

australian **fisheries surveys report** 2005



economic performance of selected fisheries in 2002-03 and 2003-04

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foreword

Estimates of the performance of operators in the northern prawn fishery and the Torres Strait prawn fishery – which were surveyed by ABARE in 2005 – are provided in this report.

ABARE survey information is used by fisheries policy makers, managers, researchers and the fishing industry. The Australian Government Department of Agriculture, Fisheries and Forestry uses the information to assess the performance of the Australian Fisheries Management Authority in managing Commonwealth fisheries. As the information is made publicly available, the fishing industry can also independently assess the performance of fisheries and the impact of management policies.

This report is another issue in a series of regular fisheries survey reports, that have been published every year since the early 1990s. Funding for these reports is provided by the Fisheries Resources Research Fund.



BRIAN S. FISHER
Executive Director

August 2006

acknowledgments

ABARE's fisheries surveys program involves a cooperative effort among industry, fisheries management and research agencies, and ABARE staff.

industry

ABARE surveys are voluntary. The cooperation of fishing operators and their accountants in providing data is essential for the success of the fisheries surveys. Without this assistance the surveys would not be possible. The advice and comments on a draft of the report provided by industry representatives and representatives of relevant Management Advisory Committees (MACs) are also greatly appreciated.

management and research agencies

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staff at ABARE

David Galeano, Simon Vieira and Paul Newton of the Fisheries Economics Section carried out the analyses and compiled the report.

Sample design and estimation were undertaken by Walter Shafron of the Regional and Farm Data Analysis and Collection Section.

Data were collected, entered and edited by David Galeano and Dana Hanna.

Programming and computer systems support was provided by Mark Neilson and Ken Colbert.

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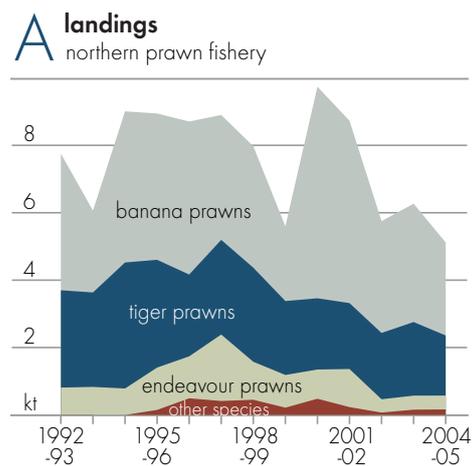
northern prawn fishery

the fishery

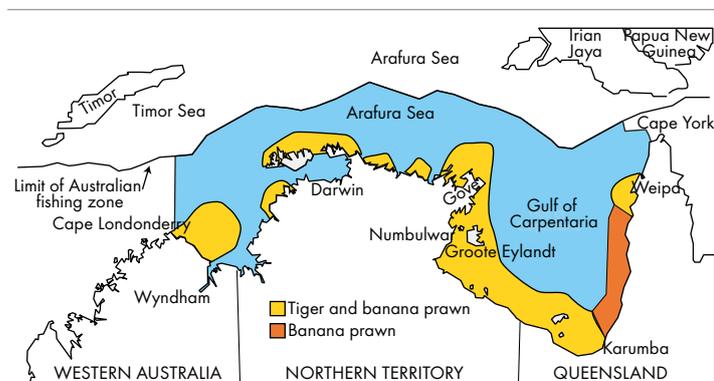
The northern prawn fishery is a multispecies fishery located in Australia's northern waters between Cape York in Queensland and Cape Londonderry in Western Australia (map 1) (Caton and McLoughlin 2005).

Eighty per cent of the fishery's catch consists of white banana prawns (*Fenneropenaeus merguensis*), grooved tiger prawns (*Penaeus semisulcatus*) and brown tiger prawns (*P. esculentus*). Other key prawn species include the red-legged banana prawn (*F. indicus*), two species of endeavour prawn (*Metapenaeus endeavouri* and *M. ensis*) and two species of king prawns (*Melicertus latisulcatus* and *M. longistylus*). Some commercially valued non-prawn species are also landed as bycatch, including bugs (*Thenus spp.*), scallops (*Amusium spp.*) and squid (*Photololigo spp.*) (Caton and McLoughlin 2005).

Vessels operating within the fishery range in length from 13 metres to 25 metres. In the 2004 season, 96 licensed vessels operated in the fishery, allocating a total of 3985 boat days to target banana prawns in the first period of the season, and 7793 boat days to target



northern prawn fishery management areas



tiger prawns in the second period. Vessels are restricted to operating with two main trawl nets. In 2004, average net headrope length (measured across both nets) per vessel was 40.8 metres (Caton and McLoughlin 2005).

In 2004-05 the catch of prawns was 5035 tonnes, which included 2764 tonnes of banana prawns, 1785 tonnes of tiger prawns, 412 tonnes of endeavour prawns and 73 tonnes of other prawn species (figure A). This level of prawn catch was the lowest recorded in the past fifteen years and is significantly lower than the highest catch recorded in 2000-01 of 9278 tonnes. A total of 89 tonnes of non-prawn bycatch was also landed in 2004-05.

The real gross value of production (GVP) of the fishery in 2004-05 was \$65 million (figure B). Again, this GVP figure is the lowest recorded in the past fifteen years and is significantly lower than the record GVP figure of \$183 million in 2000-01 (in 2004-05 dollars).

Most of the catch from the fishery is exported, predominantly to Japan. Therefore the economic and financial performance of the fishery is largely influenced by external factors, including demand in major markets, competition and the exchange rate.

biological status

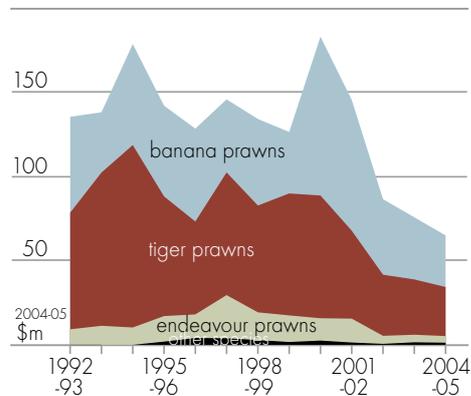
All eight commercial prawn species share common biological characteristics. Sexual maturation generally occurs at approximately six months of age and life expectancy is approximately two years. Prawn fecundity also tends to increase with age. Less than 1 per cent of juveniles survive the initial 2-4 week larval planktonic stage. Those that do survive, spend between one and three months in coastal and estuarine waters near seagrass beds and mangrove forests before moving offshore and being recruited into the fishery (Caton and McLoughlin 2005).

Each year, the Bureau of Rural Sciences collates information on the biological status of prawn stocks in the fishery. The status of each of the key species is outlined below. This scientific information, by prawn species, is sourced from Caton and McLoughlin (2005).

banana prawns

Banana prawns are caught predominately in the eastern waters of the Gulf of Carpentaria, on isolated grounds along the Arnhemland coast and in the Joseph Bonaparte Gulf. They are generally caught in depths of less than 20 metres but can be caught in depths of up to 45 metres.

B real gross value of production
northern prawn fishery



White banana prawns make up more than 80 per cent of the banana prawn catch. Typically caught in April, white banana prawns tend to only run for a few weeks before becoming unprofitable to target. Their capture involves 'spotter' planes searching for dense prawn aggregations known as 'boils'. The use of spotter planes means that all trawling occurs during the day.

Annual catches of white banana prawns are highly variable and have ranged between 2200 tonnes and 12 711 tonnes since 1971. The two main spawning periods for the species coincide with monsoonal rains in the area. High catches have been shown to follow years of high monsoonal rainfalls.

Red legged banana prawns make up a smaller proportion of the total catch, averaging around 800 tonnes a year. Unlike white banana prawns, trawling occurs both night and day, with most catches taken offshore in the Joseph Bonaparte Gulf at depths of between 45 and 85 metres. Spawning is largely linked to rainfall but schooling does not occur to the same degree as with white banana prawns.

No biological reference points exist for banana prawn stocks (both red and white) in the fishery. The sustainable long term average catch for banana prawns is thought to be about 4000 tonnes a year. This figure is approximately equivalent to the average catch for the past ten years, although catches have shown significant variation. The likely state of stocks are assessed by comparing expected catches and actual catches, with the former being determined according to rainfall data. Variations between the two tend to indicate biomass changes. Currently the stock is considered not overfished.

Catch forecasts for the Gulf of Carpentaria between the years 2000 and 2002 proved inaccurate, with the catch in 2000 being the lowest on record despite significant rainfall, and catches in 2001 and 2002 being higher than expected. There have also been poor catches in normally productive waters off Weipa.

