628	25/ 4/64	2323	38	18	1.5		16	15												
904	8	6887	26/ 4/64	2242	38	51	2.5		1	16												
905	6	6787	26/ 4/64	2026	38	82	4.0										3	185				
906	6	6788	26/ 4/64	0327	38	93	1.0		1	16												
907	4	6789	26/ 4/64	0445	38	75	0.5															
908	3	7588	26/ 4/64	1834	38	13	0.5		2	25							5	133	1	65	5	4
909	4	7490	26/ 4/64	1942	38	55	0.5		2	36							35	141			71	1
910	4	7490	26/ 4/64	2050	38	50	0.5		4	53							57	134	1	27	7	
911	3	7490	26/ 4/64	2115	38	14	0.5										2	151				
912	7	7299	1/ 5/64	2115	38	51	2.5		1	38	8	36	19							15	57	2
913	7	7299	1/ 5/64	2235	38	51	1.0													2	7	4
914	5	7299	1/ 5/64	2335	38	51	0.3		1	41	2	31	8	21						2	94	3
915	7	7299	1/ 5/64	2355	38	51	0.3		3	19	5	23	4	25						4	132	2
916	7	7299	1/ 5/64	2355	38	51	0.3		1	17	1	35	1	28						1	1	1
917	7	7197	2/ 5/64	0114	38	51	0.5		2	35	1	41	1	21								
918	2	7198	2/ 5/64	0232	38	55	0.3		1	17	1	35	1	28								
919	7	7197	2/ 5/64	0356	38	23	0.2		2	35	1	41	1	21								
920	7	7097	2/ 5/64	0516	38	23	0.5		2	14	5	15	21	28								
921	7	6997	2/ 5/64	1835	38	6	0.5		5	17	1	21	1	21								
922	8	6999	2/ 5/64	1952	38	34	1.5		28	19	24	28									1	33

STATION NUMBER	DEPTH (m)	GRID REFERENCE	DATE	TIME OF DAY	HAUL DURATION (min)	BOTTOM TEMPERATURE (deg. C)	SEGMENT CODE	TRASH QUANTITY (Buckets)	COMMERCIAL				PRAWNS				NON-COMMERCIAL PRAWNS (No.)						
									BANANA		TIGER		ENDEAVOUR		GREENTAIL & YORK		RAINBOW		BLUE LEG KING		RED SPOT KING (No.)		
									No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	
851	9	6908	2/ 5/64	2113	38	51	2.0		74	15	96	29	23	18					17	17	2	21	
852	9	6908	2/ 5/64	2155	38	51	1.5		1	12	129	29	27	18					6	14	6	6	
853	9	6901	2/ 5/64	2337	38	51	0.3					13	17	1	24								1
854	10	6905	5/ 5/64	0035	38	51	8.3		1	13	36	24											
855	9	7003	5/ 5/64	0220	38	23	1.5					8	15	1	22								
856	9	7002	5/ 5/64	0332	38	129	2.0																
857	4	7001	3/ 5/64	0455	38	51	3.0		19	17	17	27	6	17			3	227	15	82	1	23	
858	2	7597	7/ 5/64	1159	38	4	0.3		2	52							104	140	37	45	42	38	
859	2	7598	7/ 5/64	1255	38	4	0.3		19	56							1				41	24	
860	5	7549	6/ 5/64	1324	38	23	0.6																
861	2	7549	6/ 5/64	1450	38	17	0.1																
862	6	7498	6/ 5/64	1545	38	18	0.1																
863	3	7498	6/ 5/64	1649	38	12	T																
864	2	7597	7/ 5/64	1552	38	21	0.3		1	23							15	39	1				
865	3	7497	7/ 5/64	1649	38	23	0.1																
866	3	7496	7/ 5/64	1747	38	21	0.3																
867	3	7582	8/ 5/64	1425	38	4	0.3																
868	5	7582	8/ 5/64	1548	38	4	0.6		1	45							36	136	2	32			
869	3	7582	8/ 5/64	1712	38	4	0.8		8	21							2	227					
870	3	7484	9/ 5/64	0748	38	45	0.1																
871	5	7485	9/ 5/64	0857	38	7																	

STATION NUMBER	DEPTH (fm)	GRID REFERENCE	DATE	TIME OF DAY	HAUL DURATION (min)	BOTTOM TEMPERATURE (deg C)	SEDIMENT CODE	TRASH QUANTITY (Buckets)	COMMERCIAL				PRAWNS				NON-COMMERCIAL PRAWNS (Nm)			OTHER PRAWNS No./Nm							
									BANANA		TIGER		ENDEAVOUR		GREENTAIL & YORK		RAINBOW		BLUE LEG KING		RED SPOT KING (Nm)						
									No./Nm.	Count per lb.	No./Nm.	Count per lb.	No./Nm.	Count per lb.	No./Nm.	Count per lb.	No./Nm.	Count per lb.	No./Nm.	Count per lb.	No./Nm.	No./Nm.					
911	2	6711	16/ 5/64	0942	30	21.6	4	- +	1	27																	
912	3	6711	16/ 5/64	1046	30	22.0	21	0.3	1	45																	
913	2	6711	16/ 5/64	1147	15	22.3	21	0.3	1	58																	
914	1	6711	16/ 5/64	1217	15	23.0	23	1.0																			
915	1	6711	16/ 5/64	1233	30		4	- +																			
916	1	6711	16/ 5/64	1330	30		4	0.3	5	68																	
917	2	6611	16/ 5/64	1443	30		4	0.5																			
918	1	6611	16/ 5/64	1537	15		4	0.2																			
919	2	6511	16/ 5/64	1612	15	22.4	4	0.2																			
920	2	6511	16/ 5/64	1709	15	22.6	4	0.3																			
921	2	6412	17/ 5/64	0814	15	22.4	8	0.3																			
922	1	6412	17/ 5/64	0853	15	22.3	1	1.1																			
923	2	6511	17/ 5/64	0931	15	22.6	6	0.3																			
924	1	7400	19/ 5/64	0956	15	22.4	4	0.3																			
925	3	7400	19/ 5/64	1043	15	22.1	4	0.3																			
926	3	7400	19/ 5/64	1043	15	22.1	4	0.5																			
927	3	7505	19/ 5/64	1122	15	21.4	4	0.2																			
928	2	7505	19/ 5/64	1204	15	21.5	4	0.3																			
929	3	7505	19/ 5/64	1235	15	22.1	4	0.3																			
930	3	7505	19/ 5/64	1352	15	22.4	4	0.3	5	31																	
931	3	7605	19/ 5/64	1432	15	22.7	4	0.5	6	21																	
932	3	7400	19/ 5/64	1512	15	23.1	4	0.5	1	41																	
933	3	7305	19/ 5/64	1532	15	22.4	4	0.3	2	45																	
934	4	7305	19/ 5/64	1632	15	23.2	23	0.2	8	27																	
935	2	7407	19/ 5/64	0750	15	22.8	4	0.3																			
936	3	7305	19/ 5/64	0833	15	23.1	4	0.1	2	34																	
937	4	7307	19/ 5/64	0911	15	23.2	4	0.1	1	28																	
938	3	7307	19/ 5/64	0946	15	23.0	4	1.0																			
939	2	7307	19/ 5/64	1042	15	22.4	4	0.1																			
940	3	7307	19/ 5/64	1128	15	22.5	4	0.3																			
941	3	7206	19/ 5/64	1204	15	22.7	1	1.0																			
942	2	7206	19/ 5/64	1242	15	22.4	4	0.3																			
943	2	7206	19/ 5/64	1322	15	23.2	23	0.2	1	45																	
944	2	7308	19/ 5/64	1408	15	22.6	4	0.3																			
945	2	7308	19/ 5/64	1434	15	22.9	4	0.1	1	76																	
946	3	7308	19/ 5/64	1517	15	23.3	4	0.3																			
947	1	7597	22/ 5/64	0748	15	21.8	5	0.3																			
948	2	7497	22/ 5/64	0832	14	23.7	23	0.1																			
949	2	7498	22/ 5/64	0949	14	23.2	96	0.2																			
950	3	7398	22/ 5/64	1196	16	23.2	43	0.3	1	45																	
951	5	7208	22/ 5/64	1223	18	23.9	132	0.3	0	39																	
952	5	7208	22/ 5/64	1342	18	26.8	85	0.1																			
953	6	7145	22/ 5/64	1424	18	23.6	45	0.3																			
954	8	7196	22/ 5/64	1606	18	23.8	0.3																				
955	9	6996	23/ 5/64	1616	18	24.2	0.5																				
956	8	6997	23/ 5/64	1741	18	24.3	45	0.3	1	4																	
957	8	6998	23/ 5/64	1823	18	24.4	44	0.8																			
958	9	6999	23/ 5/64	1951	18	24.8	53	1.5	8	22																	
959	9	6981	23/ 5/64	2122	18	25.0	1.5	1.5	43	45																	
960	10	6982	23/ 5/64	2244	18	25.2	1.5	1.5	30	12	1	28															
961	11	6882	24/ 5/64	0808	18	25.8	0.3		29LBS	16	5LBS	16	13	22													
962	11	6882	24/ 5/64	0916	18	25.8	2.0		2	18	34LBS	16	13	43													
963	12	6882	24/ 5/64	0915	18	25.9	2.5		3	19	30LBS	14	9														
964	12	6881	24/ 5/64	0911	18	25.7	- +																				
965	12	6881	24/ 5/64	0937	18	25.5	2.8		13	15	9LBS	14	4	14													
966	11	6881	24/ 5/64	0918	18	25.3	1.5		6	16	5LBS	14	1	19													
967	10	6881	24/ 5/64	1022	18	25.2	2.8				9LBS	13	11	15													
968	13	6708	24/ 5/64	2255	18	25.3	2.0				5LBS	14	8	15													
969	12	6708	24/ 5/64	2126	18	25.3	2.5				7LBS	14	1	17													
970	12	6882	24/ 5/64	2234	18	25.6	3.0		1	16	53	14	5	20													
971	11	6880	24/ 5/64	2324	18	25.3	3.7				1	16	53	16	8	18											
972	11	6880	24/ 5/64	2324	18	25.3	3.7				2	16	54	14	4	17											
973	11	6881	25/ 5/64	0831	18	25.7	2.0		2	16	45LBS	15	1	41													
974	13	6881	25/ 5/64	0802	18	25.6	4.0				600LBS	19	14	14													
975	11	6882	25/ 5/64	0833	18	25.8	51	4.0			80LBS	14	80LBS	14													
976	11	6882	26/ 5/64	0818	18	25.6	48	4.0			2	15	1	13													
977	13	6882	19/ 5/64	1933	18	25.7	4.5	1.0				15	12	1	32												
978	13	6881	25/ 5/64	2																							

STATION NUMBER	DEPTH (m)	GRID REFERENCE	DATE	TIME OF DAY	HAUL DURATION (min)	BOTTOM TEMPERATURE (deg C)	SEDIMENT CODE	TRASH QUANTITY (Buckets)	COMMERCIAL				PRAWNS				NON-COMMERCIAL PRAWNS (No.)			OTHER PRAWNS No./Pkt.					
									BANANA		TIGER		ENDEAVOUR		GREENTAIL & YORK		RAINBOW		BLUE LEG KING		RED SPOT KING (No.)				
									No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.					
1011	12	6801	22/ 7/64	0029	30	22.7	59	1.6	1	15	10L	15	5	20							5	1			
1012	11	6800	22/ 7/64	0130	30	22.3	53	2.6			45	15	4	25											
1013	12	6708	22/ 7/64	1755	30	22.2	92	T			1	15													
1014	12	6707	22/ 7/64	1908	30	22.3		1.0			55	14	2	24											
1015	12	6831	22/ 7/64	2008	30	22.0	35	1.5			12L	13	3	17											
1016	12	6801	22/ 7/64	2107	30	22.4		0.1																	
1017	12	6832	22/ 7/64	2207	30	22.1	50	2.0			45	15	2	19											
1018	11	6802	22/ 7/64	2306	30	22.1	55	2.0			1	15	2	35											
1019	11	6903	23/ 7/64	0025	30	21.9	55	1.5																	
1020	10	7003	23/ 7/64	0119	30	21.5	55	0.1																	
1021	9	6746	24/ 7/64	1928	30	21.6	127	0.5	9	13															
1022	10	6706	24/ 7/64	1956	30	22.4	51	0.5			42	12													
1023	9	6705	24/ 7/64	2006	30	22.3	119		1	18															
1024	10	6844	24/ 7/64	2013	30	22.3	121	0.2																	
1025	10	6805	24/ 7/64	2043	30	22.1	127	0.1	2	13															
1026	11	6805	24/ 7/64	2043	30	22.1	127	0.1																	
1027	9	6805	24/ 7/64	0047	30	22.0	127	0.5																	
1028	10	6806	24/ 7/64	1943	30	21.4	93	1.0			12	12													
1029	9	6726	24/ 7/64	1140	32	21.8	93	1.0			7	12													
1030	10	6785	24/ 7/64	1300	30	21.8	93	0.5			3	14													
1031	9	6786	24/ 7/64	1357	30	21.5	91	1.0			11	11													
1032	9	6787	24/ 7/64	1458	30	21.4	75	1.0			11	12													
1033	7	6707	24/ 7/64	1555	30	21.7	48	1.0			1	9													
1034	8	6607	24/ 7/64	1710	30	21.9	78	1.0																	
1035	8	6707	24/ 7/64	1709	30	21.5	99	1.0																	
1036	8	6707	24/ 7/64	2007	30	21.7		1.0			1	13													
1037	9	6796	24/ 7/64	2104	30	21.8	48	1.5																	
1038	9	6746	24/ 7/64	2211	30	21.6	50	3.0			3	13	11	11											
1039	10	6805	24/ 7/64	2314	30	21.8	34	0.0			3	15	6	11											
1040	10	6805	24/ 7/64	0110	30	21.9	73	5.0			4	12	2	12											
1041	10	6804	24/ 7/64	0116	30	21.9	93	2.0			14	14	4	16	1	15									
1042	11	6804	24/ 7/64	0217	30	22.2	51	1.5			1	15	3	9											
1043	11	6803	24/ 7/64	1527	30	22.4	2.0				1	15	1	14											
1044	11	6802	24/ 7/64	1627	30	22.4	50	0.5																	
1045	12	6802	24/ 7/64	1729	30	22.4	56	3.0			32	14	6	13											
1046	12	6801	24/ 7/64	1835	30	22.4	51	1.5			8L	10	8L	15											
1047	13	6801	24/ 7/64	1920	30	22.5	49	1.5			3L	13	9L	14	6	22									
1048	12	6801	24/ 7/64	2022	30	22.3	50	1.5			5	13	4L	14	4	25									
1049	11	6901	24/ 7/64	2123	30	22.3	34	2.0			3L	13	2PL	14	19	23									
1050	11	6902	24/ 7/64	2233	30	22.1	50	2.0			4	14	6	14	2	28									
1051	11	6902	1/ 7/64	1915	30	22.3	51	0.0																	
1052	10	6901	1/ 7/64	1514	30	22.3	49	2.0			1	14	2	19											
1053	11	6801	1/ 7/64	1616	30	22.4	51	0.0			2	15	1	13											
1054	11	6800	1/ 7/64	1716	30	22.5	51	2.0			1	15	4	14											
1055	11	6788	2/ 7/64	0817	30	22.4	48	1.0																	
1056	12	6781	2/ 7/64	0916	30	22.4	35	1.0																	
1057	13	6781	2/ 7/64	1017	30	22.5	48	1.0																	
1058	14	6601	2/ 7/64	1117	30	22.8	49	1.5			3	13													
1059	15	6602	2/ 7/64	1242	30	22.6	50	2.5			2	10													
1060	14	6702	2/ 7/64	1302	30	22.5	48	2.5			15	13													

STATION NUMBER	DEPTH (m)	GRID REFERENCE	DATE	TIME OF DAY	HAUL DURATION (min)	BOTTOM TEMPERATURE (deg C)	SEDIMENT CODE	TRASH QUANTITY (Buckets)	COMMERCIAL				PRAWNS				NON-COMMERCIAL PRAWNS (No.)			OTHER PRAWNS No./Pkt.					
									BANANA		TIGER		ENDEAVOUR		GREENTAIL & YORK		RAINBOW		BLUE LEG KING		RED SPOT KING (No.)				
									No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.					
1061	13	6701	2/ 7/64	1905	30	22.8	40	2.0			14	12	1	11											
1062	12	6701	2/ 7/64	1925	30	22.8	40	2.0			15	12													
1063	2	6710	2/ 7/64	1925	30	22.8	21	6.0			110	18													
1064	1	6711	2/ 7/64	1618	30	21.8	21	5.0			48														
1065	2	6711	2/ 7/64	1712	30	22.8	9	3.0			7	14													
1066	2	6712	2/ 7/64	0749	30	22.9	14	4.0			2														
1067	4	6714	2/ 7/64	0834	30	21.7	51	0.5			1	21													
1068	5	6709	2/ 7/64	0932	30	21.1	51	0.5																	
1069	5	6710	2/ 7/64	1027	30	21.1	10	0.5																	
1070	5	6709	2/ 7/64	1127	30	21.1	51	0.5																	
1071	6	6609	2/ 7/64	1219	30	21.1	51	0.5																	

STATION NUMBER	DEPTH (m)	GRID REFERENCE	DATE	TIME OF DAY	HAUL DURATION (min)	BOTTOM TEMPERATURE (deg C)	SEGMENT CODE	TRASH QUANTITY (Buckets)	COMMERCIAL				PRAWNS				NON-COMMERCIAL PRAWNS (No.)				
									BANANA	TIGER	ENDEAVOUR	GREENTAIL & TURK	RAINBOW	BLUE LEG KING	RED SPOT KING (No.)	PANDA (No.)	CORAL	HARDBACK	CO-HOME	NEW GUINEA	OTHER PRAWNS No./Wt.
1111	5	61012	17/ 7/64	1307	30	23.2	65	1.0	1												
1112	4	61112	17/ 7/64	1406	30	23.2	122	0.1													
1113	5	61112	17/ 7/64	1502	30	23.1	24	0.1													
1114	2	61113	17/ 7/64	1643	30	23.4	28	1.0													
1115	4	62112	14/ 7/64	1223	30	23.2	52	0.1													
1116	4	62112	14/ 7/64	1317	30	23.1	63	0.3													
1117	6	61111	18/ 7/64	1412	30	23.2	116	0.2													
1118	7	61110	18/ 7/64	1504	30	23.1	119	0.1													
1119	8	61110	18/ 7/64	1602	30	23.2	98	0.3													
1120	10	61089	18/ 7/64	1702	30	23.3	65	0.5													
1121	10	61089	18/ 7/64	1801	30	23.2	64	1.0													
1122	11	61089	18/ 7/64	1902	30	23.2	67	1.0													
1123	11	60087	18/ 7/64	2003	29	23.2	66	0.5													
1124	19	62007	18/ 7/64	2202	30	23.2	112	0.5													
1125	14	62006	18/ 7/64	2302	30	23.2	77	0.5													
1126	9	63088	19/ 7/64	1242	30	23.1	114	T ✓													
1127	9	63087	19/ 7/64	1340	30	23.1	117	T ✓													
1128	10	63086	19/ 7/64	1437	30	23.1	82	0.5*													
1129	11	63086	19/ 7/64	1548	30	23.0	96	T ✓													
1130	12	63086	19/ 7/64	1649	30	23.1	132	0.5													
1131	11	63066	19/ 7/64	1806	30	23.0	93	2.5													
1132	10	63087	19/ 7/64	1923	30	23.1	91	0.1													
1133	9	63086	19/ 7/64	2046	30	22.9	110	T ✓													
1134	7	63086	19/ 7/64	2200	30	22.9	88	0.8	5	13											
1135	5	63110	19/ 7/64	2313	30	23.1	69	0.1													
1136	2	63111	20/ 7/64	2121	30	23.4	17	0.1													
1137	1	64111	20/ 7/64	2201	30	23.4	84	0.3													
1138	3	64111	20/ 7/64	1438	30	23.2	51	T ✓													
1139	5	64110	20/ 7/64	1548	30	23.1	69	0.4													
1140	7	64087	20/ 7/64	1725	30	23.0	115	1.0													
1141	8	64087	20/ 7/64	1836	30	23.0	66	1.0	1	11											
1142	14	65093	25/ 7/64	1610	30	22.8	80	T ✓													
1143	17	65093	25/ 7/64	1727	30	22.8	35	0.1													
1144	15	65093	25/ 7/64	1840	30	22.8	48	T ✓	1	1											
1145	15	65093	25/ 7/64	1955	30	22.8	95	0.5													
1146	13	65093	25/ 7/64	2118	30	22.8	114	0.5													
1147	11	66003	25/ 7/64	2228	30	22.5	130	T ✓													
1148	12	66003	25/ 7/64	2302	30	22.5	51	0.1													
1149	13	66002	26/ 7/64	0058	30	22.5	54	4.0													
1150	13	66002	26/ 7/64	1844	30	22.7	34	T ✓	1	23	12	6	17								
1151	14	66011	26/ 7/64	2000	30	22.6	59	T ✓	1	15	2	14	1	14							
1152	14	66002	26/ 7/64	2115	30	22.6	48	0.0													
1153	13	67003	26/ 7/64	2233	30	22.5	51	0.1													
1154	13	67002	26/ 7/64	2340	30	22.6	51	0.1													
1155	13	67002	27/ 7/64	0043	30	22.6	49	T ✓													
1156	13	67001	27/ 7/64	0215	30	22.6	44	1.0		170	14	63	12	15							
1157	13	67001	27/ 7/64	0304	30	22.6	46	0.1			11	15	1	11							
1158	12	67002	27/ 7/64	1638	30	22.6	48	0.1													
1159	12	67002	27/ 7/64	1755	30	22.6	89	0.5	2	14	1	14									
1160	12	67001	27/ 7/64	1910	30	22.6	88	0.3			25	12	6	15							

STATION NUMBER	DEPTH (m)	GRID REFERENCE	DATE	TIME OF DAY	HAUL DURATION (min)	BOTTOM TEMPERATURE (deg C)	SEGMENT CODE	TRASH QUANTITY (Buckets)	COMMERCIAL				PRAWNS				NON-COMMERCIAL PRAWNS (No.)				
									BANANA	TIGER	ENDEAVOUR	GREENTAIL & TURK	RAINBOW	BLUE LEG KING	RED SPOT KING (No.)	PANDA (No.)	CORAL	HARDBACK	CO-HOME	NEW GUINEA	OTHER PRAWNS No./Wt.
1161	13	67001	27/ 7/64	0016	30	22.6	53	1.0	65	14	68	14	0	15				143	96	18	6
1162	13	67001	27/ 7/64	0159	30	22.6	51	0.5	18LR	12	6LR	12	3	17				15	15	15	15
1163	13	67002	27/ 7/64	2147	30	22.5	51	0.5	12	15	17A	14	3	17				14	14	14	14
1164	13	67002	27/ 7/64	2250	30	22.5	14	0.5	6	14	143	15	5	23				14	14	14	14
1165	15	67002	28/ 7/64	0020	30	22.6	51	3.0	1PLR	14	6LR	15	3	21				14	14	14	14
1166	13	67002	28/ 7/64	0045	30	22.6	51	0.5	6	11	4	11	1	31				14	14	14	14
1167	14	67002	28/ 7/64	1352	30	22.6	54	0.5	40LR	15	5	13						14	14	14	14
1168	13	67001	28/ 7/64	1654	30	22.6	51	0.3	8	14	1	7						14	14	14	14
1169	13	67001	28/ 7/64	1738	30	22.7	51	T ✓	80	13	67	13	12	15				14	14	14	14
1170	13	67001	28/ 7/64	1858	30	22.7	51	0.6	80	13	67	13	12	15				14	14	14	14
1171	13	67001	28/ 7/64	1922	30	22.6	51	0.5	44	12	46	12	5	15				14	14	14	14
1172	12	66001	28/ 7/64	2026	30	22.6	19	3.0	12A	12	46	12	4	13				14	14	14	14
1173	15	68002	28/ 7/64	2129	30	22.6	51	1.5	5VLR	12	66	12	7	13				14	14	14	14
1174	12	67002	28/ 7/64	2129	30	22.6	51	T ✓	4	12	4	14						14	14	14	14
1175	11	66002	28/ 7/64	2312	30	22.6	51	1.5	1	1	1	1						14	14	14	14
1176	12	67002	28/ 7/64	1207	25	21.4	60	0.1	1	1	1	1						14	14	14	14
1177	11	66002	28/ 7/64	1433	30	21.5															

STATION NUMBER	DEPTH (m)	GRID REFERENCE	DATE	TIME OF DAY	HAUL DURATION (min)	BOTTOM TEMPERATURE (deg C)	SEDIMENT CODE	TRASH QUANTITY (kg/m)	COMMERCIAL				PRAWNS				NON-COMMERCIAL PRAWNS (kg)				OTHER PRAWNS No./Pkt.		
									BANANA		TIGER		ENDEAVOUR		GREENTAIL & YORK		RAINBOW		BLUE LEG KING		RED SPOT KING (kg)		
									No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.			
1211	18	7082	8/ 8/64	1155	30	22.1	48	0.3	18	13	3	9	1								42		
1212	14	6640	15/ 8/64	1113	30	22.2	59	1.5	1		27	11											
1213	13	6601	15/ 8/64	1236	30	21.5	51	2.0	23	14	7	16	2	3	10						11		
1214	13	6701	15/ 8/64	1356	30	22.9	49	2.0	3	14	15	10											
1215	12	6700	13/ 8/64	1510	30	22.0	88	1.0															
1216	12	6799	13/ 8/64	1619	30	22.0	86	2.5	2		4	14	1										
1217	11	6899	15/ 8/64	1727	30	22.9	51	1.5	2	14	4	14											
1218	11	6886	13/ 8/64	1838	30	21.9	49	2.0	5	10	85	19									8		
1219	11	6888	13/ 8/64	1935	30	22.0	51	3.0	251.8	14	SLB	21									175		
1220	12	6821	13/ 8/64	2003	30	21.9	51	3.0	4	13	67	17	14								10		
1221	12	6881	14/ 8/64	1222	30	22.1	51	2.5	5	15	8	15									5		
1222	12	6801	14/ 8/64	1357	30	22.1	48	1.0	4	15	24												
1223	11	6800	14/ 8/64	1445	30	22.0	48	3.0	2001.8	12	13	15											
1224	11	6886	14/ 8/64	1532	30	21.9	49	1.5	5	14	15	13	2	18									
1225	11	6886	14/ 8/64	1852	30	21.9	49	2.0	2	13	4	15											
1226	12	6881	14/ 8/64	1852	30	21.9	49	2.0	1	13	5	12	2	14									
1227	12	6881	14/ 8/64	2009	30	21.1	51	3.0	11	12	68	13	59	17									
1228	11	6882	14/ 8/64	2116	30	22.0	51	0.3	25	12	7	13	4	22							45		
1229	11	6883	14/ 8/64	2223	30	21.5	51	2.5	68	13	44	15	11	23							22		
1230	11	6982	15/ 8/64	1247	30	22.0	51	3.0	2	15	1	12									15		
1231	10	6982	15/ 8/64	1358	30	22.1	48	1.0*	1	18	6	10											
1232	11	6981	15/ 8/64	1593	30	22.1	51	3.2			3	4											
1233	10	6981	15/ 8/64	1608	30	22.0	51	2.4	30	15	32	15	1	17									
1234	11	6881	15/ 8/64	1712	30	22.0	51	1.5			52		1	18									
1235	12	6881	15/ 8/64	1828	30	22.3	51	2.5	1	16	45	15	6	17									
1236	12	6881	15/ 8/64	1920	30	22.1	51	1.0	5	13	103	14	15	17									
1237	12	6882	15/ 8/64	2032	30	22.0	51	0.2			3	14	4	28							18		
1238	7	7282	19/ 8/64	1312	30	21.1	51	0.2															
1239	6	7182	19/ 8/64	1327	30	21.5	51	0.4															
1240	7	7397	20/ 8/64	1545	30	21.0	60	0.6															
1241	8	7888	20/ 8/64	1643	30	21.0	51	1.0			9	12											
1242	7	7889	20/ 8/64	1742	30	21.0	55	T															
1243	8	7889	20/ 8/64	1841	30	21.0	51	1.0			2	2	11	1	23								
1244	8	7888	20/ 8/64	1957	30	21.0	50	1.0	1	18	5	12	1	23									
1245	9	7888	20/ 8/64	2182	30	21.0	51	1.0			18	29	13	4	19								
1246	10	6981	20/ 8/64	2298	30	21.0	51	1.0			5	12	48	13	28						6		
1247	10	6981	20/ 8/64	2317	30	21.4	51	1.5			8	15	44	15	19						3		
1248	11	6881	21/ 8/64	2427	30	21.0	51	2.0	20	13	64	15	13	19							11		
1249	6	6886	21/ 8/64	1848	30	21.0	115	0.2													1		
1250	7	6897	21/ 8/64	1956	30	21.0	51	1.0	1	13	54	12	34	15									
1251	8	6876	21/ 8/64	2059	30	21.0	51	1.5			11	29	13	4	23								
1252	7	6876	21/ 8/64	2282	30	21.5	50	2.0			15	51	11	16	13						16		
1253	8	6865	21/ 8/64	2317	30	21.0	51	2.0			3	14	72	12	11						1		
1254	9	6865	22/ 8/64	0825	30	21.0	51	1.0	10	14	48	12	15	13							31		
1255	17	6499	22/ 8/64	1642	30	22.2	78	2.0													3		
1256	16	6488	22/ 8/64	1749	30	22.5	79	1.0			9	10	35	10							2		
1257	16	6488	22/ 8/64	1856	30	22.5	36	0.2			1	4	4	19							1		
1258	17	6481	22/ 8/64	1826	30	22.3	51	2.0			16	9	38	14									
1259	14	6481	22/ 8/64	2133	30	22.4	68	1.0			14	9	16	13							10		
1260	15	6481	22/ 8/64	2248	30	22.0	48	2.0	27	14	35	10	15	15							6		

