

RESULTS OF A SURVEY FOR PENAEID RESOURCES
0 0 0 0
IN THE AREA 22 S-24 S, 152 E-154 E CONDUCTED

BY BONSERINO PTY LTD FOR FIRTA.

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MARCH 1985

1983-004

ABSTRACT

A twelve month survey of penaeid resources between 22° S and 24° S, in water depths of 200 to 700 m has been successfully undertaken. Participants in the survey identified King prawn (*Penaeus plebejus*) resources east of the Swain Reefs complex, in water depths of 150 to 225 m. A resource of giant scarlet (*Plesiopeneaus edwardsianus*) and red prawn (*Aristeomorpha foliacea*) was located in water depths of 550 to 700 m on the Saumarez Plateau. A fishery with a value to fishermen exceeding half a million dollars has developed east of the Swains Reefs as a consequence of this survey. To this time, no commercial fishery for the deep-water resource has developed. The economics of a potential fishery in this area have been examined. Prospects for exploitation of the resource under existing constraints of costs and estimated achievable catch rates do not appear good.

INTRODUCTION.

Fisheries development in Australia has been centred upon coastal fisheries, and offshore or deep water fisheries have been neglected until recent years. This has been notably so in Queensland, where trawl fishermen started to work maximum depths of 200 m in the nineteen sixties and have not worked deeper since then.

In the past five years a number of surveys have been conducted with the aim of discovering exploitable resources in waters deeper than 200 m, or further offshore than present commercial fishing operators work at this time.

Amongst those surveys was that carried out by the Fisheries Division, Commonwealth D.P.I., on the "Craigmin" in 1980. Fish and penaeid prawn resources were sought during a 3 month survey period, in water depths of 90 to 600 m between latitudes 19°S and 26°S. A survey of resources east of the continental shelf between 10°S and 21°S was commenced by Queensland Fisheries Service in 1981, and in 1982-3 a survey of penaeid prawn resources in water depths greater than 200 m and between 26°S and 28°S was completed by Mr. J. Hodges.

These surveys have been constrained by the need to work on resources which could be fished by a component of the existing Queensland trawl fleet. Evidence of overcapitalization on the fleet in 1977-9 lead to restrictions on entry to the Queensland east coast trawl fishery in 1979. This had little effect upon suppression of growth in effective fishing power as existing trawlers improved gear technology. By 1980, an appreciable number of trawler operators were either losing money or receiving lower returns to capital than would have been received on the open market (Hill and Pashen in press). At that time, inshore prawn stocks, which support most east coast trawlers (Williams 1980) were thought to be exploited to a level commensurate with maximum sustainable yield. One solution to this problem of overcapitalization upon fully exploited stocks has been to develop new fisheries.

One area covered in the "Craigmin" survey of 1980 which appeared to have some potential for development was the continental slope between 22°S and 24°S. The "Craigmin" report (Hughes 1981) noted the presence of King prawns in water depths of 180 - 200m east of the Capricorn - Bunker complex and the Swain Reefs (Fig. 1). This discovery lead to the development of a fishery off the Capricorn - Bunker group but the data from the Swains area was apparently too scanty to encourage fishermen. The survey was aimed

principally at identifying fish resources and prawn nets were not used in water depths below 250 m.

Work carried out by Mr. J. Hodges, on the FIRTA funded "Iron Summer" survey in 1982-3 showed that commercially exploitable penaeid resources existed in water depths greater than 250 m off the south east Queensland coast. Given the large area of what appeared to be trawlable ground between 22°S and 24°S (Hughes op. cit.), there seemed to be good justification for a survey of prawn resources in waters deeper than 250 m off the central Queensland coast.

Because the survey was being carried out with the ultimate aim of providing information to the existing fleet there seemed little point in employing trawlers with features or gear not available to those found in the existing fleet. In 1983 a proposal to investigate penaeid resources between 22°S - 24°S and 152° E - 154° E using an existing east coast trawler was accepted by FIRTA.

The basis of this proposal was that the trawler should investigate both the suitability of bottom for trawling and penaeid species composition and abundance in a 14,000 n. mile squared area. The survey was to extend over 12 months in order to minimize the problems associated with seasonal fluctuations commonly seen in penaeid stocks. Raw survey data were to be augmented by an economic evaluation of the potential for prawn fisheries in the area.

SURVEY AREA

Existing charts of the area between 22°S - 24°S and 152°E - 154°E (Fig. 1) show the area is roughly bounded on the western side by the continental shelf. In the southern half of the survey area, the shelf runs along a north west / south east line, but in the northern part of the area, the 200 m contour runs north easterly across the mouth of the Capricorn Channel to the southerly end of the Swain Reefs. Much of the survey area shows soundings of 350 - 400 m, suggestive of an underwater plateau. On the south eastern side of the survey area charted soundings show that depths fall rapidly from 350 m to 1500 m. To the east of the survey area this tightening of depth contours between 350 and 1000 m is also evident.

Water movements in the area are poorly documented. The eddies which ultimately generate the East Coast eddy system are thought to originate in the Coral Sea and move across the Samauarez Plateau before reacting with the coast and deflecting south. The Australian Coastal Pilot (Vol. I) (Anon 1973) reports that southerly sets of 1/2 - 3+ knots may be experienced in the area during winter.

Monthly wind roses, based on 5 years data collected at Lady Elliot Island by the Australian Bureau of Meteorology, are given in Fig. 2. The data show the predominant south easterly monsoon pattern experienced between February and August, and the less consistent northerly winds experienced between November and January. The data are averages of wind velocities recorded at a single time point each day, over a 5 year period. On this basis wind speeds greater than 17 knots could be expected on approximately 86 days/years. Local fishermen suggest that seas associated with recorded wind velocities greater than 17 knots (> Beaufort scale 5) are too heavy for them to continue operations in open water.