For white banana prawns, a new age structured model has been formulated that has so far suggested that a relationship exists between stock size and recruitment. The model therefore implies that environmental factors such as rainfall are not the only primary factors influencing recruitment. The model indicates that recruitment overfishing is not occurring, although fishing mortality is high.

According to tagging research data collected in the Gulf of Carpentaria, the red-legged banana prawn stock is subject to lower exploitation rates relative to the white banana prawn stock. However, it is still not known whether the level of fishing mortality for red-legged banana prawns is sustainable as the stock size is now thought to be significantly smaller than previously believed.

tiger prawns

Tiger prawns are caught near coastal seagrass beds in the southern and western Gulf of Carpentaria and along the Arnhemland coast. Brown tiger prawns are caught in waters between 10 and 20 metres depth but are also found in depths of up to 200 metres, while

grooved tiger prawns are caught in depths of up to 130 metres. Stocks of both brown tiger prawns and grooved tiger prawns have improved in recent years.

In a 1999 stock assessment of both species, grooved tiger prawns catches were found to be above maximum sustainable yield (MSY). These results were confirmed by a review in 2001. A more positive assessment in 2002 revealed improved recruitment of grooved tiger prawns, and that the stock was not overfished. These positive results were generally reconfirmed in the most recent assessments in 2003 and 2004, although these results did not hold under all assumptions. Recruitment rates are, however, expected to increase.

Both the 1999 and 2002 stock assessments revealed brown tiger prawns to be overfished in the northern prawn fishery. The stock assessments in 2003 and 2004 indicate that the stock has recovered and is no longer overfished, with recruitment rates expected to increase.

endeavour and king prawns

The status of both endeavour and king prawn species have not been assessed. However, recent catch trends have raised concerns. Maximum sustainable yield estimates for endeavour prawns were originally 500 tonnes. Following a high catch in 1997 of 1870 tonnes, low catches have been recorded. King prawn catches have declined over the past ten years. Changes to fishing patterns and effort are possible explanations. The Northern Prawn Resource Assessment Group (NPRAG) have examined king prawn data recently but could reach no firm conclusions. Future assessments of both species have been recommended.

management of the fishery

Prior to 1988, management responsibilities for the fishery were shared between the Australian, Queensland, Northern Territory and Western Australian governments. It was not until the endorsement of the Offshore Constitutional Settlement Agreement in 1988 that the Australian Government assumed sole management responsibility for the fishery (NORMAC 2001).

Established in 1992 to replace the Australian Fisheries Service, the Australian Fisheries Management Authority (AFMA) has since been responsible for managing the fishery. The Northern Prawn Fishery Management Advisory Committee (NORMAC) provides advice to AFMA on management issues for the fishery. The committee consists of representatives from areas of research, management and industry who provide expert advice on management arrangements, research, monitoring and budgeting (NORMAC 2001).

The fishery has historically been managed with input controls such as gear and vessel restrictions, limited entry, area closures and seasonal closures (a brief history of the management arrangements in the fishery is outlined in table 1). Since 2000, the main management tool has been input controls in the form of restrictions on the length of net headrope allowed to be towed in the fishery. Gear units allocated to each operator specify the length of headrope allowed and operators are free to buy/sell or lease these gear units. The fishery is usually open between early April and early December with a midseason closure over

the winter months. The 2004 season was from 15 April to 1 December with a midseason closure between 28 May and 31 August (Caton and McLoughlin 2005).

The catch of unwanted and vulnerable species such as turtles and sharks via trawling has led to increased effort by management and industry to reduce bycatch. Bycatch reduction devices (BRDs) and turtle exclusion devices (TEDs) were introduced in 2000. The United States allows northern prawn produce to be imported into the country so long as its specifications for the use and design of TEDs are met by industry (Caton and McLoughlin 2005).

A new target level of catch set at maximum economic yield (MEY), replacing the target at maximum sustainable yield (MSY), was introduced in 2004 (Roberts 2004). This new target implies that the fishery will be managed so that effort, catch and thus stock biomass are at levels that allow net economic returns to be maximised in the fishery. A 25 per cent reduction in total allowable headrope length was also announced for the 2005 season given the new target reference point for the fishery (Roberts 2004).

In November 2005, the Australian Government announced a \$220 million structural adjustment package to achieve a sustainable and more profitable Australian fishing industry. The major component of the package includes a \$150 million fishing concession buyout process

history of management changes in the northern prawn fishery

1971	Seasonal closures for banana prawns introduced (Rose and Kompas 2004).
1977 and 1980	Controls on boat replacement (Rose and Kompas 2004).
1984	Unitisation of fishery introduced: Class A units (fishing right) and Class B units (boat hull volume and engine power allowance) (NORMAC 2001).
Mid-1980s	Buyback scheme implemented to reduce effort according to a target of 70 000 units in the fishery (NORMAC 2001).
1989	20 810 Class A units sold under the above scheme but falls short of target (NORMAC 2001).
1990	Further restructuring through a voluntary buyback scheme and a 30 per cent reduction in units across the board, with a target of 53 844 units. Target achieved and vessel numbers reduced from 216 to 132 by 1993 (NORMAC 2001).
1990	April opening date to target market sized prawns and a midseason closure to reduce catch of spawners introduced (Caton and McLoughlin 2005).
1995	New management plan and statutory fishing rights (SFRs) introduced to replace Class A and B units (Caton and McLoughlin 2005).
1999	First season shortened by 14 days and second season by 18 days (Caton 2002).
2000	New management system based on control of gear units according to head-rope length of fishing nets (Caton and McLoughlin 2005). First season shortened by 5 days and second season by 5 days (Caton 2002).
2002	Effort cut by 40 per cent. This was achieved through a 25 per cent reduction in total allowable headrope length (Caton and McLoughlin 2005) and a shortening of the first season by 14 days and the second season by 7 days (Caton 2004).
2004	Maximum economic yield (MEY) defined as target level of catch (Roberts 2004).
2005	25 per cent reduction in total allowable headrope length (Roberts 2004).

aimed at reducing fishing effort in a number of key fisheries (MacDonald 2005). As part of the \$150 million tender, operators from the northern prawn fishery may submit tenders from their boat statutory fishing rights (SFRs) and gear SFRs (or boat SFRs alone). This is to assist the northern prawn fishery move to a management system based on output controls. An objective has been set for removing a minimum of 19 active boat SFRs and a minimum of 12 800 gear SFRs provided that it achieves value for money (DAFF 2006).

The 2006 banana prawn season recorded considerably high catches. Consequently, AFMA announced a two week extension to the banana prawn season in line with advice from NORMAC. Scientific evidence suggests that the season extension will not affect the sustainability of the resource (AFMA 2006).

boats surveyed

For the purpose of the survey, the target population was defined as boats that caught prawns in the northern prawn fishery in 2003-04. In 2003-04 the population was 98 vessels, of which 43 were sampled. Of the 43 sampled, 41 were also sampled for 2002-03 when the population was 101 vessels.

financial performance of the fishery

Key measures of the financial performance of the entire fishing fleet plus the financial performance by terciles are contained in table 3. Fleet terciles are determined by dividing the fleet into three groups based on the value of seafood sold for each of the two financial years (2002-03, 2003-04). The financial performance of the three groups can then be compared. The method of division into terciles is presented in table 2.

2 seafood receipt ranges for lower, middle and upper terciles northern prawn fishery

	lower	middle	upper
2002-03	< \$1.0 million	\$1.0-1.14 million	> \$1.14 million
2003-04	< \$830 000	\$830 000-940 000	> \$940 000

Many boats that operate in the northern prawn fishery also operate in other fisheries, such as the Torres Strait prawn fishery and Queensland east coast otter trawl fishery. Any receipts and costs earned and incurred by these boats while operating in these other fisheries are included in the financial performance measures in table 3. Definitions of items contained in table 3 are included in 'survey methods and definitions' at the end of this report.