STATION NUMBER	DEPTH (m)	GRID REFERENCE	DATE	TIME OF DAY	HAUL DURATION (min)	BOTTOM TEMPERATURE (deg C)	SEDIMENT CODE	TRASH QUANTITY (kg/m)	COMMERCIAL				PRAWNS				NON-COMMERCIAL PRAWNS (kg)				OTHER PRAWNS No./Pkt.		
									BANANA		TIGER		ENDEAVOUR		GREENTAIL & YORK		RAINBOW		BLUE LEG KING		RED SPOT KING (kg)		
									No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.			
1261	15	6502	22/ 8/64	2349	30	22.4	49	2.0	49	13	28	11	12	15									
1262	10	6684	23/ 8/64	1593	30	22.4	48	0.3															
1263	10	6684	23/ 8/64	1886	30	22.4	98	0.5															
1264	10	6683	23/ 8/64	1789	30	22.4	93	0.8															
1265	11	6682	23/ 8/64	1811	30	22.4	125	0.3															
1266	11	6881	23/ 8/64	1915	30	22.1	48	1.0	2	13	55	12	6	19									
1267	14	6880	23/ 8/64	2021	30	22.2	50	1.0	101	13	55	12	25	19									
1268	12	6889	23/ 8/64	2130	30	22.4	51	1.0	18	14	26	12	16	16									
1269	13	6700	23/ 8/64	2242	30	22.2	40	1.0	18	14	55	12	4	21									
1270	15	6880	23/ 8/64	2359	30	22.3	48	1.0	8	13	13	11	16										

STATION NUMBER	DEPTH (m)	GRID REFERENCE	DATE	TIME OF DAY	HAUL DURATION (min)	BOTTOM TEMPERATURE (deg C)	SEDIMENT CODE	TRASH QUANTITY (Buckets)	COMMERCIAL				PRAWNS				NON-COMMERCIAL PRAWNS (No.)			
									BANANA	TIGER	ENDEAVOUR	GREENTAIL & YORK	RAINBOW	BLUE LEG KING	RED SPOT KING (No.)	PANDA (No.)	COAL	HARDBACK	GO-HOME	NEW GUINEA
No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	
1361	8	7884	18/ 9/64	2354	30	49	2.0									5	22			
1362	9	7883	19/ 9/64	6853	30	50	0.5	2	14	1	18									
1363	9	7882	19/ 9/64	6821	30	38	0.2										4			
1364	9	7882	19/ 9/64	6820	30	49	0.5	2	11	1	1					1	19	10	3	
1365	8	7181	19/ 9/64	1647	30	49	0.3													
1366	7	7181	19/ 9/64	1743	30	33	0.3	7	11											
1367	7	7181	19/ 9/64	1839	30	49	1.0	7	12	1										
1368	7	7180	19/ 9/64	1930	30	48	1.0	8	12	4	15	1	24					4	4	
1369	6	7180	19/ 9/64	2022	30	49	1.0	7	12	2	17									
1370	7	7199	19/ 9/64	2120	30	51	1.0	16	12	3	19						1			
1371	8	7199	19/ 9/64	2217	30	51	1.0	10	12	1										
1372	8	7899	19/ 9/64	2317	30	51	1.0			2	15						1	12		
1373	8	6959	20/ 9/64	1854	30	49	0.2													
1374	9	6959	20/ 9/64	1550	30	51	+													
1375	10	6859	20/ 9/64	1247	30	50	0.8													
1376	11	6888	20/ 9/64	1347	30	58	0.2													
1377	11	6789	20/ 9/64	1448	30	51	0.5												2	
1378	12	6789	20/ 9/64	1544	30	51	0.1												3	
1379	10	6859	20/ 9/64	1647	30	51	0.8													
1380	9	6888	20/ 9/64	1747	30	51	0.8	2	14	2	15									
1381	9	6888	20/ 9/64	1846	30	51	1.4													
1382	6	7286	20/ 9/64	1953	30	51	0.8	1	12	3	13	5	24							
1383	8	7001	20/ 9/64	2046	30	49	0.5													
1384	8	7001	20/ 9/64	2135	30	58	2.5		10LR	13										
1385	9	7891	20/ 9/64	2217	15	58	0.1	1	11											
1386	9	7891	21/ 9/64	6843	15	48	2.5		6LR	12										
1387	9	6981	21/ 9/64	6860	30	58	0.2	6	11											
1388	10	6982	21/ 9/64	6953	30	55	0.0													
1389	10	7882	21/ 9/64	6954	30	58	0.1													
1390	8	7183	23/ 9/64	1987	30	50	2.0	5	15											
1391	9	7883	23/ 9/64	2086	30	51	3.0	87	13	1								35	5	
1392	9	7882	23/ 9/64	2136	30	51	3.0	49	15											
1393	8	7882	23/ 9/64	2236	30	49	3.0	140LR	13	6	11						1			
1394	8	7882	23/ 9/64	5253	30		1.5	2	14	4	12									
1395	6	7083	24/ 9/64	6918	30	49	0.8	1	14											
1396	9	7882	24/ 9/64	1217	30	49	0.8	1	13											
1397	8	7183	24/ 9/64	1319	30	49	1.0													
1398	8	7183	24/ 9/64	1410	30	49	+													
1399	7	7194	24/ 9/64	1838	30	49	4.0			1	15									
1400	7	7194	24/ 9/64	1941	30	49	2.0											875		
1401	8	7084	24/ 9/64	2046	30	51	3.0	2	13									525		
1402	8	7084	24/ 9/64	2149	30	49	3.5	35	11									875		
1403	8	7084	24/ 9/64	2300	30	51	2.5		6LR	13	1									
1404	8	7094	24/ 9/64	2344	30		4.0		10LR	12										
1405	8	7085	25/ 9/64	1044	30	50	5.5	73	15	1										
1406	8	7085	25/ 9/64	1949	30	52	5.5	153	11											
1407	8	7085	25/ 9/64	2180	35	51	2.0	107	12											
1408	7	7085	25/ 9/64	2213	30	49	1.5		76	11										
1409	8	7195	25/ 9/64	3524	60	54	5.0		12LR	12										
1410	8	7084	26/ 9/64	0102	60	93	7.0	110	12	1	12	1	17							

STATION NUMBER	DEPTH (m)	GRID REFERENCE	DATE	TIME OF DAY	HAUL DURATION (min)	BOTTOM TEMPERATURE (deg C)	SEDIMENT CODE	TRASH QUANTITY (Buckets)	COMMERCIAL				PRAWNS				NON-COMMERCIAL PRAWNS (Nos.)			OTHER PRAWNS No./Wt.
									BANANA		TIGER		ENDEAVOUR		GREENTAIL & YORK		RAINBOW		BLUE LEG KING	
No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	COAL	HARDBACK	GO-HOME	NEW GUINEA
1411	9	6984	26/9/64	0300	60	58	2.5	1	15	2	13									
1412	12	6799	27/9/64	1302	38	60	0.3			4	11									
1413	11	6788	27/9/64	1405	60	60	1.0			4	11									
1414	12	6680	27/9/64	1548	60	60	2.6			28	12									
1415	11	6801	27/9/64	1719	60	51	2.0			14	13									
1416	11	6802	27/9/64	1858	60	51	3.0			62	12	43	23							
1417	10	6982	27/9/64	2024	60	51	2.5			26	11	7	19							
1418	10	7082	27/9/64	2206	60	51	2.0			5	10	4	23							
1419	11	6981	28/9/64	0225	60	51	0.3			78	15	35	17							
1420	11	6801	28/9/64	0210	60	51	0.0			201.9	12	15LB	13							
1421	12	6800	28/9/64	0350	60	4.0				50LB	12	17LB	12							
1422	12	6800	28/9/64	0349	6	62	0.2			2	14	14	13							
1423	12	6800	28/9/64	0326	60	46	3.5			30LB	12	30LB	13							
1424	12	6801	28/9/64	2334	60	46	2.8			101.9	11	46	13							
1425	12	6801	29/9/64	0042	60	68	3.8	2	12	101.8	12	65	16							
1426	11	6802	29/9/64	0213	60	49	3.6	2	10	101.8	13	29	28							
1427	12	6802	29/9/64	0346	60	58	4.8	11		91.8	13	4	17							
1428	6	6795	4/10/64	0826	38	93	0.5			2	16	15								
1429	8	6797	4/10/64	0126	60	44	2.5			127	10	39	13							
1430	8	6797	4/10/64	0257	60	45	2.8			127	12	4	14							
1431	8	6696	4/10/64	0426	60	55	2.8			1	11	109	16	17	17					
1432	8	6695	4/10/64	1800	30	55	1.5			2	124	15	2	15						
1433	8	6695	4/10/64	1852	60	55	2.5			139	15	35LB	15	21	17					
1434	8	6795	4/10/64	2007	60	51	1.5			3	13	15LB	14	17	15					
1435	7	6796	4/10/64	2140	60	51	2.9			4	15	106	13	19	16					
1436	8	6796	4/10/64	2316	60	55	2.8			42	12	73	12	15						
1437	7	6696	5/10/64	0034	60	55	0.30			18	14	24	14	16	21					
1438	8	6696	5/10/64	0207	60	51	1.8			39	13	81.8	14	19	15					
1439	8	6796	5/10/64	0320	60	58	1.5			122	13	7	10							
1440	9	6981	12/10/64	1640	30	51	0.2				15	14	12	21						
1441	10	6801	12/10/64	1941	60	51	0.8			106	12	47	17							
1442	11	6800	12/10/64	2111	60	51	0.8	6	11	68	12	46	15							
1443	11	6808	13/10/64	0043	60	80	0.5			48	13	30	12							
1444	12	6780	13/10/64	0215	60	88	0.5			15	112	13	49	13						
1445	12	6799	13/10/64	0252	60	89	0.3			71	12	17	12							
1446	15	6680	13/10/64	1942	60	87	1.7			7	18	5	12							
1447	15	6800	13/10/64	2115	60	77	0.1			25	10	9	12							
1448	8	7099	17/10/64	1811	60	55	4.5													
1449	8	7099	17/10/64	1928	60	55	0.5			2	12	47	15	61	16					
1450	8	6998	17/10/64	2048	60	55	1.0			3	11	126	10	39	14					
1451	8	6997	17/10/64	2216	60	51	2.0			2	12	106	14	39	16					
1452	8	6997	17/10/64	2353	60	51	0.3			73	14	36	15							
1453	8	6696	18/10/64	0128	60	51	0.5			5	13	99	13	29	14					
1454	8	6695	18/10/64	0432	60	41	0.3			31	14	4	26							
1455	6	6696	18/10/64	2035	48	51	0.3			2	57									
1456	6	6696	18/10/64	2145	60	83	0.3			35	13	4	16							
1457	8	6796	18/10/64	2314	60	56	0.3	19	1b	107	14	16	15							
1458	7	6795	19/10/64	0043	60	82	0.2	1	15	125	17	16	17							
1459	7	6895	19/10/64	0212	60	128	0.2			11	13	1	16							
1460	7	6896	19/10/64	0348	75	46.8				2	9									

STATION NUMBER	DEPTH (m)	GRID REFERENCE	DATE	TIME OF DAY	HAUL DURATION (min)	BOTTOM TEMPERATURE (deg C)	SEDIMENT CODE	TRASH QUANTITY (Buckets)	COMMERCIAL				PRAWNS				NON-COMMERCIAL PRAWNS (Nos.)			OTHER PRAWNS No./Wt.
									BANANA		TIGER		ENDEAVOUR		GREENTAIL & YORK		RAINBOW		BLUE LEG KING	
No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	COAL	HARDBACK	GO-HOME	NEW GUINEA
1461	6	6996	19/10/64	1923	60	113	0.1	2	24								6	15		
1462	7	6997	19/10/64	2050	60	49	1.0	1	11	79	12	3.4	17							
1463	8	6997	19/10/64	2229	60	49	0.8	8	13	61	13	42	14							
1464	8	6997	19/10/64	2357	60	50	0.2	19	14	198	15	48	15							
1465	8	6897	20/10/64	0127	60	51	0.1			6	16	4	14							
1466	8	6696	20/10/64	0334	60	50	0.2			15	12	5								
1467	10	6899	20/10/64	0432	60	50	0.1			18	19	2	14							
1468	8	7095	20/10/64	0826	48	93	0.2			35	13	4	16							
1469	8	6797	20/10/64	2135	60	43	0.2	1		22	14	6	13							
1470	8	7095	20/10/64	2383	60	51	0.5	4	47	5	54									
1471	7	6991	21/10/64	0031	60	50	0.5	1	17											
1472	4	7300	25/10/64	1429	30	26.3	50	0.2												
1473	5	7300	25/10/64	1455	30	26.3	0.3													
1474	5	7295	25/1																	

STATION NUMBER	DEPTH (fm)	GRID REFERENCE	DATE	TIME OF DAY	HAUL DURATION (min)	BOTTOM TEMPERATURE (deg C)	SEDIMENT CODE	TRASH QUANTITY (Pounds)	COMMERCIAL				PRAWNS				NON-COMMERCIAL PRAWNS (Nos.)					
									BANANA		TIGER		ENDEAVOUR		GREENTAIL & YORK		RAINBOW		BLUE LEG KING		RED SPOT KING (Nos.)	
									No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.
1611	3	7287	16/	1/65	0855	38	29.9	16	1.0													
1612	3	7287	16/	1/65	0933	38	30.1	17	0.3													
1613	4	7188	16/	1/65	1046	38	30.1	16	0.3													
1614	4	7188	16/	1/65	1130	38	30.3	17	0.1													
1615	3	7188	16/	1/65	1233	38	30.4	16	0.1													
1616	4	7888	16/	1/65	1356	38	30.5	19	0.3													
1617	5	7888	16/	1/65	1454	38	30.5	9	0.1													
1618	6	6987	16/	1/65	1548	38	30.5	18	0.1													
1619	7	6987	16/	1/65	1642	38	30.4	41	0.5	1	19											
1620	6	6788	16/	1/65	1736	38	30.3	16	0.3													
1621	2	6789	17/	1/65	0842	38	30.4	17	1.0	16	30					1	6					
1622	3	6789	17/	1/65	0935	38	30.4	10	0.5	1	24					1						
1623	4	6789	17/	1/65	1829	38	30.3	17	0.1													
1624	4	6788	17/	1/65	1921	38	30.3	18	0.1													
1625	5	7086	17/	1/65	1215	38	30.5	18	0.5													
1626	4	7086	17/	1/65	1336	38	30.6	18	0.5													
1627	5	7187	17/	1/65	1431	38	30.6	51	0.1													
1628	6	7187	17/	1/65	1523	38	30.6	51	0.1													
1629	5	7287	17/	1/65	1617	38	30.5	50	0.3													
1630	6	7287	17/	1/65	1712	38	30.6	51	0.1													
1631	4	7386	17/	1/65	1803	38	30.6	44	0.1	2	27					1	1					
1632	6	7386	17/	1/65	1857	38	30.4	23	0.5	2	16					6	9					35
1633	4	7385	18/	1/65	1901	38	30.2	23	0.1													
1634	4	7385	18/	1/65	1933	38	30.4	51	0.1													
1635	5	7386	18/	1/65	1446	38	30.4	41	0.1													
1636	5	7384	18/	1/65	1548	38	30.6	51	0.1													
1637	6	7383	18/	1/65	1633	38	30.4	18	0.1													
1638	7	7384	18/	1/65	1728	38	30.4	17	0.1													
1639	7	7284	18/	1/65	1822	38	30.3	51	0.1													
1640	7	7285	18/	1/65	1951	38	30.4	51	0.1													
1641	7	7285	18/	1/65	2045	38	30.3	51	0.3													
1642	7	7188	18/	1/65	2136	38	30.5	44	0.5													
1643	7	7188	18/	1/65	2233	38	30.5	58	0.3													
1644	7	7084	19/	1/65	0627	38	30.2	59	0.5	1	13											
1645	10	6983	19/	1/65	1812	38	30.1	51	2.0													
1646	11	6983	19/	1/65	1936	38	29.9	51	0.1													
1647	12	6788	20/	1/65	1332	38	29.9	39	0.1													
1648	12	6789	20/	1/65	1427	38	29.8	50	0.5													
1649	11	6681	20/	1/65	1524	38	29.9	49	1.6													
1650	12	6681	20/	1/65	1623	38	30.1	51	1.5													
1651	13	6681	20/	1/65	1723	38	30.2	51	0.5													
1652	12	6788	20/	1/65	1821	38	30.1	51	0.1													
1653	13	6788	20/	1/65	1916	38	30.0	51	1.0													
1654	11	6880	20/	1/65	2100	38	29.9	51	1.5													
1655	7	6790	20/	1/65	0752	38	30.0	117	0.1													
1656	7	6798	20/	1/65	0847	38	30.0	93	0.3													
1657	7	6798	20/	1/65	0937	38	30.2	59	0.1													
1658	7	6797	20/	1/65	1029	38	30.2	51	0.1													
1659	7	6797	20/	1/65	1124	38	30.3	18	0.1													
1660	7	6797	20/	1/65	1222	38	30.5	51	0.6													
1661	7	6997	22/	1/65	1347	38	30.2	51	0.1													
1662	7	7097	22/	1/65	1441	38	30.2	18	0.1													
1663	7	6996	22/	1/65	1554	38	30.8	d4	0.5													
1664	7	7097	22/	1/65	1633	38	30.5	82	0.1													
1665	6	6895	23/	1/65	1852	38	30.5	14	1.6													
1666	6	6894	23/	1/65	1947	38	30.5	17	2.5													
1667	7	6790	23/	1/65	1947	38	30.4	25	0.1													
1668	6	6702	24/	1/65	2017	38	30.5	51	0.1													
1669	5	6892	24/	1/65	2017	38	30.6	51	0.1													
1670	6	6893	24/	1/65	2112	38	30.6	51	0.3													
1671	5	6893	24/	1/65	2224	38	29.9	50	0.1													
1672	7	6795	24/	1/65	2319	38	30.2	23	0.1													
1673	7	6795	24/	1/65	1937	38	30.2	18	0.1													
1674	7	6795	24/	1/65	2035	38	30.2	18	0.1													
1675	6	6795	24/	1/65	2130	38	30.1	18	0.1													
1676	7	6795	24/	1/65	2117	38	29.2	18	1.6													
1677	7	6794	24/	1/65	1307	38	29.2	18	+													
1678	7	6794	24/	1/65	1484	38	29.5	93	0.5													
1679	7	6795	24/	1/65	1459	38	29.4	93	1.5													
1680	7	6795	24/	1/65	1553	38	29.3	93	3.0													
1681	7	6795	24/	1/65	1658	38	29.4	51	0.5													
1682	8	6795	24/	1/65	1752	38	29.4	63	0.1													
1683	8	6795	24/	1/65	2027	38	29.5	114	0.5													
1684	9	6897	24/	1/65	2127	38	29.5	83	0.6													

STATION NUMBER	DEPTH (m)	GRID REFERENCE	DATE	TIME OF DAY	HAUL DURATION (min)	BOTTOM TEMPERATURE (deg C)	SEDIMENT CODE	TRASH QUANTITY (grams)	COMMERCIAL PRAWNS						NON-COMMERCIAL PRAWNS (No.)				OTHER PRAWNS No./wt.								
									BANANA		TIGER		ENDEAVOUR		GREENTAIL & YORK		RAINBOW		BLUE LEG KING	RED SPOT KING (No.)	PANDA (No.)	CORAL	HARDBACK	GO-HOME	NEW GUINEA		
									No./wt.	Count per lb.	No./wt.	Count per lb.	No./wt.	Count per lb.	No./wt.	Count per lb.	No./wt.	Count per lb.	No./wt.	Count per lb.	No./wt.	No./wt.	No./wt.	No./wt.			
1711	5	7297	4/ 2/65	1425	38	29.5	91	6.2	6	37	9	33	2	3						185	12						
1712	6	7197	4/ 2/65	1522	38	29.4	18	6.2	7	28	8	15							95	13							
1713	7	7197	4/ 2/65	1654	38	29.5	17	6.1	18	18	37	21							217	23							
1714	7	7896	5/ 2/65	0747	38	29.5	58	0.1																			
1715	7	7897	5/ 2/65	0842	38	29.5	19	0.0	2	18	4	16															
1716	8	6998	5/ 2/65	0936	38	29.6	50	1.6	6	11	2	14	1	23						1	2	1					
1717	6	7896	4/ 2/65	1535	38	29.5	51	1.6	5	13	2	2	2	34	1												
1718	7	7897	5/ 2/65	1133	38	29.7	18	0.3	11	15	4	19															
1719	8	7897	5/ 2/65	1252	40	29.6	18	1.0	39	17																	
1720	7	7897	5/ 2/65	1425	38	29.6	93	0.3	28	22	1	17	1	25													
1721	6	7197	5/ 2/65	1522	60	29.7	59	0.8	208	25	2	50	99	25					1	19	206	7					
1722	6	7297	6/ 2/65	1484	38	29.6	18	0.1												1	1	1					
1723	5	7297	6/ 2/65	1500	38	29.7	51	0.3	19	22										1	1	1					
1724	6	7197	6/ 2/65	1557	38	29.6	50	0.3	42	18	1	38	6	22						1	1	1					
1725	7	7197	6/ 2/65	1652	38	29.6	17	0.1	9	14										1	2	2					
1726	6	7197	6/ 2/65	1752	60	29.7	54	0.8												1							
1727	7	7197	6/ 2/65	1954	38	29.7	17	0.1	7	15	1	57	24	23						258	15						
1728	7	7297	6/ 2/65	2035	38	29.8	51	0.1	8	19	2	57	28	25	1					185	11						
1729	6	7297	6/ 2/65	2137	38	29.8	91	0.1	127	24										88	6	15					
1730	7	7297	6/ 2/65	2248	38	29.8	50	0.1	17	22	2	78	14	7						65	28						
1731	6	7297	6/ 2/65	2318	38	29.8	50	0.1	15	24	3	40	20	31						105	11						
1732	6	7296	7/ 2/65	0812	60	29.8	16	0.1	3	19	3	35	39	38	1					88	9						
1733	6	7299	7/ 2/65	0812	30	29.8	51	0.1	31	24										108	2						
1734	6	7297	7/ 2/65	0847	38	29.8	50	0.1	27	23										56	1	7					
1735	6	7197	7/ 2/65	0845	38	29.7	51	0.1	29	22										23	23	23	23	23	23	23	
1736	6	7197	7/ 2/65	0842	38	29.8	53	0.1	16	20	1	65	3	32	2					75	11						
1737	7	6996	7/ 2/65	1922	30	30.0	57	1.0			17	10	2	11													
1738	8	6997	7/ 2/65	2017	38	30.0	57	0.1																			
1739	8	6997	7/ 2/65	2116	38	30.0	51	0.1																			
1740	9	6998	7/ 2/65	2208	38	30.0	51	0.1																			
1741	6	6998	7/ 2/65	2302	38	29.8	51	1.0																			
1742	9	6999	8/ 2/65	0800	60	29.8	51	2.0																			
1743	9	6998	8/ 2/65	0813	60	29.7	51	1.0																			
1744	9	6998	8/ 2/65	0830	60	29.7	51	1.0																			
1745	3	7109	13/ 2/65	1022	30	30.7	18	1																			
1746	3	7009	13/ 2/65	1121	30	30.6	17	3.0																			
1747	4	7009	13/ 2/65	1230	38	30.5	17	1.3																			
1748	5	7009	13/ 2/65	1330	45	30.6	15	7																			
1749	4	7008	13/ 2/65	1434	38	30.6	4	1.0																			
1750	2	7009	13/ 2/65	1528	38	31.1	23	0.3*																			
1751	3	7009	13/ 2/65	1625	38	31.0	51	0.3*																			
1752	3	6998	13/ 2/65	1732	38	30.9	23	0.1																			
1753	2	6998	14/ 2/65	0842	38	30.6	51	0.5																			
1754	2	6998	14/ 2/65	0736	38	30.6	6	0.7																			
1755	3	6998	14/ 2/65	0826	60	30.2	40	2.0																			
1756	3	6998	14/ 2/65	1809	30	30.4	14	0.0																			
1757	2	6710	14/ 2/65	1102	36	30.5	25	0.1																			
1758	3	6710	14/ 2/65	1155	38	30.5	17	0.18																			
1759	2	6710	14/ 2/65	1255	60	30.4	17	0.0																			
1760	21	6699	28/ 2/65	2244	60	29.9	50	0.3																			
1761	5	6809	14/ 2/65	1558	30	30.4	18	0.3																			
1762	6	6808	14/ 2/65	1710	38	30.3	51	0.3																			
1763	8	6808	15/ 2/65	1732	38	30.2	51	0.3																			
1764	4	6808	16/ 2/65	1940	38	30.5	51	0.1																			
1765	4	6808	16/ 2/65	2025	38	30.5	51	0.3																			
1766	4	6809	16/ 2/65	2121	38	30.4	51	0.3																			
1767	6	6808	16/ 2/65	2215	60	18.6	55	0.1																			
1768	8	6598	14/ 2/65	2348	40	30.5	18	0.5	11	17	78	15	41	17													
1769	11	6489	14/ 2/65	2184	38	30.5	16	0.1	1	12	4	17															
1770	11	6489	14/ 2/65	2184	38	30.4	16	0.1																			
1771	10	6489	14/ 2/65	2552	38	29.3	16	0.3																			
1772	9	6489	14/ 2/65	0536	38	30.5	51	0.1																			
1773	8	6598	14/ 2/65																								

