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economic performance of selected fisheries in 2001-02 and 2002-03

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ABARE is a professionally independent government economic research agency.

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foreword

Estimates of the performance of operators in the eastern tuna and billfish fishery and the gillnet, hook and trap fishery — that were surveyed by ABARE in 2004 — are given in this report. The southern squid jig fishery was also surveyed in 2004 but the sample response was insufficient for reliable estimates to be made.

Detailed information on business performance has been collected each year since the early 1990s and is published in an ongoing series of fisheries survey reports, as outlined at the end of this report.

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

ABARE's fisheries surveys provide estimates of net returns to Commonwealth fisheries which can be used to examine the returns from fisheries to the economy as a whole, within the policy constraints of safeguarding sustainability and biodiversity. In addition, this report contains assessments of AFMA's performance against pursuing their economic efficiency objective for each surveyed fishery.

BRIAN S. FISHER
Executive Director

August 2005

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 is also greatly appreciated.

Management and research agencies

The Australian Fisheries Management Authority (AFMA) provided the logbook information necessary to select a sample as well as information on fishery management costs. In particular, Thim Skousen and Andrew Kettle provided valuable assistance. Comments on the report were also provided by Andrew McNee, Andrew Benton and Trent Timmis from AFMA.

ABARE staff

David Galeano and Paul Newton of the Fisheries Economics Section undertook the analyses and compiled the report. Sample design and estimation was undertaken by Walter Shafron and Caroline Levantis of the Survey Data Analysis Section. Data were collected, entered and edited by Ron Godenzi, Richard Paton, Lou Sissian, Robin Stafford and David Galeano. Tony Wain, Bruce McConnell and Paul Phillips carried out survey administration and questionnaire design. Programming and computer systems support was provided by Mark Neilson and Ken Colbert. Leanna Tedesco, Peter Gooday and Kevin Burns provided comments on the report.

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introduction

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 two years. Every time a fishery is surveyed, data for two financial years are collected, with the aim being to develop a consistent time series of economic information for each fishery. This survey database, in conjunction with scientific assessments, is vital for assessing the economic performance of each fishery.

ABARE surveyed three fisheries in 2004 — the eastern tuna and billfish fishery, the gillnet, hook and trap fishery and the southern squid jig fishery. Information was collected for the 2001-02 and 2002-03 financial years. Based on this information, estimates have been calculated for the financial and economic performance of the eastern tuna and billfish fishery and the gillnet, hook and trap fishery. However, in the southern squid jig fishery, an insufficient number of operators were willing or able to participate in the survey for both financial years. Therefore, this report does not present results for that fishery.

The latest survey results for other surveyed fisheries can be found in previous reports — these are listed at the end of this report.

eastern tuna and billfish fishery – longline fleet only

- The gross value of production in real terms (2004-05 dollars) of the eastern tuna and billfish fishery reached a record $85 million in 2001-02, before falling to $71 million in 2002-03 and below $48 million in 2003-04.
- As a result of lower receipts and higher cash costs, the average per boat cash income was estimated as –$22 000 per boat in 2002-03. This compares with an average of $62 000 per boat in 2001-02.
- Real net returns (including management costs) were estimated to have fallen significantly — from $2.4 million in 2000-01 to –$2.1 million in 2001-02 and –$18 million in 2002-03.

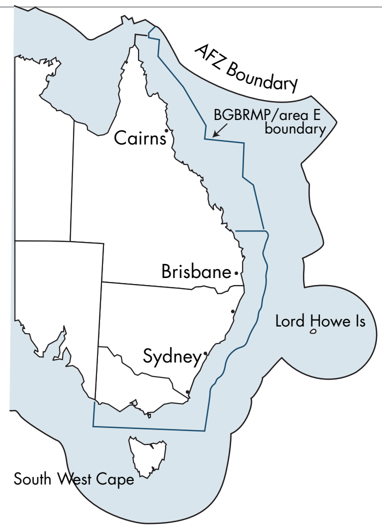
The fishery

The eastern tuna and billfish fishery, while managed as a single fishery, is a complex fishery involving multiple species and fishing methods (longline, minor line, purse seine and pole). The fishery extends to the limit of the 200 nautical mile Australian Fishing Zone from the tip of Cape York to the southernmost point of the Australian Fishing Zone to the South Australian – Victorian border (figure A). The fishery also encompasses waters around Lord Howe Island. No tuna fishing is permitted inside the Great Barrier Reef Marine Park (GBRMP) without a permit from the GBRMP Authority. Major ports used by the fleet include Cairns, Mooloolaba, Coffs Harbour and Hobart.

As at June 2003, there were 305 fishing permits in the fishery, while at June 2002, there were 312 fishing permits.

In recent years there have been minimal catches recorded in the purse seine and pole sectors. The activities of these sectors are now managed separately under management arrangements for the eastern skipjack fishery.

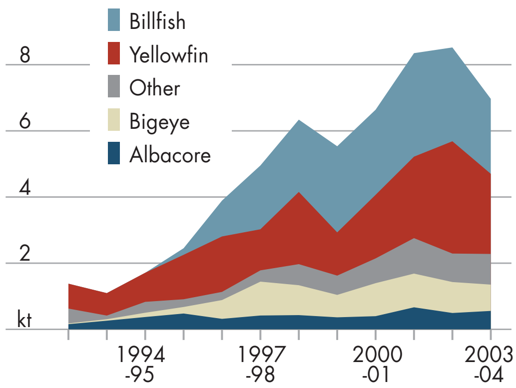
A Eastern tuna and billfish fishery management areas



Species landed

The principal species landed are yellowfin tuna, bigeye tuna, albacore tuna and broadbill swordfish (figure B). However, many other species are caught as byproducts, such as striped marlin, pelagic sharks, longtail tuna, rudder fish, black oilfish, dolpinfish, rays bream, moonfish and wahoo. Incidental catches of blue and black marlin occur, but these must be returned to the sea under a legislative amendment that came into effect in July 1998, in recognition that these species are the key target species of the game fishing sector.