3 financial performance of boats operating in the northern prawn fishery – lower, middle and upper terciles and all boats average per boat

	lower				middle			
	2002-03		2003-04		2002-03		2003-04	
Seafood receipts	\$ 834 030	(6)	644 259	(6)	1 097 575	(11)	893 964	(11)
Nonfishing receipts	\$ 65 877	(16)	71 013	(21)	58 524	(37)	69 465	(37)
Total cash receipts	\$ 899 907	(6)	715 272	(4)	1 156 099	(2)	963 429	(2)
Administration	\$ 50 409	(33)	39 047	(42)	65 732	(39)	55 727	(34)
Labor costs	\$ 230 919	(8)	183 376	(9)	248 491	(3)	204 228	(7)
Freight and marketing expenses	\$ 16 035	(20)	16 100	(18)	17 713	(23)	18 771	(23)
Fuel	\$ 194 212	(6)	196 818	(4)	192 385	(7)	193 703	(4)
Insurance	\$ 30 181	(16)	28 382	(15)	34 423	(15)	36 080	(16)
Interest paid	\$ 22 932	(41)	30 034	(38)	17 015	(46)	12 721	(47)
Licence fees and levies	\$ 20 920	(10)	20 654	(11)	25 981	(3)	26 865	(6)
Packaging	\$ 11 152	(18)	9 233	(19)	18 455	(12)	19 809	(6)
Repairs and maintenance	\$ 125 505	(20)	108 617	(19)	188 912	(16)	157 782	(14)
Other costs	\$ 67 736	(24)	64 041	(22)	54 514	(24)	56 722	(25)
Total cash costs	\$ 770 001	(6)	696 300	(6)	863 622	(5)	782 410	(7)
Boat cash income	\$ 129 906	(28)	18 972	(159)	292 477	(22)	181 020	(38)
less depreciation a	\$ 16 352	(90)	27 773	(30)	26 436	(28)	7 383	(306)
Boat business profit	\$ 113 554	(32)	- 8 802	(355)	266 041	(27)	173 637	(40)
plus interest, leasing and rent	\$ 53 133	(32)	63 702	(27)	30 059	(28)	24 922	(27)
Profit at full equity	\$ 166 687	(25)	54 901	(63)	296 100	(25)	198 559	(36)
Capital (excl. quota and licences)	\$ 902 190	(19)	726 813	(18)	1 094 445	(12)	1 156 913	(15)
Capital (incl. quota and licences)	\$ na		2 952 406	(12)	na		3 635 255	(6)
Rate of return to boat capital b	% 18.5	(29)	7.6	(76)	27.1	(36)	17.2	(48)
Rate of return to full equity c	% na		1.9	(70)	na		5.5	(40)

	upper				all boats			
	2002-03		2003-04		2002-03		2003-04	
Seafood receipts	\$ 1 333 968	(2)	1 159 253	(2)	1 080 847	(2)	891 328	(4)
Nonfishing receipts	\$ 9 097	(35)	9 140	(45)	45 240	(18)	50 500	(21)
Total cash receipts	\$ 1 343 065	(2)	1 168 393	(2)	1 126 088	(2)	941 828	(4)
Administration	\$ 41 170	(28)	64 377	(21)	52 462	(21)	52 617	(18)
Labor costs	\$ 318 354	(2)	278 403	(2)	264 744	(3)	220 836	(4)
Freight and marketing expenses	\$ 17 424	(11)	13 585	(13)	17 031	(11)	16 147	(11)
Fuel	\$ 189 216	(4)	210 404	(3)	192 010	(3)	200 209	(2)
Insurance	\$ 49 048	(6)	41 915	(3)	37 627	(7)	35 241	(7)
Interest paid	\$ 11 254	(22)	14 117	(29)	17 245	(25)	19 305	(24)
Licence fees and levies	\$ 27 064	(1)	26 789	(2)	24 550	(3)	24 639	(4)
Packaging	\$ 20 682	(4)	27 687	(4)	16 604	(6)	18 611	(7)
Repairs and maintenance	\$ 223 240	(6)	180 995	(5)	177 649	(8)	147 876	(8)
Other costs	\$ 68 984	(12)	62 799	(15)	63 806	(12)	61 280	(12)
Total cash costs	\$ 966 435	(3)	921 072	(2)	863 727	(3)	796 762	(3)
Boat cash income	\$ 376 630	(8)	247 321	(12)	262 360	(10)	145 066	(20)
less depreciation a	\$ 37 275	(8)	37 230	(8)	26 372	(22)	24 261	(28)
Boat business profit	\$ 339 355	(9)	210 090	(15)	235 989	(12)	120 805	(25)
plus interest, leasing and rent	\$ 29 407	(32)	41 460	(27)	37 959	(19)	44 008	(18)
Profit at full equity	\$ 368 762	(8)	251 550	(12)	273 948	(11)	164 814	(18)
Capital (excl. quota and licences)	\$ 1 369 458	(3)	1 385 681	(4)	1 115 169	(7)	1 078 564	(8)
Capital (incl. quota and licences)	\$ na		3 879 765	(2)	na		3 472 469	(5)
Rate of return to boat capital b	% 26.9	(10)	18.2	(15)	24.6	(15)	15.3	(21)
Rate of return to full equity c	% na		6.5	(13)	na		4.7	(18)

a Depreciation adjusted for profit or loss on capital items sold. **b** Excluding value of quota and licences. **c** Including value of quota and licences. **na** Not applicable.

Note: Figures in parentheses are relative standard errors. A guide to interpreting these is included in 'survey methods and definitions'.

receipts

Average per boat seafood receipts for the entire fishery fell by over 17 per cent between 2002-03 and 2003-04 to around \$891 000. This occurred despite slightly higher landings in the fishery. With much of the product from the fishery being exported, the 22 per cent appreciation of the Australian dollar against the US dollar between 2002-03 and 2003-04 reduced the prices received by fishers.

While average per boat seafood receipts fell between 2002-03 and 2003-04 in all terciles, seafood receipts fell by 23 per cent in the lower tercile compared with 19 per cent and 13 per cent in the middle and upper terciles respectively.

costs

For the fishery as a whole, average per boat total cash costs fell from around \$864 000 per boat in 2002-03 to \$797 000 in 2003-04. Between 2002-03 and 2003-04, average total cash costs fell by 5 per cent in the upper tercile, 9 per cent in the middle tercile and 10 per cent in the lower tercile. Costs have therefore declined more for boats that received lower seafood receipts compared to boats with higher receipts.

Labor costs were the highest single expense in the fishery in 2002-03 and 2003-04. As crew are generally paid a percentage share of revenue, average per boat labor costs across the fleet fell to an estimated \$221 000 per boat in 2003-04 accounting for 28 per cent of total cash costs. Labor costs includes payments to skipper and crew as well as shore based labor and the opportunity cost of owner and family labor (see survey methods and definitions for more detail).

Fuel was the second largest cost item in the fishery, estimated at \$200 000 per boat in 2003-04, or a quarter of total cash costs.

Repairs and maintenance costs were the third highest cost item, estimated at an average of around \$148 000 per boat in 2003-04. Repairs and maintenance costs across the whole fleet fell by around 17 per cent over the survey period, but the largest fall was recorded for boats in the upper tercile, where repairs and maintenance costs fell 19 per cent to an average per boat of around \$181 000.

The majority of other cost components for the whole fleet remained relatively constant between 2002-03 and 2003-04. Together labor, fuel and repairs and maintenance expenditure accounted for 71 per cent of total cash costs in 2003-04.

boat cash income and profit

As a result of the decrease in seafood receipts relative to cash costs, average per boat cash income for the entire fishery is estimated to have fallen by around 45 per cent to around \$145 000 in 2003-04.

Boat business profit, which is boat cash income less an allowance for depreciation, is estimated to have been around \$121 000 per boat in 2003-04, around half of what it was in 2002-03.

Profit at full equity which is boat business profit plus interest, leasing and rent, is estimated to have been around \$165 000 per boat in 2003-04. Boat business profit represents the average return that would have been earned by the business unit had the boat and capital (including quota and licences) been fully owned by the operator. While these costs affect the financial position of the operator, they represent some profits that have been redistributed to other investors in the fishery.

rates of return

The rate of return to boat capital is calculated on the value of boat capital (excluding the value of quota and licences) as if the operators wholly owned all assets so that the financial performance of all boats can be compared regardless of the operators' equity in the business. The estimated average rate of return to boat capital (excluding the value of quota and licences) fell from 24.6 per cent in 2002-03 to 15.3 per cent in 2003-04.