STATION NUMBER	DEPTH (m)	GRID REFERENCE	DATE	TIME OF DAY	HAUL DURATION (min)	BOTTOM TEMPERATURE (deg C)	SEDIMENT CODE	TRAWL QUANTITY (kg/t)	COMMERCIAL				PRAWNS				NON-COMMERCIAL PRAWNS (Nm)			OTHER PRAWNS No./Nm.									
									BANANA		TIGER		ENDEAVOUR		GREENTAIL & YORK		RAINBOW		BLUE LEG KING	RED SPOT KING (Nm)	PANDA (Nm)	CORAL	HARDBACK	GO-HOME	NEW GUINEA				
									No./Nm.	Count per lb.	No./Nm.	Count per lb.	No./Nm.	Count per lb.	No./Nm.	Count per lb.	No./Nm.	Count per lb.	No./Nm.	Count per lb.	No./Nm.	Count per lb.	No./Nm.	Count per lb.	No./Nm.				
1811	3	7288	11/ 3/65	1807	38	27.4	93	0.5																			2LB		
1812	2	7407	14/ 3/65	0905	38	27.4	4	0.5	5	50																46			
1813	2	7406	14/ 3/65	0946	38	27.1	4	0.5			15															53			
1814	2	7406	14/ 3/65	1042	30	27.4	17	0.1	4	50															10				
1815	3	7406	14/ 3/65	1121	38	27.0	16	0.3	6	60															11				
1816	2	7585	14/ 3/65	1213	38	27.4	18	0.3			25														12				
1817	2	7584	14/ 3/65	1300	38	27.3	4	0.4	2	113															31				
1818	1	7584	14/ 3/65	1352	38	27.4	23	0.5			25														15				
1819	3	7406	14/ 3/65	1582	38	26.6	18	0.6*	76	54															50				
1820	4	7308	14/ 3/65	1602	38	28*	16	0.1	3	32															4				
1821	4	7308	14/ 3/65	1644	38	28*	16	0.3	16	41															4				
1822	4	7308	14/ 3/65	1726	38	28.4	16	0.3	17	58															11				
1823	4	7308	14/ 3/65	1888	38	28.4	4	0.5	71	42															10				
1824	1	7407	15/ 3/65	0705	38	27.7	4	0.4	43	51															12				
1825	2	7407	15/ 3/65	0743	38	27.9	18	0.6	1	25															6				
1826	2	7307	15/ 3/65	0822	38	27.9	14	0.5																					
1827	3	7307	15/ 3/65	0981	38	27.9	17	0.3																					
1828	3	7307	15/ 3/65	0949	2																								
1829	3	7307	15/ 3/65	1039	38	27.6	23	0.3																					
1830	2	7306	15/ 3/65	1127	38	27.7	21	0.3																					
1831	2	7306	15/ 3/65	1207	38	27.9	21	0.1	9	58																			
1832	2	7407	15/ 3/65	1302	38	28.6	55	1.5																					
1833	2	7307	15/ 3/65	1354	38	28.2	4	0.5	1	30																			
1834	3	7306	15/ 3/65	1431	38	28.1	23	0.7	1	57																			
1835	1	7109	16/ 3/65	1123	38	28.6	96	0.5																					
1836	2	7109	16/ 3/65	1287	45	28.5	90	0.5	1	20																			
1837	2	7885	16/ 3/65	1316	38	28.4	55	1.5																					
1838	1	8018	17/ 3/65	0910	38	27.8	18	0.5	120	48																			
1839	2	8018	17/ 3/65	0954	38	27.7	50	0.3	68	55																			
1840	3	6710	17/ 3/65	1047	38	27.7	17	0.5	25	34																			
1841	2	6710	17/ 3/65	1137	38	28.1	9	0.5	56	39																			
1842	4	6711	17/ 3/65	1216	38	27.9	9	-																					
1843	4	6710	17/ 3/65	1327	38	27.8	106	0.3																					
1844	5	6710	17/ 3/65	1423	38	27.7	41	0.6	6	25																			
1845	6	6689	17/ 3/65	1519	38	27.9	50	0.3	2	25																			
1846	5	6610	17/ 3/65	1625	38	27.9	51	0.3																					
1847	5	6610	17/ 3/65	1717	38	27.9	51	0.3	6	27																			
1848	3	6710	18/ 3/65	0702	38	27.9	8	0.3	20	38																			
1849	2	6610	18/ 3/65	0750	38	27.9	51	0.3	26	29																			
1850	3	6689	18/ 3/65	0846	38	28.0	51	1.0	6	28																			
1851	4	6689	18/ 3/65	0948	38	28.0	51	0.5	1	38																			
1852	5	6986	18/ 3/65	1042	38	28.0	18	0.3																					
1853	7	7307	18/ 3/65	1430	38	28.1	23	0.1																					
1854	7	7108	18/ 3/65	1445	38	28.6	51	0.1	3	1																			
1855	8	7108	18/ 3/65	1539	38	28.1	51	0.1	2	17																			
1856	8	7108	18/ 3/65	1625	38	28.1	51	0.3	6	18																			
1857	9	7002	18/ 3/65	1721	38	28.6	51	0.1	6	18																			
1858	9	7002	18/ 3/65	1821	38	28.7	51	2.1*																					
1859	10	7002	18/ 3/65	1917	60	28.7	49	2.0	12	15	2																	5	21
1860	10	6981	19/ 3/65	2049	38	28.0	50	0.5	83	13	2	19																6	6

STATION NUMBER	DEPTH (m)	GRID REFERENCE	DATE	TIME OF DAY	HAUL DURATION (min)	BOTTOM TEMPERATURE (deg C)	SEDIMENT CODE	TRAWL QUANTITY (kg/t)	COMMERCIAL				PRAWNS				NON-COMMERCIAL PRAWNS (Nm)			OTHER PRAWNS No./Nm.							
									BANANA		TIGER		ENDEAVOUR		GREENTAIL & YORK		RAINBOW		BLUE LEG KING	RED SPOT KING (Nm)	PANDA (Nm)	CORAL	HARDBACK	GO-HOME	NEW GUINEA		
									No./Nm.	Count per lb.	No./Nm.	Count per lb.	No./Nm.	Count per lb.	No./Nm.	Count per lb.	No./Nm.	Count per lb.	No./Nm.	Count per lb.	No./Nm.	Count per lb.	No./Nm.	Count per lb.	No./Nm.		
1861	10	6982	21/ 3/65	1405	38	24.5	51	1.0																		1	15
1862	10	6982	21/ 3/65	1405	38	24.5	51	1.0																			
1863	11	6983	21/ 3/65	1656	38	24.5	51	1.0																			
1864	11	6984	21/ 3/																								

STATION NUMBER	DEPTH (fm)	GRID REFERENCE	DATE	TIME OF DAY	HAUL DURATION (min)	BOTTOM TEMPERATURE (deg C)	SEDIMENT CODE	TRASH QUANTITY (Buckets)	COMMERCIAL				PRAWNS				NON-COMMERCIAL PRAWNS (No.)			
									BANANA		TIGER		ENDEAVOUR		GREENTAIL & YORK		RAINBOW		BLUE LEG KING	
									No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	RED SPOT KING (No.)	PANDA (No.)
1911	8	6898	30/ 3/65	2005	30	26.2	93	0.5	28	2	143	2	27	1	21	1	1	6	16	
1912	8	6898	30/ 3/65	2135	30	26.2	93	0.5	28	2	143	2	32	2	21	1	1	14	21	
1913	8	6798	30/ 3/65	2217	30	26.2	93	0.5	28	2	143	2	2	2	21	1	1	13	20	
1914	8	6798	30/ 3/65	2312	30	26.2	92	0.5	28	2	143	2	2	2	21	1	1	13	17	
1915	9	6798	30/ 3/65	2353	30	26.2	92	1.5	28	2	143	2	2	2	21	1	1	13	15	
1916	10	6798	31/ 3/65	0109	30	26.2	93	0.5	28	2	143	2	2	2	21	1	1	13	15	
1917	11	6798	31/ 3/65	0223	30	26.2	93	0.5	28	2	143	2	2	2	21	1	1	13	15	
1918	11	6798	31/ 3/65	0330	30	26.2	94	2.5	28	2	143	2	2	2	21	1	1	6	17	
1919	11	6808	31/ 3/65	0456	30	26.2	94	1.5	28	2	143	2	2	2	21	1	1	6	15	
1920	11	6808	31/ 3/65	1607	30	26.2	91	0.5	28	2	143	2	2	2	21	1	1	1	15	
1921	11	6808	31/ 3/65	1927	30	26.2	94	0.5	28	2	143	2	2	2	21	1	1	1	15	
1922	10	6808	31/ 3/65	2008	30	26.2	91	0.5	28	2	143	2	2	2	21	1	1	1	15	
1923	11	6808	31/ 3/65	2052	30	26.2	91	0.5	28	2	143	2	2	2	21	1	1	1	14	
1924	10	6808	31/ 3/65	2149	30	26.2	90	0.5	28	2	143	2	2	2	21	1	1	1	14	
1925	9	6808	31/ 3/65	2322	60	26.2	51	0.5	28	2	143	2	2	2	21	1	1	4	16	
1926	9	6808	1/ 4/65	0041	60	26.2	49	2.0	28	2	143	2	2	2	21	1	1	2	19	
1927	9	6808	1/ 4/65	0206	60	26.2	51	1.0	28	2	143	2	2	2	21	1	1	2	22	
1928	9	6808	1/ 4/65	0315	60	26.2	51	0.5	28	2	143	2	2	2	21	1	1	2	22	
1929	10	6808	1/ 4/65	0854	30	26.2	49	0.5	28	2	143	2	2	2	21	1	1	2	22	
1930	10	6808	1/ 4/65	1437	30	26.2	51	0.5	28	2	143	2	2	2	21	1	1	2	22	
1931	10	6808	1/ 4/65	2021	30	26.2	51	1.0	28	2	143	2	2	2	21	1	1	3	16	
1932	10	6808	1/ 4/65	2117	30	26.2	51	0.1	28	2	143	2	2	2	21	1	1	1	16	
1933	9	6808	1/ 4/65	2281	30	26.2	49	1.0*	28	2	143	2	2	2	21	1	1	1	15	
1934	9	6808	1/ 4/65	2327	60	26.2	51	0.7	28	2	143	2	2	2	21	1	1	1	15	
1935	9	6808	1/ 4/65	2241	60	26.2	51	1.0*	28	2	143	2	2	2	21	1	1	1	15	
1936	9	6808	2/ 4/65	0200	30	26.2	51	0.5	28	2	143	2	2	2	21	1	1	1	15	
1937	9	6808	2/ 4/65	0338	30	26.2	48	0.5	28	2	143	2	2	2	21	1	1	1	15	
1938	9	6808	2/ 4/65	1928	30	26.2	50	2.0	28	2	143	2	2	2	21	1	1	3	16	
1939	9	6808	2/ 4/65	2014	30	26.2	48	1.5	28	2	143	2	2	2	21	1	1	3	16	
1940	10	6808	2/ 4/65	2053	30	26.2	49	2.0*	28	2	143	2	2	2	21	1	1	6	16	
1941	10	6808	2/ 4/65	2206	30	26.2	49	2.0	28	2	143	2	2	2	21	1	1	6	16	
1942	10	6808	2/ 4/65	2247	30	26.2	48	3.0	28	2	143	2	2	2	21	1	1	6	16	
1943	9	6808	2/ 4/65	0085	30	26.2	48	2.0	28	2	143	2	2	2	21	1	1	1	15	
1944	10	6808	2/ 4/65	0455	30	26.2	49	2.0*	28	2	143	2	2	2	21	1	1	1	15	
1945	10	6808	2/ 4/65	0138	30	26.2	49	2.5	28	2	143	2	2	2	21	1	1	1	15	
1946	9	6808	2/ 4/65	0225	30	26.2	49	4.0	28	2	143	2	2	2	21	1	1	3	16	
1947	9	6808	2/ 4/65	0318	30	26.2	48	1.5	28	2	143	2	2	2	21	1	1	3	16	
1948	9	6808	2/ 4/65	0407	30	26.2	48	2.0	28	2	143	2	2	2	21	1	1	3	16	
1949	9	6808	2/ 4/65	1845	30	26.2	48	2.5	28	2	143	2	2	2	21	1	1	3	16	
1950	9	6808	2/ 4/65	1926	30	26.2	48	6.3*	28	2	143	2	2	2	21	1	1	3	16	
1951	9	6808	2/ 4/65	2039	30	26.2	48	9.5	28	2	143	2	2	2	21	1	1	3	16	
1952	9	6808	2/ 4/65	2125	30	26.2	48	2.5	28	2	143	2	2	2	21	1	1	3	16	
1953	10	6808	2/ 4/65	2224	60	26.2	49	8.0	28	2	143	2	2	2	21	1	1	3	16	
1954	9	6808	2/ 4/65	2357	60	26.2	49	8.0	28	2	143	2	2	2	21	1	1	3	16	
1955	9	6808	2/ 4/65	0110	40	26.2	49	8.0	28	2	143	2	2	2	21	1	1	3	16	
1956	9	6808	2/ 4/65	0240	60	26.2	49	7.0	28	2	143	2	2	2	21	1	1	3	16	
1957	9	6808	2/ 4/65	0410	60	26.2	48	1.5	28	2	143	2	2	2	21	1	1	3	16	
1958	9	6808	2/ 4/65	1852	30	26.2	48	1.5	28	2	143	2	2	2	21	1	1	3	16	
1959	9	6808	2/ 4/65	1949	30	26.2	49	1.5	28	2	143	2	2	2	21	1	1	3	16	
1960	9	6808	2/ 4/65	2045	30	26.2	51	1.0	28	2	143	2	2	2	21	1	1	3	16	
1961	9	6808	6/ 4/65	2287	30	26.2	51	1.0	28	2	143	2	2	2	21	1	1	3	16	
1962	10	6808	6/ 4/65	2383	30	26.2	50	9.0	28	2	143	2	2	2	21	1	1	3	16	
1963	10	6704	6/ 4/65	2359	30	26.2	50	9.5	28	2	143	2	2	2	21	1	1	3	16	
1964	11	6704	7/ 4/65	0034	30	26.2	50	9.3	28	2	143	2	2	2	21	1	1	3	16	
1965	11	6704	7/ 4/65	0151	30	26.2	50	0.1	28	2	143	2	2	2	21	1	1	3	16	
1966	12	6704	7/ 4/65	0247	30	26.2	50	0.1	28	2	143	2	2	2	21	1	1	3	16	
1967	9	6808	7/ 4/65	1958	30	26.2	48	1.0	28	2	143	2	2	2	21	1	1	3	16	
1968	9	6808	7/ 4/65	2227	30	26.2	49	1.5	28	2	143	2	2	2	21	1	1	3	16	
1969	9	6808	7/ 4/65	2310	30	26.2	51	2.5	28	2	143	2	2	2	21	1	1	3	16	
1970	9	6808	7/ 4/65	2359	30	26.2	51	1.0*	28	2	143	2	2	2	21	1	1	3	16	
1971	9	6808	8/ 4/65	0049	40	26.2	51	0.7	28	2	143	2	2	2	21	1	1	3	16	
1972	10	6808	8/ 4/65	0155	30	26.2	50	1.5	28	2	143	2	2	2	21	1	1	3	16	
1973	9	6808	8/ 4/65	0255	30	26.2	51	2.0	28	2	143	2	2	2	21	1	1	3	16	
1974	9	6808	8/ 4/65	0356	30	26.2	51	1.0	28	2	143	2	2	2	21	1	1	3	16	
1975	9	6808	8/ 4/65	1932	30	26.2	51	1.0	28	2	143	2	2	2	21	1	1	3	16	
1976	9	6808	11/ 4/65	1812	28	26.5	45	0.5	28	2	143	2	2	2	21</					

STATION NUMBER	DEPTH (m)	GRID REFERENCE	DATE	TIME OF DAY	HAUL DURATION (min)	BOTTOM TEMPERATURE (deg C)	SEDIMENT CODE	TRASH QUANTITY (Buckets)	COMMERCIAL				PRAWNS				NON-COMMERCIAL PRAWNS (No.)				OTHER PRAWNS No.			
									BANANA		TIGER		ENDEAVOUR		GREENTAIL & YORK		RAINBOW		BLUE LEG KING					
									No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.				
2111	12	6801	12/ 5/65	2343	30	27.1	8A	2.0	1	18	15	13	5	22					2	11				
2112	9	6805	13/ 5/65	2154	30	26.6	4B	2.5																
2113	9	6805	13/ 5/65	2235	45	26.7	4B	2.5	2	15	1	15												
2114	9	6806	14/ 5/65	0022	30	26.7	51	0.8																
2115	8	6806	14/ 5/65	0332	30	26.6	49	2.0																
2116	8	6806	14/ 5/65	1912	30	26.6	51	3.0																
2117	9	6805	14/ 5/65	2687	30	26.6	59	7.0																
2118	9	6805	14/ 5/65	2696	60	26.7	51	12.0 ⁺																
2119	9	6805	14/ 5/65	2822	30	26.7	59	4.0	1	15														
2120	10	6804	14/ 5/65	2305	30	26.6	59	3.0																
2121	9	6804	15/ 5/65	0082	30	26.6	49	9.0		14	25	3	13											
2122	9	6805	15/ 5/65	1124	30	26.6	58	0.6	1	16	1	11												
2123	9	6807	15/ 5/65	1980	30	26.6	59	0.5																
2124	9	6806	15/ 5/65	1928	30	26.6	51	0.3																
2125	9	6786	15/ 5/65	2303	30	26.7	51	1.5																
2126	9	6786	15/ 5/65	2153	30	26.6	58	1.5																
2127	9	6786	15/ 5/65	2243	30	26.6	51	0.5																
2128	9	6786	15/ 5/65	2325	30	26.6	51	0.3																
2129	9	6786	16/ 5/65	P038	32	26.8	91	4.5																
2130	9	6786	16/ 5/65	0117	60	26.6	91	1.0																
2131	10	6785	16/ 5/65	0243	60	26.8	91	1.5																
2132	8	6806	16/ 5/65	1947	30	26.9	51	2.0																
2133	9	6806	16/ 5/65	2002	15	26.0	59	0.1																
2134	9	6806	16/ 5/65	2044	20	26.0	51	4.0													20			
2135	9	6806	16/ 5/65	2145	15	26.0	51	0.1																
2136	9	6806	16/ 5/65	2153	15	25.6	51	0.1													5			
2137	9	6806	16/ 5/65	2528	40	26.3	51	0.6																
2138	9	6786	19/ 5/65	1818	30	26.7	51	0.3																
2139	9	6786	19/ 5/65	1912	30	26.7	51	0.5																
2140	9	6806	19/ 5/65	P085	15	26.2	93	1.0													20			
2141	9	6806	19/ 5/65	2033	60	26.6	127	3.0													20			
2142	9	6806	19/ 5/65	2080	30	26.2	127	0.3													50			
2143	8	6806	19/ 5/65	2250	15	26.2	127	0.3																
2144	9	6807	20/ 5/65	1312	30	26.1	44	0.1																
2145	8	6787	20/ 5/65	1417	30	26.3	51	1.0																
2146	9	6807	20/ 5/65	1526	30	26.4	91	0.1																
2147	8	6806	20/ 5/65	1625	30	26.0	105	T																
2148	9	6806	20/ 5/65	1725	30	26.5	93	0.1																
2149	9	6806	20/ 5/65	2045	60	26.6	98	0.5													30			
2150	9	6806	20/ 5/65	P080	30	26.6	98	0.1																
2151	9	6806	21/ 5/65	1738	30	26.1	48	1.5 ⁺	3	15														
2152	9	6807	21/ 5/65	1632	30	26.1	49	0.5																
2153	9	6806	21/ 5/65	1929	30	26.2	49	2.0																
2154	9	6806	21/ 5/65	2015	60	26.1	49	2.0																
2155	9	6807	21/ 5/65	2157	30	26.1	58	0.8 ⁺																
2156	9	6807	21/ 5/65	2245	30	26.1	58	0.8																
2157	9	6807	21/ 5/65	2337	45	26.0	48	7.0	106	15	1	15												
2158	9	6807	22/ 5/65	P052	30	26.0	48	6.0	84															
2159	9	6806	23/ 5/65	1980	30	26.1	51	3.0																
2160	9	6806	23/ 5/65	1956	40	26.1	51	1.0	25	14											16			

STATION NUMBER	DEPTH (m)	GRID REFERENCE	DATE	TIME OF DAY	HAUL DURATION (min)	BOTTOM TEMPERATURE (deg C)	SEDIMENT CODE	TRASH QUANTITY (Buckets)	COMMERCIAL				PRAWNS				NON-COMMERCIAL PRAWNS (No.)				OTHER PRAWNS No.	
									BANANA		TIGER		ENDEAVOUR		GREENTAIL & YORK		RAINBOW		BLUE LEG KING			
									No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.		
2161	9	6806	23/ 5/65	2030	45	25.2	51	2.0	25L	15											54	
2162	9	6806	23/ 5/65	2266	15	26.1	51	1.5	T	✓											23	
2163	9	6806	23/ 5/65	2311	30	26.0	51	2.0			78	14										
2164	9	6806	24/ 5/65	0104	60	26.8	51	1.0														
2165	9	6806	24/ 5/65	1926	30	26.8	51	0.8														
2166	10	6806	24/ 5/65	2012	40	26.2	49	1.0														
2167	9	6806	24/ 5/65	2113	30	26.3	49	0.8														
2168	9	6806	24/ 5/65	2155	60	26.3	51	1.0														
2169	9	6806	25/ 5/65	P014	30	26.2	48	1.0														
2170	9	6806	25/ 5/65	0856	60	26.2	48	3.0														
2171	9	6806	25/ 5/65	P229	60	26.2	48	3.0														
2172	10	6806	25/ 5/65	1792	30	26.4	49	1.0														
2173	9	6806	25/ 5/65	1755	30	26.3	51	4.0														
2174	9	6806	25/ 5/65	1845	30	26.3	51	4.0														
2175	9	6786	25/ 5/65	1958	30	26.3	51	1.0														
2176	9	6806	25/ 5/65	2116	60	26.2	51	2.0			</											

STATION NUMBER	DEPTH (m)	GRID REFERENCE	DATE	TIME OF DAY	HAUL DURATION (min)	BOTTOM TEMPERATURE (deg. C)	SEDIMENT CODE	TRASH QUANTITY (kg)	COMMERCIAL			PRAWNS			NON-COMMERCIAL PRAWNS (No.)		
									No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	
2211	10	6787	11/ 6/65	1354	23	49	4.8	150Lb	14								
2212	10	6787	11/ 6/65	1433	15	51	4.8	150Lb	14								
2213	9	6886	11/ 6/65	1611	30	24.3	51	0.3									
2214	8	6787	12/ 6/65	1008	15	24.3	51	1.0	5								
2215	9	6787	12/ 6/65	1317	14	24.4	51	0.3	+								
2216	9	6787	12/ 6/65	1358	13	51	0.5	50	14								
2217	9	6787	12/ 6/65	1411	15	51	3.0	190Lb	15								
2218	9	6787	12/ 6/65	1425	38	23.8	51	0.5	5	150Lb	14						
2219	9	6787	12/ 6/65	1525	32	51	1.0	5	150Lb	15							
2220	9	6787	12/ 6/65	1618	34	51	0.5	250Lb	14								
2221	9	6787	12/ 6/65	1653	35	51	1.0	600Lb	15								
2222	18	6886	15/ 6/65	1012	30	24.3	51	0.8	4								
2223	9	6886	15/ 6/65	1139	30	24.3	50	0.3	5	28Lb	13						
2224	9	6886	15/ 6/65	1235	30	24.4	51	2.0	5	18	13						
2225	9	6785	15/ 6/65	1432	30	24.4	51	6.1									
2226	9	6886	15/ 6/65	1610	30	24.4	51	6.1									
2227	18	6886	17/ 6/65	1514	30	24.3	49	0.2									
2228	9	6886	17/ 6/65	1628	30	24.3	49	0.1	1		12						
2229	8	6887	17/ 6/65	1734	30	24.2	51	5.4		1	13						
2230	9	6886	17/ 6/65	1849	30	24.2	51	1.0	158		14						
2231	9	6886	17/ 6/65	1954	68	24.2	51	1.0	112		14						
2232	8	6886	17/ 6/65	2148	30	24.2	51	0.5	19		15						
2233	8	6887	17/ 6/65	2250	30	24.0	51	1.5	58		14						
2234	8	6887	17/ 6/65	2345	30	24.0	51	1.0	15								
2235	18	6886	19/ 6/65	1245	30	24.2	51	0.1									
2236	9	6886	19/ 6/65	1348	30	24.2	51	0.1	1								
2237	8	6886	19/ 6/65	1439	30	24.2	51	1.0									
2238	6	6886	20/ 6/65	1816	30	23.8	51	1.0									
2239	7	6886	20/ 6/65	1987	30	23.8	51	0.6									
2240	9	6885	20/ 6/65	1224	60	24.3	49	1.5	5								
2241	9	6785	20/ 6/65	1430	30	24.2	51	0.7	5								
2242	9	6885	20/ 6/65	1522	30	24.3	51	0.7	1								
2243	11	6784	20/ 6/65	1749	30	24.7	97	0.7									
2244	11	6783	20/ 6/65	1855	68	24.6	122	1.1									
2245	10	6886	21/ 6/65	1120	30	24.3	49	0.5	2								
2246	10	6886	21/ 6/65	1289	60	24.2	51	1.0									
2247	9	6886	21/ 6/65	1324	30	24.0	51	1.6	6								
2248	9	6886	21/ 6/65	1438	30	23.9	51	0.5	2								
2249	8	6886	21/ 6/65	1558	30	23.8	51	0.5	1		15						
2250	8	6887	21/ 6/65	1648	30	23.7	51	0.5	2		13						
2251	7	6887	21/ 6/65	1732	30	23.8	19	0.1									
2252	3	7889	20/ 6/65	1445	30	18.1	4	0.1	10								
2253	3	7889	20/ 6/65	1538	30	18.5	4	0.7	32		40						
2254	3	7889	20/ 6/65	1622	30	18.6	4	0.5	63		34						
2255	2	6887	20/ 6/65	1717	30	18.6	4	0.1	3		43						
2256	1	6819	20/ 6/65	1817	30	18	4	0.3	8		42						
2257	7	6887	20/ 6/65	1835	30	20.4	51	0.1	4		25						
2258	7	6887	20/ 6/65	1122	15	20.4	51	0.1	2		14						
2259	8	6887	20/ 6/65	1217	30	20.9	51	1.5									
2260	9	6886	20/ 6/65	1314	30	21.2	51	1.0	9		13						

STATION NUMBER	DEPTH (m)	GRID REFERENCE	DATE	TIME OF DAY	HAUL DURATION (min)	BOTTOM TEMPERATURE (deg. C)	SEDIMENT CODE	TRASH QUANTITY (kg)	COMMERCIAL			PRAWNS			NON-COMMERCIAL PRAWNS (No.)		
									No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	No./Wt.	Count per lb.	
2261	9	6886	27/ 6/65	14P9	30	21.3	51	0.1	1								
2262	9	6886	27/ 6/65	1582	30	21.9	51	0.3	3		13						
2263	8	6886	27/ 6/65	1557	30	20.9	51	0.1									
2264	7	6887	27/ 6/65	1593	30	20.9	51	0.5	2		14						
2265	6	6886	27/ 6/65	1895	30	19.1	51	0.1									
2266	9	6887	28/ 6/65	0948	30	21.9	51	0.1	1								
2267	19	6906	28/ 6/65	1046	30	21.7	68	0.1									
2268	9	6906	28/ 6/65	1134	30	20.9	46	0.7	3		13						
2269	9	6906	28/ 6/65	1228	30	20.9	51	0.3									
2270	8	6887	28/ 6/65	1318	40	20.9	51	0.1									
2271	7	6906	28/ 6/65	1402	30	19.4	50	0.1									
2272	6	6906	28/ 6/65	1534	30	19.4	51	0.1									
2273	4	6909	28/ 6/65	1627	10	18.5	21	0.3									
2274	3	6909	28/ 6/65	1720	30	17.9	4	0.3	5		27						
2275	9	6886	1/ 7/65	1305	30	21.0	58	1.0	3		14						
2276	9	6886	1/ 7/65	1358	30	21.9	51	0.5	8		14						
2277	9	6786	1/ 7/65	1450	30	21.2	51	0.8	4		13						
2278	9	6786	1/ 7/65	1532	30	21.0	51	1.0	41		13						
2279	7	6786	1/ 7/65	1721	30	21.0	51	1	7		14						
2280	9	6705	1/ 7/65	1814	30	21.5	51	0.3	9		12						
2281	9	6705	1/ 7/65	1851	45	21.0	49	1.0	41		13						
2282	10	6886	2/ 7/65	0741	30	21.6	48	4.0	2		13						
2283	10	6886	2/ 7/65	0847	30	21.4	49	0.1									
2284	9	6907	2/ 7/65	0958	30	21.2	51	0.3	5		14						
2285	9	6907	2/ 7/65	1050	30	21.1	51	0.5									
2286	9	6907	2/ 7/65	1142	30	21.1	51	4.5	7		12						
2287	9	6906	2/ 7/65	1612	30	21.0	48	0.6	2		13						
2288	9	6907	2/ 7/65	1985	30	21.0	51	0.3	3		12						
2289	8	6887	2/ 7/65	2002	30	21.2	50	0.3	10		13						
2290	8	6887	2/ 7/65	2054	30	21.4	51	4.3	26		13						
2291	8	6887	2/ 7/65	222													

2.3 AREA OF OPERATIONS

As indicated in Section 1.2.3 of Part 1 of this Atlas, a guiding committee at an inter-departmental conference in 1963 selected the survey area largely on logistic reasons with strong influence from the circumstance that fishing support would be available from a commercial venture that was about to operate in that area. Survey operations were mostly confined to the area selected and as defined in Section 2.3.1 below. However during the course of investigations it was deemed expedient to extend beyond the defined area to check the nature and productivity of the sea floor adjacent to the north-east (seaward of the Nassau River) and to the north and west of Mornington Island. Although some data from the environs of Groote Eylandt and Weipa were contributed by commercial vessels, on which a member of the survey team acted in an observatory capacity, such data have not been utilized in this Atlas.

2.3.1 DEFINITION OF SURVEY AREA

The survey area as defined had an area of about 25000 km². It was defined as being that part of the south-east corner of the Gulf bounded on the north by a line due east from the north-east tip of Mornington Island, on the west by a line due south from the south-west tip of Mornington Island, and on the east and south by the mainland coast. This represented all waters of the south-east part of the Gulf south of 16°24'S latitude and east of 139°06'E longitude.