B **Landed catch** Eastern tuna and billfish fishery, longline and minorline

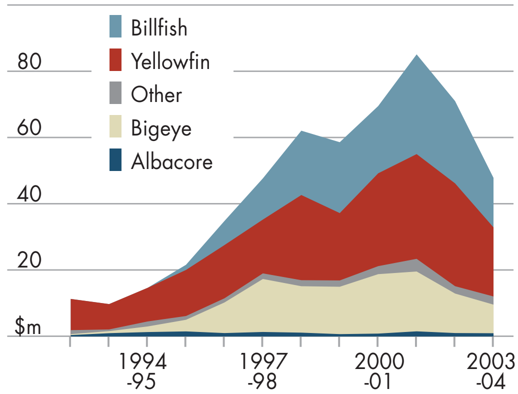


Value of catch and exports

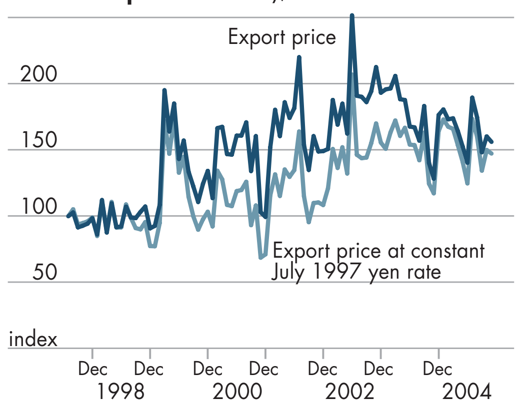
The real gross value of production of the longline and minor line sectors in 2003-04 was $47.9 million, down from $71.1 million in 2002-03 (figure C). This was caused by an 18 per cent fall in the landed catch and lower prices. Over 99 per cent of the landed catch in the fishery is caught by longliners. Consequently, this economic survey is of the longline fleet only.

Much of the yellowfin tuna and bigeye tuna caught in the fishery is exported to Japan. Much of the billfish catch is exported to the United States. Consequently, changes in exchange rates can have a marked impact on the price received by fishers. Figure D shows that between July 1997 and November 2000, the depreciation of the Australian dollar relative to the yen increased the prices received by fishers, compared with what would have been achieved if the exchange rate had stayed constant at the July 1997 rate. However, since November 2000, the Australian dollar relative to the Japanese yen has appreciated steadily to the point where in November 2004, actual prices received were just above what they would have been if the exchange rate had stayed constant at the July 1997 rate.

C **Real gross value of production** Eastern tuna and billfish fishery, longline and minorline



D **Impact of exchange rates on yellowfin tuna prices** Monthly, ended November 2004



Biological status of the fishery

Yellowfin tuna

Yellowfin tuna inhabit tropical and subtropical waters where the temperature is greater than 15°C and spawn in waters north of Coffs Harbour where the surface temperature is greater than 26°C. They are fast growing, reaching maturity at about two years of age and can grow to over 100 kilograms, although the average dressed weight of yellowfin tuna caught by Australian longliners is around 30 kilograms (Caton and McLoughlin 2004).

Two semi-independent stocks of yellowfin tuna are thought to exist in the Western and Central Pacific Ocean and there may be further substructuring within them. Tagging studies indicate that yellowfin tuna move between the eastern tuna and billfish fishery and the Western and Central Pacific Ocean. However, even after prolonged periods, many tagged yellowfin tuna are recovered in areas where they were tagged.

According to Caton (2003), the status of yellowfin tuna in the eastern tuna and billfish fishery is uncertain, but fully fished in the Western Central Pacific. Poor recruitment in recent years may have influenced the availability of yellowfin tuna to the fishery, but may also reflect changes in line setting practices associated with the increased focus on swordfish and bigeye tuna (Caton and McLoughlin 2004). Uncertainty remains about whether purse seine catches in the wider Western and Central Pacific Ocean affect longline catches in the eastern tuna and billfish fishery. Nevertheless, localised depletions cannot be ruled out as a possible cause of poor recruitment in recent years (Caton 2002).

Bigeye tuna

Bigeye tuna are slower growing than yellowfin tuna. They mature at about three years of age and can reach 2 metres in length and 180 kilograms when eight years or older. The average bigeye tuna caught by Australian longliners weighs around 35 kilograms.

Overall, overfishing of bigeye tuna stocks is occurring in the Western Central Pacific and Eastern Pacific Ocean, but the stock is not yet overfished (Caton and McLoughlin 2004). Catch of bigeye tuna in the Western Central Pacific Ocean has been increasing with the expansion of purse seining and record catches by longliners. In the Eastern Pacific Ocean, purse seine catches have been increasing while longline catches have been steadily declining. The Secretariat of the Pacific Community presented results in 2003 that indicate recent fishing mortality rates have exceeded recruitment and overfishing is occurring (Caton and McLoughlin 2004).

While the origin of bigeye tuna recruits in the Australian Fishing Zone is unclear, it is unlikely that bigeye tuna caught in the eastern tuna and billfish fishery are a separate stock, but there could be some isolation from the broader Western Central Pacific Ocean (Caton and McLoughlin 2004). Catch rates of bigeye tuna in the eastern tuna and billfish fishery have fluctuated, but the cause of the decline in catch rate between 1997 and 2000 may have reflected localised depletions (Caton and McLoughlin 2004).

Broadbill swordfish

Swordfish can grow to over 550 kilograms and reach sexual maturity between two and four years of age. They have a high reproductive capacity and spawn broadly across the Pacific, including the tropical waters of the eastern tuna and billfish fishery where the sea surface temperature exceeds 24°C (Caton 2002).