The estimated average value of quota and licences attached to each boat operating in the northern prawn fishery in 2003-04 was around \$2.39 million. This includes the value of licences for other fisheries in which these boats are endorsed to fish, such as the Torres Strait prawn or Queensland east coast otter trawl fishery. The rate of return to full equity includes this value of quota and licences in addition to other capital, and therefore provides an indication of the return to total capital invested in the business unit. It reflects changes in the value of quota and licences as well as changes in the profitability of the fishing operation – that is, the profit from fishing that accrues to the owners of capital. In 2003-04 the average rate of return across the fishery was 4.7 per cent.

economic performance of the fishery

The results presented in table 3 show changes in the average receipts and costs of boats that operated in the northern prawn fishery in 2002-03 and 2003-04. However, they shed little light on the economic performance of the whole fishery as they include receipts and costs earned and incurred from operations in other fisheries and no allowance is made for the opportunity costs of capital employed in the fishery. Table 4 shows boat cash profit and net returns generated from the northern prawn fishery for the period 1992-93 to 2003-04. Only receipts and costs earned and incurred in the northern prawn fishery are included.

Receipts in the fishery fluctuated significantly over the period 1992-93 to 2003-04. Since 2000-01 fishing revenue has fallen by 56 per cent to \$88.5 million in 2003-04.

Boat cash profit, which is fishing income less operating costs, averaged around \$41 million a year between 1992-93 and 2003-04, with a high of \$77 million in 2000-01. In 2003-04, boat cash profit was around \$10.8 million.

While boat cash profit sheds light on the cash position of a fishery, it is not a measure of the economic performance of a fishery. This is because no allowance has been made for depreciation expense, the opportunity cost of owner and family labor and the opportunity cost of capital. To calculate net returns, these costs need to be deducted from boat cash

4 net returns in the northern prawn fishery

in 2005-06 dollars

		1992-93	1993-94	1994-95	1995-96	1996-97	1997-98
Receipts							
Fishing revenue	\$m	148.5 (4)	166.9 (4)	186.4 (8)	158.9 (3)	148.9 (3)	178.6 (2)
Cash costs							
Operating costs	\$m	111.8 (4)	121.9 (6)	128.2 (6)	125.0 (3)	113.3 (3)	122.3 (2)
Boat cash profit	\$m	36.7 (8)	45.0 (11)	58.2 (12)	33.9 (10)	35.5 (9)	56.3 (4)
<i>less</i>							
- owner and family labor	\$m	8.1 (11)	10.7 (8)	3.8 (13)	3.3 (15)	4.6 (20)	4.8 (18)
- opportunity cost of capital	\$m	5.7 (6)	5.0 (5)	5.8 (5)	6.9 (7)	6.1 (7)	5.8 (6)
- depreciation	\$m	4.0 (15)	8.4 (5)	8.3 (5)	9.5 (6)	8.7 (7)	9.3 (6)
<i>plus interest, leasing and management fees</i>	\$m	8.5 (10)	10.0 (7)	10.3 (14)	11.6 (9)	13.3 (8)	13.6 (6)
Net returns (excluding management costs)	\$m	27.3 (11)	31.0 (16)	50.7 (15)	25.8 (16)	29.5 (12)	50.0 (5)
Management costs	\$m	- na	- na	- na	1.3 na	1.2 na	1.3 na
Net returns (including management costs)	\$m	27.3 na	31.0 na	50.7 na	24.5 na	28.3 na	48.7 na
Number of active boats	no.	129	132	133	134	128	130
		1998-99	1999-2000	2000-01	2001-02	2002-03	2003-04
Receipts							
Fishing revenue	\$m	165.2 (3)	131.6 (4)	208.0 (3)	147.6 (4)	114.3 (4)	88.5 (5)
Cash costs							
Operating costs	\$m	124.7 (3)	103.0 (4)	131.0 (3)	106.3 (4)	89.7 (4)	77.7 (5)
Boat cash profit	\$m	40.5 (7)	28.7 (14)	77.0 (6)	41.3 (7)	24.7 (12)	10.8 (25)
<i>less</i>							
- owner and family labor	\$m	3.8 (18)	4.4 (21)	4.1 (19)	3.2 (18)	1.5 (32)	1.3 (29)
- opportunity cost of capital	\$m	5.5 (8)	4.4 (8)	4.2 (9)	3.3 (8)	2.4 (13)	2.1 (13)
- depreciation	\$m	7.9 (8)	7.1 (9)	6.0 (10)	5.3 (8)	2.8 (21)	2.5 (29)
<i>plus interest, leasing and management fees</i>	\$m	15.2 (8)	11.1 (6)	8.4 (22)	6.6 (8)	6.4 (12)	6.5 (12)
Net returns (excluding management costs)	\$m	38.4 (7)	23.9 (16)	71.1 (6)	36.1 (8)	24.2 (12)	11.4 (22)
Management costs	\$m	1.5 na	1.8 na	1.9 na	1.5 na	1.7 na	2.2 na
Net returns (including management costs)	\$m	36.9 na	22.1 na	69.2 na	34.6 na	22.5 na	9.2 na
Number of active boats	no.	133	130	120	118	101	98

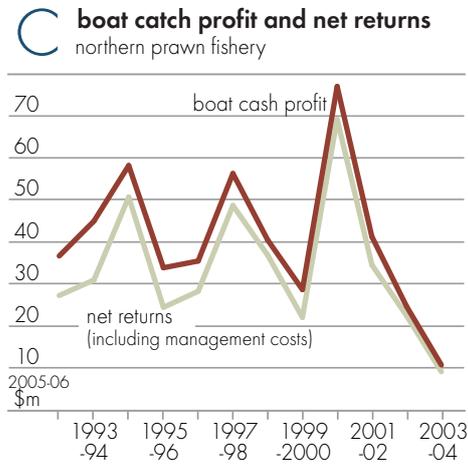
na Not applicable. Management costs prior to 1995-96 not available.

Note: Figures in parentheses are relative standard errors. A guide to interpreting these is included in 'survey methods and definitions'.

profit. Interest and quota/permit leasing costs are added as these items represent profits that have been redistributed to other investors in the fishery and therefore need to be added to provide an indication of net returns of the fishery. Management fees are also added, as management fees that appear on fishers' financial statements only represent the industry recoverable component of fishery management costs. This allows the deduction of total fishery management costs (both recoverable and nonrecoverable) to calculate net returns including management costs.

Once these adjustments have been made, net returns (including management costs) show a decreasing trend since 2000-01, and in 2003-04 were \$9.2 million. Net returns (including management costs) averaged around \$34 million between 1992-93 and 2003-04. Figure C shows net returns and boat cash profit for the fishery over this period.

It is important to note that factors outside the control of fishery management influence both the net return and other measures of financial return in the fishery. For example, the appreciation/depreciation of the Australian dollar and its impact on the prices received by fishers. Also the price of inputs such as fuel and gear are not controlled by fishery managers. These types of external factors can be expected to have had a substantial impact on the performance of the fishery in recent years. However, the fishery manager has a role to play in ensuring that a fishery is able to maximise profits subject to these external factors.