In practice the survey vessel also carried out some operations outside this defined area but within boundaries north to 15°48'S latitude and 138°54'E longitude. One extension to the area comprised 57 stations in 29 grid squares to the north east of the defined area between 15°48' and 16°24'S latitude, and between 140°12'E longitude and the coastline between the Nassau and Staaten Rivers. The majority (38) of these stations were occupied during Cruise 70 during

July 1964, and the remainder were occupied during October 1963 and April 1964 mostly during general reconnaissance across the northern boundary of the survey area.

The second extension to the selected area comprised 22 stations in eleven grid squares between Mornington Island north to 16°00'S latitude and west to 138°54'E longitude. These were all worked during Cruise 94 in February 1965.

2.3.2 IDENTIFICATION OF GRID SQUARES

A total of 245 grid squares were sampled during the survey, 40 of these being outside the boundaries of the survey area as originally defined. All grid squares with their identification numbers are shown in Figure 38.

The grid square system is the standard one employed by CSIRO Division of Fisheries and Oceanography. Each square is one tenth part of a degree of latitude by a tenth part of a degree of longitude. The grid is drawn by parallel horizontal lines spaced at intervals of six minutes of latitude and by parallel vertical lines spaced at intervals of six minutes of longitude. The resultant squares are numbered 0 to 9 from north to south and 0 to 9 from west to east. Each has a four digit identification number comprising two digits for latitude and two digits for longitude. The couplets represent the last digit of a whole degree and the individual square number.

In Figure 38 whole degrees of south latitude are marked along the left hand margin and whole degrees of east longitude along the upper margin. Components of square numbers are represented as two digit numbers representing divisions of latitude along the right hand margin, and two digit numbers representing divisions of longitude along the lower margin. The squares are identified by reading from top to bottom

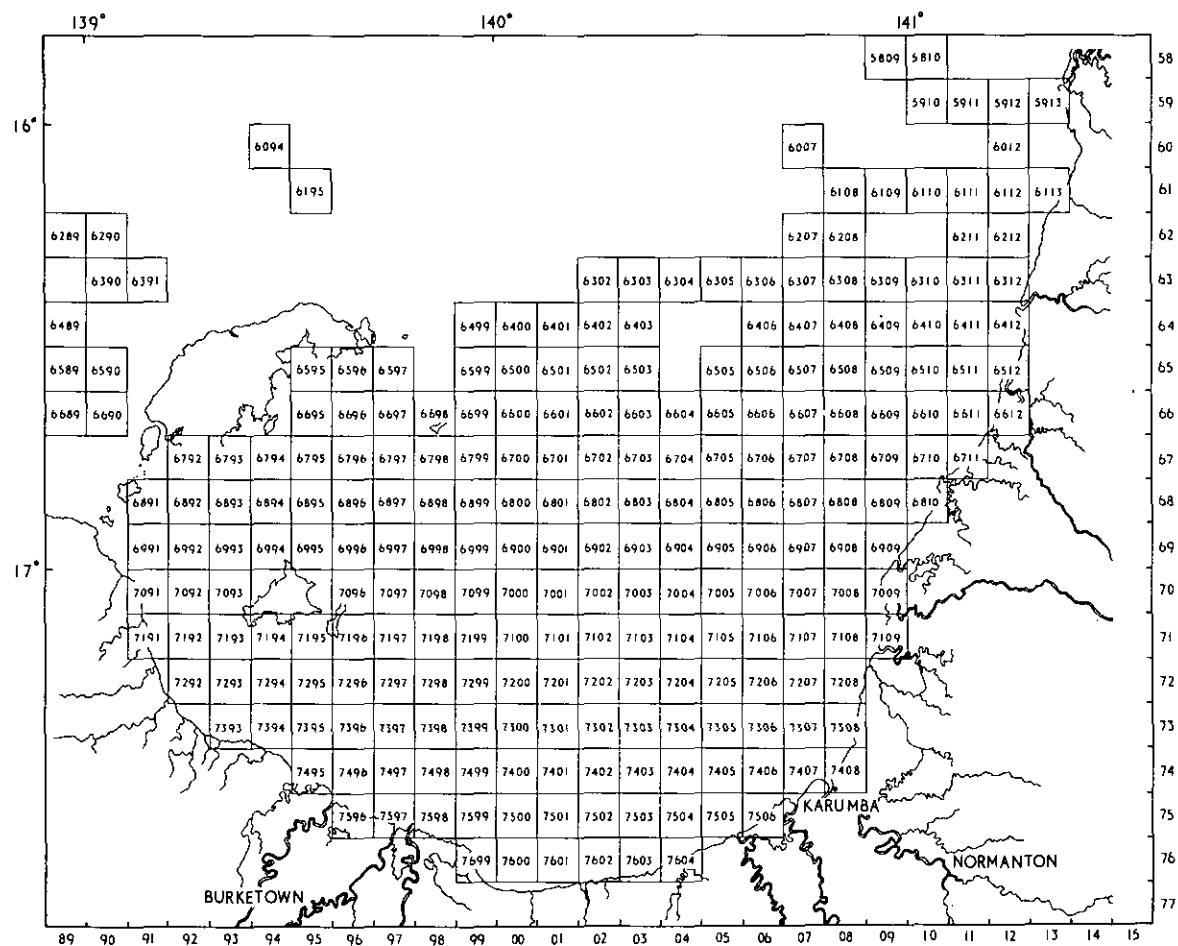


Figure 38 The survey area and environs showing the 245 grid squares in which trawls were made. The grid squares are identified by four digit numbers as explained in the accompanying text.

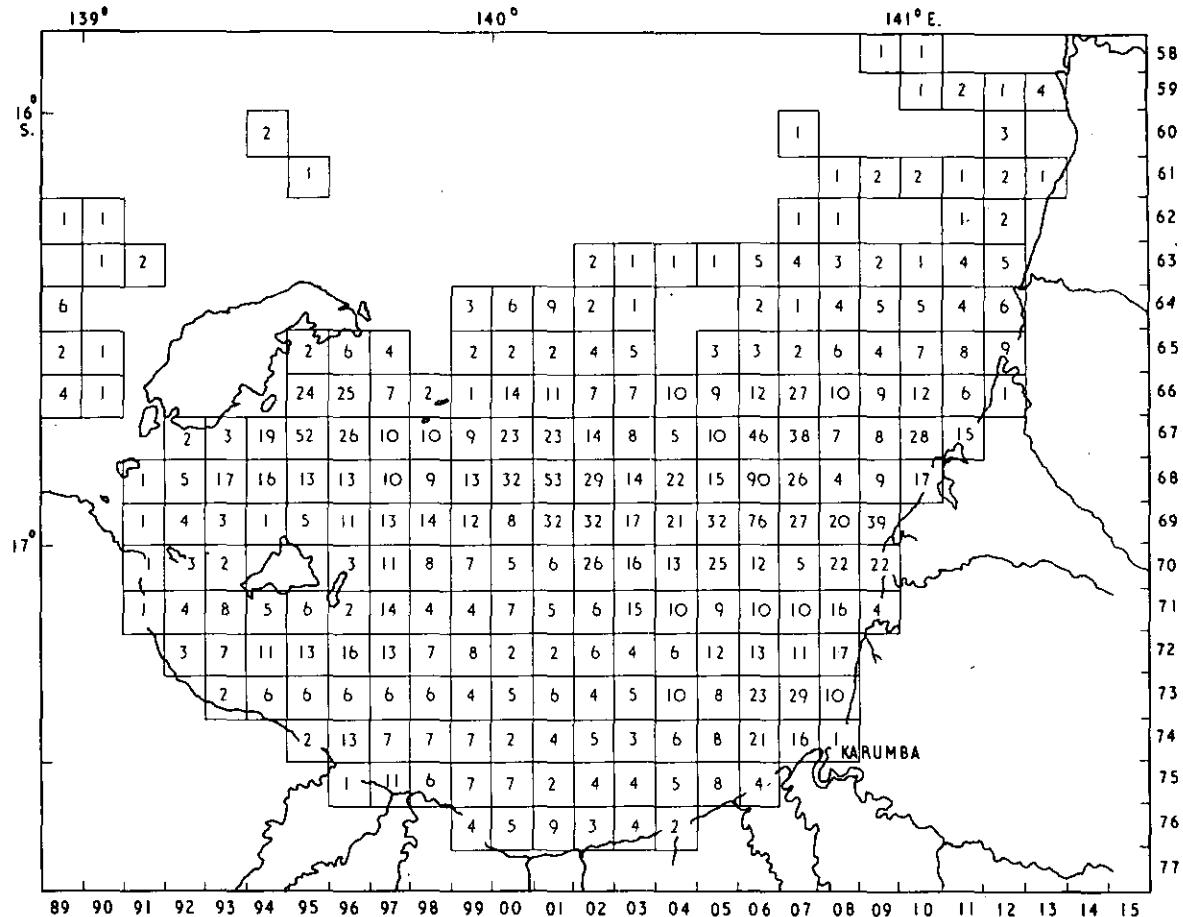
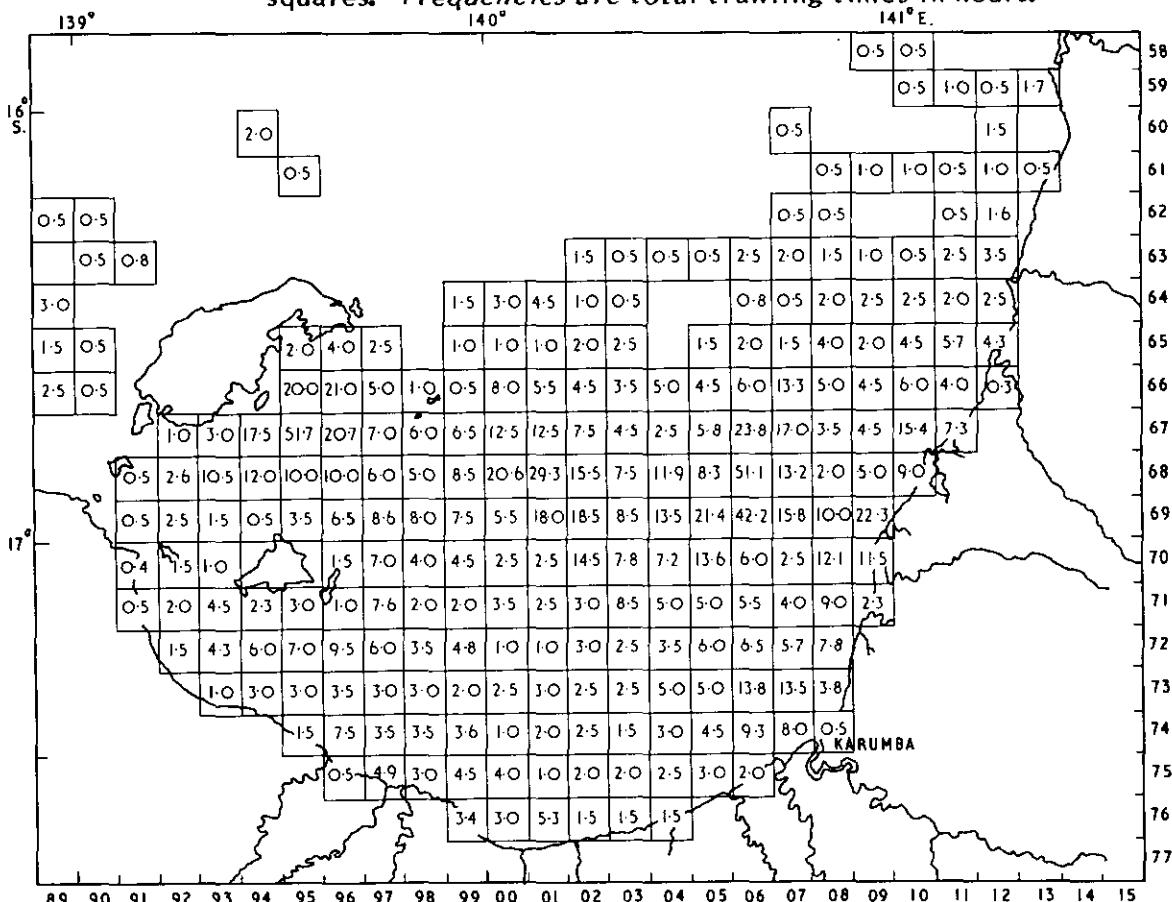


Figure 39 (above) Frequency distribution of trawl stations in relation to grid squares. Frequencies are numbers of trawls.

Figure 40 (below) Frequency distribution of trawling time in relation to grid squares. Frequencies are total trawling times in hours.



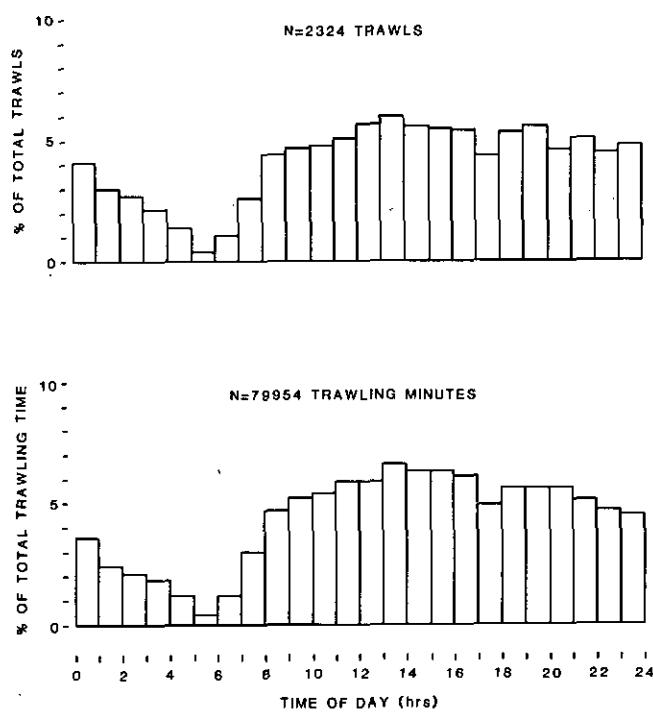


Figure 41

Distribution of trawling effort according to time of day based on 24 hourly intervals.

Upper - Frequency distribution as percentage of total trawl shots

Lower - Frequency distribution as percentage of total trawling time

and then from left to right. The origin of the area displayed in this figure is 15°48'S latitude and 138°54'E longitude. The first marked square is numbered 5809, meaning that it is the ninth six-minute division between 15° and 16°S latitude and the tenth six-minute division between 140° and 141°E longitude. Its boundaries are thus 15°48' and 15°54'S latitude and 140°54' and 141°00'E longitude.

2.4 SAMPLING PATTERN (Stations 1-2334)

The initial basic plans for survey (see Section 1.2.3 (b) of Part 1 of this Atlas) required that the vessel was to obtain evidence in respect to the whole nominated area by systematic sampling, satisfying, as nearly as possible, the requirements of statistical analysis. Such a plan was considered to be appropriate to the condition of almost total ignorance of the area. The theoretical approach was to conduct early reconnaissance of the nominated area by placing one trawl station in the centre of each grid square and repeating the procedure at seasonal intervals. The theoretical procedure would be systematic sampling with parallel traverses along straight lines from east to west or south to north. The impracticability of this approach quickly became evident in face of the logistics of sending a single inadequately equipped small vessel to sea without fleet support, and only slowly developing shore-base support, in a remote area with lots of unexpected problems.

The turn of events during the course of two years continuous surveying brought about great changes in approach which were accompanied by wide deviations from the statistical ideals for sampling. While the whole area on a geographical basis was covered, sampling was concentrated in three zones corresponding to testing of (a) general nocturnal trawling, (b) search for adult banana prawns in the schooling phase, and (c) appraisal of stocks of small prawns in coastal shallows.

It may be argued that diversion from sampling necessary to satisfy strict statistical needs, distracts from the usefulness of the data presented in this Atlas. However it must be remembered that the terms of reference made clear that the project was primarily a prospecting exercise in prawn trawling in an unknown area, but opportunity was to be taken to gather environmental and biological data. This secondary aspect of the survey operation represented the first approach to what was virtually a subject new to Australian fisheries investigations, and concerned a geographical area not previously examined. At the time it was hoped that the survey might lead on to more specialized subject investigations with more elaborate coverage including strict statistical approach. This hope has actually materialized and such studies are continuing at the time of publication of this Atlas.

In presenting data accumulated during 1963-65 and processed over the succeeding decade and a half, it is useful to look at the various sampling patterns that emerged, and to consider coverage in terms of bias to results and conclusions. Accordingly this section has been prepared to demonstrate achievements in sampling in relation to some principal factors which may contribute to fishing results and the distribution of prawns and associated organisms. Such factors are geographical area, depth, time of day and season of year. Also in the case of banana prawns sampling is considered in relation to behaviour in schooling in response to solar and lunar progression and the tidal cycle.

2.4.1 PATTERN BY AREA AS TRAWL NUMBERS PER GRID

Figure 39 displays the pattern of relative trawling effort in relation to geographical area on the basis of the grid square system. The figures are frequency distribution of 2324 trawl shots in relation to 245 grid squares. These frequencies represent the number of times each grid square was visited for the

purpose of occupying a trawl station irrespective of the amount of time involved in trawling. The total trawls were made during a period of two years elapsed time. The association of a particular trawl with a particular grid square is rated on the commencement position of that trawl being in that grid square, even if part, including the greater part, of the duration of that trawl was in an adjacent grid square. Grid squares can be identified by scales along the right hand and bottom borders of the map frame in accordance with the method described in Section 2.3.2 above.

2.4.2 PATTERN BY AREA AS TRAWL DURATIONS PER GRID

Figure 40 displays the pattern of relative trawling effort in relation to geographical area on the basis of the grid square system. The figures are frequency distribution of time spent trawling in 245 grid squares during 2324 trawls shots occupying a total of 55 days 12 hours 34 minutes (79954 minutes) over a period of two years elapsed time. These frequencies represent the total time in hours spent in actual trawling in each grid square irrespective of the number of trawl stations occupied in the respective grid squares. The association of a particular time interval of trawling with a particular grid square is rated on the commencement time of that trawl being in that grid square, even if part, including the greater part, of the duration of that trawl was in an adjacent grid square. Grid squares can be identified by scales along the right hand and bottom borders of the map frame in accordance with the method described in Section 2.3.2 above.

2.4.3 PATTERN BY TIME OF DAY BASED ON HOUR INTERVALS

The overall relative distribution of trawling effort is examined in relation to time of day in two ways (Figure 41). In both, frequency distributions are arranged according to one-hour intervals of time over the diurnal period 0000 hr to 2400 hr, but irrespective of differences

in geographical area, depth, or season of the year. One frequency distribution histogram (Figure 41, upper) displays the relative division of trawling effort in terms of the total number of trawl stations (2324) between the 24 hourly intervals. The second frequency distribution histogram (Figure 41, lower) displays the relative division of trawling effort in terms of total trawling time of 55 days 12 hours 34 minutes (79954 minutes) between the 24 hourly intervals. Trawling effort in both terms relates to the period of two years elapsed time. The frequencies are expressed as percentage of total effort respectively in terms of total number of trawls and total trawling time.

The close correspondence in form of the two histograms may well be related to the standardization of trawling duration at 30 minutes for the majority of stations. Trawling periods of greater duration were also characteristic of segments of the 24-hour period during night trawling. Effort drops to a minimum between 0500 and 0600 hr as a consequence of a work pattern based on daylight or night trawling. Most daylight work was executed between 0800 and 1800 hr. Most night work began at sunset and continued to about 0300 hr, sometimes continuing to sunrise. When daylight and night work were combined, work was conducted between noon and midnight.

2.4.4 PATTERN BY AREA BY DAY/NIGHT BASED ON GRIDS

The preceding Sections 2.4.1 to 2.4.3 have demonstrated patterns of total trawl sampling in relation to the area as a whole and according to the 24 hour intervals of day. As a means of demonstrating inter-relationship of area, season of the year, and time of day during the period of two years elapsed time in which 2324 trawl shots were made, the accompanying two sets of map diagrams are presented (Figures 42 and 43). These show on a presence or absence basis which grid squares were sampled during daylight (Figure 42) and night (Figure 43) during each of the

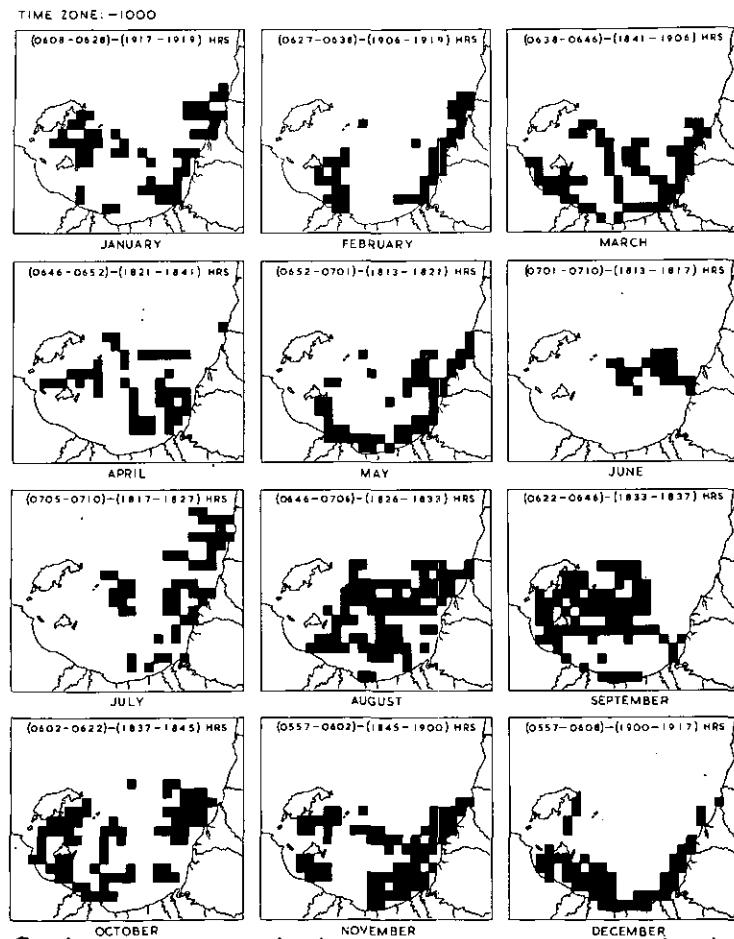


Figure 42

Grid squares in which trawl shots were made during daylight hours during each of the twelve months of the year.

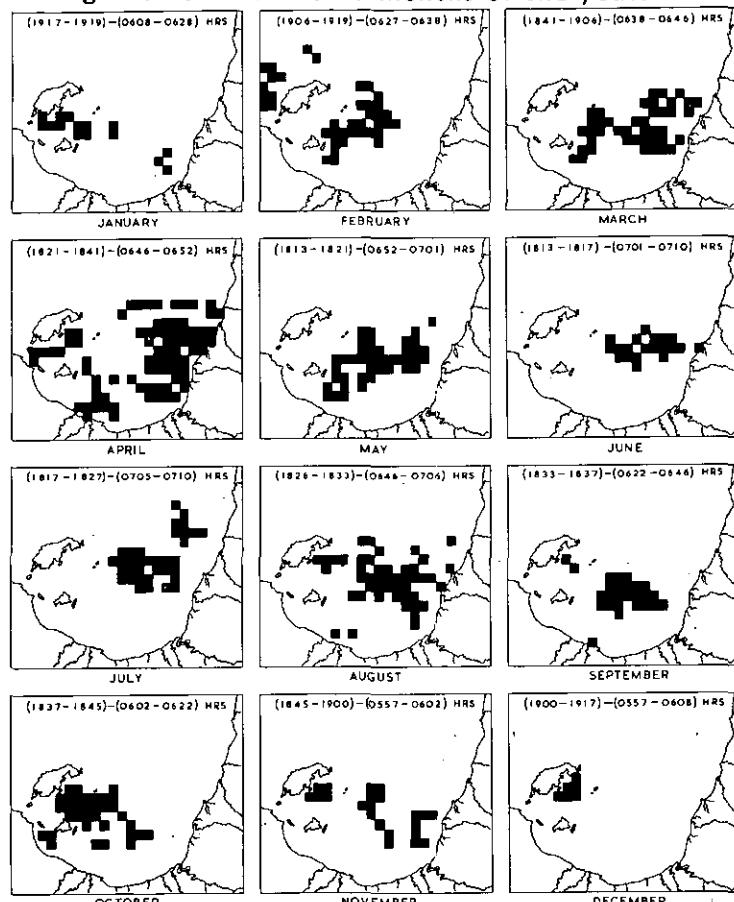


Figure 43

Grid squares in which trawl shots were made during night hours during each of the twelve months of the year.

twelve month segments of the year. Each map frame is marked with the period in hours which constitutes either daylight or night for its respective month period. According to seasonal progression through summer and winter solstices, times of sunrise and sunset vary. The values shown represent the range of times of sunrise and sunset for the particular calendar month through the successive years 1963, 1964 and 1965. Times of sunrise and sunset are from The Nautical Almanac. They have been corrected to be applicable to latitude 17°S, longitude 140°E. Times are expressed according to Time Zone -1000 (Australian Eastern Standard Time, as used throughout the State of Queensland), although this is actually 40 minutes fast on local longitudinal time.

2.4.5 PATTERN BY SEASON BASED ON MONTH INTERVALS

Further detailed examination of trawling effort according to season is presented as part of the accompanying set of histograms (Figure 44). Sampling by season is examined only in terms of frequency distribution of the total number of trawl stations (2324) over the two year period in relation to intervals of calendar months. For this purpose data relating to all depth intervals in the range 1-22 fathoms are combined. Frequencies are expressed as percentage of total number of trawls. The relatively higher percentages of effort during April and May and again in August onwards relates to greater stability in weather conditions. Rough windy weather during June and July caused reduction in effort, and mechanical breakdown coupled with cyclonic disturbances and flooding during the monsoonal wet season reduced effort in mid-summer.

2.4.6 PATTERN BY DEPTH BASED ON FATHOM INTERVALS - DISTRIBUTION BY YEAR

Sampling by depth is in a general way related to sampling by geographical area because of the slowly shelving nature of

the Gulf floor, but because of gutter depressions following seaward from river mouths, contouring is not nicely concentric. Examination of the sampling pattern in relation to depth is conducted firstly on an annual basis, combining all data for the 2324 trawl stations occupied during the two year period irrespective of season and area (Figure 44). The appropriate histogram displays frequency distribution according to depth intervals of one fathom. Frequencies are percentage of total trawls. This distribution shows two modes. The mode at 3 fathoms represents trawling effort in the coastal fringes associated with capture of small prawns, and the one at 8 fathoms corresponds with effort devoted to fishing for nocturnal species and search for adult banana prawns in schooling phase in the gutter systems of the central and eastern sectors of the survey area. This gives a strong bias towards trawl effort in depths of 12 fathoms or less. Part of the reason for this, other than the specialized fishing described, is that only a small percentage of the nominated survey area exceeded 12 fathoms. Also much of the bottom in deeper waters along the northern boundary of the survey area proved unproductive and trawling in that area was not pursued further.

2.4.7 PATTERN BY DEPTH BASED ON FATHOM INTERVALS - DISTRIBUTION BY QUARTER

The sampling pattern according to depth is also displayed according to the four quarterly periods of the year. The appropriate set of frequency distribution histograms (Figure 44) divide the total trawling effort in terms of number of trawl stations into four sets of blocks of three months comprising (1) January to March (Months 1-3) with 514 trawls, (2) April to June (Months 4-6) with 672 trawls, (3) July to September (Months 7-9) with 636 trawls, and (4) October to December (Months 10-12) with 502 trawls. Frequencies are expressed as percentage of total trawls for each quarter according to depth intervals of one fathom.