Similar to bigeye tuna and yellowfin tuna, swordfish have a Pacific-wide distribution. Recent genetic studies indicate that there may be several semi-independent stocks, but the amount of mixing among these stocks is unknown.

There is no quantitative assessment of the South Western Pacific stock, so the status of stocks harvested in the eastern tuna and billfish fishery is uncertain. However, there are strong indications of localised depletions around seamounts off southern Queensland (Caton and McLoughlin 2004).

Marlins

Striped marlin, blue marlin and black marlin are distributed throughout the tropical and subtropical waters of the Pacific Ocean. The evidence on the structure of stocks of these three species is relatively unclear, with some evidence suggesting that black and blue marlins have a single genetic stock while striped marlin form several semi-independent stocks in the Pacific Ocean.

Legislation requires the release of blue and black marlin caught by commercial operators. However, mortality of hooked blue and black marlins by longliners is estimated at around 30 per cent (Caton and McLoughlin 2004). The stock status of striped marlin in the eastern tuna and billfish fishery as well as the wider Pacific Ocean is uncertain, with no reliable stock assessment available (Caton 2003).

Management of the fishery

The eastern tuna and billfish fishery incorporates both commercial and recreational fishing activities. The commercial sector of the fishery is managed by both Commonwealth and state governments. Under Offshore Constitutional Settlement agreements, the Australian Government manages the commercial sector, including the major tuna and billfish species. The small tuna and tuna-like species generally found on the continental shelf are managed by the states. The recreational fishing sector is also managed by state authorities.

Currently, the commercial fishery is managed using input controls that include limited entry, zoning, boat restrictions, bycatch provisions and gear restrictions. Longline endorsements relate to specific areas of access, with a total of seven categories of endorsements issued. Vessels fishing within 50 nautical miles of the coast are subject to a maximum size of 32.67 metres. Further, vessels fishing in the southern part of the fishery are required to hold minimum amounts of southern bluefin tuna quota at certain times of the year (generally June–November). In 2005, a minimum quota holding of 2000 kilograms is required for the core zone and 500 kilograms for the buffer zone. The boundaries for core and buffer zones vary within a season, but the restrictions typically apply south of a particular location between Coffs Harbour and Eden. Vessels fishing at these times of the year are required to have an AFMA observer on board 100 per cent of the time in the core zone and 25 per cent of the time in the buffer zone.

In 2003, AFMA released a draft management plan for public comment, which was approved by the AFMA board in May 2005. While the proposal does not change the boundaries of the fishery, all zones, except the current zone E, will be removed. The current zone E will be renamed the Coral Sea Zone. To fish in this area, fishers will need an additional permit. It is also proposed under the draft plan that effort be controlled by restricting the number of hooks that can be set in the fishery. Each operator will be allocated individual transferable effort (ITE) units from a total allowable effort (TAE) for the fishery. Under the proposed management plan, the allocation that each operator receives depends on the level of their past fishing activities in the fishery.

It is expected that effort units will be transferable both permanently and temporarily. Some provision will likely be made for a proportion of unused quota in a given season to be transferred to the next. Likewise, an operator may be able to use more than their allocated effort units in a particular season by debiting their entitlement for the following year.

Two methods may be used to monitor the operator's effort once an ITE has been allocated. The first is known as the clip nomination method. This requires the operator to inform AFMA in writing of the number of branchline clips that will be used per longline operation. Drum monitoring equipment installed on the vessel will then inform AFMA that a set has been shot, and a corresponding number of hooks are deducted from the fisher's allocation. Under the proposed plan it is an offence to leave port with more than the nominated number of branchline clips on the vessel.

The second method is known as the clip monitoring method. This requires the operator to install approved clip monitoring equipment that counts the number of hooks used in a fishing operation. This amount is then deducted from the fisher's allocation. Under both methods, it is the operator's responsibility to ensure that monitoring equipment is working correctly. Operators will also be required to fit a vessel monitoring system (VMS) that allows AFMA to track the location of fishing operations. This is particularly important because the final management plan is likely to include a formula for deducting more or less than one effort unit depending on where in the fishery a boat operates.

Minorline statutory fishing rights will also be introduced, defining the maximum number of lines that may be used at any one time in the fishery.

Pending the development of their own skipjack specific management plan, operators in the purse seine sector will be allocated a fishing permit.

Boats surveyed

For the purpose of the survey, the target population was defined as longline endorsed eastern tuna and billfish boats, with a catch of greater than 1 tonne of tuna and/or billfish in the survey years. In 2002-03 the population was 134 vessels, of which 44 were sampled, and in 2001-02 the population was 141 vessels, of which 32 were sampled.

Financial performance of the fishery

Key measures of the financial performance of the fleet are contained in table 1. Definitions of items contained in table 1 are included in 'Survey methods and definitions.'

Average per boat total cash receipts fell by around 13 per cent in 2002-03 to around $559 000 per boat (table 1). This is despite slightly higher landings in the fishery. With the appreciation of the Australian dollar, the prices received by fishers fell.

Total boat cash costs were estimated to have risen slightly between 2001-02 and 2002-03 to an average of almost $582 000 per boat. In particular, the average fuel expenditure per boat increased by around 27 per cent to over $93 000 per boat. Together, labor, fuel and repairs and maintenance accounted for 63 per cent of total cash costs in 2002-03.