Torres Strait prawn fishery

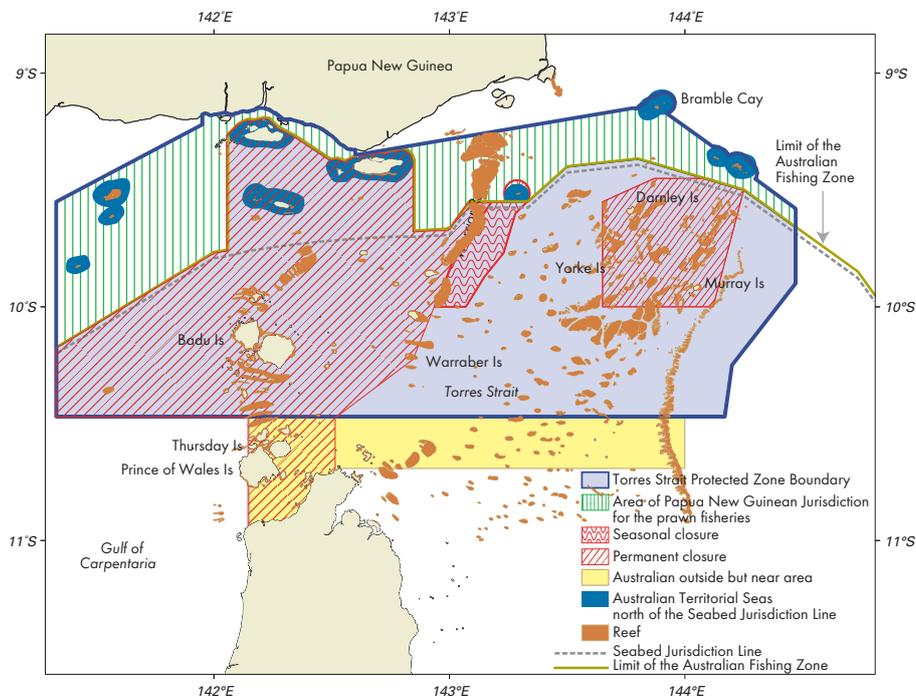
the fishery

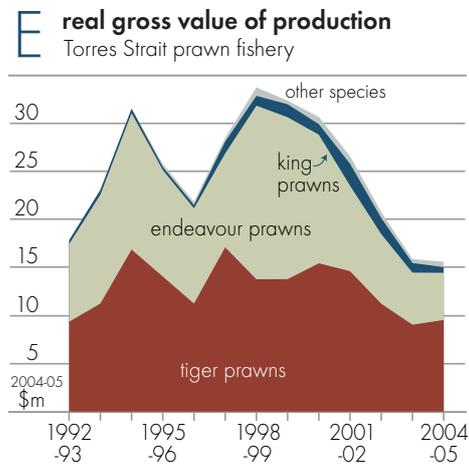
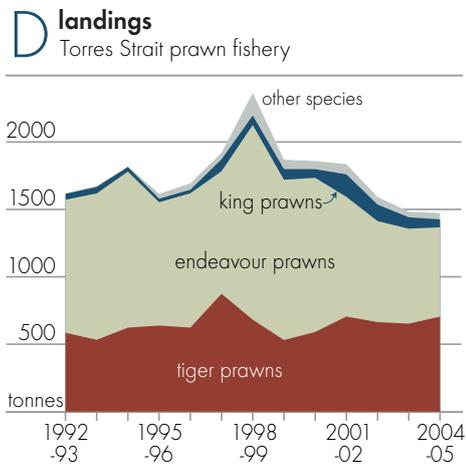
The Torres Strait prawn fishery is located within an area of water known as the Torres Strait Protected Zone (TSPZ) which is shared between Australia and Papua New Guinea. This area of water is bordered by Cape York Peninsula in the south, Papua New Guinea in the north, the Arafura Sea to the west and the Coral Sea to the east (map 2). Commercial resource sharing arrangements within the zone between Australia and Papua New Guinea are governed by the *Torres Strait Treaty* which was ratified in 1985 (PZJA 2006).

Operators in the fishery use boats of up to 20 metres in length and use otter trawl nets. Nets are limited to mesh sizes of no greater than 45 millimetres and a combined footrope and headrope length of no more than 88 metres (Caton and McLoughlin 2005).

The fishery operates between March and December and all trawl activity occurs at night. Vessels operating in the fishery are able to remain at sea for lengthy periods of time given support from motherships as well as fuel barges located in several anchorages around the

2 Torres Strait prawn fishery management areas





Torres Strait. Few vessels fish exclusively in the Torres Strait prawn fishery with many also operating in the Queensland east coast otter trawl fishery to the south and the northern prawn fishery to the west (Caton and McLoughlin 2005).

The two main species targeted in the fishery include brown tiger prawns (*Penaeus esculentus*) and blue endeavour prawns (*Metapenaeus endeavouri*). In 2004-05, landings consisted of 706 tonnes of brown tiger prawns, 663 tonnes of blue endeavour prawns plus 59 tonnes of the red-spot king prawn (*Melicertus longistylus*) (figure D). The remainder of landings included mainly Moreton Bay bugs, scallops and squid.

The real gross value of production of the fishery in 2004-05 was \$15.6 million, which was less than half the record value of \$33.7 million in 1998-99 (figure E). Prices received in the fishery have fallen at least in part through increased international competition (particularly with farmed substitutes from Asia) and the appreciation of the Australian dollar against the United States dollar.

biological status

Both brown tiger prawns and blue endeavour prawns are endemic to tropical and subtropical Australia. Biologically similar, they have high fecundity, a fast growth rate (sexually maturing after six months), and a life span of between one and two years (Caton and McLoughlin 2005).

The earliest official stock assessment of prawn stocks in the fishery was conducted in 1991. This initial assessment was updated in 1994. Results from the assessment indicated a long term sustainable yield for the fishery of 1900 tonnes. This total was broken down into a separate yield for each prawn species caught in the fishery – 680 tonnes of brown tiger prawns, 1035 tonnes of endeavour prawns and 185 tonnes of king prawns (Caton and McLoughlin 2005).

A stock assessment for Torres Strait tiger prawns in 2001 incorporated an improved assessment method. The new outputs indicated that the tiger prawn catch over the previous decade approximated maximum sustainable yield (MSY), with an average catch of 656 tonnes. The estimated level of effort associated with MSY (E_{MSY}) was 10 300 operating days (range 9131 to 13 256 days). The most recent 2003 stock assessment provided a best estimate of E_{MSY} for tiger prawns of 9197 fishing days (range 8400 to 12 600 days). This figure, when compared with catch and effort records over recent years, indicates that tiger prawn stocks are being fully fished at recent levels of fishing effort but are not being overfished (Caton and McLoughlin 2005).

Both endeavour prawns and king prawns have not been subject to individual stock assessments and thus the status of both stocks are uncertain, although endeavour prawns are believed to be not overfished (Caton and McLoughlin 2005).

Given that trawling in the Torres Strait is not selective, bycatch in the fishery is significant. A Bycatch Action Plan was introduced in 2005 to address this issue, and bycatch reduction devices and turtle exclusion devices have been used in the fishery since 2002 (TSPZJA 2005a).

management of the fishery

Prior to 1985, the fishery was jointly managed with both the Queensland east coast otter trawl fishery and the northern prawn fishery. In 1985, the fishery became managed as a single and separate fishery with the ratification of the Torres Strait Treaty (Hanna et al. 2006).

The Protected Zone Joint Authority (PZJA) is now responsible for the management of the fishery, in addition to all other fishing activities in Australian waters within the Torres Strait Protected Zone (TSPZ). The PZJA membership consists of representation from the Commonwealth and Queensland ministers responsible for fisheries and the chair of the Torres Strait Regional Authority (PZJA 2006). Licensing, enforcement and research activities are carried out on behalf of the PZJA by the Australian Fisheries Management Authority (AFMA), the Queensland Boating and Fisheries Patrol, and the Queensland Department of Primary Industries and Fisheries (Hanna et al. 2006).

The fishery is managed according to two major objectives:

- > to conserve the prawn stocks, while allowing their optimum utilisation, and
- > to maximise opportunities for traditional inhabitants to participate in the fishery.

Under the Torres Strait Treaty, Papua New Guinea is entitled to a 25 per cent share of all fishery resources located within Australian fisheries jurisdictional waters within the Protected Zone, south of the fisheries jurisdiction line. It also entitles Australia to a 25 per cent share of fishery resources in Papua New Guinea's fisheries jurisdictional waters within the zone. Furthermore, each country has a 50 per cent entitlement in Australian territorial seas north of

the fisheries jurisdictional line within the Torres Strait Protected Zone (map 2). Papua New Guinea has never applied for the total number of licences that they are entitled to. PNG operators who have been endorsed to operate in Australian waters have fished minimally. For the purposes of management, annual bilateral discussions with Papua New Guinea usually convert resource entitlements to effort entitlements in terms of number of boat days (DAFF 2004). Torres Strait Islanders no longer participate in the fishery following the permanent surrender of their interests in 2005 (TSPZJA 2005b).

When the treaty was ratified in 1985, approximately 500 vessels were endorsed to operate in the fishery. Limited entry was first introduced into the fishery in 1987 together with a number of other restrictions to reduce effort and to further prepare the fishery for allocation of the fishery resource to meet Australia's obligations under the treaty (Taylor et al. 2006).

Important management changes were made in 1993 to cap effort with the introduction of a transferable fishing rights system based on effort units. Entitlements to fish became governed by a fishing day allowance per operator per season. The initial allocation of effort was determined according to the highest number of fishing days that an operator had participated in the fishery for any one year between 1988-89 and 1991-92. Additional effort allocations were also made to operators to address cases where boats had nonfishing time and breakdowns in these reference years (PZJA 2006). In the following year, these effort units were made transferable in ten day blocks. However, operators who sold units were prevented from participating in the fishery in the following season (Hanna et al. 2006).

Input restrictions on trawl boat size (limited to 20 metres) apply in the fishery (Caton and McLoughlin 2005). This restriction was complemented by a boat replacement policy approved in October 2001 that provides a disincentive to increase boat size. The policy penalises the replacement of a smaller boat with a larger boat by reducing fishing day entitlement for the following year by 20 per cent (Hanna et al. 2006). This boat replacement policy was suspended by the PZJA in February 2006 for the entire 2006 fishing season to further assist the industry to restructure itself. The PZJA has noted that boat replacement issues will be addressed for future fishing seasons through the development of new management plans (Abetz 2006a).