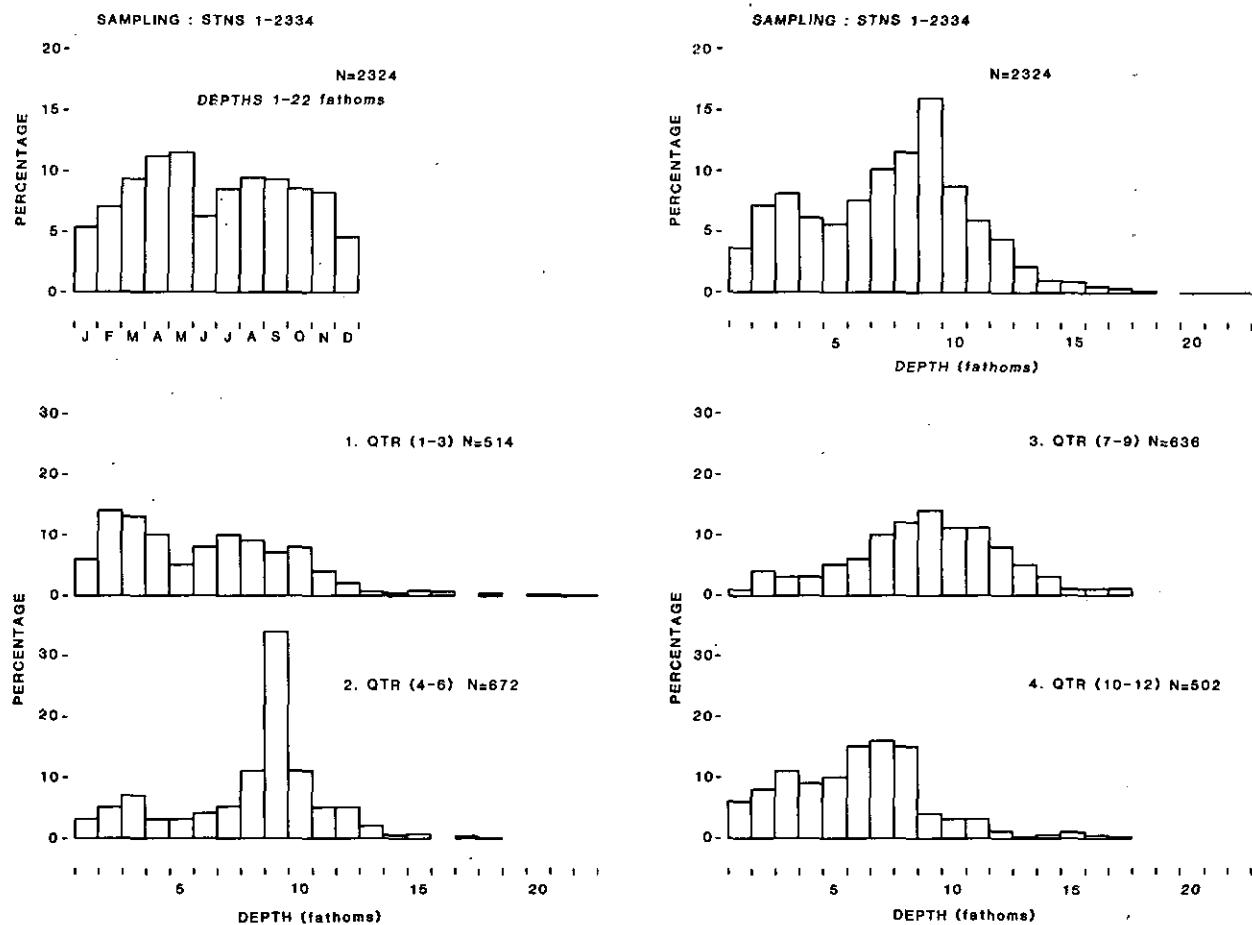


Figure 44

Trawl sampling patterns according to depth and season.

Upper left - Frequency distribution of trawl stations according to month, all depths combined.

Upper right - Frequency distribution of trawl stations according to depth, all months combined.

Bottom set of four - Frequency distribution of trawl stations according to depth and quarters of the year.

Sampling effort was 22.1, 28.9, 27.4 and 21.6% of total number of trawls respectively for quarters 1 to 4, being noticeably higher during the winter months. Time was lost during the mid-summer periods because of cyclonic weather and during that period of 1964-65 the vessel was out of action for six weeks because of mechanical breakdown. All depths to 15 fathoms were sampled to some degree during all quarters. The higher proportion of sampling in coastal fringes (1-5 fathoms) was undertaken during the two summer quarters. Trawling for nocturnal species during 1963 in the basin between Bountiful, Sydney and Bentinck Islands accounts for the higher percentage in the 6-8 fathom range during the fourth quarter. The high mode at 9 fathoms in the second quarter relates to intensive fishing for adult banana prawns in schooling phase in the eastern gutter systems during 1965.

2.4.8 PATTERN BY DEPTH BASED ON FATHOM INTERVALS - DISTRIBUTION BY MONTH

To complete the picture of sampling effort in respect to the relationship between depth and season, the accompanying block of twelve frequency distribution histograms is provided

(Figure 45). In these the total number of trawl stations (2324) is divided according to the twelve calendar months over the two-year period of elapsed time during 1963 to 1965. Frequencies are percentages of total trawl stations in each monthly block according to depth intervals of one fathom.

Trawling effort was distributed rather unevenly over the twelve-monthly intervals of season (Table 5), being highest in April and May and lowest in December and January, due, as stated in Section 2.4.7, to the vessel being out of service for six weeks including one complete month in December 1964. December is further characterized by no trawling being done in depths greater than 9 fathoms. In June very little trawling was done in depths outside the range 7-13 fathoms. The relatively high percentage of trawling for small prawns in 1-5 fathoms, as shown in the previous section for the summer quarters, is traced to the period late November 1963 to early March 1964, with repetition in March 1965. These depths were sampled again rather intensively in May 1964. The high mode at nine fathoms shown for the second quarter persists strongly through all months of that quarter because intensive fishing was done in that depth zone for banana prawns in 1965.

Table 5. Distribution of trawling effort according to calendar month.
N = 2324. Years 1963, 1964 and 1965 combined.

Month	Number of trawls	Percentage of total trawls
January	136	5.85
February	162	6.97
March	216	9.29
April	260	11.18
May	268	11.52
June	144	6.19
July	199	8.56
August	221	9.50
September	216	9.29
October	203	8.73
November	193	8.30
December	106	4.56

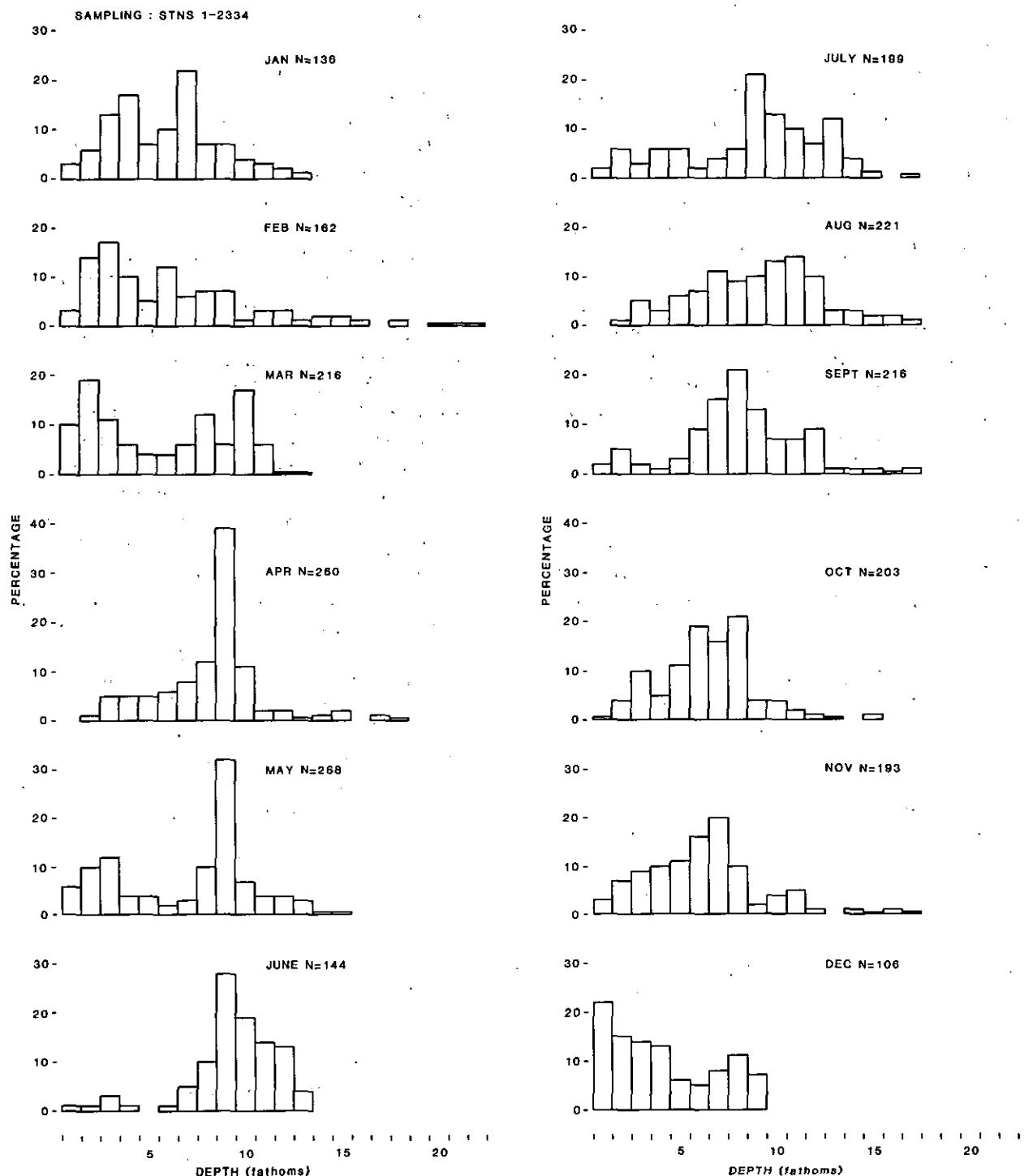


Figure 45

Trawl sampling patterns according to depth and season. Frequency distributions of trawl stations according to depth and months of the year.

2.5 FISHING PATTERNS FOR ADULT BANANA PRAWNS

Location of adult banana prawns in a fishable phase was the most important immediate commercial result of the survey. Analysis of the catching pattern for this species is presented here with fishing data rather than with prawn distribution and biology in Part 4 of this Atlas.

Adult banana prawns have shown consistently, but seldom in commercial quantities, over much of the survey area except in coastal shallows and in the barren tract across the northern part of the survey area seaward of the Nassau, Staaten and Gilbert Rivers. The first large school was located in a gutter system near the centre of the survey area in May 1964 and this stimulated further specific search effort through the second year of survey.

Most of the work of the second year was commercial style fishing in association with a commercial trawler, dividing effort between attempting to catch nocturnal species in deeper waters, and searching for banana prawn schools along suspected migration paths from river nurseries into deeper waters.

Systematic search for the large compact schools became the sole project during the eighth quarter when two more commercial trawlers joined the team. This work was aided by a preliminary computer sorting and listing of catch data covering the first eighteen months. By this time it seemed clear that gutter systems were favoured as a habitat by adult banana prawns in the mass schooling phase most vulnerable to fishing. These gutter systems appeared to be seaward extensions of river courses and were more characteristic of the rivers emptying along the eastern shore south of the Gilbert River. The preliminary analysis considered five factors other than area, namely season, depth, time of day, moon phase and tidal state. As each factor had only four categories, the classification was unsatisfactorily coarse. It indicated that the larger lifts were made east of 140° E longitude in 8-11 fathoms during

the period April to September on flood tide mainly at night during full moon. Re-examination of tidal data suggested that the best lifts were made within a two-hour period of recorded slack water at Karumba and that all were made within five days of 'double tides' as recorded at Karumba.

Tidal data related to recordings made on a gauge in the Norman River at Karumba and difference could be expected in the time of events there and in the area being fished. The trawlers were of the opinion that in that area the 'double tide' phenomenon was often manifest by long periods of slack water, and for some days either side of the 'doubles' there may be a strong set to the north-east without apparent change in direction. A theory of minimal water movement being the basis of schooling behaviour suggested that the best time to search would be at slack water during the double tides. A definite prediction along these lines was made for the second week in June 1965 with the knowledge that the double tides would occur about 11 June which was three days before full moon. The result was that the four vessels working together landed about 5 tonnes in 4 and 8 hours respectively over two consecutive days. On 11 June balling-up was evident for about 2 hours either side of HW slack (neap LHW) about noon, and on 12 June it appeared to persist through most hours of daylight. (See Table 6).

The pilot fishing operations by *Rama* and three commercial trawlers during the eighth quarter of the survey (April to July 1965) have been described in detail in Section 2.2.2 (h). Data relating to the major catches of adult banana prawns by all vessels are summarized in this accompanying table (Table 6).

A synoptic picture of the circumstances of catches of banana prawns in relation to solar, lunar and tidal events during this period of pilot fishing is given in the accompanying set of diagrams (Figures 46-49). In this set of diagrams data are plotted for only those days on which searching and fishing for banana prawns was undertaken by any or all of

Table 6. Major lifts of adult banana prawns by four prawn trawlers during April to July 1965 in relation to moon and tide.

HW slack high tide. LW slack low tide. LHW lowest high tide in cycle. HTW highest low tide in cycle. Double tides are period of transition between cycles when normal diurnal tides become semi-diurnal. *Lost because of gear damage.

Date	Time (hr)	Vessel	Lifts (lb)	Moon Day	Moon Period	Solar Period	Days \pm		Days \pm		Grid	Depth (fm)
							LHW	Neaps	LHW/LW	Double Tides		
April 4	2115-2330	Toowoon Bay	40, 10, 20	New +2	Down	Night	± 0	± 0	(HW +3)-(HW +3)		6906	9-10
April 5	0005-0255	Rama	25, 30, 20, 20	New +3	Down	Night	± 1	± 0	(LW -3)-(LW -3)		6906	9.5-10
April 5-6	2015-0105	Toowoon Bay	15, 15, 8, 15	New +3/4	Down	Night	$+1/2$	$\pm 0/1$	(LW -3)-(LW -1)		6906	9.5-10
April 6	2345-0430	Toowoon Bay	15, 35, 20, 25	New +5/6	Down	Night	$+3/4$	$\pm 2/3$	(LW -1)-(LW +1)		6906	9
April 7-8	2020-0120	Toowoon Bay	20	Full -4	Up	Night	-5	-5	(HW +4)-(HW +6)		6706	9
April 11	0430-1100	Toowoon Bay	340, 80, 130, 100, 80 (+ 500-700)*	Full -1	Down	Night/Day	-2	-2	(LW -3)-(LW +4)		6806	8.75-9.5
April 14	0702-1230	Rama	370, 65, 8, 550 (+ 500)*	Full -1	Down	Day	-2	-2	(LW -5)-(LW +5)		6806	9.25-9.5
May 7	0017-0217	Rama	25, 100, 70	New +6	Down	Night	$+6$	$+5$	(LW -1)-(LW +1)		7005	8.5
	0235-0305	Toowoon Bay	30	New +6	Down	Night	$+6$	$+5$	(LW -1)-(LW +2)		7005	8.5
	2135-2350	Toowoon Bay	30, 10	New +6	Up	Night	$+6$	$+5$	(LW -5)-(LW -3)		7005	8.5
May 18	2000-2100	Toowoon Bay	30	Full +3	Rises	Night	$+4$	$+3$	(LW -4)-(LW -3)		6806	9
May 19	2033-2133	Rama	15	Full +4	Down	Night	$+5$	$+4$	(LW -3)-(LW -2)		6606	9
May 21	2157-2227	Rama	12	Full +6	Down	Night	$+7$	$+6$	(LW -4)-(LW -3)		6907	9
May 23	2038-2123	Rama	25	New -7	Down	Night	-6	-5	(LW -6)-(LW -5)		6806	9.5
	2005-2135	Toowoon Bay	30, 20	New -7	Down	Night	-6	-5	(LW -6)-(LW -5)		6806	9
May 30	1222-1252	Rama	160	New	Up	Day	$+1$	± 0	(HW +5)		6706	9.25
	2110-2325	Toowoon Bay	25, 25	New	Down	Night	$+1$	$+1$	(LW +4)-(LW +2)		6706	8-8.5
May 31	0937-1140	Rama	1700, 1500	New +1	Up	Day	$+2$	$+1$	(HW +1)-(HW +3)		6706	10.5
	1110-1155	Toowoon Bay	25, 1500	New +1	Up	Day	$+2$	$+1$	(HW +4)-(HW +4)		6706	10-10.5
June 3	1510-1540	Toowoon Bay	12	New +4	Up	Day	$+5$	$+4$	(HW +5)		6706	10
June 7	1430-1438	Avis	100 (+ 900-1200)*	Full -7	Up	Day	-4	-2	(HW +4)		7	10
June 11	1035-1445	Toowoon Bay	35, 300, 15, 320	Full -7	Down	Day	± 0	± 0	(LW -5)-(HW +2)		6706	10
	1227-1448	Rama	9, 150, 150	Full -3	Down	Day	± 0	± 0	(LW -5)-(HW +2)		6706	10-10.25
	1510-1540	Toowoon Bay	12	Full -3	Down	Day	± 0	± 0	(LW -5)-(HW +2)		6706	10
June 12	0915-1720	Toowoon Bay	25, 1100, 60, 160, 200, 300, 500	Full -2	Rises	Day	$+1$	± 0	(HW +2)-(LW -4)		6707	8-9
	1020-1230	Avis	800, 760	Full -2	Down	Day	$+1$	± 0	(HW +3)-(HW +5)		6707	9.5
	1317-1653	Rama	300, 500, 100, 150, 250, 600	Full -2	Down	Day	$+1$	± 0	(HW +6)-(LW -5)		6707	9.25-9.5
	1130-1200	Rama	200 (2 or 3 lifts)	Full -2	Down	Day	$+1$	± 0	± (HW +5)		6707	9.5
		Lotami	20	Full +1	Down	Day	$+4$	$+3$	HW +3		6806	9.75
		Lotami	70, 80	Full +1	Down	Day	$+4$	$+3$	± (HW +3)		6806	9.75
	1215-1415	Avis	265, 500	Full +1	Down	Day	$+4$	$+3$	(HW +3)-(HW +5)		6806	9-9.5
	2000-0100	Avis	60, 15, 120	New +3/4	Sets	Night	$-6/5$	$-5/4$	(LW -5)-(LW -1)		6707	8.5-10
July 3	0030-0430	Lotami	600 (several lifts)	New +4	Up	Night	-5	-4	(LW -7)-(LW +4)		6707	8.5-10
	1923-1953	Rama	13	New +4	Down	Night	-5	-4	LW -6		6707	9.5
	± 2400	Avis	150 (several lifts including one 60)	New +4	Down	Night	-5	-4	± (LW -2)		6707	9.5
July 4	1109-1139	Rama	400	New +5	Rises	Day	-4	-3	HW -1		6607	9.5
	AM	Avis	450 (several lifts)	New +5	Rises	Day	-4	-3	LW -		6607	9.5
	AM	Lotami	700 (several lifts)	New +5	Rises	Day	-4	-3	LW -		6607	9.5

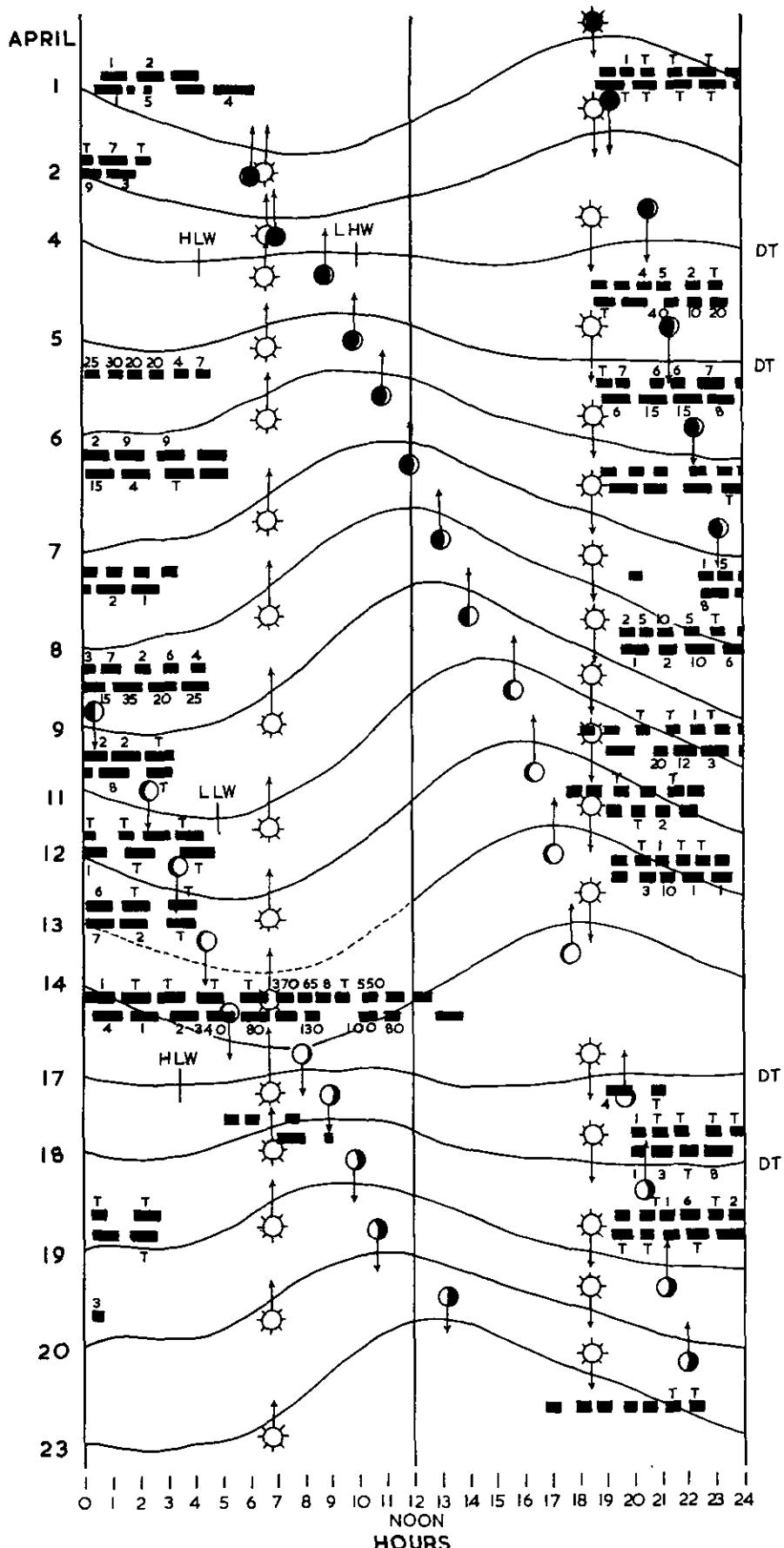


Figure 46

Figures 46-49 are synoptic representation of landings of banana prawns by four trawlers during the period 1 April to 27 July 1965 in relation to solar, lunar and tidal events. The data and legend are explained in the accompanying text.

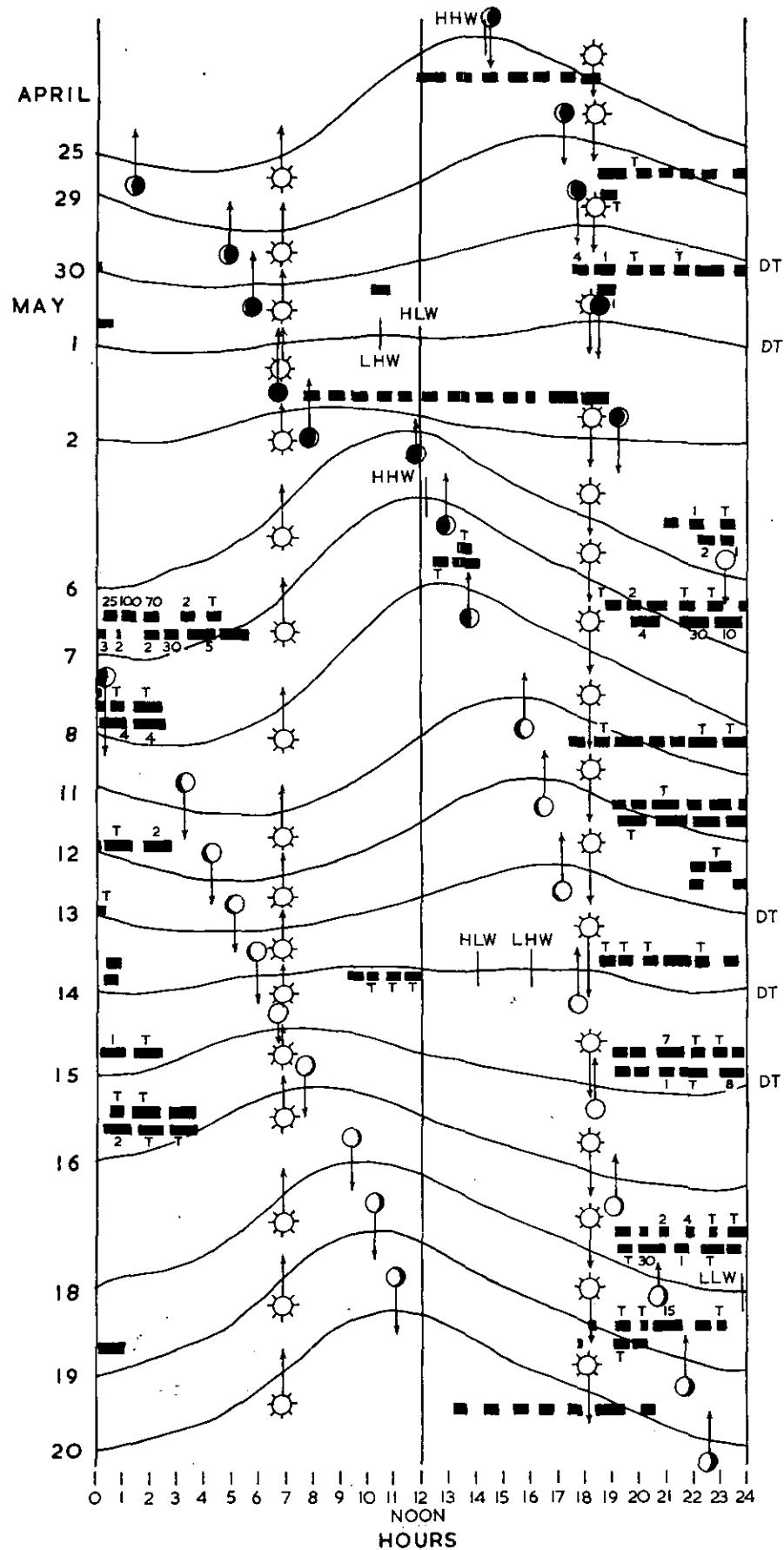


Figure 47

See caption to Fig. 46.

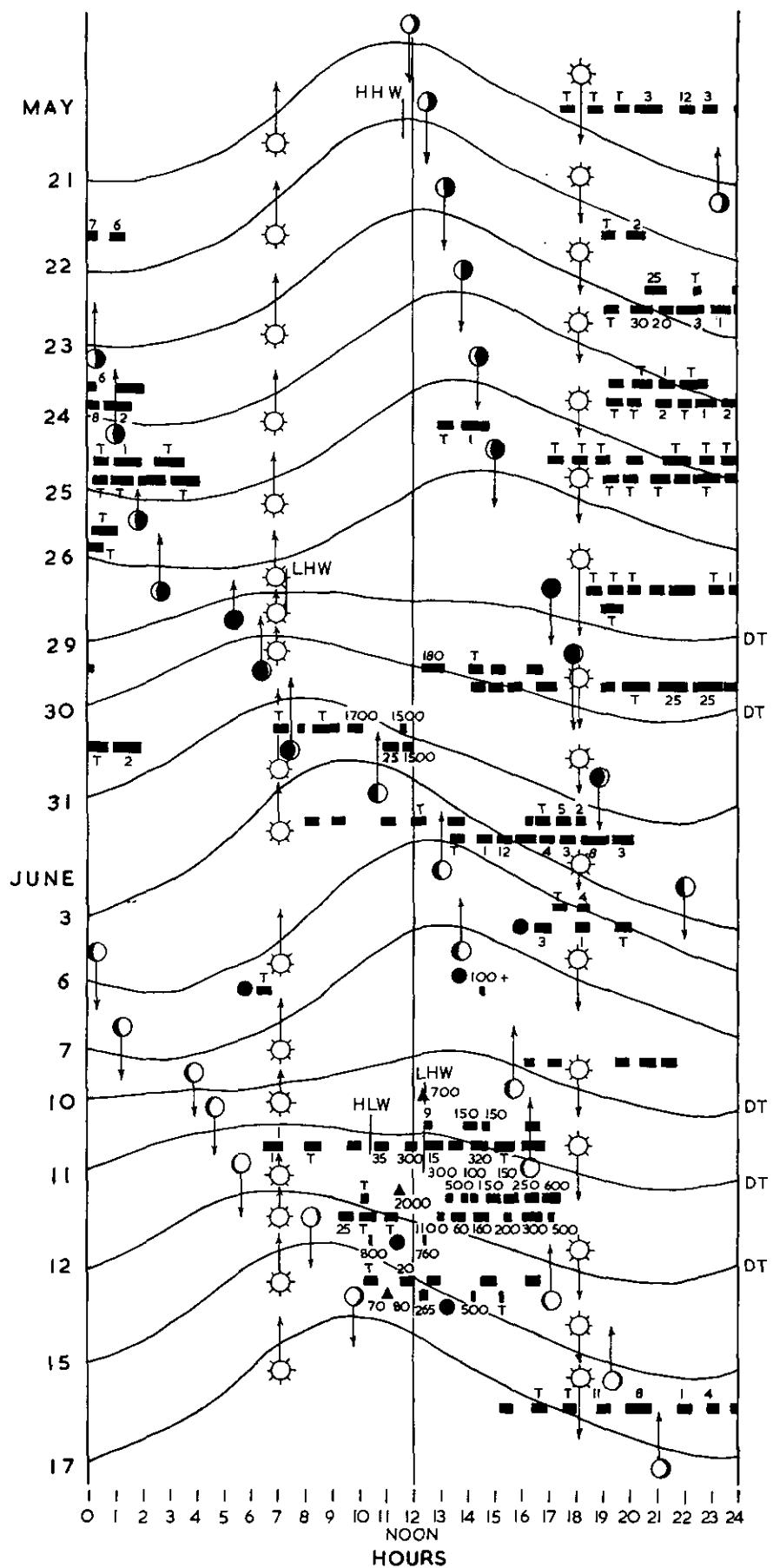


Figure 48

See caption to Fig. 46.