Fig 1. Survey area with transect lines emphasized

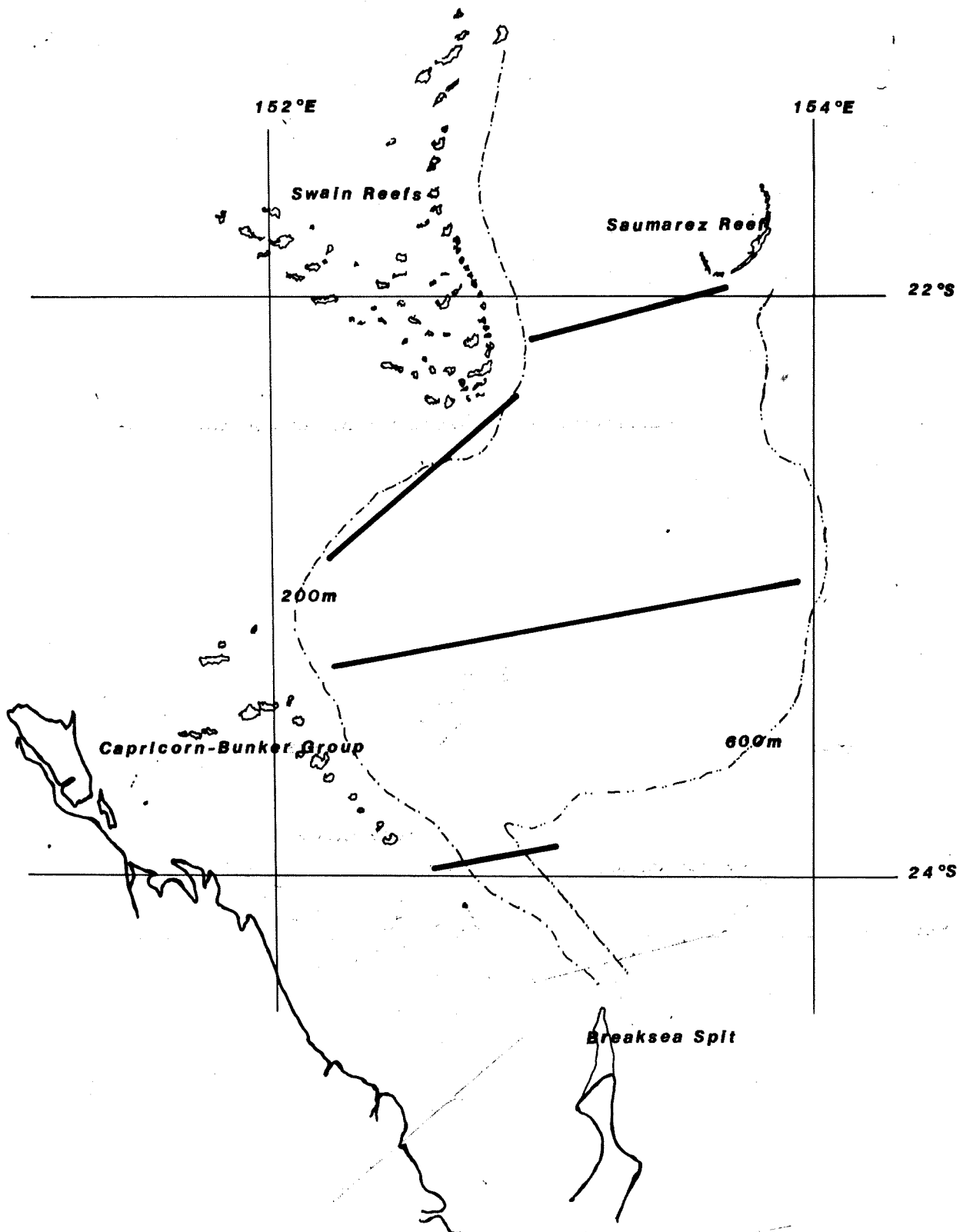
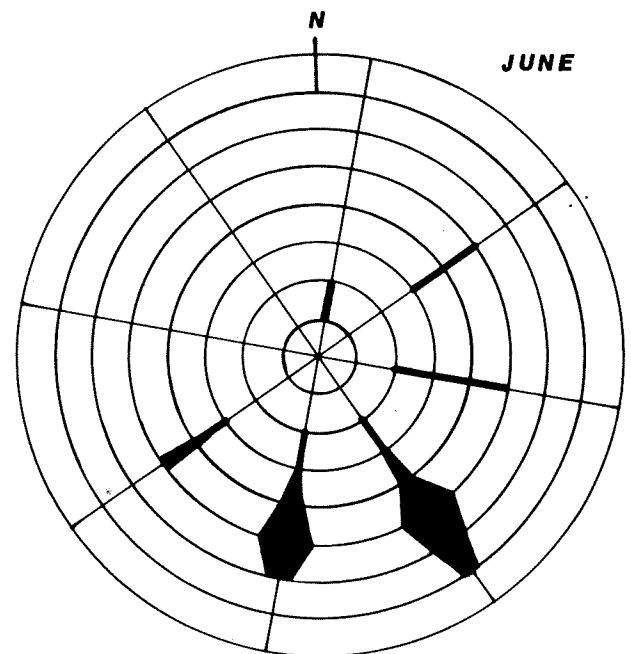
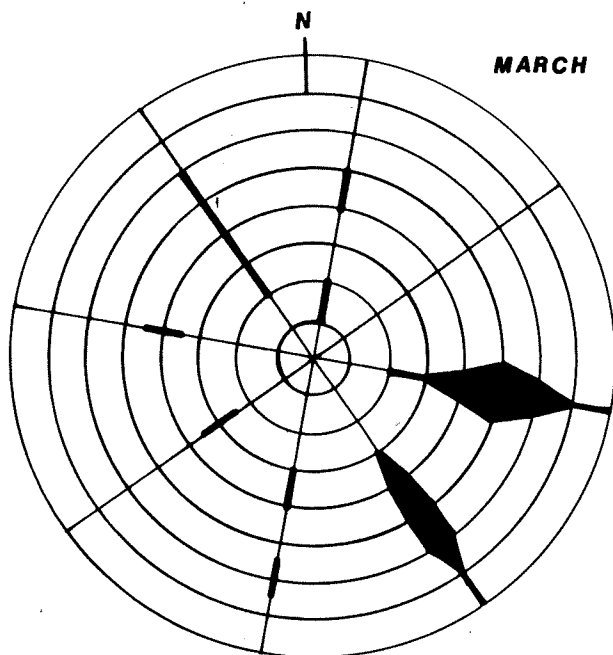
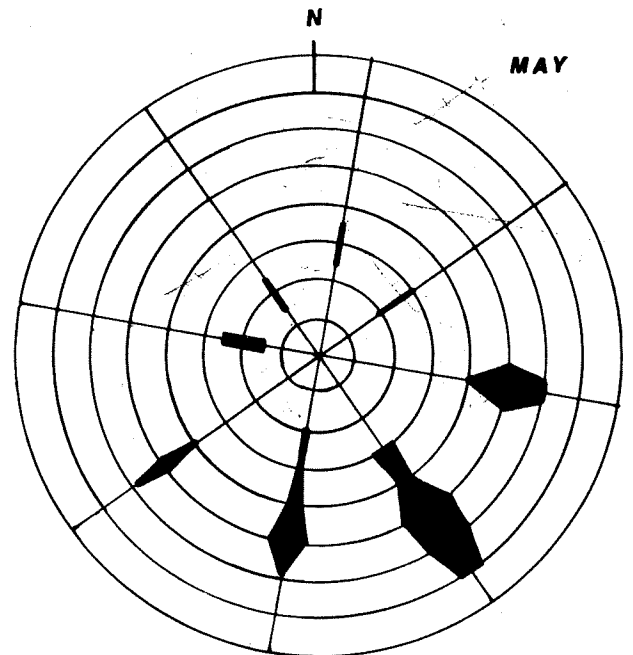
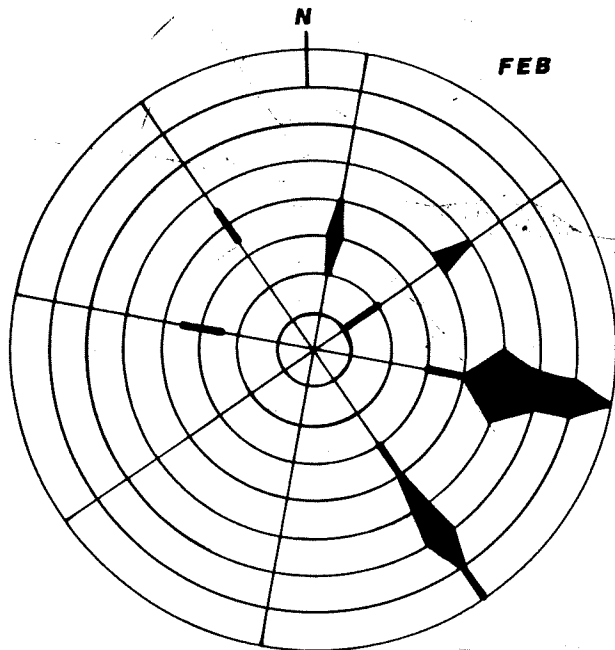
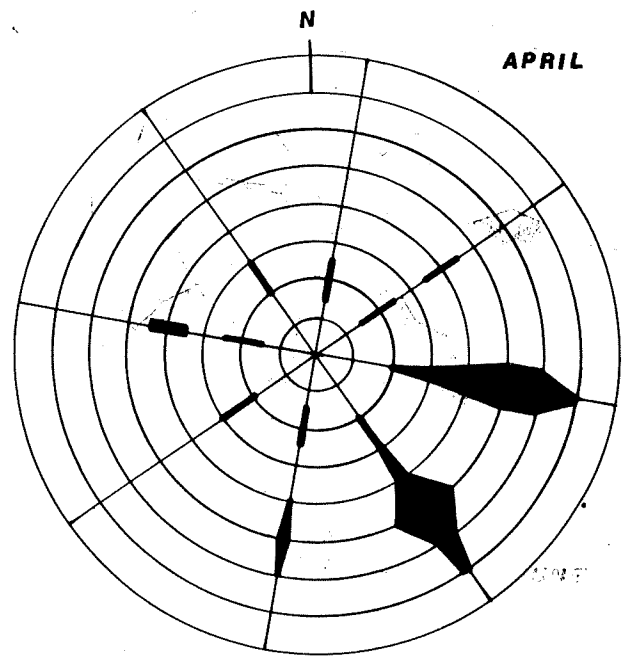