As a result of lower receipts and higher cash costs in 2002-03, average cash income in the fishery was estimated to be –$22 000 per boat in 2002-03. This compares with an average

1 Financial performance of boats in the eastern tuna and billfish fishery
Average per boat

		2001-02		2002-03	
Tuna and billfish receipts	$	572 937	(8)	497 492	(5)
Other fishing receipts	$	39 148	(23)	23 394	(14)
Nonfishing receipts	$	27 585	(25)	38 239	(12)
Total cash receipts	$	639 670	(8)	559 125	(5)
Administration	$	16 472	(11)	21 134	(10)
Bait	$	44 405	(15)	42 360	(10)
Labor costs	$	197 210	(10)	170 596	(4)
Freight and marketing	$	42 156	(19)	40 857	(15)
Fuel	$	73 438	(12)	93 480	(8)
Insurance	$	20 567	(11)	20 549	(7)
Interest paid	$	13 054	(20)	17 759	(17)
Leasing	$	7 641	(26)	8 467	(17)
Licence fees and levies	$	17 137	(12)	17 628	(7)
Repairs and maintenance	$	93 676	(10)	99 575	(7)
Other costs	$	51 720	(18)	49 099	(9)
Total cash costs	$	577 475	(9)	581 503	(5)
Boat cash income	$	62 195	(31)	–22 378	(59)
less depreciation **a**	$	42 575	(15)	50 637	(11)
Boat business profit	$	19 620	(99)	–73 016	(20)
plus interest, leasing and rent	$	21 140	(15)	26 586	(12)
Profit at full equity	$	40 760	(44)	–46 429	(28)
Capital					
– excluding quota and licences	$	648 905	(11)	790 464	(6)
– including quota and licences	$	na	na	1 391 145	(4)
Rate of return to boat capital **b**	%	6.3	(49)	–5.9	(27)
Rate of return to full equity **c**	%	na	na	–3.3	(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'.

of $62 000 per boat in 2001-02. Boat business profit and profit at full equity were also estimated to be significantly lower in 2002-03. On average, it is estimated that boats in the fishery made substantial losses in 2002-03.

Economic performance of the fishery

While the results presented in table 1 show changes in the average receipts and costs per boat in the eastern tuna and billfish fishery, they shed little light on the economic performance of the whole fishery. In this section, some economic performance indicators for the eastern tuna and billfish fishery are outlined, followed by an assessment of AFMA's proposed management arrangements for the fishery.

Table 2 shows receipts, operating costs, noncash costs and net returns for the eastern tuna and billfish fishery for the period 1993-94 to 2002-03. Following a significant increase in fishing effort, receipts from the fishery rose substantially from $11.2 million in 1993-94 to $93.2 million in 2001-02 before falling to $74.3 million in 2002-03.

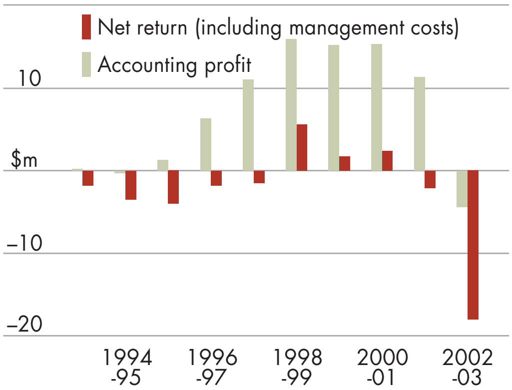
Associated with the increased fishing effort and receipts, operating costs (including interest and leasing charges) also rose substantially from $11.0 million in 1993-94 to $81.9 million in 2001-02. While receipts fell by around $19 million between 2001-02 and 2002-03, operating costs fell by only $3.2 million. This at least in part reflects higher fuel costs.

Accounting profit, which is receipts less operating costs, fell substantially from $11.3 million in 2001-02 to –$4.4 million in 2002-03. Accounting profit for the period 1993-94 to 2001-02 averaged around $8.5 million a year, with a peak in 1998-99 of $15.9 million.

While accounting 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 three costs are included and interest and leasing charges are added back in, as these items represent some profits that have been redistributed to other investors in the fishery. Management charges are also added, as management costs collected as a part of the surveys only represent industry's contribution. Deducting these management costs allows for total management costs, both industry recoverable and nonrecoverable management costs, to be subsequently included as a cost.

Once these adjustments have been made, net returns (including management costs) are low, and in many years negative. Net returns (including management costs) averaged -$0.6 million between 1993-94 and 2001-02 (table 2). Figure E shows net return

E **Net returns and accounting profit**
Eastern tuna and billfish fishery



2 Economic return in the eastern tuna and billfish fishery

Total for fishery in 2004-05 dollars

	1993-94		1994-95		1995-96		1996-97		1997-98	
	no.		no.		no.		no.		no.	
Number of active vessels	35		49		69		99.0		123	
	$m		$m		$m		$m		$m	
Receipts										
Fishing income	11.2	(26)	16.2	(14)	22.4	(10)	42.1	(12)	62.3	(16)
Cash costs										
Operating costs	11.0	(27)	16.5	(14)	21.0	(10)	35.8	(14)	51.3	(11)
Accounting profit	0.2	(215)	–0.3	(214)	1.3	(42)	6.3	(17)	11.0	(44)
Noncash costs										
Owner and family labor	1.2	(19)	1.2	(13)	2.7	(19)	5.2	(12)	8.7	(12)
Opportunity cost of capital	0.9	(23)	1.1	(14)	1.6	(20)	2.0	(19)	3.7	(23)
Depreciation	1.3	(23)	1.9	(14)	2.4	(19)	3.3	(18)	5.7	(22)
plus interest, leasing and management fees	1.3	(31)	2.1	(17)	2.3	(13)	3.3	(12)	6.6	(10)
Net return (excluding management costs)	–1.8	(30)	–2.4	(22)	–3.1	(32)	–1.0	(105)	–0.6	(859)
Management costs	na	na	1.1	na	1.0	na	0.8	na	0.9	na
Net return (including management costs)	–1.8	na	–3.5	na	–4.0	na	–1.8	na	–1.5	na
Total capital value	12.2	(23)	16.0	(14)	22.8	(20)	28.6	(19)	53.1	(23)