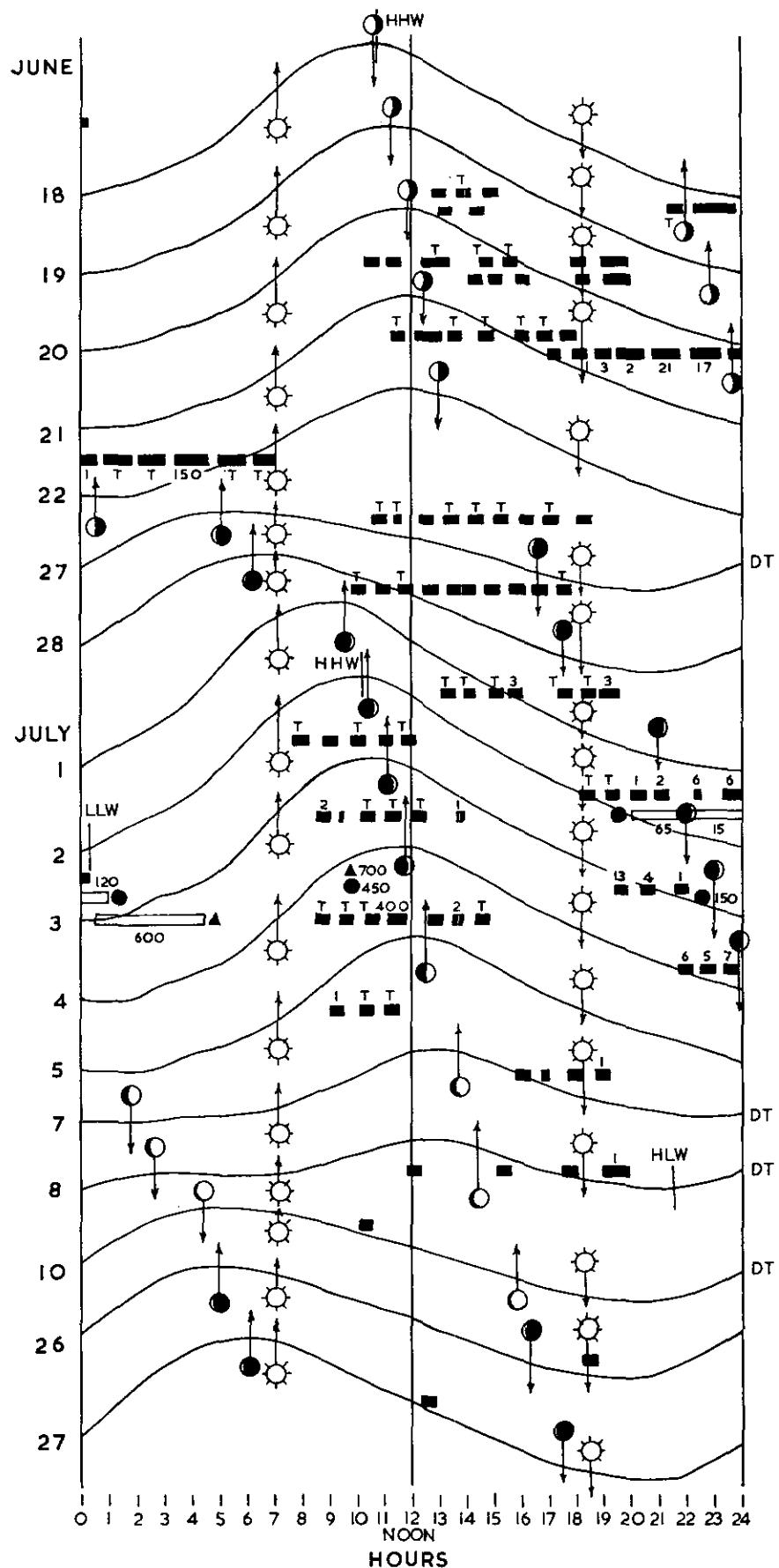


Figure 49

See caption to Fig. 46.

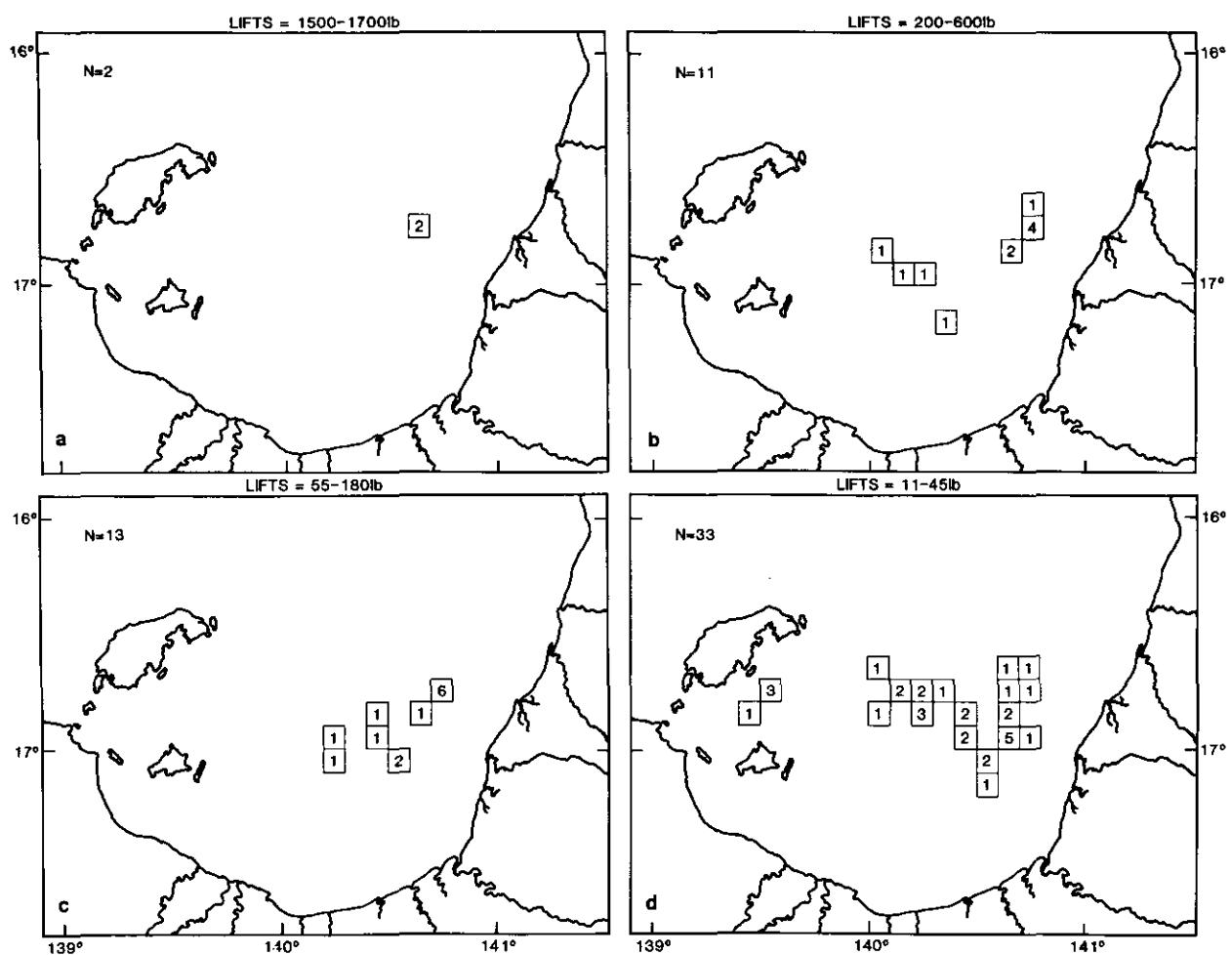


Figure 50 Frequency distribution by grid square of (A) 1500-1700 lb (B) 200-600 lb, (C) 55-180 lb, (D) 11-45 lb lifts of adult banana prawns by *Rama*.

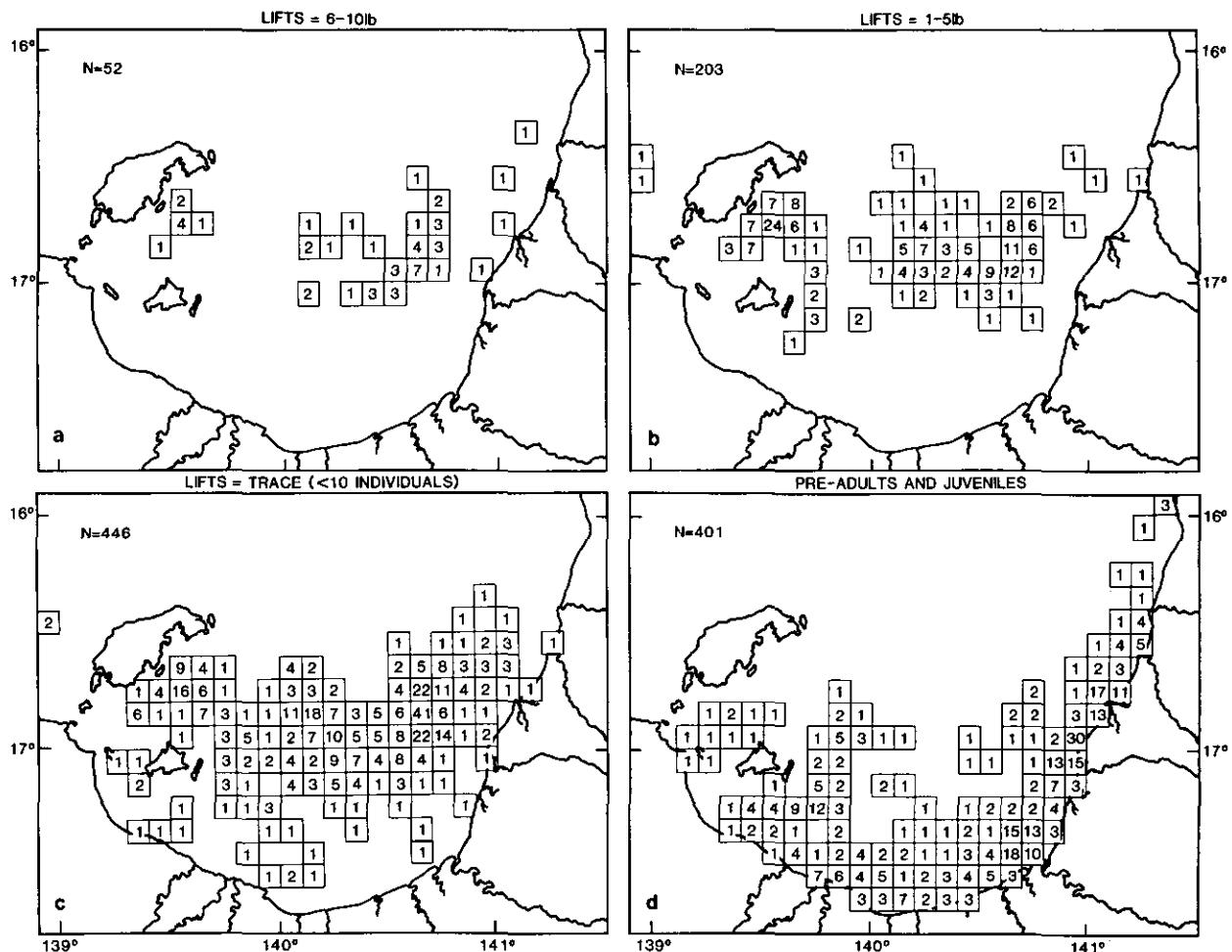


Figure 51

Frequency distribution by grid square of (A) 6-10 lb, (B) 1-5 lb lifts, (C) trace quantities of adult banana prawns, and (D) all lifts of juvenile and sub-adult banana prawns by *Rama*.

the vessels. Tidal, lunar and solar events should be considered in association with a full monthly cycle to be illustrated in Section 3.6 of Part 3 of this Atlas.

Each horizontal data set represents a separate day as indicated by date on the left hand margin and the twenty four hour scale along the lower margin. Trawl shots are represented by the black rectangles plotted according to start time and duration. The upper set in each pair with lettering above are trawls by *Rama* and the lower set in each pair with lettering below are trawls by *Toowoon Bay*. Trawl catches by *Avis* and *Lottami* are indicated by blackened circles and triangles respectively. The figures (if any) associated with these symbols are catches of banana prawns as total lifts in pounds (not catch rates per 30 minutes as used elsewhere in this Atlas). In cases where the catch was less than 0.5 lb it is regarded as trace and indicated by the symbol T.

The catch data are plotted alongside tidal, lunar and solar events. The curve represents the changes in tidal height through each day as observed from the tide gauge in the Norman River at Karumba. The highest and lowest amplitudes indicate times of HW and LW respectively. LHW and HLW are indicated on the tidal curves for those days when neap tides occurred, and HHW and LLW are indicated for those days when spring tides occurred. An indication is given on the right hand margin for those days rated as an event of "double tides" by means of the symbol DT.

The time scale is for Time Zone -1000 namely Australian Eastern Standard Time. The sun is indicated by a plain circle with radiating lines and the moon by a plain circle usually blackened in part. The degree of blackening follows the code of The Nautical Almanac and thus indicates the phase of the moon. Times of sunrise, sunset, moonrise and moonset are indicated by the direction of the vertical arrows. These times have been corrected for the position 17°S latitude and 140°E longitude and thus represent events at local longitudinal time expressed in terms of the time scale for Time Zone -1000.

2.5.1 CATCH PATTERN ACCORDING TO AREA

The catch pattern is examined in relation to area using grid squares as a basis for dividing up the total area (Figures 50-51). In this set of maps, representing frequency distributions of catch by grid square, the catch is weight in pounds of adult banana prawns actually lifted irrespective of the duration of trawling. It is not a standard catch rate per 30 minutes as used in Part 4 of this Atlas.

Adult banana prawns have been separated on the basis of count per pound irrespective of sex. In most cases the value has been recorded but in a small number it has been assumed either on the basis of depth or from records from associated stations. Prawns with count 20 or smaller number per pound are regarded as adult. Prawns with count 21 or greater number are regarded as juvenile or sub-adult.

Generally adult prawns occurred in waters of 6 fathoms or greater depth but were also taken in shallower water at some stations. Smaller prawns are mainly associated with areas of 5 fathoms or less depth, but sub-adults have a wider depth range.

Catch quantity is arranged in seven categories, namely 1500-1700 lb (2), 200-600 lb (11), 55-180 lb (13), 11-45 lb (33), 6-10 lb (52), 1-5 lb (203) and Trace (446). The last named category comprises lifts of nine or fewer individuals. Ten or more individuals have been rated as 1 lb.

2.5.2 SAMPLING AND CATCH PATTERNS ACCORDING TO STATE OF TIDE

The catch pattern is examined in relation to the state of tide (Figure 52). Catch and sampling data are displayed as frequency distribution histograms using intervals of one hour plus or minus slack High Water (left column), and intervals of one hour plus or minus slack Low Water (right column).

Tidal data are those recorded on the gauge in the Norman River at Karumba

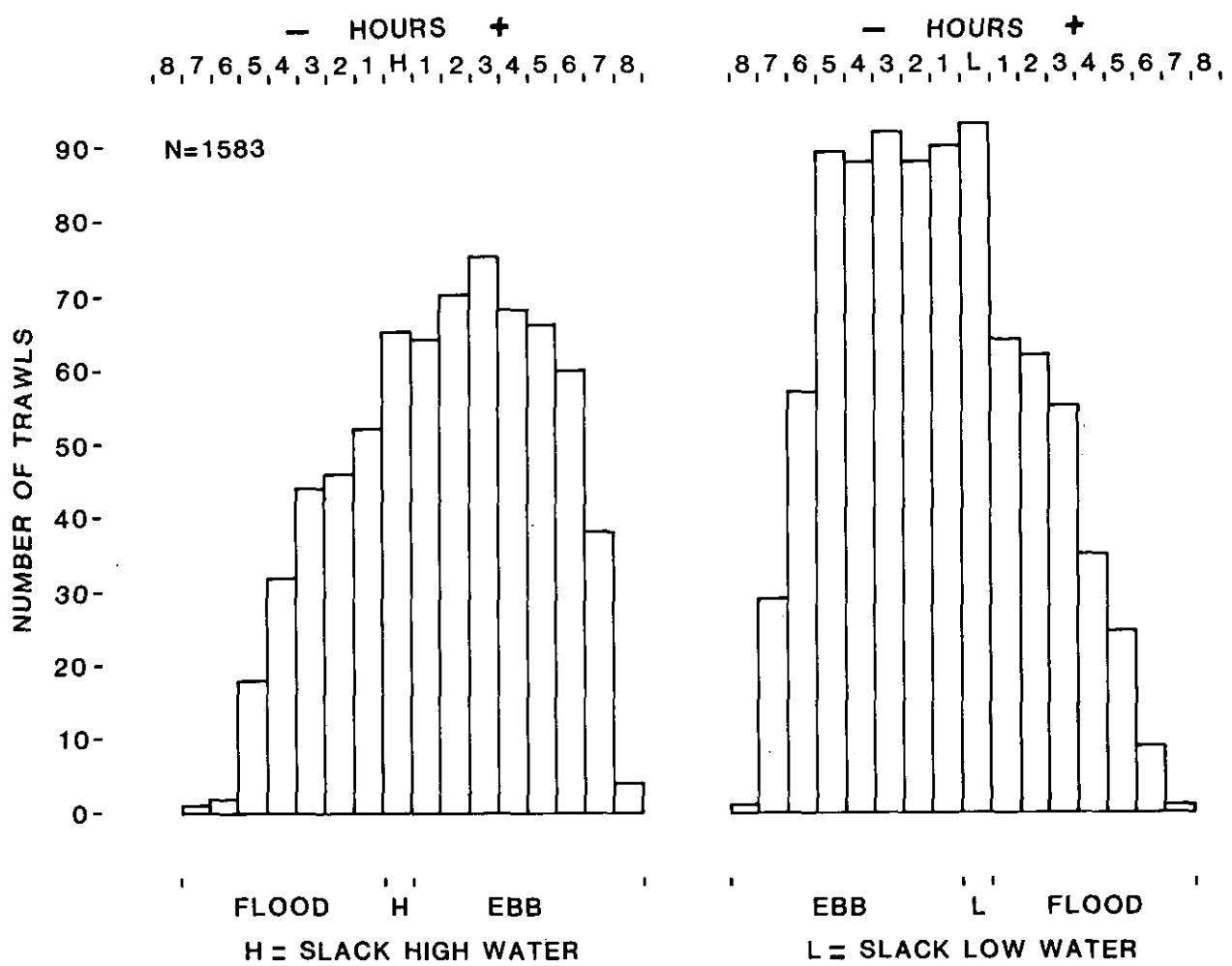


Figure 52A Frequency distribution of *Rama* trawl stations in depths of six fathoms or greater in relation to times of slack high water and slack low water.

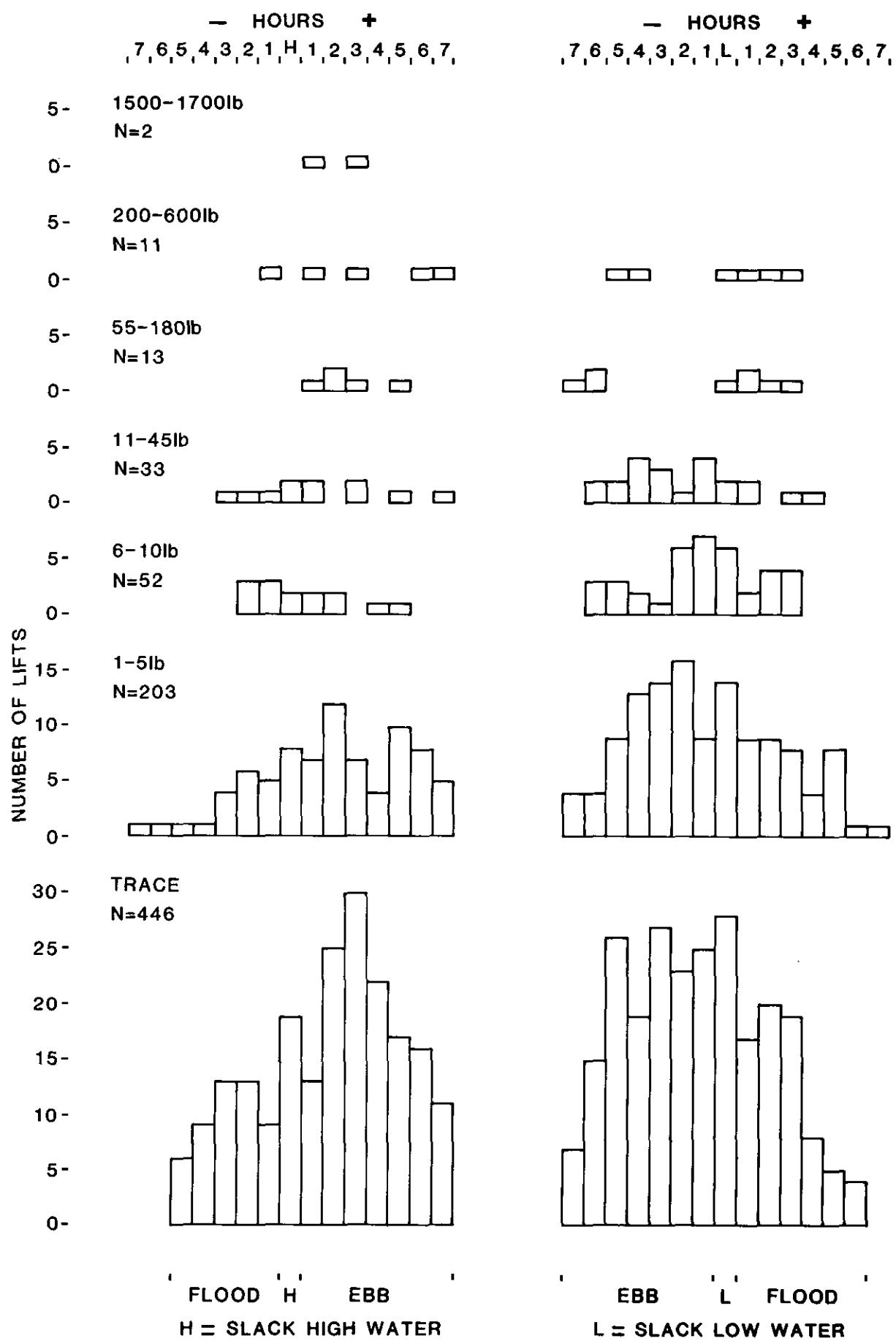


Figure 52B

Frequency distributions of seven size categories of lifts of adult banana prawns by *Rama* in relation to times of slack high water and slack low water.

and are not necessarily those at the actual fishing sites in the survey area.

Adult banana prawns and catch categories are as defined in Section 2.5.1 above.

The sampling pattern represents all stations where lifts of trace or greater quantities were made, together with all stations in depths of 6 fathoms or greater irrespective of area.

2.5.3 SAMPLING AND CATCH PATTERNS ACCORDING TO PROGRESSION OF TIDAL CYCLE

Catch data for adult banana prawns are examined in relation to days on which neap and 'double' tides occurred (Figure 53). Catch and sampling data are displayed as frequency distribution histograms using intervals of one day plus or minus the dates identified as neap tide (left column), and intervals of one day plus or minus the dates identified as double tides (right column).

Tidal characteristics of the south-east corner of the Gulf are described in detail in Part 3 of this Atlas. These tides are lunar and thus two cycles occupy each lunar month. Thus for approximately one fortnight time of high water closely follows that of moonrise and moonset in alternate cycles. The oscillation is diurnal but for several days representing the transition from one cycle to the next the oscillation tends to become semi-diurnal producing the phenomenon locally called 'double' tides. The neaps are identified as those days on which HLW and LHW occur. The doubles are identified as those days covering the period when there is departure from the normal intervals between successive slack waters. Data pertinent to these events through the period of survey are listed (Table 7). The source of tidal data is indicated in Section 2.5.2 above, and times and dates of events are not necessarily identical at the actual fishing sites.

In estimating distance in time from neap tides the minus value is reckoned from the first day and the plus value from the last day on which either HLW or LHW

was recorded. Similarly in estimating distance in time from double tides the minus value is reckoned from the first day and the plus value from the last day on which abnormal intervals between consecutive slack waters occurred irrespective of whether the event was very early or very late on that calendar date.

Adult banana prawns and catch categories are as defined in Section 2.5.1 above. Sampling is as defined in Section 2.5.2 above.

2.5.4 SAMPLING AND CATCH PATTERNS ACCORDING TO AGE OF MOON

Catch data for adult banana prawns are examined in relation to the age of the moon (Figure 54). Catch and sampling data are displayed as frequency distribution histograms using intervals of one day plus or minus dates of new moon and full moon. This system illustrates the 'dark' and 'bright' periods of the moon more clearly than using numbered moon days as an index of moon age in each lunar cycle. Dates of new moon and full moon are from The Nautical Almanac.

Adult banana prawns and catch categories are as defined in Section 2.5.1 above. Sampling is as defined in Section 2.5.2 above.

2.5.5 SAMPLING AND CATCH PATTERNS ACCORDING TO SOLAR AND LUNAR COMBINATIONS

Catch data for adult banana prawns are examined in relation to the combinations of moon up during daylight, moon down during daylight, moon up during night and moon down during night (Figures 55-56). The data are displayed as frequency histograms according to the age of the moon as in Section 2.5.4 above, namely using intervals of one day plus or minus dates of new moon and full moon. In effect this shows catch characteristics during daylight and night periods in association with the so-called 'bright' and 'dark' periods of the lunar cycle. It takes into consideration possible effects of gravitational pulls and illumination from both bodies. It is to be noted that

Table 7. Identification of periods of double tides and neap tides at Karumba during the survey period, July 1963 to July 1965.