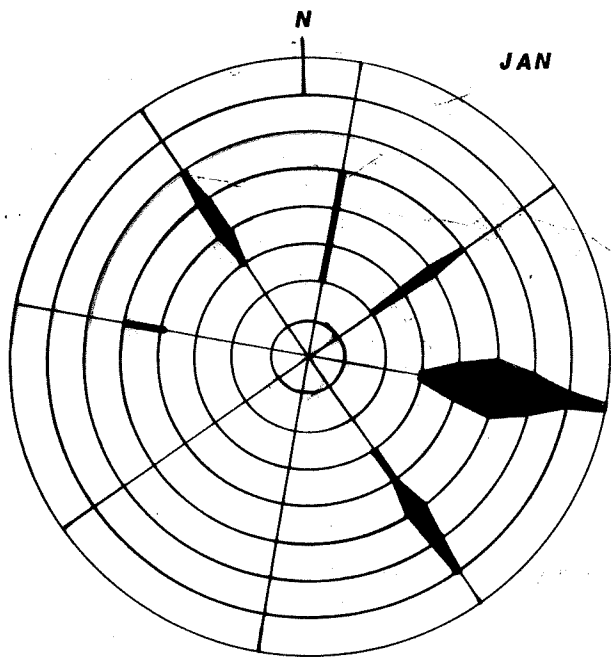
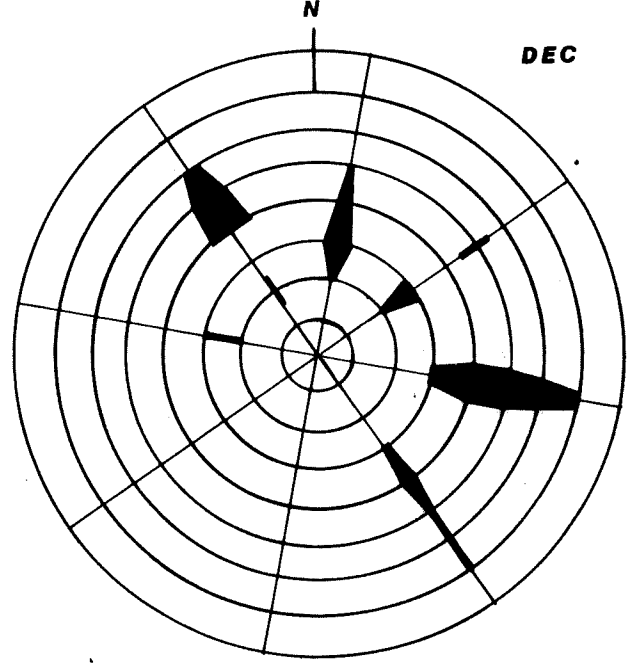
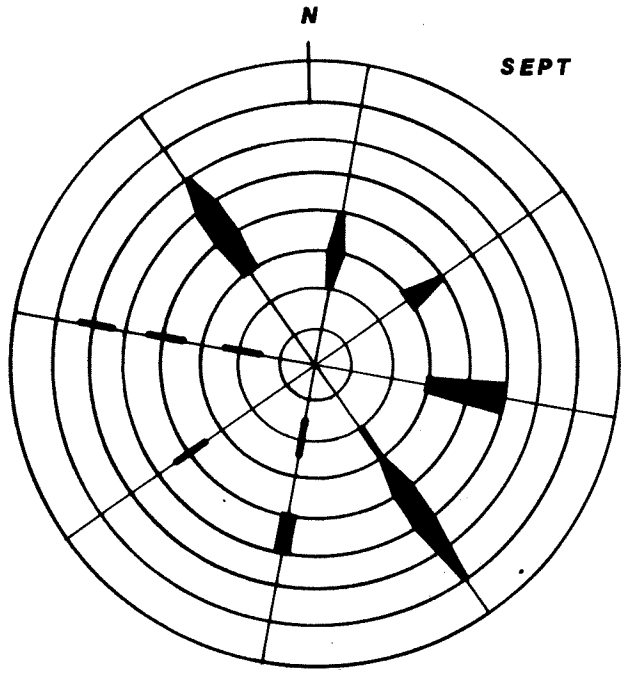
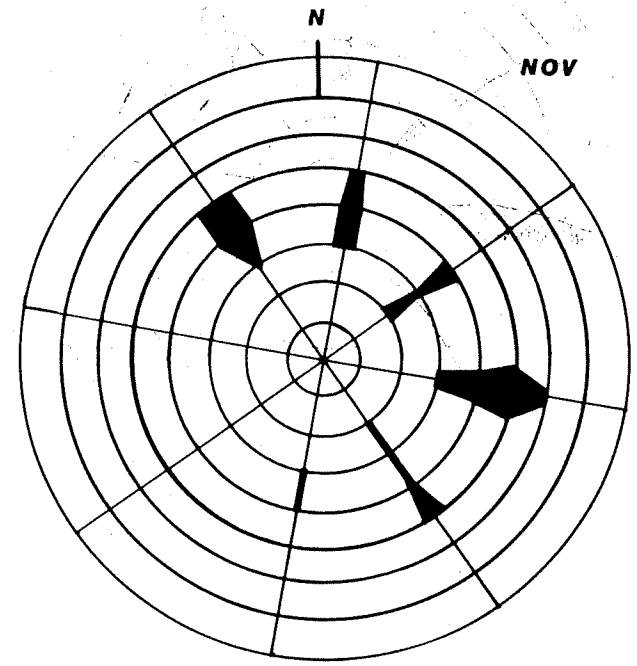
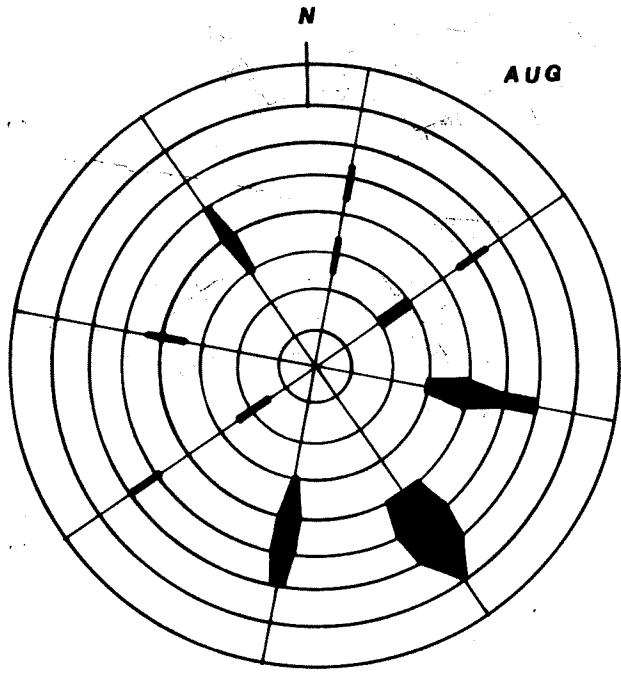
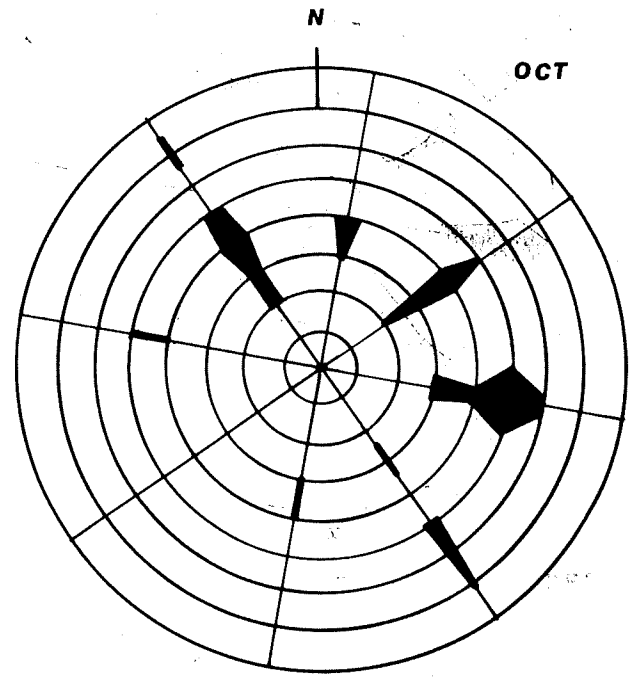
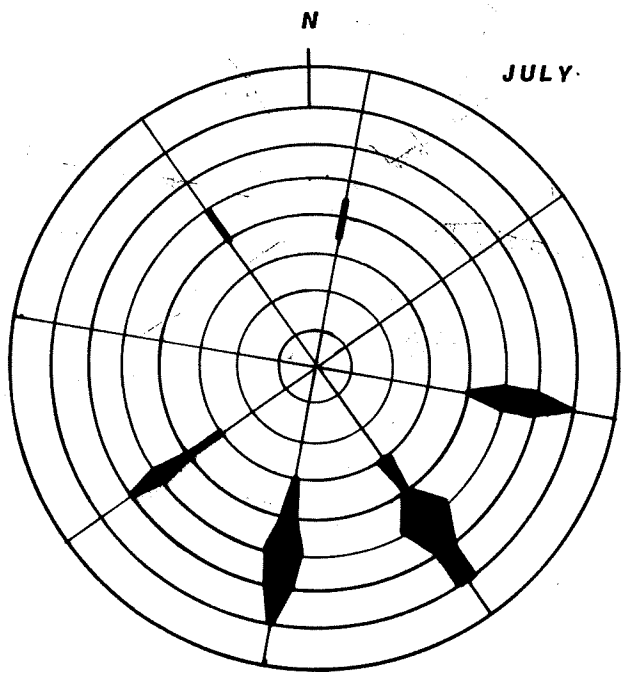