	1998-99		1999-2000		2000-01		2001-02		2002-03	
	no.		no.		no.		no.		no.	
Number of active vessels	129		143		125		141		134	
	$m		$m		$m		$m		$m	
Receipts										
Fishing income	82.2	(8)	77.2	(11)	85.7	(8)	93.2	(7)	74.3	(5)
Cash costs										
Operating costs	66.3	(9)	62.0	(11)	70.5	(7)	81.9	(9)	78.7	(5)
Accounting profit	15.9	(33)	15.2	(21)	15.3	(22)	11.3	(25)	–4.4	(50)
Noncash costs										
Owner and family labor	9.6	(13)	9.3	(19)	10.7	(11)	6.1	(19)	4.2	(14)
Opportunity cost of capital	4.5	(19)	4.1	(22)	4.0	(12)	4.5	(15)	5.0	(8)
Depreciation	7.7	(19)	6.3	(22)	6.8	(12)	6.5	(15)	8.0	(8)
plus interest, leasing and management fees	12.7	(21)	7.4	(17)	9.9	(13)	5.8	(11)	6.2	(7)
Net return (excluding management costs)	6.7	(77)	3.0	(94)	3.8	(94)	0.1	(307)	–15.4	(14)
Management costs	1.2	na	1.3	na	1.3	na	2.2	na	2.7	na
Net return (including management costs)	5.6	na	1.7	na	2.4	na	–2.1	na	–18.0	na
Total capital value	63.6	(19)	59.2	(22)	56.8	(12)	63.8	(15)	70.8	(8)

na Not applicable.
Note: Figures in parentheses are relative standard errors. A guide to interpreting these is included in 'Survey methods and definitions'.

and accounting profit for the fishery over the ten year period. It shows that in 2002-03, both net returns and accounting profit fell substantially, driven at least in part by the large fall in fishing receipts and higher fuel costs. It is important to note that factors outside the control of fishery management influence the net returns of a fishery. For example, the appreciation of the Australian dollar and its impact on the prices received by fishers.

From table 2 and figure E it can be seen that, while accounting profits have been positive in most years, net returns have been low. The estimated negative net return in 2002-03 of –$18 million is not likely to continue in the long run. Such a result is feasible in the short run, however, as operators only need to cover variable costs such as fuel and crew costs to justify continued operation in the fishery. In the longer term, operators will require a return on their capital and labor invested in the fishery, otherwise they will leave the fishery and invest their labor and capital elsewhere.

It is important to note that if net returns are estimated at zero, fishers are covering all operating costs, depreciation expense, the opportunity cost of owner and family labor and the opportunity cost of capital. However, at this point, no return is being generated for the use of the fish stock as an input. AFMA's economic efficiency objective is to maximise the long run net returns generated from a fishery, not maximise accounting profit.

There are two possible explanations for the low net returns estimated for the fishery. First, it could be that the fishery is being managed optimally and the estimated net returns are the highest possible. Second, it could be that changes to the management arrangements in the fishery could improve net returns.

The low net returns for the fishery might have been expected given the management arrangements under which the fishery operates. A large body of latent effort exists in the fishery, as some operators do not use their pelagic longline entitlements and many operators fish relatively few days in the fishery (table 3). This implies that any above average profits could be

3 Active and latent permits in the eastern tuna and billfish fishery – longline

	Permits	Active vessels a	Average days fished per vessel	Total number of sets in the fishery	Total number of hooks set in the fishery
	no.	no.	no.	no.	no.
1994	202	88	45	3 988	2 770 504
1995	227	104	48	5 058	3 835 832
1996	229	121	50	6 252	4 554 198
1997	217	138	60	8 759	6 283 416
1998	222	151	73	11 428	9 711 867
1999	220	152	74	11 548	10 282 040
2000	220	142	75	11 050	9 551 772
2001	220	140	87	12 545	11 284 560
2002	220	143	88	12 860	11 919 050
2003	220	135	95	13 227	12 749 670
2004	na	122	84	10 525	9 905 180

a Those that returned a logbook. **na** Not available.
Sources: Caton (2002); Campbell and Hartog (2005); D. Bromhead, BRS, personal communication, January 2005.

competed away relatively quickly with the activation of previously latent effort. The reason for this is that latent permit holders would activate their permit when profitable conditions arise in the fishery. The result of this would be increased fishing costs and reduced profits. Until a management arrangement is implemented that effectively constrains fishing effort, it is unlikely that the larger positive net returns, such as those estimated for 1998-99, could be generated and sustained.

Proposed management changes

AFMA's proposed management arrangement is a system of individual transferable effort (ITE) units that limit total allowable effort (TAE) by restricting the number of branchline clips (hooks) allowed to be set in the fishery. This system has the potential to constrain fishing effort to a greater degree than the current management arrangements of limited entry and zone restrictions. However, a major concern with input controls (such as ITEs) is that the fishery manager does not have direct control over the total catch in the fishery, or the species composition of that catch. Effectively, the manager has to set a total allowable catch and then determine the number of hooks required in the fishery to achieve that level of catch.

Input control regimes provide fishers with an incentive to find new ways to fish within the rules. To maintain their share of the total catch, fishers will substitute unrestricted inputs for the restricted input in an attempt to increase their relative fishing power. In addition, the fishing power of individual vessels can be expected to rise as fishing gear and techniques become more efficient and operators' knowledge about the fishery improves. While fishers may become better at catching fish, they are forced to use a combination of inputs that do not necessarily minimise costs for the level of catch. These higher costs mean that net returns are not maximised and increased pressure on the fish stocks is also likely.

Where effort creep occurs, it is likely that input controls will need to be tightened frequently to ensure that fishing mortality is in line with management targets. As Rose (2002) explains, each set of rule changes can be expensive as they generally make some boats and gear redundant. As well, the process of researching, designing and negotiating changes in management regimes can be costly for both fishers and managers. In estimating the long run net returns to the fishery, both sets of periodic costs — those of research and negotiation and those of reinvestment — should be set against any apparent net returns in the years between changes in management regime.