Doubles start Date	Time (hr)	Doubles finish Time (hr)		Tide	Date	Neap LHW Time (hr)		Height (ft)	Neap H1W Time (hr)		Height (ft)
		Date	Tide		Date	Date	Tide		Date	Tide	
28.7.63	1145	HW	1, 8.63	0500	HW	30,7.63	1200	5.0	31,7.63	0900	4.9
11,8.63	1115	HW	14, 8.63	0230	HW	12,8.63	0315	5.6	13,8.63	0700	5.8
24,8.63	1145	LW	28, 8.63	1800	LW	26,8.63	0230	5.4	26,8.63	0600	6.2
7,9.63	2230	LW	11, 9.63	0115	HW	9,9.63	1045	4.1	8,9.63	1115	5.5
20,9.63	2100	LW	23, 9.63	2400	HW	23,9.63	1030	5.4	21,9.63	1645	5.5
4,10,63	2145	LW	7,10,63	2300	HW	7,10,63	1430	5.0	6,10,63	1115	5.8
16,10,63	1645	HW	20,10,63	0815	LW	18,10,63	0930	5.8	18,10,63	0230	5.4
31,10,63	0430	HW	2,11,63	2100	HW	2,11,63	0400	7.4	2,11,63	0030	7.2
13,11,63	1330	LW	15,11,63	1900	HW	15,11,63	0430	6.4	15,11,63	0315	6.2
28,11,63	0200	HW	30,11,63	2000	HW	29,11,63	2030	8.7	28,11,63	1300	5.3
11,12,63	0045	HW	13,12,63	1945	HW	12,12,63	2330	9.4	11,12,63	1100	4.4
25,12,63	1245	LW	28,12,63	1900	HW	27,12,63	2330	9.4	26,12,63	1045	4.6
8,1,64	1030	LW	11,1,64	0600	LW	10,1,64	2030	9.1	9,1,64	0900	5.0
23,1,64	1000	HW	24,1,64	0730	LW	24,1,64	2215	9.8	23,1,64	1000	5.0
5,2,64	0015	HW	7,2,64	0630	LW	6,2,64	2300	10.1	7,2,64	0630	7.8
19,2,64	1300	LW	22,2,64	1445	HW	20,2,64	1445	8.8	19,2,64	1300	6.8
2,3,64	2230	HW	6,3,64	1445	HW	4,3,64	1400	7.2	4,3,64	1715	6.9
17,3,64	2030	HW	20,3,64	1315	HW	18,3,64	1915	8.3	19,3,64	1930	8.3
30,3,64	0800	LW	1,4,64	1000	HW	30,3,64	1215	6.5	31,3,64	1545	6.4
12,4,64	1900	HW	15,4,65	0930	HW	13,4,64	1030	6.4	15,4,64	0315	6.0
25,4,64	1730	HW	28,4,64	0930	HW	27,4,64	0730	8.0	26,4,64	0345	6.0
10,5,64	1700	HW	13,5,64	0815	HW	11,5,64	1000	6.2	11,5,64	1200	5.8
23,5,64	1430	HW	25,5,64	0745	HW	25,5,64	1515	6.8	24,5,64	1300	6.7
7,6,64	0130	LW	9,6,64	0615	HW	8,6,64	0930	6.5	8,6,64	1045	6.5
19,6,64	1315	HW	22,6,64	0630	HW	21,6,64	0530	7.6	19,6,64	2230	4.6
4,7,64	2400	LW	7,7,64	-	HW	4,7,64	1300	6.6	5,7,64	2245*	3.9*
17,7,64	1215	HW	20,7,64	0445	HW	19,7,64	0500	7.8	17,7,64	2200	4.4
1,8,64	0045	LW	4,8,64	0400	HW	3,8,64	1130	4.3	3,8,64	0815	3.6
14,8,64	1130	HW	16,8,64	0130	HW	15,8,64	0300	6.8	15,8,64	0630	6.1
27,8,64	2230	LW	31,8,64	0145	HW	29,8,64	0230	6.5	30,8,64	0630	6.4
8,9,64	2245	LW	18,9,64	0015	HW	12,9,64	1515	4.5	10,9,64	1700	5.8
23,9,64	2000	LW	26,9,64	2300	HW	24,9,64	0045	6.4	26,9,64	1145	6.5
6,10,64	1830	LW	9,10,64	2215	HW	9,10,64	1345	6.8	7,10,64	1430	7.2
20,10,64	1700	LW	23,10,64	1000	LW	21,10,64	2245	7.4	22,10,64	0930	7.1
1,11,64	1730	LW	3,11,64	2200	HW	3,11,64	2200	7.8	2,11,64	1615	6.0
18,11,64	0215	HW	19,11,64	1945	HW	18,11,64	2030	9.5	19,11,64	1100	6.2
30,11,64	1300	LW	1,12,64	2000	HW	3,12,64	1945	10.2	30,11,64	1300	5.8
16,12,64	0030	HW	17,12,64	1930	HW	16,12,64	2315	10.2	16,12,64	1000	4.9
6,3,65	0930	LW	10,3,65	1345	HW	7,3,65	1315	7.8	7,3,65	1445	7.1
19,3,65	2130	HW	23,3,65	-	LW	13,1,65	2315	9.8	21,3,65	1200	5.8
12,1,65	1200	LW	14,1,65	-	LW	26,1,65	1915	10.8	25,1,65	1000	5.9
24,1,65	1200	LW	27,1,65	1645	HW	10,2,65	1530	9.3	9,2,65	0945	5.6
8,2,65	2315	HW	11,2,65	1630	HW	21,2,65	1500	7.3	23,2,65	0515	8.0
20,2,65	1115	LW	23,2,65	1430	HW	14,5,65	1600	6.9	14,5,65	1400	6.8
28,5,65	0130	LW	30,5,65	0715	HW	29,5,65	0715	8.4	28,5,65	2330	5.1
9,6,65	1415	HW	12,6,65	0945	HW	11,6,65	1230	7.0	11,6,65	1030	6.8
24,6,65	0500	LW	27,6,65	0530	HW	26,6,65	0430	5.8	26,6,65	0700	5.5
7,7,65	1300	HW	10,7,65	1515	HW	9,7,65	0330	6.9	8,7,65	2130	3.9
21,7,65	2315	LW	25,7,65	0400	HW	24,7,65	0330	6.9	21,7,65	2315	4.6

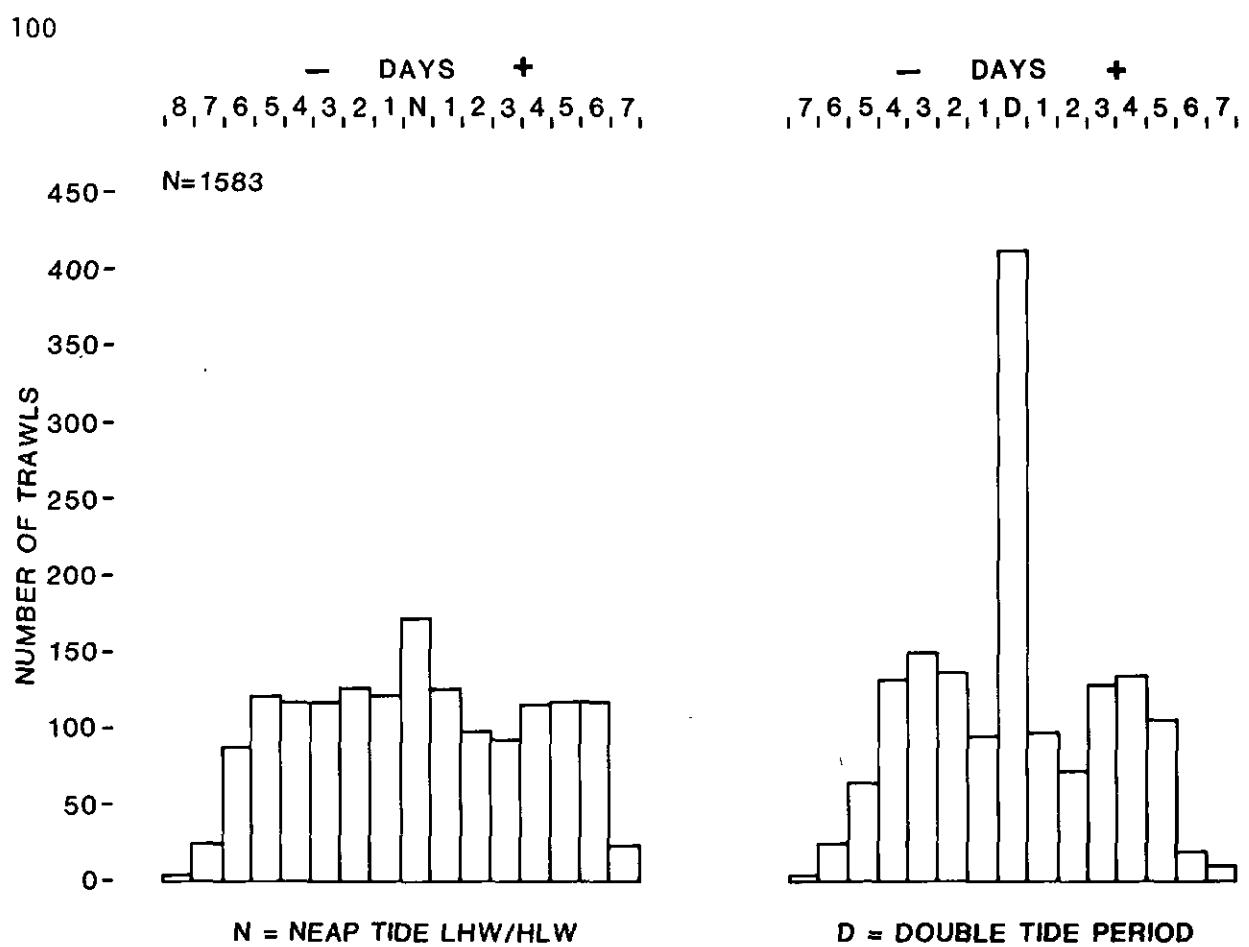


Figure 53A

Frequency distribution of *Rama* trawl stations in depths of six fathoms or greater in relation to dates of neap tides and dates of "double" tides.

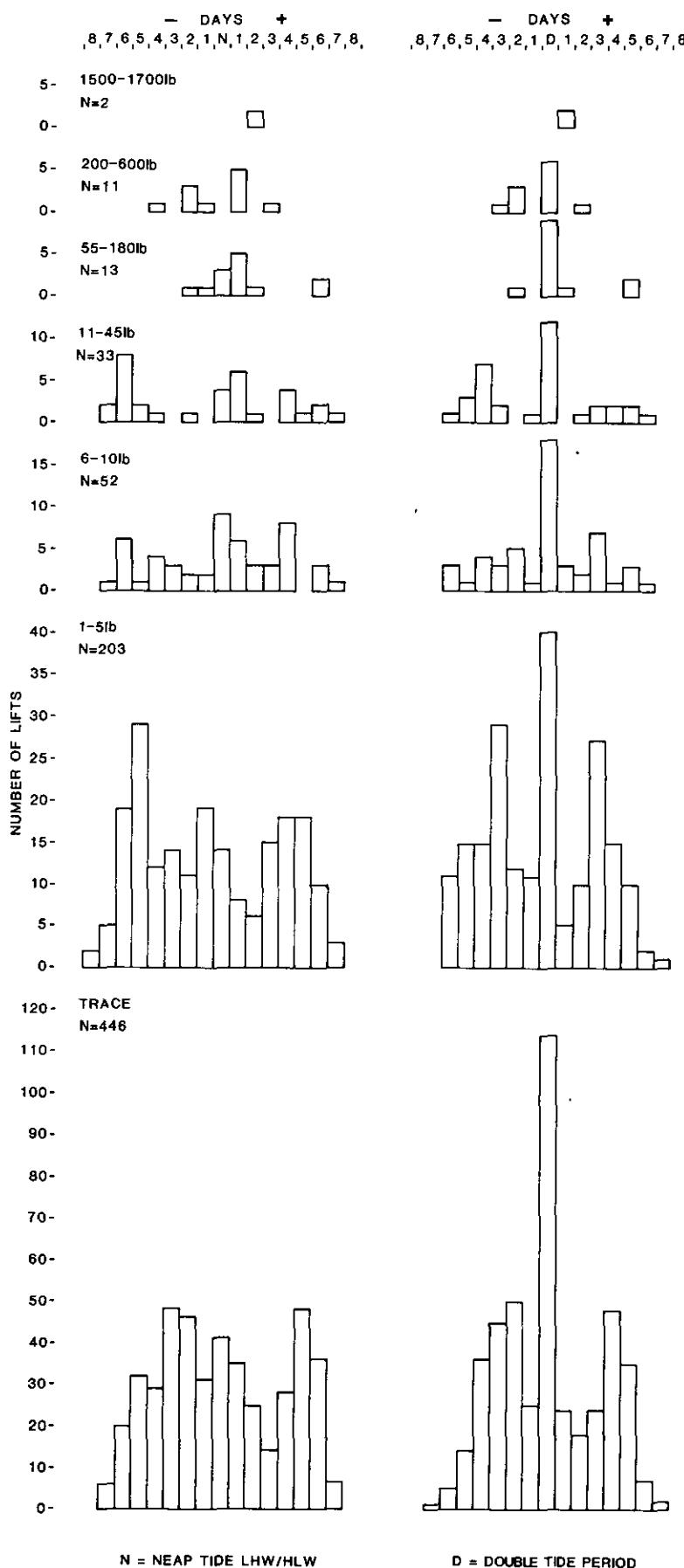


Figure 53B

Frequency distributions of seven size categories of lifts of adult banana prawns by *Rama* in relation to dates of neap tides and dates of 'double' tides.

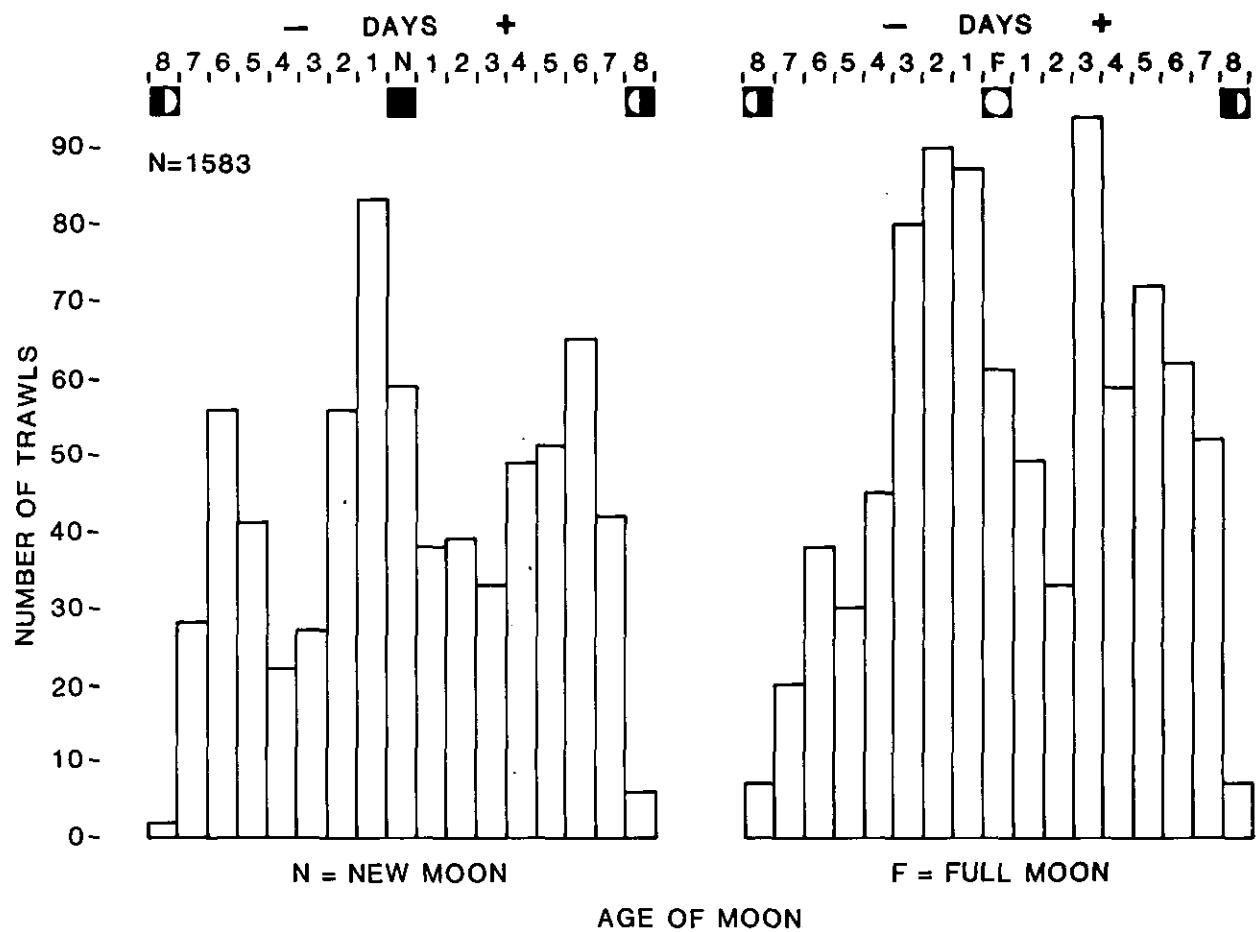


Figure 54A

Frequency distribution of *Rama* trawl stations in depths of six fathoms or greater in relation to dates of new moon and full moon.

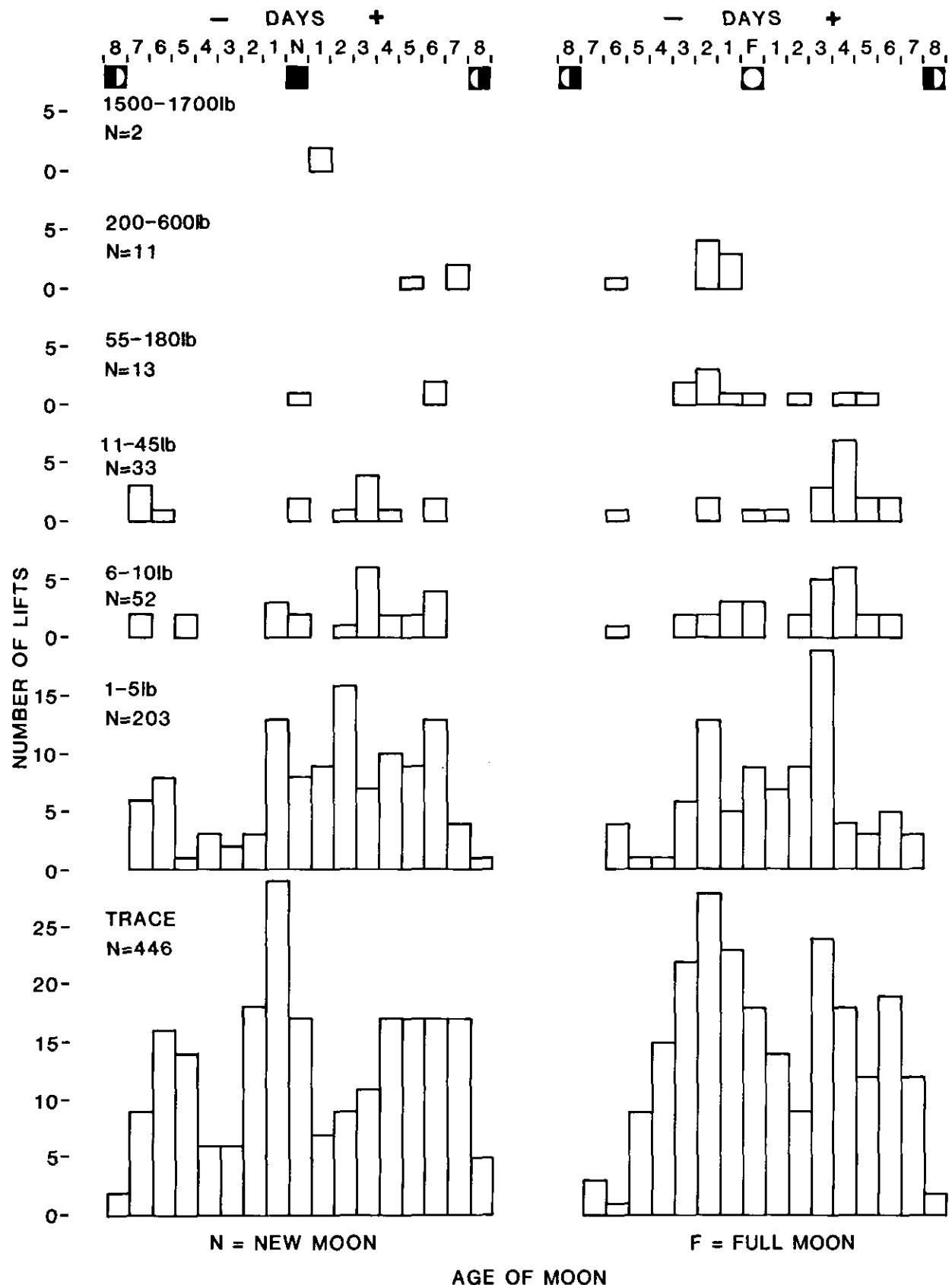


Figure 54B

Frequency distributions of seven size categories of lifts of adult banana prawns by *Rama* in relation to dates of new moon and full moon.

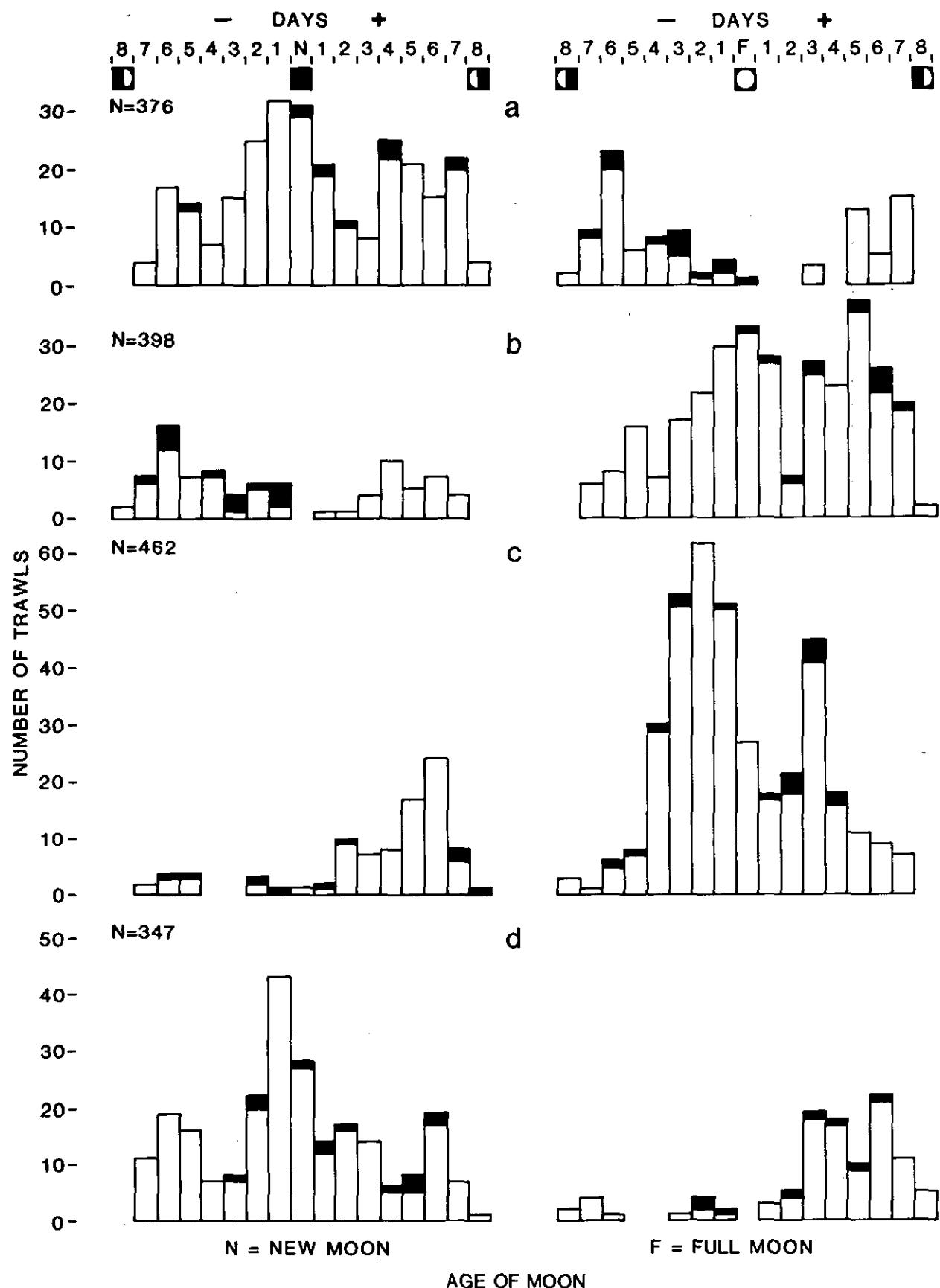


Figure 55

Frequency distribution of *Rama* trawl stations in depths of six fathoms or greater during (a) daylight between moonrise and sunset.
 (b) daylight between moonset and sunset.
 (c) night between moonrise and sunrise.
 (d) night between moonset and sunrise.

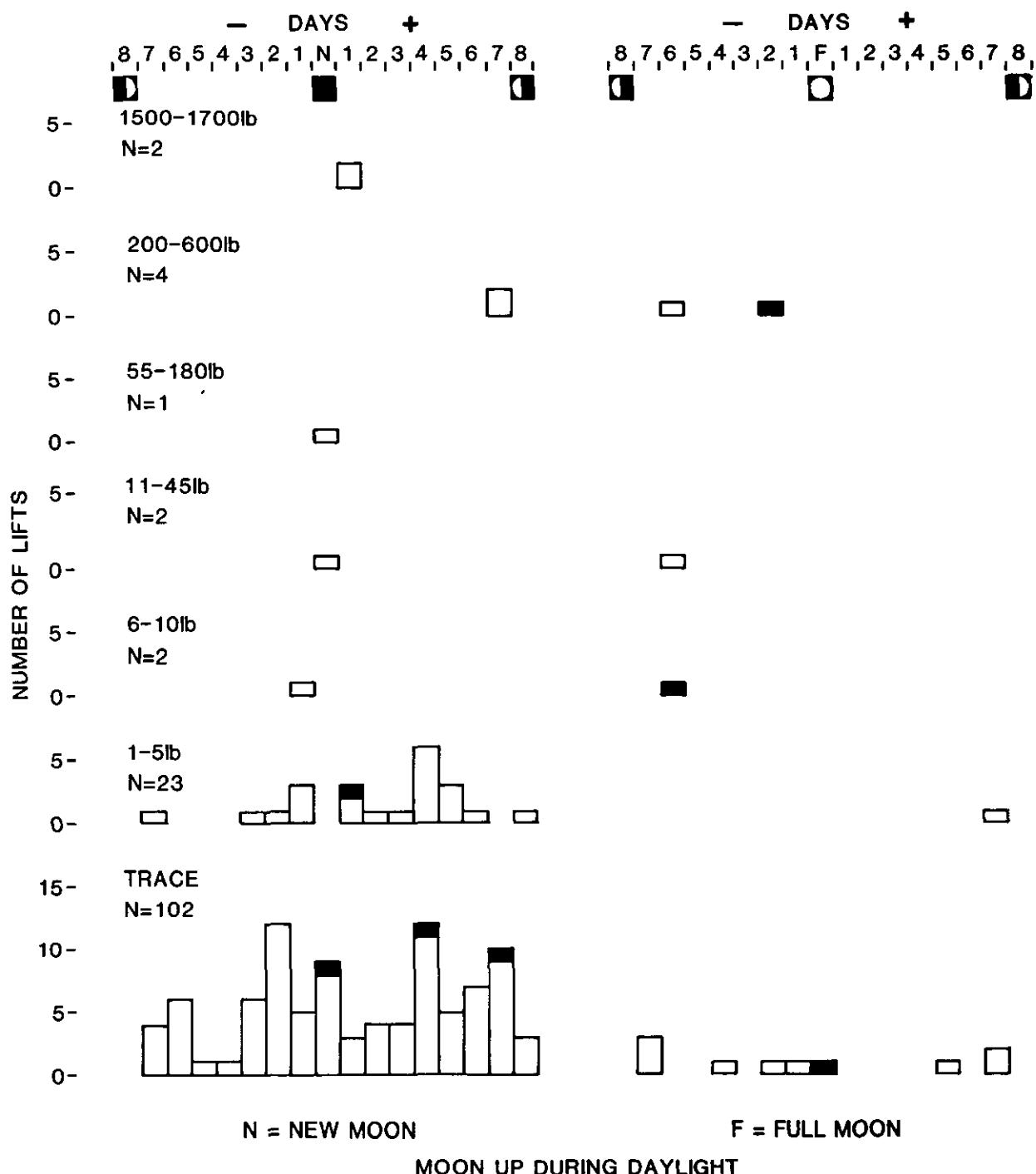


Figure 56A

Frequency distribution of seven size categories of lifts of adult banana prawns by *Rama* during daylight between moonrise and sunset.