Fig 2. Monthly wind roses for Lady Elliot Island. Wind velocities averaged from daily readings taken between 1976 and 1980. Concentric circles represent Beaufort scale classification, with inner circle being Beaufort scale 0, and outermost ring being Beaufort scale 7+. The relative area of shading in each of the concentric rings represents the proportion of recorded wind speeds which fell into the corresponding Beaufort classification. Proportion of wind from a given direction and of given speed is represented by relative shaded area in corresponding compass representation.





EQUIPMENT

The vessel used for this survey was the 18m steel hulled trawler "Southern Intruder". The vessel is powered by a V-8 GM main, with a GM 4-71 auxilliary. Hydraulic Jaden winches were loaded with 2000m of 10mm wire per side. The only modification required for deep water work was the addition of a heat exchange system for the hydraulic oil. The boat is rigged with the gantry aft and very short trawl arms, originally fitted to work triple gear. For the purpose of manoeuvring and stability this set up worked well in deep water. Shooting time in water depths of 600 m did not exceed 20 minutes and retrieval time from that depth was approximately 25 minutes.

Trawl gear used in the survey was a single 27 m headrope Siebenhausen made of 54 mm mesh. This net design was modified slightly in the later stage of the survey to minimize trawl trash taken on very soft bottom. The gear was spread by conventional rectangular timber boards, 3 m x 1.2 m.

Electronics used in the course of the survey were a Sailor 802 sounder (which gave remarkably good service), a Decca RM 916 48 n. mile range radar, which was of limited value because of distance from radar targets through much of the survey, and a Dellar satellite navigation unit interfaced to a sumlog. The lack of a gyrocompass interface and difficulties encountered with aeriels on the sat. nav. system resulted in some fixes being made by dead reckoning.

SURVEY PROCEDURE

Given the extent of the survey area, a detailed survey of the whole ground was not feasible. To impose some order on survey and sampling strategy, a set of five transect lines were picked as being representative of the survey area.

Co-ordinates of these lines were:-

- | | | | | | |
|-------|-----------|------------|---|-----------|------------|
| (I) | 22° 15' S | 153° 00' E | - | 21° 50' S | 153° 50' E |
| (II) | 23° 00' S | 152° 40' E | - | 22° 30' S | 153° 25' E |
| (III) | 23° 20' S | 153° 25' E | - | 23° 00' S | 154° 10' E |
| (IV) | 23° 40' S | 152° 45' E | - | 23° 30' S | 153° 40' E |
| (V) | 24° 10' S | 152° 50' E | - | 24° 10' S | 153° 15' E |

The lines were selected either on the basis of their covering a wide range of depths (often a crucial factor in determining penaeid distribution) or covering areas where depth was the range of known King prawn habitat, but in which little fishing or searching for the species had taken place.

Sample strategy was to conduct a cruise over the transects three times in the twelve month survey period. On the initial cruise echo soundings were used to determine the suitability of the bottom for trawling, and a series of trawls were carried out to determine bottom type and species composition / abundance of penaeids.

Trawl shots were spaced largely on the basis of depth contours. On the southern (deeper) transects trawl shots were spaced at 50 or 100 m depth ranges, whilst along the northern transects, which were conducted in depths where King prawns could be expected, shots were spaced by depths of 5 to 10 m. In areas where depth contours were widely spaced, irregular trawl shots were put down to determine if there was variation in the penaeid fauna as a consequence of geographic variation.

Continuous echo soundings were recorded at all times the survey was in progress. By frequently noting position (from sat. nav. fixes) and course changes, a map of bottom configuration adjacent to transect lines was built up.

At each trawl station, position was recorded from either a sat. nav. fix or dead reckoning. The commencement and finish of the trawl shot was noted on the echo sounder paper currently in use. On completion of the trawl, penaeids were sorted from the catch, separated by species and weighed.

Collections from the remaining trawl by-catch were made on the basis of a single member of each species present being collected. When time permitted, an additional collection to give relative species abundance was made. Irregular size frequency samples of penaeids were taken as time allowed, and in the latter stages of the survey gonad development of penaeid species with commercial potential was recorded.

Collections of fish, crustaceans and other invertebrates were stored in formalin or alcohol at sea, and resorted and code classified according to a reference collection at the laboratory. This reference collection has been lodged at the Queensland Museum for specific identifications. In excess of 300 species have been identified or are awaiting further attention. Many of the species are new to Queensland and results from this work will not be available for at least a year.

RESULTS

During the survey, the "Southern Intruder" spent 32 days at sea and carried out echo soundings over approximately 800 n. miles. Forty nine effective trawl shots were carried out in water depths between 50 and 750 m. Details of trawl shots in the terms of date, position and depth are given in Table 1.

Topography

The areas to be examined in detail were based upon five major transect lines. Echo soundings showed that the most southerly of these (between $24^{\circ}10'S$ $152^{\circ}50'E$ and $24^{\circ}10'S$ $153^{\circ}15'E$) was untrawlable.

Further north, the transect east of Lady Musgrove Island (based on $23^{\circ}40'S$ $152^{\circ}45'E$ - $23^{\circ}30'S$ $153^{\circ}40'E$) was trawlable in the depth range 200 - 720 m. Canyons running north westerly in the vicinity of $23^{\circ}20'S$ $154^{\circ}40'E$ were untrawlable. East of the continental shelf the bottom sloped very gradually from 330 to 550 m. Between 550 m and 700 m the depth contours were tighter, leaving a sloping shelf of 5- 20 n. miles wide running northeast to southwest in the vicinity of $23^{\circ}46'S$ $153^{\circ}05'E$, $23^{\circ}35'S$ $153^{\circ}33'E$.

The transect based on $23^{\circ}20'S$ $153^{\circ}25'E$ - $23^{\circ}00'S$ $154^{\circ}10'E$ covered the widest area of the Saumarez Plateau. From the area east of the continental shelf to the eastward limit of the transect, the area consisted of an almost uniformly flat bottom (330 m to 400 m) which appeared to be trawlable over almost its entire length. The bottom consisted of soft oozes and muds, except in one area around $23^{\circ}05'S$ $153^{\circ}55'E$, where harder bottom was found.

The transect across the mouth of the Capricorn Channel ($23^{\circ}00'S$ $152^{\circ}40'E$ - $23^{\circ}30'S$ $153^{\circ}25'E$) covered a depth range of 180 - 220m and appeared to be untrawlable. Considerable damage to trawl gear occurred in this area because of loose gravel on the bottom.

An appreciable amount of time was spent in the area south and east of $21^{\circ}45'S$ $152^{\circ}45'E$, east of the Swain Reefs. In water depths of less than 150 m little ground was trawlable, but between 150 and 220 m, (a west-east distance of up to 10 n. miles) the bottom was for the most part trawlable sand flats.

Catch

(a) Penaeid Prawns

Catches of penaeids are documented in Table 1. The data cover only those species or species groups which were taken in sufficient abundance to have commercial potential. Rare species will be documented in publications such as "Record of the Queensland Museum" at a later date.

The data show that three species were taken in sufficient quantities to offer commercial fishing potential. These were the eastern king prawn, *Penaeus plebejus*, the giant scarlet prawn, *Plesiopenaeus edwardsianus*, and the red prawn *Aristeomorpha foliacea*.

Mixed catches of red prawn and giant scarlet prawn were taken in water depths greater than 550 m, with giant scarlets making up a larger proportion of the catch as depth increased towards 750 m. The only area in which the survey covered such depths was in the vicinity of 23°35'S 153°05'E, 23°45'S 153°50'E. Results obtained when the Australian Maritime College vessel "Bluefin" carried out a series of trawls north of 21°S in similar depths suggest that this resource extends east and north of the area covered in the present survey.

Good catches of king prawn were taken from water depth of 150-220 m, east of the Swain Reefs. Commercial fishing operations carried out subsequent to this survey have located similar quantities as far north as Elusive Cay (21°05'S 152°45'E).

Catches of royal red prawn (*Haliporoides sibogae*) taken in this survey were negligible, an unexpected result in the light of catches taken in waters south of 27°S by the "Iron Summer". An as yet undescribed species of *Haliporoides* was abundant in water depths between 380 and 500 m but was too small to be of commercial interest at this time.

b) Bycatch

Of the 300 plus species which were recorded as bycatch during the survey only a small number appeared to be of commercial interest. Ling (Moridae) and tusk fish (Ophidiidae) were taken in most of the trawl shots carried out in water depths greater than 220 m, with maximum catch rates of up to 10 kgs per hour trawled. Individual large

(>2kg) Scorpaenidae were taken on rare occasions. Given that the prawn trawl being used in this survey had been rigged to limit bycatch of fish, the possibility of a commercial resource of finfish existing in the survey area should not be completely discounted.