Input restrictions also exist on net dimensions with combined headrope and footrope length of nets restricted to 88 metres and net mesh size restricted to 45 millimetres. The combined headrope and footrope length limit had been reduced from 88 metres to 80 metres for the 2002 and 2003 seasons (Caton and McLoughlin 2005), but was reversed in 2004 back to the current 88 metres (MacDonald 2004).

Seasonal and area closures are also enforced in the fishery. The season runs from 1 March to 1 December. An area west of Warrior Reef and a smaller area in the east of the TSPZ are closed permanently to trawling. Additionally, an area east of the Warrior Reef is only open during the season after 31 July (map 2) (PZJA 2006). These closures encourage targeting of predominately adult prawns, reducing juvenile catches and allowing improvements in juvenile recruitment rates (Caton and McLoughlin 2005).

Latent or unused effort remains a concern for management. In 2003 the total number of fishing days allocated in the Australian fishery was 13 486; however, only 9000 days were used. This has been a common occurrence in recent seasons, with actual effort falling well short of the total allowable days (Caton and McLoughlin 2005).

Given these concerns, a number of management changes have been introduced in 2006 and are also being developed for a new management plan to be implemented in 2007. A new effort cap of 9200 days has been applied to the 2006 season following scientific recommendations on a sustainable level of harvest for the fishery (MSY) (TSPZJA 2006). Additionally, the Australian Government carried out a voluntary tender process in early 2006 to fund payments for the surrender of licences by operators to assist Australia in meeting its resource sharing obligation under the Torres Strait Treaty. In February 2006, it was announced that the tender process had been completed and resulted in the removal of sixteen licences from the fishery and the surrender of approximately 25 per cent of the fishing effort (Abetz 2006b).

A number of other management decisions were also announced by the PZJA for the 2006 season in February 2006. The first was a reduction of the minimum number of days that a licence holder is required to hold in order to operate in the fishery – from 50 days to 34 days. Boats whose effort holdings fell below 50 days due to a total allowable effort reduction in 2006 are therefore still allowed to operate in the fishery (Abetz 2006a).

Given the nature of trawling, the bycatch of other nonprawn species in the Torres Strait prawn fishery is a significant management issue. A bycatch action plan for the fishery was released in 1999. Since its release, turtle exclusion devices became mandatory in 2002 and bycatch reduction devices have been adopted from the Queensland east coast otter trawl fishery. These were made compulsory at the start of the 2004 season. Shark bycatch limits were also introduced in 2002 – shark bycatch is now restricted to five trunks (with a maximum combined weight of 30 kilograms) and shark finning is banned (Hanna et al. 2006). An updated bycatch action plan was also released in 2005.

boats surveyed

For the purpose of the survey, the target population was defined as boats that caught prawns in the Torres Strait prawn fishery in 2003-04. In 2003-04, the population was 69 vessels, of which nineteen were sampled. Of these, eighteen were also sampled for 2002-03 when the population was 74 vessels.

financial performance of the fishery

Key measures of the financial performance of the entire fishing fleet are contained in table 5. Definitions of items contained in table 5 are included in 'survey methods and definitions' at the end of this report. Many boats that operate in the Torres Strait prawn fishery also

5 financial performance of boats operating in the Torres Strait prawn fishery average per boat

		2002-03		2003-04	
Seafood receipts	\$	613 279	(9)	560 172	(10)
Nonfishing receipts	\$	42 279	(24)	62 380	(21)
Total cash receipts	\$	655 558	(9)	622 552	(11)
Administration	\$	13 663	(23)	14 880	(24)
Labor costs	\$	178 033	(5)	158 316	(7)
Freight and marketing expenses	\$	16 438	(14)	15 752	(20)
Fuel	\$	170 496	(5)	169 092	(4)
Insurance	\$	17 712	(7)	19 156	(5)
Interest paid	\$	17 739	(24)	24 517	(21)
Licence fees and levies	\$	14 889	(13)	16 145	(16)
Packaging	\$	10 642	(15)	10 891	(21)
Repairs and maintenance	\$	75 772	(12)	68 058	(10)
Other costs	\$	32 408	(12)	30 349	(17)
Total cash costs	\$	547 793	(5)	527 155	(5)
Boat cash income	\$	107 765	(36)	95 397	(46)
<i>less depreciation a</i>	\$	21 491	(17)	20 525	(18)
Boat business profit	\$	86 274	(45)	74 872	(59)
<i>plus interest, leasing and rent</i>	\$	20 373	(22)	27 757	(19)
Profit at full equity	\$	106 647	(38)	102 629	(43)
Capital (excl. quota and licences)	\$	458 924	(11)	476 979	(11)
Capital (incl. quota and licences)	\$	na		1 514 438	(18)
Rate of return to boat capital b	%	23.2	(32)	21.5	(36)
Rate of return to full equity c	%	na		6.8	(28)

a Depreciation adjusted for profit or loss on capital items sold. **b** Excluding value of quota and licences. **c** Including value of quota and licences. **na** Not applicable.

Note: Figures in parentheses are relative standard errors. A guide to interpreting these is included in 'survey methods and definitions'.

operate in other fisheries such as the northern prawn fishery and Queensland east coast otter trawl fishery. Any receipts earned and costs incurred by these boats while operating in these other fisheries are included in the financial performance measures in table 5.

receipts

Average per boat seafood receipts fell by around 9 per cent between 2002-03 and 2003-04 – from approximately \$613 000 to just over \$560 000 per boat. With a proportion of the product from the fishery exported, the appreciation of the Australian dollar over the survey period reduced the prices received by fishers.

costs

The majority of costs remained relatively stable over the survey period, with average total boat cash costs not changing significantly between 2002-03 and 2003-04. Total cash costs were estimated at an average of around \$527 000 per boat in 2003-04.

Boat labor is generally paid a percentage share of revenue, so in line with lower revenue, average per boat labor costs fell between the survey years from \$178 000 to \$158 000 per boat in 2003-04. This was equivalent to 30 per cent of total cash costs in 2003-04.

Repairs and maintenance costs fell by around 10 per cent between 2002-03 and 2003-04 from \$76 000 to an estimated average of \$68 000 per boat in 2003-04.

Average per boat fuel expense did not change significantly over the survey period and was estimated at \$169 000 in 2003-04. Together, labor, fuel and repairs and maintenance costs accounted for 75 per cent of total cash costs in 2003-04.

boat cash income and profit

As a result of the greater fall in seafood receipts relative to total boat cash costs, average per boat cash income fell by an estimated 11 per cent to just over \$95 000 in 2003-04.

Boat business profit which is boat cash income less an allowance for depreciation, is estimated to have been just under \$75 000 per boat in 2003-04, a fall of 13 per cent from the previous year.

Profit at full equity, which is boat business profit plus interest, leasing and rent, is estimated to have been \$103 000 per boat in 2003-04. Boat business profit represents the average return that would have been earned by the business unit if the boat and capital (including quota and licences) were fully owned by the operator. While these costs affect the financial position of the operator, they represent some profits that have been redistributed to other investors in the fishery.

rates of return

The rate of return to boat capital is calculated on total capital (excluding the value of quota and licences) as if the operators wholly owned all assets so that the financial performance of all boats can be compared regardless of the operators' equity in the business. The estimated average rate of return to boat capital (excluding the value of quota and licences) fell from 23.2 per cent in 2002-03 to 21.5 per cent in 2003-04.

The rate of return to full equity (including quota and licences) provides an indication of the return to total capital invested in the business unit. This measure includes changes in the value of quota and licences as well as changes in the profitability of the fishing operation – that is, the profit from fishing that accrues to the owners of capital.