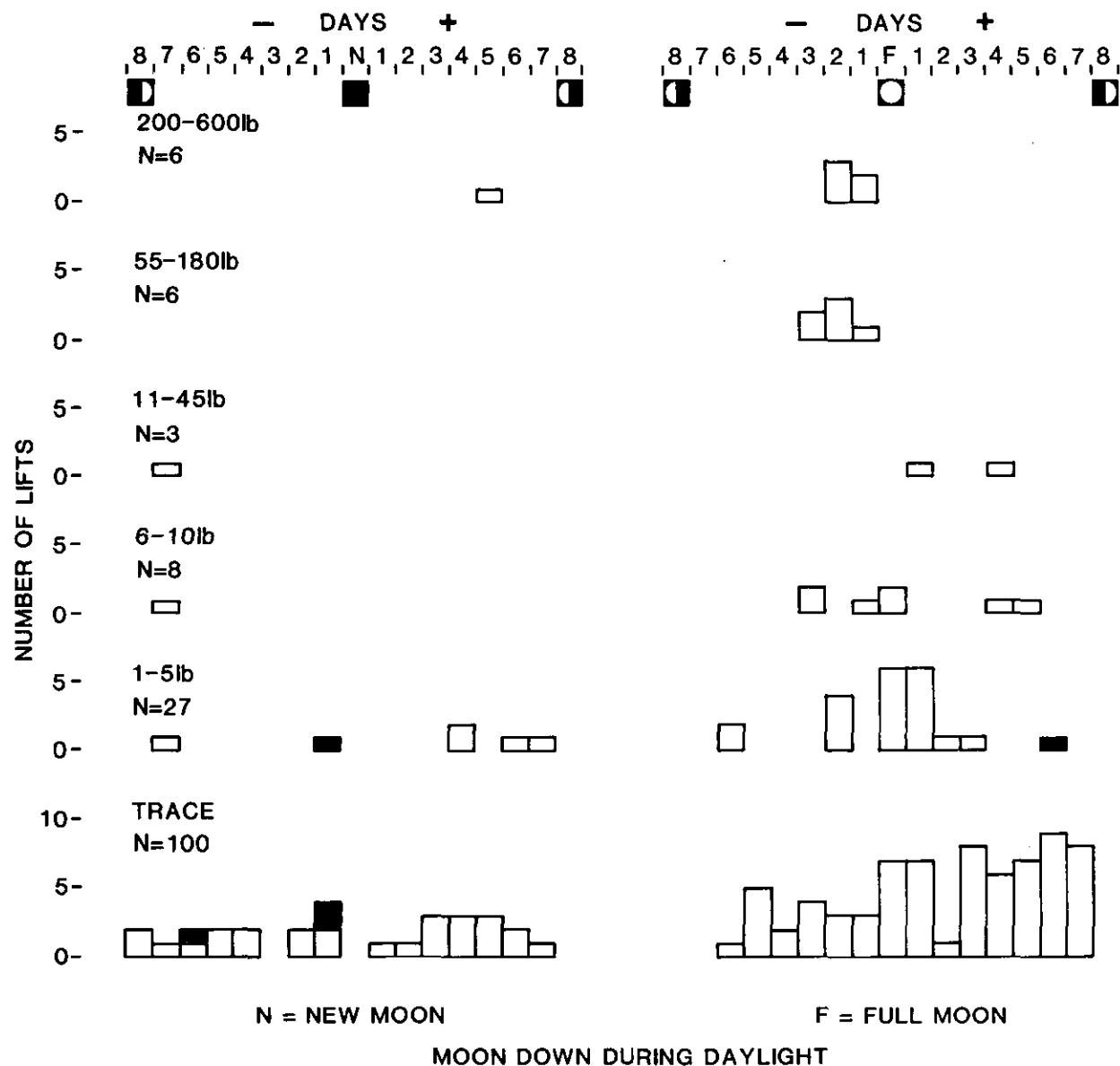


Figure 56B Frequency distribution of six size categories of lifts of adult banana prawns by *Rama* during daylight between moonset and sunset.

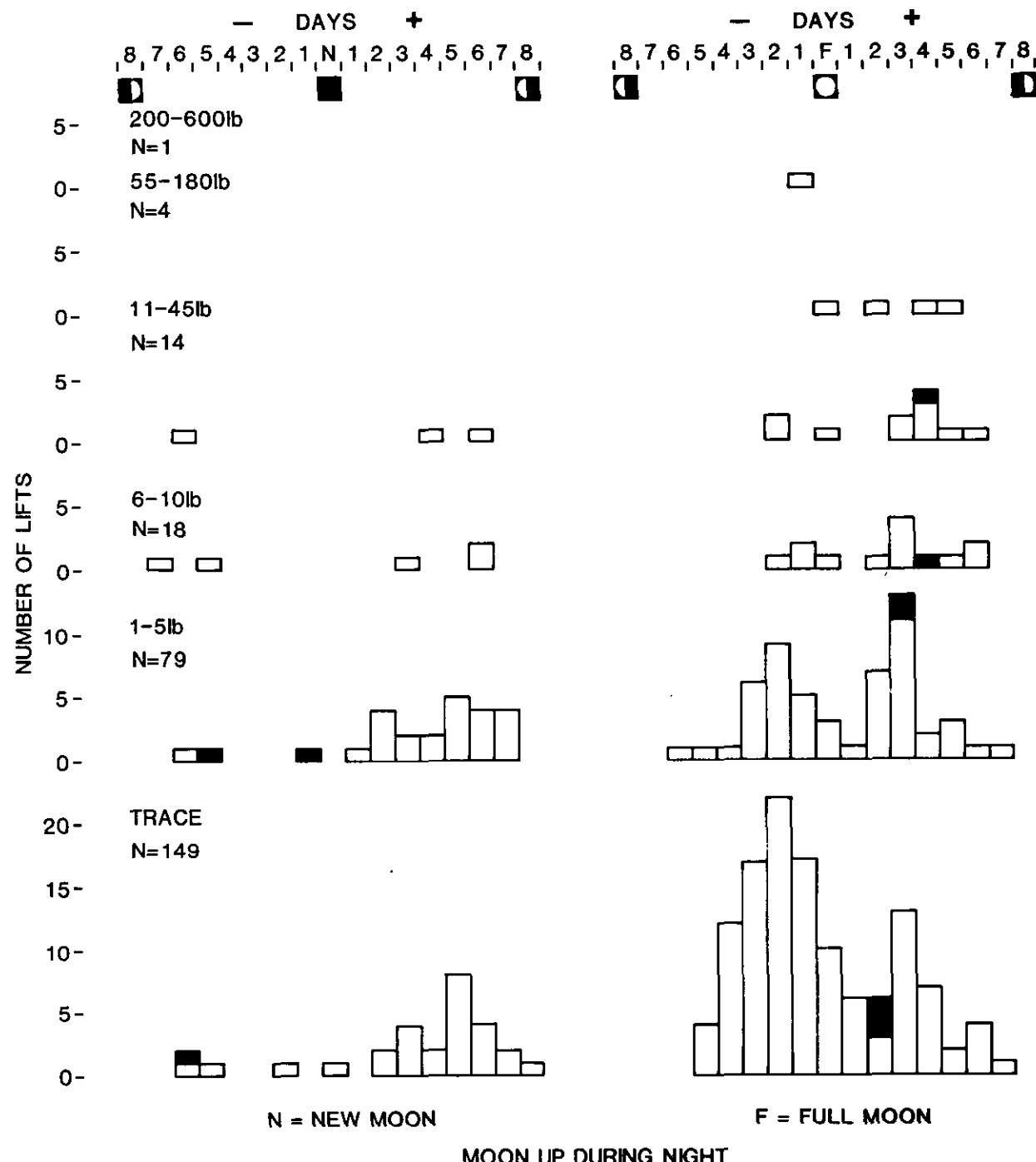


Figure 56C

Frequency distribution of six size categories of lifts of adult banana prawns by *Rama* during night between moonrise and sunrise.

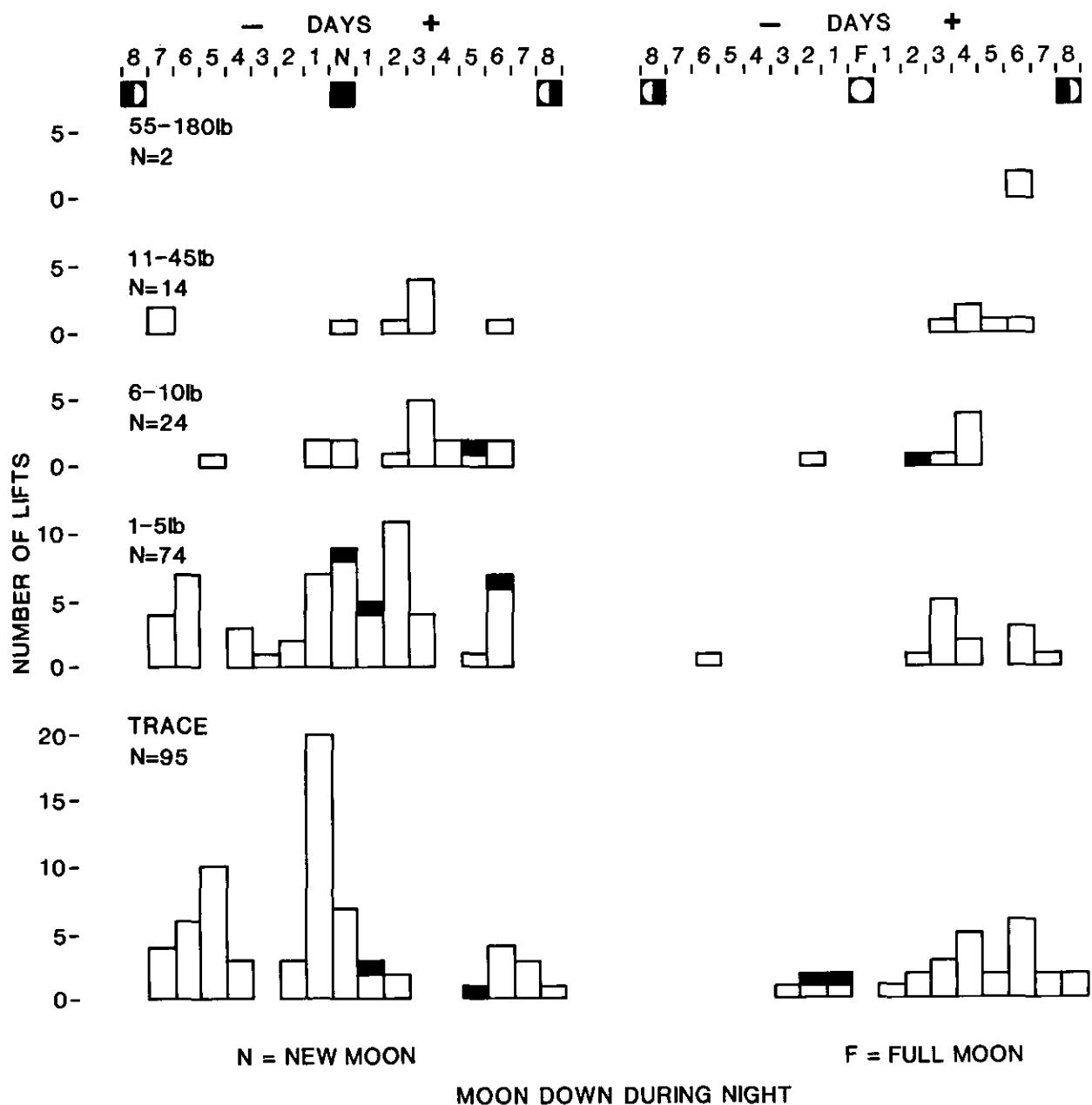


Figure 56D

Frequency distribution of five size categories of lifts of adult banana prawns by *Rama* during night between moonset and sunrise.

on the date of the new moon, the moon rises at approximately sunrise and sets at approximately sunset, thus providing no illumination during the hours of darkness. Also on the date of full moon, the moon rises at approximately sunset and sets at approximately sunrise, thus providing the maximum amount of illumination during the hours of darkness.

Data on dates of new moon and full moon, and times of sunrise, sunset, moonrise and moonset are from The Nautical Almanac. Times of rising and setting of the sun and moon have been corrected so as to apply to the position 17°S latitude and 140°E longitude. Times are expressed according to Time Zone -1000, (Australian Eastern Standard Time), although this is actually 40 minutes fast on local longitudinal time.

Adult banana prawns and catch categories are as defined in Section 2.5.1 above. Sampling is as defined in Section 2.5.2 above.

There are some variations from the four clear cut categories including cases where the sun either rose or set during a trawl and where the moon either rose or set during a trawl. In the first circumstance the choice is made according to the greater part of the trawl being before or after the solar event. In the second circumstance the frequencies of the lunar event are shown in black.

2.5.6 DETECTION OF BANANA PRAWN SCHOOLS BY ECHO-SOUNDER

As stated in Section 2.2.2 banana prawns, when in the phase of forming up into densely packed schools or "balls", can often be detected by echo-sounder. The first such school fished by *Rama* at Stns 981 and 982 was detected in this way. All further searching, especially during the pilot fishing operations during April to July 1965, made extensive use of the echo-sounder.

The kind of marks produced by banana prawn schools vary. Marks produced by prawn schools are often associated with marks produced by small fish, and may

sometimes be confused with them. Often the prawn schools show as paler patches close to the sea floor with more intense marks representing schools of small fish close above or to the side of the prawn schools. In some cases the marks show schools of larger fish or individual sharks or sawfish in mid-water above the prawn schools. Marks that are produced by small fish and sometimes mistaken for prawn schools, have been attributed by trawermen to dollarfish or ponyfish (*Leiognathidae*) or small grey leather jackets (*Paramonacanthus* spp.). Although both types are very numerous and frequently caught in prawning areas, they were not consistently taken by *Rama* with larger lifts of banana prawns.

There is a tendency for dense schools of banana prawns, after being detected close to the sea floor and then fished by a succession of trawl sweeps through the school, to break up and rise well clear of the sea floor. This behaviour can produce a tall short-based mark rising several fathoms above the sea floor, having the characteristic shape of a traditional Christmas tree.

Some recordings were obtained of schools fished by *Rama*, many of them representing schools being fished jointly by several vessels simultaneously (Figures 57-59). These show representative types of marks produced by prawns and fish when the schools were first detected, and in some cases the effect of fishing on the prawn schools. The traces illustrated are identified by the station number and marked with the catch of banana prawns in pounds actually lifted by *Rama*. The scale along the top of each trace is graduated in minutes. Trawling speed was normally two knots, so each minute division represents a travel distance of the trawl across the sea floor of approximately 62m.

Stn 991 trace shows much activity by fish close to the sea floor and in mid-water where there are also some larger individual fish. The prawn school which yielded only 280 lb is relatively small and confined to about 100m of sea floor. Stn 2190 trace shows virtually no activity by fish near the sea floor

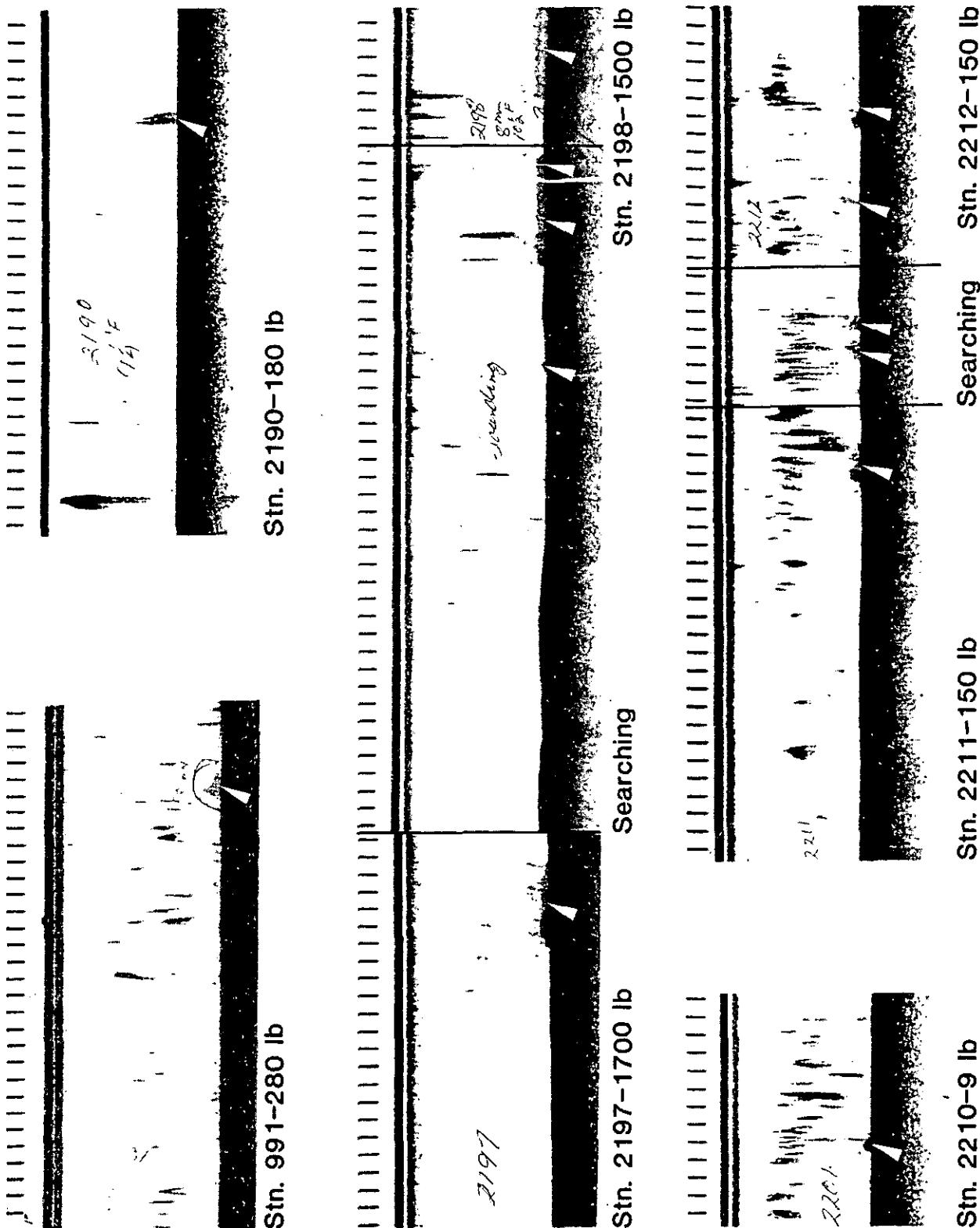
through the duration of the trawl. The prawn school which yielded only 180 lb is confined to a very small area but had the high Christmas tree form. The heights of these schools can be gauged from the fishing depths of 12 and 9.25 fathoms respectively (Figure 57, upper row).

The prawn school shown in traces for Stns 2197 and 2198 is very large and was located in a gutter about 350m wide and about one fathom deep. *Rama* trawled through it for 5 minutes and lifted 1700 lb (left frame), relocated it (central frame), trawled through it again for 5 minutes and lifted another 1500 lb (right frame). *Toowoon Bay* then lifted another 1500 lb but the school appeared unaltered (Figure 57, middle row).

The traces for Stns 2013-2017 (Figure 58) relate to a profitable morning in April 1965 during which *Rama* lifted nearly 1000 lb in five consecutive trawls between 0700 and 1035 hr and *Toowoon Bay* lifted about 730 lb in six consecutive trawls between 0430 and 1130 hr. Both vessels lost estimated quantities in excess of 500 lb due to breakages from excess weight and damage to nets by sharks. The prawn schools appear to be small but fairly numerous. At Stn 2017 *Rama* lifted 550 lb by changing direction and trawling twice through the same

school. Some of the marks appear to represent fish.

The traces for Stns 2210-2212 also show relatively small schools of prawns and much fish activity especially in mid-water. *Rama* lifted 150 lb in a few minutes prior to lifting the trawl at Stn 2211, quickly re-located the school and trawled through it again twice to lift another 150 lb at Stn 2212 (Figure 57, bottom row). The other trawlers in the vicinity obtained larger catches. The traces for Stns 2215-2221 (Figure 59) represent schooling activity on the following day (12 June 1965). One or more schools of moderate size appear to have yielded a total catch for *Rama* of about 2050 lb in seven consecutive lifts during four hours trawling in the afternoon, the lifts varying between 100 and 600 lb. On this occasion *Rama* was working around a marker buoy and trawling through the school several times before lifting the net. The other three trawlers also obtained large catches (see Table 6). The prawn schools and associated fish, at the start of fishing produced marks reaching 2 to 3 fathoms above the sea floor (Stns 2215-2216), but continued trawling caused lifting away from the sea floor (Stns 2218-2219) and great increase in height of the marks.



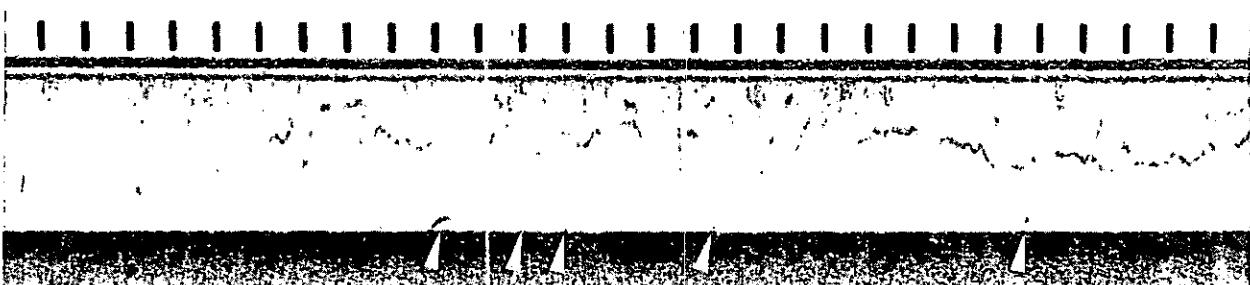
Figures 57-59 Representative echo-sounder recordings of banana prawn schools and associated fish. For details see text.



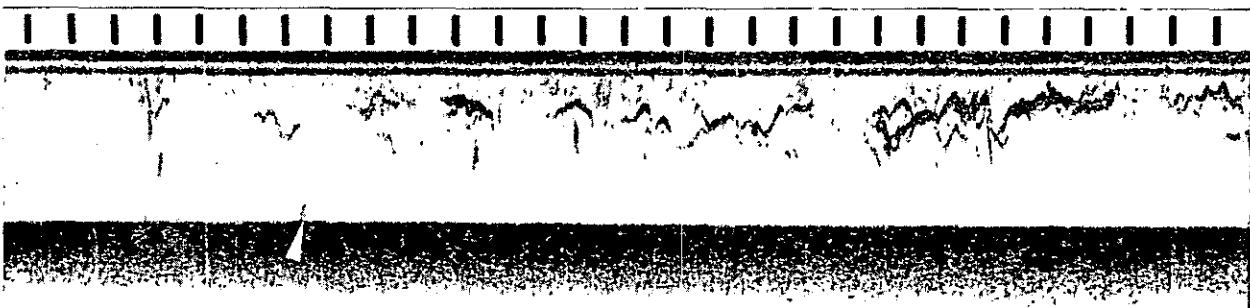
Stn. 2013-370 lb

1000 2013

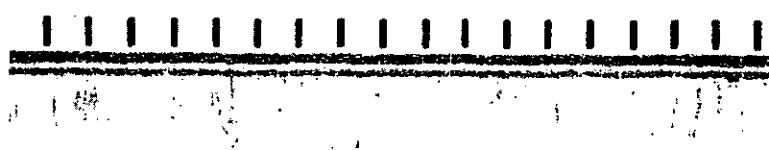
↑



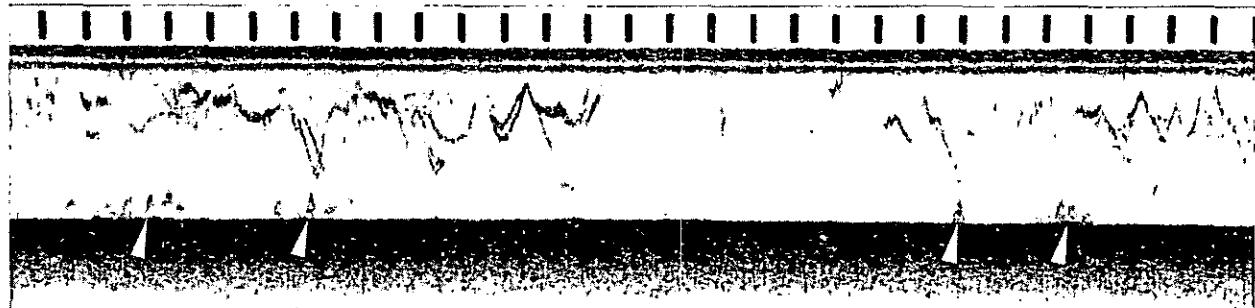
Stn. 2014-65 lb



Stn. 2015-8 lb



Searching

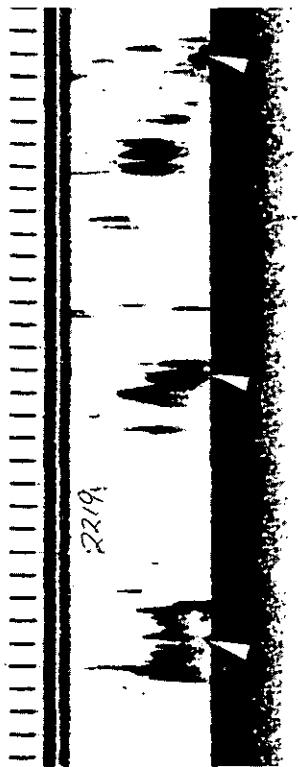
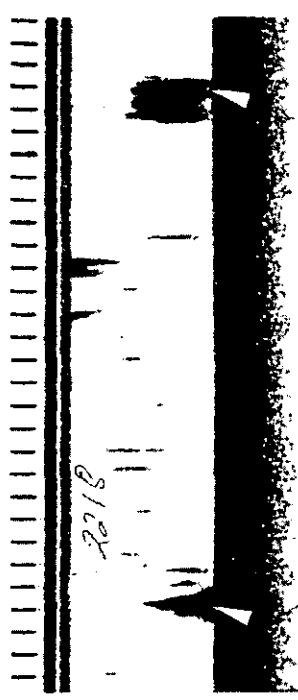


Stn. 2017-550 lb



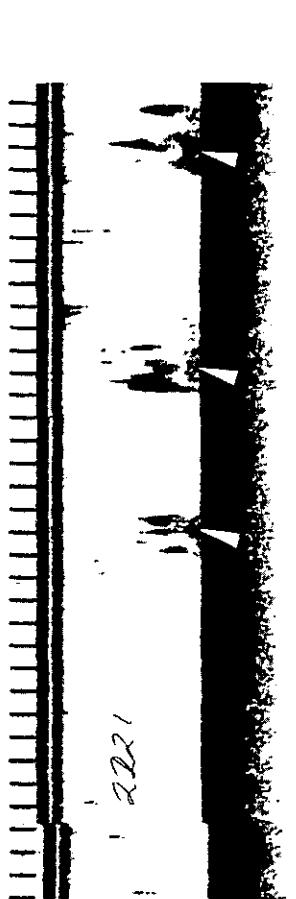
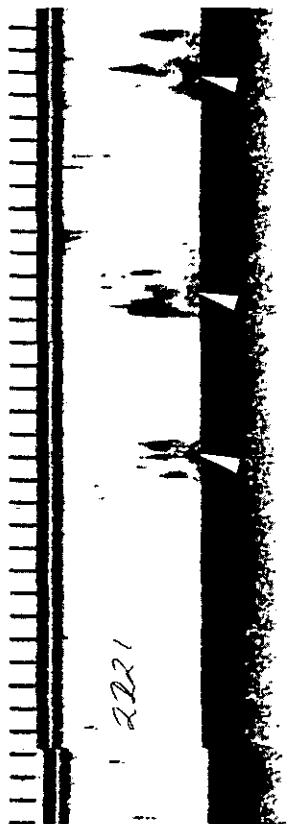
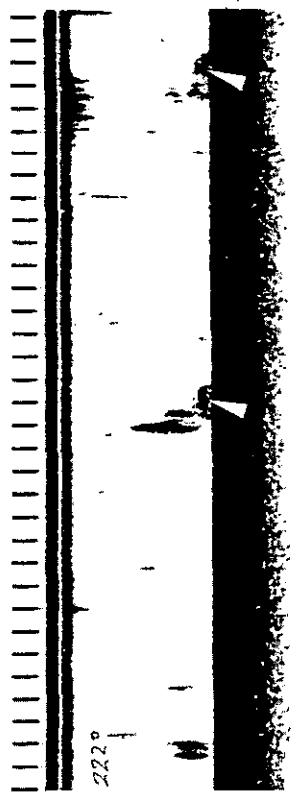
Stn. 2215-300 lb

Stn. 2217-100 lb



Stn. 2218-150 lb

Stn. 2219-150 lb



CSIRO
Marine Laboratories

comprise

Division of Fisheries Research

Division of Oceanography

Central Services Group

NEW SOUTH WALES LABORATORY

202 Nicholson Parade, Cronulla, NSW

P.O. Box 21, Cronulla, NSW 2230, Australia

TASMANIAN LABORATORY

Castray Esplanade, Hobart, Tas

G.P.O. Box 1538, Hobart, Tas 7001

QUEENSLAND LABORATORY

233 Middle Street, Cleveland, Qld

P.O. Box 120, Cleveland, Qld 4163

WESTERN AUSTRALIAN LABORATORY

Leach Street, Marmion, WA

P.O. Box 20, North Beach, WA 6020