Another potential problem associated with ITEs is that, without additional controls, they provide little management control of effort directed at any particular target species. In a multispecies fishery where a degree of targeting is possible, such as the eastern tuna and billfish fishery, fishers will direct their effort at the species and locations that maximise profits. As such, a number of factors may lead to changes in targeting behavior. For example, changes in the relative prices of target species, changes in relative abundance (perhaps as a result of environmental factors) and changes in catchability (perhaps as a result of a change in fishing technology) can be expected to affect the proportion of effort directed at each of the major species.

A major challenge in implementing an ITE based management regime that is efficient and sustainable in the eastern tuna and billfish fishery will be to provide an adequate degree of control over catches of target species without substantially restricting the potential for industry development. It seems that other input controls, in addition to the ITE measures that have been proposed, will be required to achieve this.

The potential for localised depletion of major target species is a major management challenge in the fishery. If stocks in the eastern tuna and billfish fishery are prone to localised depletion then this implies that, depending on their cost, some form of area based restrictions will be required to ensure economic efficiency.

Detailed analysis of the relative costs and benefits of alternative management arrangements in the eastern tuna and billfish fishery has not been undertaken. However, the obvious alternative to ITE management would be a system of individual transferable quotas (ITQs) and a total allowable catch. This form of management would avoid the problems associated with effort creep and changes in targeting practices. However, ITQs have other potential problems. The potential for ITQs to encourage discarding and difficulties in setting an optimal total allowable catch in fisheries with unpredictable abundance have been recognised (Rose 2002). The problems that result if stocks in the eastern tuna and billfish fishery are prone to localised depletions are common to ITEs and ITQs, but perhaps less so under ITQs if the total allowable catch is set appropriately. However, it is likely that some form of area based management would also be required in addition to ITQs to ensure economic efficiency.

It is not clear that the problems associated with implementing ITQs would result in the net benefits of ITQ management being outweighed by those of ITE management in the eastern tuna and billfish fishery. In comparing the net benefits of ITEs and ITQs it is important that the full costs associated with each regime are accounted for. For example, the periodic costs involved in the development of new sets of rules under an ITE controlled fishery to correct for effort creep must be taken into account. Similarly, the potential loss of profitable opportunities under an ITQ regime in years of high abundance needs to be considered. Detailed analysis of the relative costs and benefits of management alternatives is required for the efficient management of the fishery in the longer term.

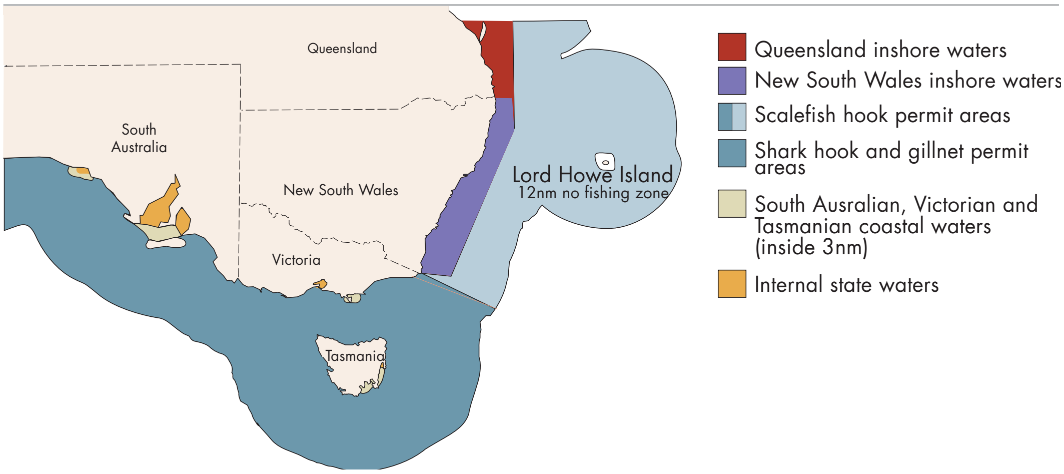
gillnet hook and trap fishery

- The gross value of production in real terms (2004-05 dollars) of the gillnet, hook and trap fishery has been steadily increasing since 1999-2000, reaching $24 million in 2003-04.
- Average boat cash income in the fishery remained stable over the two years 20001-02 and 2002-03. In 2002-03 it is estimated to have been around $59 000 per boat.
- Real net returns (including management costs) have fluctuated around zero since 1998-99. In 2001-02 they were an estimated –$0.2 million and in 2002-03 $0.4 million.

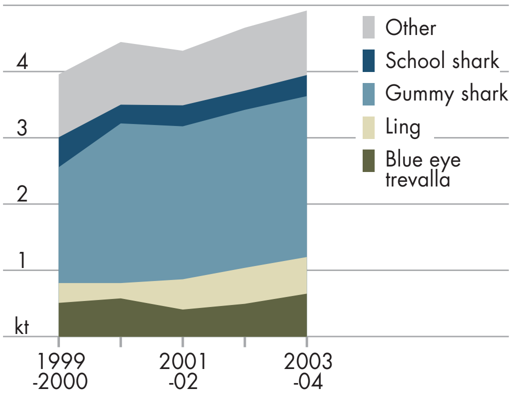
The fishery

The gillnet, hook and trap fishery was formed after the southern shark and south east nontrawl fisheries management arrangements were merged in the beginning of the 2003 fishing season. Since then, the gillnet, hook and trap fishery has merged with the south east trawl and Great Australian Bight trawl fisheries and is now a separate sector under this new southern and eastern scalefish and shark fishery. The management area for the gillnet, hook and trap sector includes waters in the Australian Fishing Zone (AFZ) off South Australia, Victoria and Tasmania (figure F). It extends to waters off New South Wales and into southern Queensland as far as Sandy Cape, but in these states begins at the 4000