Catches of the barking or champagne crayfish, *Linuparus trigonus*, were made in small numbers throughout most of the survey grounds in water depths between 200 and 600 m, with best catches being taken in water depth of 350-450 m.

PUBLICATION OF RESULTS

Results generated from this survey have been made available to industry users through a variety of outlets. An interim survey report was published in Australian Fisheries (Dredge and Gardiner 1984) (Appendix 1) and a more general discussion of the implications of the study, including an economic appraisal of the fishery's future, was presented at NPS2 (Potter and Dredge in press). Some 20-30 copies of a chart overlay (Appendix 2) on which survey results are summarized have been distributed and word of mouth discussion of the survey results have resulted in the survey's findings being well known along the Queensland coast.

DEVELOPMENT OF FISHERIES.

Since field operations for this survey were completed, the king prawn grounds east of the Swain Reefs complex have been sufficiently fished for them to be considered an established component of the deep water prawning grounds used by Queensland fishermen. At least 30 boats, working from ports between Yeppon and Southport, have fished these grounds. Whilst the absence of landing statistics in Queensland precludes an accurate assessment of catch from this region, we estimate that total king prawn catch from these grounds in the past year has exceeded 80 tonnes, and gross value of fisheries products from the area exceed half a million dollars. There has been an appreciable, but undocumented, catch of champagne lobster. Pressure from companies traditionally involved in the Northern DMZ fisheries to participate in the fishery has been observed.

On the other hand, there has been little interest expressed by local fishermen in developing the penaeid resources (*P. edwardsianus* and *A. foliacea*) which were identified in water depths of 500-700 m. One vessel based on the Queensland east coast spent two days on the grounds, and one of the companies referred to above had one of its boats spend a short time in the area. Another company has indicated interest in working the deep ground (and possibly those off the Swain Reefs area as well). Whilst catches of up to 800 kg of mixed prawn per day could be taken in water depths of 500-700 m (based on projections of survey catch rates for a vessel towing three 25 m headrope trawls), market acceptance of these prawns is not good at this time.

ECONOMIC POTENTIAL OF THE DEEP-WATER RESOURCE

If the presently unexploited resource of *P. edwardsianus* and *A. foliacea* is to be developed, fishing effort can come either by diverting existing east coast trawlers to these deep-water grounds or by putting specialised deep water vessels (new capital) into the fishery. We have attempted to model the economic viability of these alternatives.

Data on costs and returns of a sample of large (>18 m) central Queensland trawlers currently working in water depths of 225 m or less are summarized in Table 2, together with a first estimate of potential earnings from the deepwater resource. The prices obtained for red prawns were poor, varying between \$1.50/kg and \$2.60/kg. These prawns made up between two thirds and three quarters of the catch from grounds with water depths greater than 300m. Giant scarlet prawn prices ranged from \$2.80/kg to \$4.00/kg - considerably better prices than for red prawns but less than half of present King prawn prices. For the purpose of this exercise, we have set a daily catch rate of 800 kg of penaeids and an average price of \$2.25 per kg.

To upgrade a conventional 15-18 m east coast trawler to work in the deep-water fishery, a minimum investment of \$10,000 would be required. Most existing vessels would require an upgrading expenditure of the order of \$50,000. This would be needed for additional warp wire, a satellite navigator and to upgrade sounders and winches. At least one commercial vessel fishing deepwater prawns off southern Queensland in November 1982 had serious problems with a mechanical winch, and experience suggests that a hydraulic system with external oil cooling is essential for this fishery.

The average return to capital from vessels fishing on traditional grounds was 18.5%, compared with an estimated potential return from the deep-water grounds of 10.5%.

The analysis can be extended by using the same price structure and estimating the average daily catch from the deep-water grounds needed to give the equivalent return to capital as that from traditionally fished stocks. We estimate that a catch rate of 900 kg per day of the deep-water species would be required.

In summary it would appear that there is little incentive for well-performed vessels in the east coast prawn fishery to move into this potential fishery. The catch rates required to match their present performance are high, the

grounds are new and more difficult to work, the product is more difficult to handle and the market less certain.

The alternative strategy is to bring in new vessels to work the presently unexploited deep-water prawn stocks. A more conventional form of break even analysis, summarized in Table 3, has been used to consider the economic consequences of this strategy. The negative return to capital projected from our model incorporating a daily catch rate of 800 kg/day suggests that a fishery will not develop. But further exploratory work, concentrated on optimising catch rates for these stocks, would be necessary before the future of the resource can be determined.

SOUTHERN INTRUDER SURVEY

1983-1984 DATA

CATCH (KG)
from 1x24M HEAD ROPE NET

SHOT	DATE	TIME	DURATION (H)	POSITION	DEPTH (M)	GIANT SCARLET	RED	HALIPOR- OIDES	EASTERN KING	CARIDS
1	8/8	1930	2.5	23° 59' S 152° 59' E	380			1		3
2	9/8	0020	1.5	23° 51' S 153° 00' E	460		1			4
3	9/8	0600	2.0	23° 46' S 153° 06' E	550		25	1		15
4	9/8	0930	2.0	23° 37' S 153° 16' E	590	2	70			10
5	9/8	1230	2.0	23° 34' S 153° 16' E	650	15	55			15
6	9/8	1700	Shot unsatisfactory							
7	26/8	1910	2.0	23° 56' S 152° 55' E	390			1		1
8	26/8	2225	2.0	23° 49' S 152° 58' E	420			2		5
9	27/8	0310	2.0	23° 59' S 152° 51' E	330					
10	28/8	1810	2.25	22° 06' S 153° 02' E	150					3
11	28/8	2155	2.0	22° 03' S 153° 05' E	170					7
12	29/8	0045	2.25	21° 57' S 153° 05' E	190					11

13	29/8	0350	2.25	21° 52' S 153° 05' E	210		7	
14	29/8	2045	2.25	22° 05' S 153° 15' E	225		3	
15	29/8	2325	Shot unsatisfactory					
16	30/8	0015	2.5	22° 02' S 153° 10' E	210	7		
17	30/8	0315	2.5	21° 56' S 153° 04' E	190- 150		22	
18	30/8	2330	3.0	22° 00' S 153° 08' E	155		20	
19	31/8	0300	3.0	22° 09' S 153° 09' E	165		18	
20	31/8	1440	2.0	23° 14' S 153° 59' E	425		2	
21	31/8	1730	2.0	23° 21' S 153° 56' E	460	1	2	
22	6/9	0200	2.0	23° 15' S 153° 18' E	425	1	1	
23	6/9	0500	2.0	23° 07' S 153° 24' E	400	1	5	
24	6/9	1000	1.5	23° 15' S 153° 45' E	415	1	5	
25	6/9	1530	2.0	22° 56' S 153° 50' E	370			
26	6/9	2130	2.0	22° 40' S 153° 35' E	310		1	
27	7/9	0040	2.0	22° 35' S 153° 26' E	260		6	
28	7/9	0345	2.25	22° 36' S 153° 17' E	220		12	
29	7/9	0645	Shot unsatisfactory					
30	1/11	1730	Shot unsatisfactory					

31	1/11	2315	2.5	22° 00' S 153° 31' E	270					3
32	2/11	0230	2.5	21° 57' S 153° 25' E	330					12
33	2/11	0645	1.0	22° 14' S 152° 27' E	60					1
34	3/11	2000	Shot unsatisfactory							
35	29/11	0615	Shot unsatisfactory							
36	29/11	1015	2.5	23° 52' S 153° 02' E	650				5	10
37	29/11	1400	2.0	23° 45' S 153° 07' E	550	1		3		1
38	29/11	1730	2.5	23° 45' S 153° 12' E	660	5		10	2	1
39	29/11	2045	2.0	23° 47' S 153° 14' E	740	2		10	2	10
40	30/11	1030	2.5	23° 17' S 153° 56' E	460				25	2
41	30/11	1540	2.0	23° 21' S 153° 23' E	410				25	2
42	30/11	2130	2.5	23° 22' S 152° 45' E	350- 310					
43	1/12	0400	2.0	23° 33' S 152° 23' E	240					7
44			Shot unsatisfactory							
45	25/4	1710	1.5	24° 00' S 153° 01' E	470				3	
46	25/4	2030	2.0	23° 53' S 153° 08' E	560			10	10	5
47	26/4	0010	2.0	23° 46' S 153° 11' E	600	1		3	20	
48	26/4	0315	2.5	23° 34' S 153° 16' E	650	15		5	15	5

49	26/4	0725	2.0	23° 35' S 153° 23' E	690	1	22	10	15	
50	26/4	1100	1.5	23° 35' S 153° 20' E	650	12	18	3	3	
51	25/5	1000	.5	22° 26' S 152° 45' E	100	nil				
52	25/5	1130	.5	22° 17' S 152° 49' E	110	nil				
53	25/5	1620	2.5	22° 02' S 153° 18' E	320	nil				
54	26/5	0140	Shot unsatisfactory							
55	26/5	0200	1.5	22° 17' S 152° 49' E	110				1	
56	26/5	0400	1	22° 23' S 152° 46' E	110				1	
57	03/8	0600	2.5	23° 28' S 153° 00' E	460		5		3	

Table 2. Average costs and earnings for central Queensland trawlers >18m compared with potential earnings from deepwater stocks.