The estimated value of licences attached to each boat operating in the Torres Strait prawn fishery in 2003-04 was around \$1.04 million. This includes the value of licences for other fisheries in which these boats are endorsed to fish such as the Queensland east coast otter trawl fishery. For the fleet as a whole, the rate of return to full equity was estimated to be 6.8 per cent in 2003-04.

economic performance of the fishery

The results presented in table 5 show changes in the average receipts and costs of boats that operated in the Torres Strait prawn fishery in 2002-03 and 2003-04. However, they shed little light on the economic performance of the whole fishery as they include receipts earned and costs incurred from operations in other fisheries and no allowance is made for

6 net returns in the Torres Strait prawn fishery

in 2005-06 dollars

		1993-94	1994-95	1995-96	1996-97	1997-98	1998-99
Receipts							
Fishing revenue	\$m	32.1 (15)	33.2 (14)	30.1 (8)	32.7 (11)	36.6 (6)	39.4 (15)
Cash costs							
Operating costs	\$m	24.7 (15)	27.5 (14)	25.4 (8)	23.8 (11)	25.3 (7)	30.1 (16)
Boat cash profit	\$m	7.4 (17)	5.7 (26)	4.7 (16)	8.9 (17)	11.3 (9)	9.3 (24)
<i>less</i>							
- owner and family labor	\$m	3.6 (16)	2.0 (25)	2.4 (16)	5.5 (16)	4.8 (16)	3.6 (20)
- opportunity cost of capital	\$m	1.3 (14)	1.4 (14)	1.1 (10)	1.0 (9)	0.8 (7)	1.2 (22)
- depreciation	\$m	2.2 (14)	2.0 (14)	1.8 (9)	1.5 (11)	1.3 (7)	1.9 (22)
<i>plus</i> interest, leasing and management fees	\$m	1.2 (27)	1.6 (24)	1.6 (13)	2.2 (16)	2.1 (9)	2.2 (26)
Net returns (excluding management costs)	\$m	1.5 (81)	1.9 (61)	1.0 (54)	3.1 (39)	6.4 (16)	4.8 (41)
<i>less</i> management costs	\$m						
Net returns (including management costs)	\$m	1.5 na	1.9 na	1.0 na	3.1 na	6.4 na	4.8 na
Number of active vessels	no.	64	60	60	80	83	82
1999-2000 2000-01 2001-02 2002-03 2003-04							
Receipts							
Fishing revenue	\$m	37.8 (13)	41.2 (11)	37.2 (8)	25.5 (11)	23.0 (10)	
Cash costs							
Operating costs	\$m	28.4 (13)	29.6 (12)	29.1 (8)	21.9 (12)	20.7 (12)	
Boat cash profit	\$m	9.4 (20)	11.6 (16)	8.2 (11)	3.7 (29)	2.3 (32)	
<i>less</i>							
- owner and family labor	\$m	3.2 (18)	2.8 (28)	2.2 (23)	1.6 (17)	1.9 (22)	
- opportunity cost of capital	\$m	1.0 (17)	1.1 (21)	1.0 (12)	0.8 (22)	0.6 (18)	
- depreciation	\$m	1.8 (17)	1.7 (21)	1.6 (13)	1.1 (24)	0.9 (19)	
<i>plus</i> interest, leasing and management fees	\$m	2.3 (19)	1.3 (29)	1.8 (17)	1.3 (16)	1.7 (15)	
Net returns (excluding management costs)	\$m	5.6 (28)	7.2 (20)	5.2 (14)	1.4 (45)	0.5 (163)	
<i>less</i> management costs	\$m	0.1 na	0.2 na	0.3 na	0.4 na	0.4 na	
Net returns (including management costs)	\$m	5.5 na	7.0 na	4.9 na	1.0 na	0.1 na	
Number of active vessels	no.	79	78	75	74	69	

na Not applicable.

Note: Figures in parentheses are relative standard errors. A guide to interpreting these is included in 'survey methods and definitions'. Management costs prior to 1999-2000 not available.

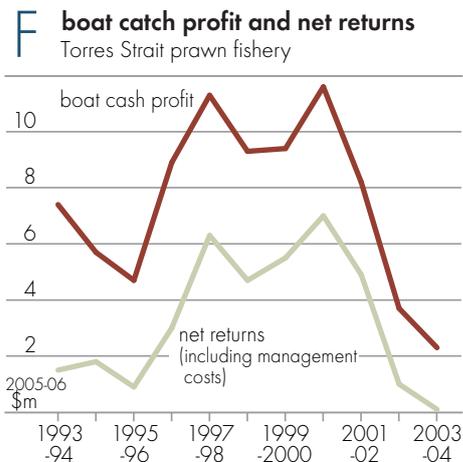
the opportunity costs of capital employed in the fishery. Table 6 shows boat cash profit and net returns generated from the Torres Strait prawn fishery for the period 1993-94 to 2003-04. Only receipts earned and costs incurred in the Torres Strait prawn fishery are included in table 6.

Boat cash profit, which is fishing income less operating costs, averaged around \$7.3 million a year between 1993-94 and 2003-04, with a high of \$11.6 million in 2000-01. In 2003-04, boat cash profit fell to around \$2.3 million.

While boat cash profit shows the cash position of a fishery, it is not a measure of the economic performance of a fishery. This is because no allowance has been made for depreciation expense, the opportunity cost of owner and family labor and the opportunity cost of capital. To calculate net returns, these costs need to be deducted from boat cash profit. Interest and quota/permit leasing costs are added as these items represent profits that have been redistributed to other investors in the fishery. Management fees are also added as management fees that appear on fishers' financial statements represent only the industry recoverable component of fishery management costs. This allows the deduction of total fishery management costs (both recoverable and nonrecoverable) to calculate net returns including management costs.

Once these adjustments have been made, net returns (including management costs) show a decreasing trend since 2000-01, and in 2003-04 were around \$0.1 million. Net returns (including management costs) averaged around \$3.3 million between 1993-94 and 2003-04. Figure F shows net returns and boat cash profit for the fishery over this period.

It is important to note that factors outside the control of fishery management influence both the net return and other measures of financial return in the fishery. For example, the appreciation/depreciation of the Australian dollar and its impact on the prices received by fishers. Also the price of inputs such as fuel and gear are not controlled by fishery managers. These types of external factors can be expected to have had a substantial impact on the performance of the fishery in recent years. However, the fishery manager has a role to play in ensuring that a fishery is able to maximise profits subject to these external factors.



survey methods and definitions

collecting economic survey data

ABARE has been undertaking economic surveys of selected Commonwealth fisheries since the early 1980s and on a regular basis for particular fisheries since 1992. The current fisheries survey program involves surveying major Commonwealth fisheries every few years, or more frequently where the fishery is undergoing major changes and monitoring is particularly important. The aim is to develop a consistent time series of economic information for each fishery. Such a database, in conjunction with scientific assessments of each fishery, is vital for assessing the economic performance of fisheries.

Information from the surveys is made publicly available so the performance of fisheries and the impact of management policies can be independently assessed.

ABARE surveys are designed and samples selected on the basis of information supplied by the Australian Fisheries Management Authority (AFMA). This information includes data on the size of the catch, fishing effort and boat characteristics.

Because it is not possible to survey all the boats in a fishery, a sample of boats is selected based on how representative they are. Where possible, boats are classified into subgroups based either on the fishing method used (longline boats, purse seine boats, trawlers) or on the size of operations (typically small, medium and large producers). A number of representative boats from each subgroup are then targeted for the survey.

In practice this sample is seldom fully realised. Nonresponse is relatively high across fishery surveys, reflecting the difficulty in contacting some operators and a reluctance of others to participate in the survey. Sample design and weighting systems have been developed that reduce the impact of nonresponse, but care is still required when interpreting the information from the surveys.

Between February and June an ABARE officer visits the owner of each boat selected in the sample. The officer interviews the boat owner to obtain physical and financial details of the fishing business for the survey years. In a number of instances the skipper of the boat is also interviewed. Further information is subsequently obtained from accountants, selling agents and marketing organisations on the signed authority of the survey respondents.

The information obtained from various sources is reconciled to produce the most accurate description possible of the financial characteristics of each sample boat in the survey.

the 2005 surveys

ABARE surveyed two fisheries in 2005 – the northern prawn fishery and the Torres Strait prawn fishery. Information was collected for the 2002-03 and 2003-04 financial years.

The definitions of key variables used in this analysis are provided in box 1.

sample weighting

All population estimates presented in this report are calculated from the weighted survey data of sample boats. A weight is calculated for each boat in the sample, based on how representative that boat is in the population. Sample weights are calculated such that the weights sum to the population of boats that the sample is representing, and the weighted sum of catch reported by the sample boats equals the total catch for the fishery according to AFMA logbook data.

box 1: definitions of key variables

Total cash receipts represent returns from the sale of fish, nonfishing activities including charter operations, and other sources (insurance claims and compensation, quota and or endorsements leased out, government assistance and any other revenue) in the financial year.

For the majority of operators, this information is readily available from their own records. However, different operators record their fishing income in different ways. In some cases, such as where fish are sold through a cooperative, some operators may only record the payments received from the cooperative. These payments may be net of commissions and freight as well as net of other purchases made through the cooperative.

In other cases, the crew is paid directly for the catch by the cooperative or agency and the owner's financial records might include only the amount of revenues they received after the crew's share had been deducted.