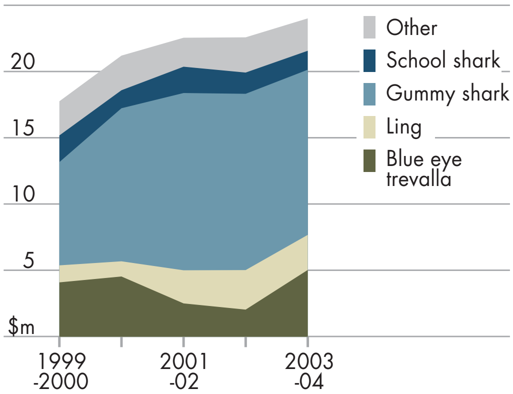
F **Gillnet, hook and trap fishery**



G **Landed catch**
Gillnet, hook and trap fishery



H **Real gross value of production**
Gillnet, hook and trap fishery



metre depth contour (approximately 60–80 nautical miles off the coast). Waters around Lord Howe Island are also included, although a 12 nautical miles exclusion zone encircles the island. Tasmania controls catches of blue warehou and certain other species in its state waters. Operators use a range of methods to catch a variety of species, the majority of which is destined for the domestic market.

Within the gillnet hook and trap sector of the southern and eastern scalefish and shark fishery (SESSF), there are several discreet concessions allowing the use of certain gears or certain areas of waters. These are the scalefish hook, shark hook, trap, gillnet and inside 3 nautical miles sectors. On 30 June 2003, there were 426 fishing permits in the gillnet hook and trap fishery.

Catches of gummy shark represented almost half of fishery production in 2003-04 (figure G). Blue eye trevalla and pink ling were the principal scalefish species landed, together representing approximately a quarter of production. School shark and saw shark each accounted for approximately 6 per cent of the catch. Other common landings include elephant fish, ocean perch, spotted warehou, blue grenadier, gemfish and jackass morwong.

The real gross value of production has increased steadily over the past five years in line with increased landings (figure H).

Biological status of the fishery

Blue eye trevalla

Blue eye trevalla reach an age of forty years or more and a length of 120 centimetres and are found mostly in depths of 300–550 metres. A genetic study indicates a common Australian stock, which range from mid New South Wales to south western Western Australia. Catches have tended to be comprised of young, immature fish, while larger mature fish become vulnerable to line fishing when forming seasonal spawning aggregations. The biological status of blue eye trevalla is classified as not overfished, but localised overfishing may be occurring (Caton and McLoughlin 2004).

Ling

Ling are thought to attain a maximum age of about thirty years and length of 130 centimetres, reach maturity at five to seven years of age and are commonly caught in waters 300–550 metres deep. While ling are located between central New South Wales and southern Western Australian and a common stock is assumed for management purposes, it is believed that fish caught in the fishery may not form part of a single Australian stock.

The status of ling is not overfished west of Bass Strait, but overfishing is probably occurring east of Bass Strait. The 2003 pink ling workshop and subsequent CSIRO assessment estimated the sustainable catch to be around 1200 tonnes (Caton and McLoughlin 2004), well below the 1800 tonne TAC in 2004 and 1400 tonne TAC in 2005.

Gummy shark

Gummy sharks live for around sixteen years, with females maturing at about five years of age. Depending on their size they can carry from 1 to 38 young at a time.

Gummy sharks are endemic to the waters of the continental shelf and slope off southern Australia. They show no well defined movement patterns and are thought to mix less between regions of Australia than school shark.

An updated assessment of gummy shark stocks in 2000 indicated that recruitment had been fairly stable over the past thirty years (Caton 2003). Gummy shark are classified as not overfished (Caton and McLoughlin 2004).

School shark

School sharks can live for more than fifty years, with females maturing at around eight to ten years of age. Each female will bear on average between 15 and 43 young. School sharks move extensively throughout the waters of Southern Australia, probably forming a single genetic stock within the fishery and Western Australian waters (Caton 2002). School sharks are also found around New Zealand, western Europe, the east coast of South America and southern Africa. While there is some evidence of interaction between Australian and New Zealand sharks, significant genetic differences have been found between these stocks.

The status of school shark stocks is overfished. The management target is to rebuild the mature biomass by 2011 to above 1996 levels (with 80 per cent probability). However, a recent assessment indicated that this was unlikely to be reached with the planned quota levels, so the TAC schedule was subsequently revised (Caton and McLoughlin 2004).

Management of the fishery

Output controls are the principal method by which the southern and eastern scalefish and shark fishery is managed. Global total allowable catches (TACs) have been determined for thirty species/species groups for the 2005 season. For twenty species, these have been allocated in the form of quota statutory fishing rights (quota SFRs). For the remaining ten species, they have been allocated as individual transferable quotas (ITQs). In addition to holding quota, to be able to fish in particular areas using particular methods, a fisher must also hold the relevant boat statutory fishing right (SFR) or fishing permit that specifies the area and methods that may be used. Table 4 shows the different boat SFRs and fishing permits that have been issued in the southern and eastern scalefish and shark fishery. The boat SFRs and fishing permits in the left hand column of table 4 are relevant to the gillnet, hook and trap sector of the southern and eastern scalefish and shark fishery.

Scalefish quota (quota SFRs or ITQs) may be permanently transferred between operators in the southern and eastern scalefish and shark fishery, although fish caught against quota must be taken in the area and with the method specified on the fisher's permit. Quota for all scalefish species may be seasonally leased except for blue eye trevalla where only 10 per cent of the TAC may be seasonally leased from the scalefish hook sector to the trawl sector on a first come first served basis.

Although seasonal leasing of shark quota is permitted, only whole package permanent transfers (quota and associated fishing permit) are currently allowed. This restriction has been in place since 2001 and will continue until the current legal challenges to the shark quota allocation formula are resolved.