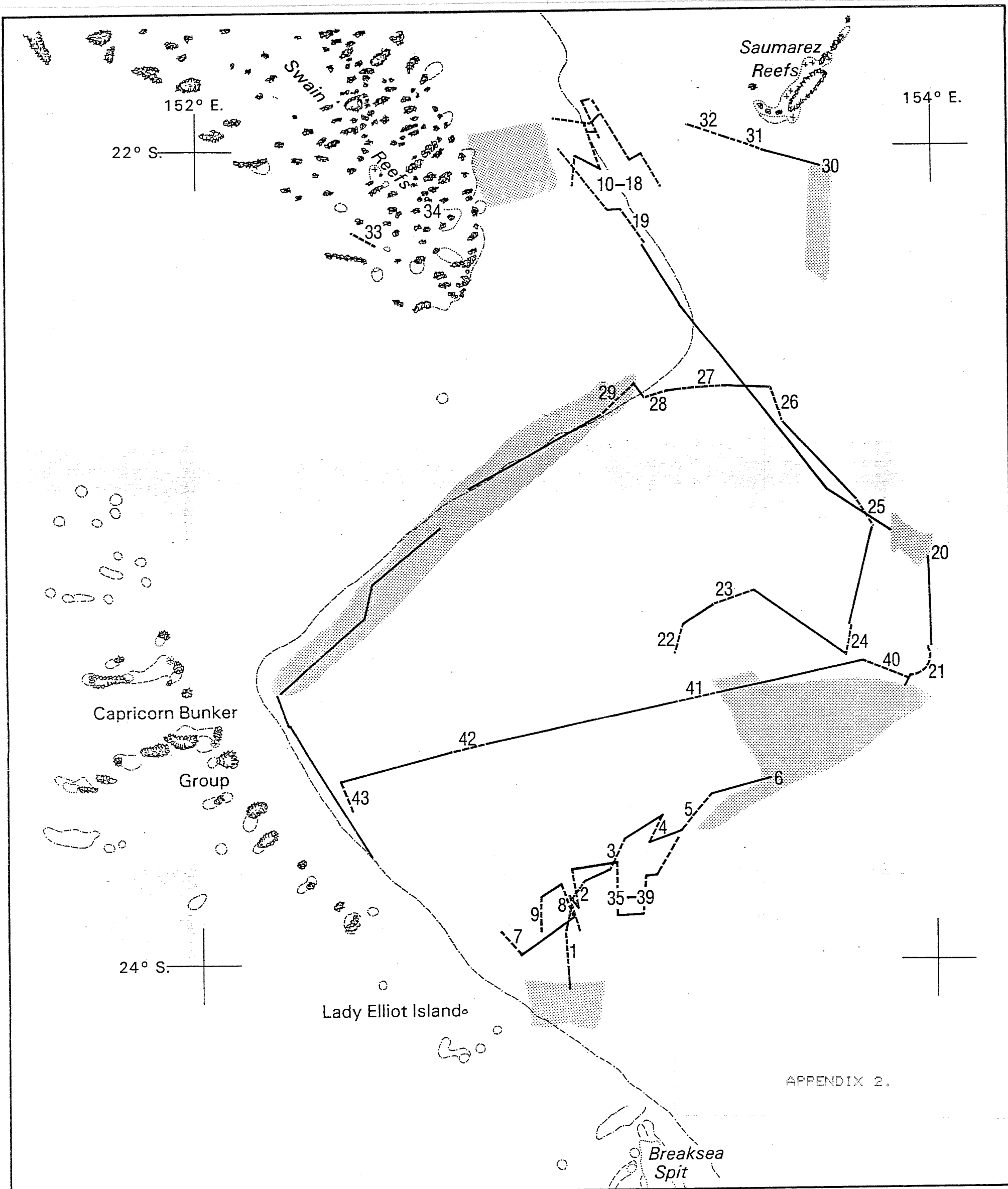
COSTS/RETURNS IN EXISTING FISHERY		COSTS/RETURNS IN POTENTIAL DEEPWATER FISHERY	
	\$		\$
Average Capital Investment	300,000		350,000
Costs			
Fixed			
Depreciation	30,000		35,000
Insurance	9,000		9,000
Licences, etc	2,000		2,000
Wharfage, Slippage	8,500		8,500
Variable			
Wages (Skipper, Crew)	96,000		120,000
Fuel	56,000		70,000
Repairs	27,000		27,000
Hardware, Equipment	24,000		35,000
Processing Costs	15,000		-
Total	267,500		306,500
Income			
Average no. of days fished	190		190
Average gross daily income	1,700		1,800
Average gross annual income	323,000		342,000
Net Average Annual Earnings	55,500		35,500
Net Average Return to Capital	18.5%		10.1%

Table 3. Estimated costs and earnings for new 20m vessel in deepwater prawn fishery.

Capital Investment	\$	600,000
Annual Costs		
Depreciation		60,000
Insurance		15,000
Licences, etc.		1,000
Wharfage, Slippage		5,000
Wages (Skipper and Crew)		108,000
Fuel		125,000
Repairs, refit		35,000
Hardware, Equipment		50,000
Overheads, Administration		
Costs		50,000
Total Costs		449,000
Net income to generate 15% return to capital		90,000
Imputed Total Cost		539,000
Gross Income		
Catch of 800kg per day at average price of \$2.25		1,800
Number of days worked		240
Annual Income		432,000
Excess of cost over income, without return to capital		17,000
Daily catch rate required to achieve break even point with average price of \$2.25/kg		1,000 kg

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APPENDIX 2.