For these reasons, operators are asked to provide a breakdown of the total catch of their boat and an estimate of the total value of that catch. For consistency, marketing charges may need to be added back into fishing receipts for some boats to give a gross value. Where this is necessary these selling costs are also added into the cost estimates to offset the new revenue figure. Receipts also include amounts received in the survey year for fish sold in previous years.

Total cash costs include the payments made for both permanent and casual hired labor and payments for materials and services (including payments on capital items subject

continued ...

box 1: **definitions of key variables** *continued*

to leasing, rent, interest, licence fees and repairs and maintenance). Capital and household expenditures are excluded.

Labor costs are usually the highest cash cost in the fishing operation. Labor costs include wages and an estimated value for owner/partner, family and unpaid labor. Labor costs cover the cost of labor involved in boat related aspects of the fishing business, such as crew or onshore administration costs, but do not cover the cost of onshore labor involved in processing the fisheries products.

On many boats, the costs of labor are reflected in the wages paid by boat owners and/or in the share of the catch they earn. In some cases, however, such as where owner skippers are involved, or where family members work in the fishing operation, the payments made can be low or even nil, which will not always reflect the market value of the labor provided. To allow for this possible underestimation, all owner/partner and family labor was based on estimates collected at the interview of the amount it would cost to employ someone else to do the work.

Boat cash income is the difference between total cash receipts and total cash costs.

Depreciation costs have been estimated using the diminishing value method based on the current replacement cost and age of each item. The rates applied are the standard rates allowed by the Commissioner of Taxation. For items purchased or sold during the survey year, depreciation is assessed as if the transaction had taken place at the midpoint of the year. This method of calculating depreciation is also used in other ABARE industry surveys.

Boat business profit is boat cash income less depreciation.

Profit at full equity is boat profit, plus rent, interest and lease payments.

Capital is the value placed on the assets employed by the owning business of the surveyed boat. It includes the value of the boat, hull, engine and other onboard equipment (including gear). Estimates are also reported for the value of quotas and endorsements held by the surveyed boat. Estimates of the value of capital are based on the market value of capital and are usually obtained at interview but in some cases quota and endorsement values are obtained from industry sources.

Depreciated replacement value is the depreciated capital value based on the current age and replacement values of the boat and gear. The value of quota and endorsements held is not included in the estimate.

Rate of return to boat capital is calculated as if all fishing assets were wholly owned by the proprietors. This enables the financial performance of sample boats to be compared regardless of the proprietor's equity in the business. Rate of return to boat capital is calculated by expressing profit at full equity as a percentage of total capital (excluding quota and licence value).

Rate of return to full equity is calculated by expressing profit at full equity as a percentage of total capital (including quota and licence value).

That is, $\sum w_i x_i = X$

where

w_i = the weight for boat i

x_i = the catch for boat i

X = the total catch for the target population.

Technical details of the method of weighting used are given in Bardsley and Chambers (1984).

reliability of estimates

A relatively small number of boats out of the total number of boats in a particular fishery are surveyed. Estimates derived from these boats are likely to be different from those that would have been obtained if information had been collected from a census of all boats. How closely the survey results represent the population is influenced by the number of boats in the sample, the variability of boats in the population and most importantly the design of the survey and the estimation procedures used.

To give a guide to the reliability of the survey estimates, measures of sampling variation have been calculated. These measures, expressed as percentages of the survey estimates and termed 'relative standard errors', are given next to each estimate in parentheses. In general, the smaller the relative standard error, the more reliable the estimate.

use of relative standard errors

These relative standard errors can be used to calculate 'confidence intervals' for the survey estimate. First, calculate the standard error by multiplying the relative standard error by the survey estimate and dividing by 100. For example, if average total cash receipts are estimated to be \$100 000 with a relative standard error of 6 per cent, the standard error for this estimate is \$6000.

There is roughly a two in three chance that the 'census value' (the value that would have been obtained if all boats in the target population had been surveyed) is within one standard error of the survey estimate. There is roughly a nineteen in twenty chance that the census value is within two standard errors of the survey estimates. Thus, in this example, there is approximately a two in three chance that the census value is between \$94 000 and \$106 000, and approximately a nineteen in twenty chance that the census value is between \$88 000 and \$112 000.

comparing estimates

When comparing estimates across groups or years it is important to recognise that the differences are also subject to sampling error. As a rule of thumb, a conservative estimate of the

standard error of the difference can be constructed by adding the squares of the estimated standard errors of the component estimates and then taking the square root of the result.

For example, suppose the estimates of total cash receipts were \$100 000 in one year and \$125 000 in the previous year – a difference of \$25 000 – and the relative standard error is given as 6 per cent for each estimate. The standard error of the difference can be estimated as

$$\sqrt{[(0.06 \times \$100\,000)^2 + (0.06 \times \$125\,000)^2]} = \$9605$$

so the relative standard error of the difference is:

$$(\$9605/\$25\,000) \times 100 = 38 \text{ per cent.}$$

It should be noted that there may be changes in the population of a fishery from one year to the next. If these population changes are substantial, differences in estimates may be caused more by the changes in population than by changes in the variables themselves.

nonsampling errors

The values obtained in a survey may be affected by errors other than those directly related to the sampling procedure. For example, it may not be possible to obtain information from certain respondents, respondents may provide inaccurate information or respondents may differ from nonrespondents for a particular variable being surveyed.

In conducting surveys, ABARE draws on a depth of experience. The survey staff are generally very experienced and undergo rigorous pre-survey training, aimed at minimising nonsampling errors. However, when drawing inferences from estimates derived from sample surveys, users should bear in mind that both sampling and nonsampling errors occur.

estimating the economic performance of Commonwealth managed fisheries

Under the *Fisheries Management Act 1991*, one of the objectives of the Australian Fisheries Management Authority (AFMA) is to maximise the economic efficiency of each of the Commonwealth fisheries. Maximising the economic efficiency of a fishery involves maximising the economic returns from the use of the natural resource (the fish stock). As part of monitoring the performance of AFMA against this objective, ABARE's economic surveys provide some of the necessary data to calculate performance indicators such as net returns and productivity indexes. In addition, survey data provides some of the necessary data to construct bioeconomic models. This section outlines how net returns are calculated using ABARE survey data.

net returns

Net returns are the long run profits from a fishery after all costs have been met, including fuel, crew costs, repairs, the opportunity cost of capital, depreciation and the opportunity cost of family and owner labor. Although they do not provide an indication of the potential returns available from a fishery in the long run, a time series of net returns may indicate in which direction returns in a fishery are heading. For instance, a fishery in which estimated net returns are regularly close to zero or negative is probably not being managed effectively. A positive trend may suggest a fishery is approaching the point of maximum economic yield (MEY) – the level of catch/effort where the profits of a fishery are maximised.

The measure of net returns of a fishery can be calculated by summing the net returns of each boat in a fishery. The net return of each boat can be defined as:

$$NR = R - [OC + (d + r)K] - M$$

NR = net returns

R = total cash receipts attributable to the fishery, excluding any receipts from leasing licences or quota

OC = total operating cash costs less interest paid, less expenditure on leasing licences or quota, less licence fees and levies

K = value of capital associated with vessel (depreciated replacement value)

d = depreciation rate for vessel

r = real interest rate

M = costs of managing the fishery.

Operating costs include day to day expenses such as fuel, crew costs, repairs, administration, gear etc. These cost items are usually easily identified in fishers accounts.

Both receipts and operating costs exclude any income (costs) from leasing in or leasing out quota and licences. These are excluded, because the amount that fishers pay or accept for leasing quota and licences represents the expected future profits that can be generated from the quota or licence. This is precisely what net returns are measuring. If leasing were included as revenues and costs, double counting would occur and estimates of net returns would be incorrect.

Depreciation expense is the cost of capital becoming less valuable over time through wear and tear and obsolescence. Depreciation expense is not consistently identifiable in fishers' accounts, so ABARE calculates the depreciation of boats based on a capital inventory list collected during the surveys.

The opportunity cost of owner and family labor is estimated at interview. Often owners and their families are involved in the operation of a boat, either as skippers and crew or onshore as accountants and shore managers. While some will be paid the market value for their labor, some will not be paid at all and others paid very high amounts through 'directors fees' or 'management fees'. ABARE survey officers ask survey respondents what is the market value of each owner and family labor, and this amount is considered as a cost.

The opportunity cost of capital is a return that would have been earned if the capital was invested elsewhere, rather than invested in fishing capital. The standard rate that ABARE adopts is 7 per cent a year, and this is used in this analysis. This cost is not identifiable in fishers accounts.

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