Department of Primary Industries Queensland

**OVERLAY OF
ADMIRALTY CHART B.A.1024**

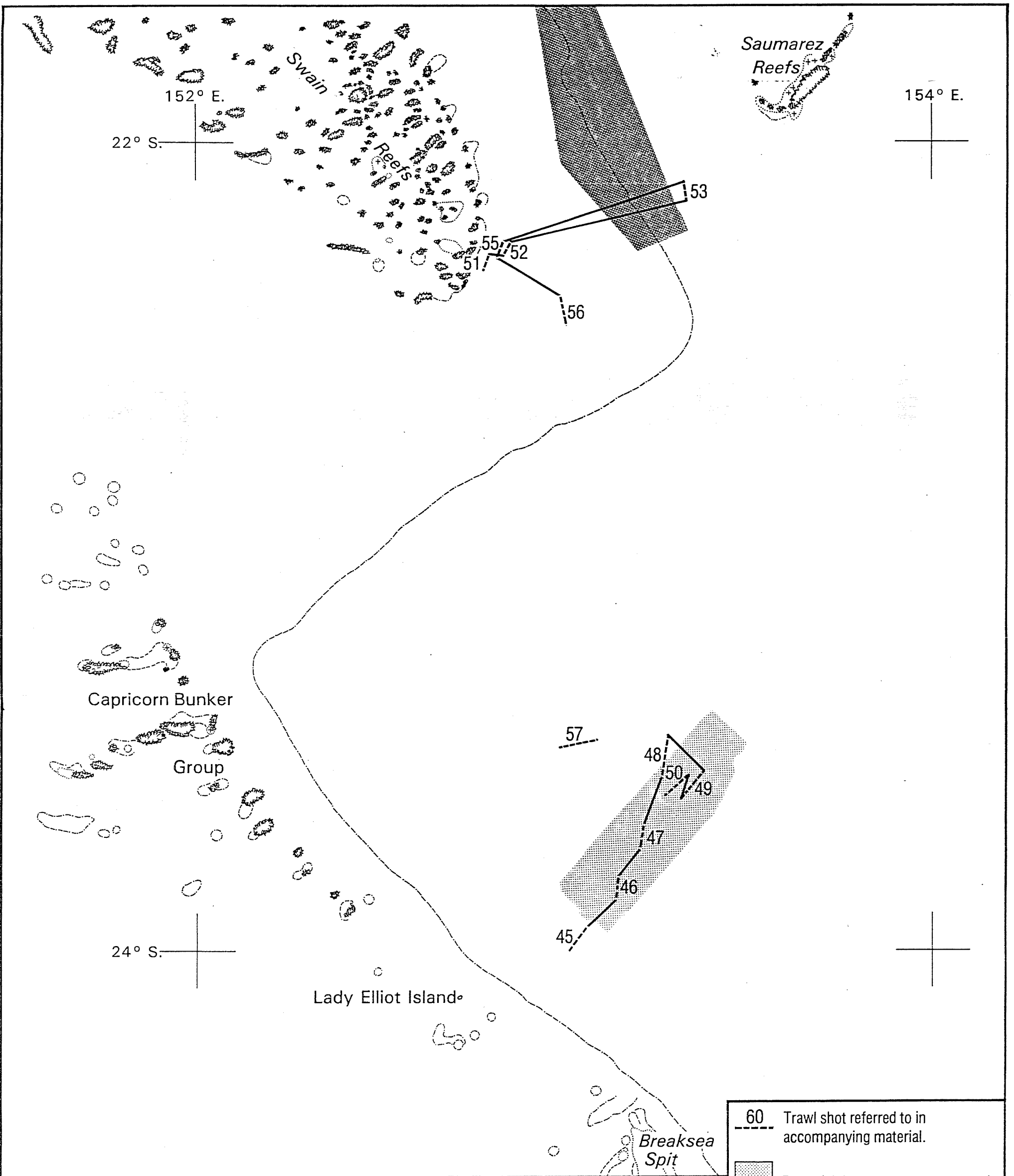
March 1985

NOTE:

Overlay based on surveys by P. Gardiner, Bonserino Pty. Ltd. and M. Dredge, Fisheries Research Branch in 1983 / 1984.

 60 Trawl shot referred to in Table 1.

 Untrawled Ground.







Department of Primary Industries Queensland

OVERLAY OF ADMIRALTY CHART B.A.1024

March 1985.

NOTE:

Overlay based on surveys by P. Gardiner, Bonserino Pty. Ltd. and M. Dredge, Fisheries Research Branch in 1983 / 1984.

-  60 Trawl shot referred to in accompanying material.
-  Potential deep water prawn grounds.
-  Potential king prawn grounds.
-  100 fathom contour.

Survey discovers new central Qld prawning grounds

COMMERCIAL boats are taking good catches of eastern king and deeper-water prawns on grounds discovered during a continuing survey off central Queensland.

Fishermen's interest was attracted when the survey vessel took catches equivalent to 800 kg a day of mixed species in the area between Breaksea Spit and the Swains, up to 120 miles off the coast.

The survey began in August. It has been suspended for the worst three months of the cyclone season but will begin again in April, and is scheduled to end in July.

Staff from the Queensland Department of Primary Industries Fisheries Laboratory at Burnett Heads are working with a private fishing company (Bonserino Pty Ltd) to conduct the survey of prawn resources on the Saumarez Plateau, between 22° to 24° and 52° to 154° E, in water depths of 150 to 750 m.

Interest in the potential of this area was raised following a survey of trawlable fisheries resources conducted by the Commonwealth Department of Primary Industry in September-December 1980 (*Australian Fisheries*, February 1981).

In that survey eastern king prawns (*Penaeus plebejus*) were taken in water depths of 150 to 240 m on the edge of the continental shelf between the Swain Reefs (22° S) and Lady Elliot Island (24° 10' S).

Large areas of trawlable ground were found to the east of the Capricorn-Bunker complex in water depths of 350 to 550 m, but the fish trawls used in this area failed to take commercially usable species.

A winter fishery for adult king prawns developed to the east of the

by M. Dredge and P. Gardiner
Mike Dredge is a biologist with the Fisheries Research Branch, Department of Primary Industries; Paul Gardiner is a director of Bonserino Pty Ltd and skipper of the trawler *Southern Intruder*.

Capricorn group as a consequence of this survey, but little interest had been shown in exploiting the king prawn resources east of the Swain Reefs complex.

More recently a FIRTA-funded survey undertaken by Mr J. Hodges, from Southport, and staff from the Southern Fisheries Centre at Deception Bay, located commercially workable quantities of giant scarlet (*Plesiopenaeus edwardsianus*) and royal red (*Hali-poroides* spp.) prawns in depths of 450 to 650 m in an area between Mooloolaba and Tweed Heads. (See article in this issue of *Australian Fisheries*.)

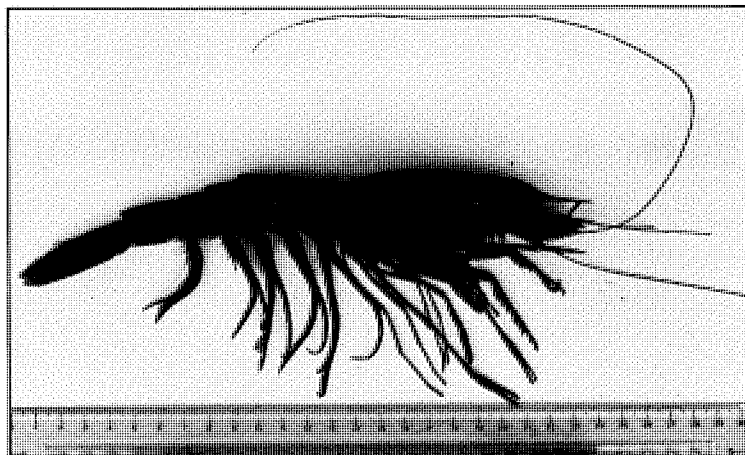
The northward extent of these stocks was a matter for conjecture, but given the apparently vast area of trawlable ground outside the

Capricorn-Bunkers there appeared to be a good chance of locating commercially usable quantities of these exotic prawns in this area.

Bonserino Pty Ltd applied for, and received, funds for a survey of prawn resources in the area between 22° to 24° 30' S, 152° to 154° E for the financial year 1983-84. The area involved is vast (more than 15 000 sq. miles) and the survey was planned to allow three sessions of 10 days at sea, spaced over the year to allow for seasonal variation in prawn abundance.

Given such constraints, a systematic survey of the whole area was out of the question. Rather, a survey sampling program based on five transects which cross the survey area was proposed.

The transect lines were set out in areas where water depths varied between 150 to 240 m (where king prawns should be found), or across a range of depth contours in deeper water. Prawns often have specific depth preferences, and coverage of as wide a range of depths as possible was planned to allow for this preference.



Giant scarlet prawn.

The vessel being used in the survey is the 18-m steel-hulled trawler *Southern Intruder*. It is powered by an 871 GM through a nozzle and has a similar hull configuration to many east coast trawlers. The gantry and gallows are unusual in being set aft, giving good control over the trawl gear as well as increased open deck space.

Winches were built by Jaden and carry 1800 m of 10-mm-diameter wire. The boat is fitted with a Skipper 802 sounder and Decca 402 satnav system, which have so far proved adequate for this type of survey. A single 26-m-headrope Siebenhausen trawl, spread by 200-kg, 2.5-m by 1.1-m Humphrey flat boards, is being used for sampling.

At the date of writing (December 1983) two of the three 10-day survey 'legs' have been completed. Echo soundings have been made over 670 nautical miles of bottom and 43 two to three-hour trawl shots have been carried out.

Bottom configuration in the survey area is relatively simple. On the western edge of the survey area, the continental shelf drops sharply from water depths of 50 or 60 m to 180 m along a generally north-westerly line as far north as 23° 15' S, where the 180-m contour extends north-east to the Swain Reefs.

East of the continental shelf is a

vast plateau, on which water depths vary between 330 and 460 m. To the south and east of the survey area this plateau falls away to much greater depths.

The only large areas of untrawlable ground so far identified are a series of gravel beds in water depths of 150 to 220 m at the mouth of the Capricorn Channel (22° 50' S, 153° 00' E to 23° 15' S, 152° 10' E); an area of hard bottom south of 24° S, between 152° 50' E and 153° 15' E; and an area of canyons in the south-east sector of the survey area. These canyons occur in the area bounded by 23° 15' S, 153° 25' E, 23° 40' S, 153° 20' E, and 23° 20' S, 153° 53' E. They appear to run from south-east to north-west, towards the Capricorn Channel.

Soundings and trawl shots suggest that there is a vast area of trawlable ground in the survey area. Catches of prawns made so far on certain parts of this ground have been encouraging. (Locations, depths and catch rates for all trawl shots completed are given in Table 1.)

Five species of prawns which appear to have some commercial potential have been identified. In the northern sector of the survey area the known distribution of eastern king prawns has been extended northward to 21° 40' S, with catch rates good enough to

support commercial operations being made in water depths of 150 to 220 m over an extensive area to the east of the Swains Reefs.

Over the greater part of the Saumarez Plateau, catches in water depths of 330 to 550 m have been disappointing. A so far undescribed species of royal red prawn (*Haliporoides* sp ?) has been taken consistently but catch rates have been low, and the prawns have been too small for commercial utilisation. Catches of royal reds (*Haliporoides sibogae*) have also been small. The commercial viability of a fishery based on these species remains to the proven.

Catches in water depths between 550 and 740 m have been much more encouraging. Substantial catches of a little known prawn (*Aristeamorpha foliacea*, known as a red prawn) and giant scarlets (*P. edwardsianus*) have been made. The best catch rates of red prawns have been made in water depths of 550 to 650 m, whereas giant scarlets have been most abundant in water depths greater than 650 m.

Optimum catch rates achieved in the survey on this resource can be extrapolated to catch rates of 800 kg per 24-hour day for a boat using conventionally rigged triple gear.

The area of ground in the depth range 550 to 740 m is not great. In the survey area the distance between these two depth contours appears to be in the order of 10 to 20 miles, and canyons (referred to earlier) further limit the extent of the ground. There appears to be considerable scope for a larger vessel to survey prawn resources in these depths to areas east and north of the presently surveyed area.

Follow-up fisheries have already developed as a consequence of this survey. Half a dozen boats are fishing king prawns east of the Swains and at least a dozen more skippers or owners have expressed interest in these new grounds.

Response by fishermen to catch rates in the deeper waters has been slower. The vessel being used to conduct the survey has been deployed in the area for a limited proportion of its private fishing operations.

Owners of larger boats based in



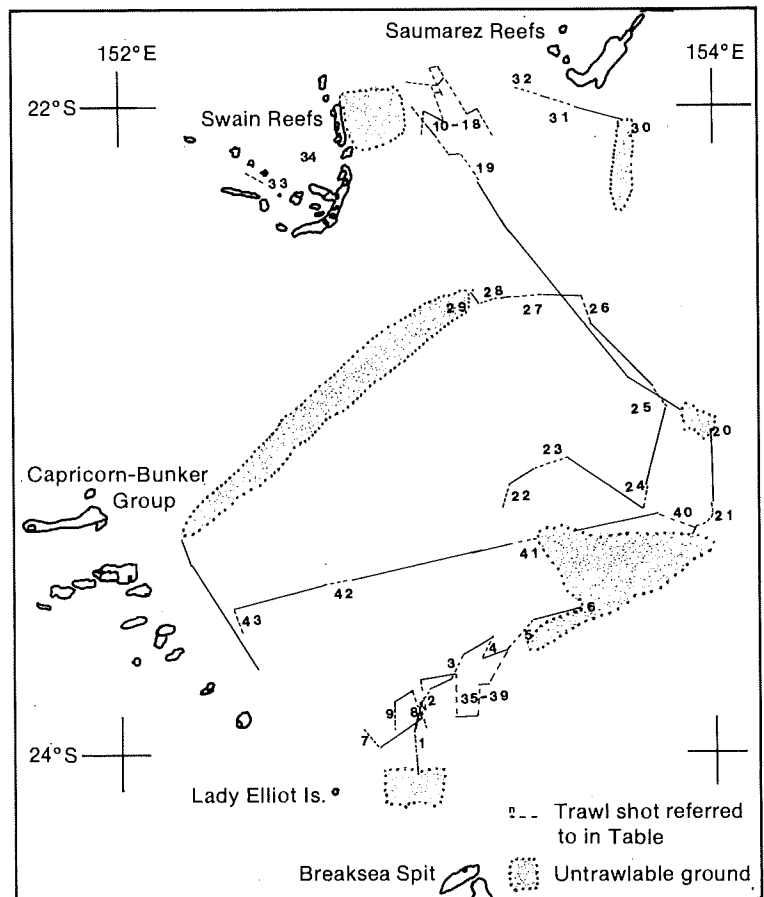
The survey vessel *Southern Intruder*.

northern waters have suggested the area may be fished during that time when a proportion of Gulf of Carpentaria waters are closed, but cyclones, which normally occur in the Coral Sea during December-April, may limit such activity.

So far results from the survey have been obtained with a high degree of co-operation between the survey vessel's principals and the biologists and technicians who are assisting with the survey. Commercial resources have been located, and research personnel have been able to collect more than 200 species of fish and crustaceans, many of which are either rare or new records for Australia.

It is worth noting that the survey is being conducted from a vessel currently participating in the in-shore prawn fishery. Consequently results generated by the survey can be applied directly by larger boats in the existing fleet.

(Editor's note: More detailed plots of the area so far surveyed are presently being drawn up, and should be available from the author C/- Fisheries Laboratory, Department of Primary Industries, Burnett Heads, Qld 4670, within the next two months.)



The survey area.

Location, date and sites of completed trawl shots

Shot number	Date	Time	Duration (hours)	Position at start of shot	Depth (m)	Catch (kg) — 1 x 26 m head rope							Comment
						Giant scarlet prawn	Royal red Red Haliporoides sibogae	Royal red Haliporoides sp.	Eastern king	Red spot king	Mixed carids etc.	Other	
1	8.8.83	1930	2.5	23°59'S 152°59'E	380			1	1		3	Sea urchins	Dirty bag
2	9.8	0020	1.5	23°51'S 153°00'E	460		1				4	Sea urchins	Dirty bag
3	9.8	0600	2.0	23°46'S 153°06'E	550		25		1		15		
4	9.8	0930	2.0	23°37'S 153°16'E	590	2	70	1			10		
5	9.8	1230	2.0	23°34'S 153°16'E	650	15	55	1			15		
6	9.8	1700	—	23°34'S 153°33'E	740								Gear plaited
7	26.8	1910	2.0	23°56'S 152°55'E	390			1	1		1		
8	26.8	2225	2.0	23°49'S 152°58'E	420				2		5		
9	27.8	0310	2.0	23°59'S 152°51'E	330								
10	28.8	1810	2.25	22°06'S 153°02'E	150					3			
11	28.8	2155	2.0	22°03'S 153°05'E	170					7			
12	29.8	0045	2.25	21°57'S 153°05'E	190					11			

Shot number	Date	Time	Duration (hours)	Position at start of shot	Depth (m)	Catch (kg) — 1 x 26 m head rope							Other	Comment	
						Giant scarlet prawn	Royal red Haliporoides sibogae	Royal red Haliporoides sp.	Eastern king	Red spot king	Mixed carids etc.				
13	29.8	0350	2.25	21°52'S	210										
				153°05'E											
14	29.8	2045	2.25	22°05'S	225										
				153°15'E											
15	29.8	2325	—	22°03'S	220										
				153°12'E											
16	30.8	0015	2.5	22°02'S	210										
				153°10'E											
17	30.8	0315	2.5	21°56'S	190-										
				153°04'E	150										
18	30.8	2330	3.0	22°00'S	155										
				153°08'E											
19	31.8	0300	3.0	22°09'S	165										
				153°09'E											
20	31.8	1440	2.0	23°14'S	425										
				153°59'E											
21	31.8	1730	2.0	23°21'S	460										
				153°56'E											
22	6.9	0200	2.0	23°15'S	425										
				153°18'E											
23	6.9	0500	2.0	23°07'S	400										
				153°24'E											
24	6.9	1000	1.5	23°15'S	415										
				153°45'E											
25	6.9	1530	2.0	22°56'S	370										
				153°50'E											
26	6.9	2130	2.0	22°40'S	310										
				153°35'E											
27	7.9	0040	2.0	22°35'S	260										
				153°26'E											
28	7.9	0345	2.25	22°36'S	220										
				153°17'E											
29	7.9	0645	2.0	22°35'S	175										
				153°12'E											
30	1.11	1730	2.0	22°17'S	280										
				153°41'E											
31	1.11	2315	2.5	22°00'S	270										
				153°31'E											
32	2.11	0230	2.5	21°57'S	330										
				153°25'E											
33	2.11	0645	1.0	22°14'S	60										
				152°27'E											
34	3.11	2000	—	22°03'S	55										
				152°35'E											
35	29.11	0615	—	23°54'S	465										
				153°01'E											
36	29.11	1015	2.5	23°52'S	650										
				153°02'E											
37	29.11	1400	2.0	23°45'S	550	1	3								
				153°07'E											
38	29.11	1730	2.5	23°45'S	660	5	10	1	2						
				153°12'E											
39	29.11	2045	2.0	23°47'S	740	2	10	1	2						
				153°14'E											
40	30.11	1030	2.5	23°17'S	460										
				153°56'E											
41	30.11	1540	2.0	23°21'S	410										
				153°23'E											
42	30.11	2130	2.5	23°22'S	350-										
				152°45'E	310										
43	1.12	0400	2.0	23°33'S	240										
				152°23'E											