The southern and eastern scalefish and shark fishery quota system allows operators to transfer some percentage (zero per cent in some cases) of any quota not harvested in one season to the next (referred to as undercatch). Similarly overcatch of a quota holder's entitlement is permitted and the overcatch is debited off the following season quota (table 5). In addition to the percentage overcatch allowed that is deducted from the following season's holding on a one for one basis, an additional amount is permitted to be overcaught (determined amount). This amount is deducted from the following season's entitlement on a two for one basis. Any catch in excess of the determined amount needs to be covered with quota or the fisher will risk prosecution.

Prior to January 1998, the former south east nontrawl fishery was managed exclusively by gear and area restrictions. However, the ineffectiveness of these input controls was evident by increased catches of many species, particularly blue eye trevalla, in the years leading up to 1998 (AFMA 1999). Prior to 2001, the former southern shark fishery was also managed by input controls, such as limited entry and restricted mesh size. Both the southern shark and south east nontrawl fisheries had implemented an ITQ system prior to the merger, although some input restrictions remained.

4 Boat statutory fishing rights and permits in the southern and eastern scalefish and shark fishery

Scalefish hook boat SFR	East coast deepwater permit
Shark hook boat SFR	Commonwealth trawl boat SFR
Trap permit	Great Australian Bight trawl boat SFR
Coastal waters permit	Victorian inshore trawl permit
Gillnet boat SFR	

Source: AFMA (2004).

Similarly, some input and area restrictions prevail in the gillnet, hook and trap sector of the southern and eastern scalefish and shark fishery. These include limited entry, restrictions on certain methods as well as spatial management. Scalefish can be taken by hook using only demersal longline, dropline, trotline or handline methods.

The adoption and use of auto-longlining equipment is also restricted to fifteen concession holders, and only two systems have been approved by AFMA. Operators may fish a maximum of 15 000 hooks (racked up in magazines on the vessel at any one time) in waters at least 100 fathoms deep, and their vessels must carry a vessel monitoring system (VMS) which allows AFMA to trace areas fished. Additional area restrictions and trip limits also apply for school and gummy shark. Bird-scaring tori lines must also be fitted to auto-

5 Global TACs and permitted undercatch/overcatch for quota species in 2005

Quota species	Global TAC	Overcatch	Undercatch a	Determined amount a
	t	%	%	kg
Blue eye trevalla	621	10	10	500
Blue grenadier	5 000	10	0	500
Blue warehou	300	10	10	500
Flathead	3 150	10	0	500
Gemfish east	100	10	0	500
Gemfish west	300	10	10	500
Jackass morwong	960	10	10	500
John dory	240	10	10	500
Ling	1 400	10	0	500
Mirror dory	700	10	10	500
Ocean perch	500	10	10	500
Orange roughy east	720 + 100t for research	10	10	500
Orange roughy south	100 + 10t for research	10	0	500
Orange roughy west	450	10	0	400
Orange roughy Cascade Plateau	1300 + 100t for research	10	0	500
Redfish	1 300	10	0	500
Royal red prawn	500	10	10	500
School whiting	1 500	10	10	500
Silver trevally	320	10	10	500
Spotted warehou	4 400	10	10	500
School shark	275	0	0	0
Gummy shark	1 800	0	0	0
Elephant fish family	130	0	0	0
Sawshark	434.4	0	0	0
Oreos	200	0	0	0
Ribaldo	100	0	0	0
Smooth dory – Cascade	100	0	0	0
Smooth dory	50	0	0	0
Deepwater sharks – east	92	0	0	0
Deepwater sharks – west	108	0	0	0

a Undercatch and determined amounts set at zero allow for the allocation of quota statutory fishing rights for these species in 2006.
Source: AFMA (2004).

longlining vessels and all interactions with seabirds must be reported. Assessment of the impact of auto-longlining on seabirds is considered important, so approximately 25 per cent of trips must carry an authorised observer at the operator's expense.

Gillnets are excluded from use in waters below latitude 41 degrees south in depths greater than 200 metres. Gillnet mesh must be greater than or equal to 15 centimetres in width with a diagonal length of less than or equal to 16.5 centimetres.

Murat Bay in South Australian waters is closed to the use of nets, and hooks cannot be set in the Cascade Plateau area. Fishers must apply to catch quota species outside the Australian Fishing Zone and in the Great Australian Bight Marine Park outside of the seasonal closure between May and October each year.

Boats surveyed

For the purpose of the surveys, the population was defined as boats that caught fish in the gillnet, hook and trap fishery in 2002-03. Based on the type of fishing method employed, the fleet was divided into two groups:

- gillnet boats
- nongillnet boats (includes longline, dropline and traps).

For the entire fishery in 2002-03, the population was 131 vessels, of which 28 were sampled. In that year 17 of 78 gillnet boats were sampled and 11 of 53 nongillnet boats were sampled. In 2001-02, the population for the entire fishery was 127 vessels, of which 23 were sampled and in that year 14 of 80 gillnet boats were sampled and 9 of 47 nongillnet boats were sampled.

Financial performance of the fishery

Key measures of the financial performance of the fleet are contained in table 6. Definitions of items contained in table 6 are outlines in 'Survey methods and definitions'.

Gillnet boats

Average total cash receipts for gillnet boats are estimated to have fallen by around 15 per cent in 2002-03 to around $301 000 per boat. Total boat cash costs are also estimated to have fallen by 15 per cent between the survey years to an average of around $246 000 per boat in 2002-03.

Labor expenses were the largest single expense, accounting for 43 per cent of total boat cash costs in 2002-03. Together, labor, fuel and repairs and maintenance accounted for 70 per cent of total boat cash costs in that year.

The rate of return to full equity, which measures profit as a percentage of capital value, was estimated at 7.2 per cent in 2002-03. It is important to note that this capital value includes the estimated market value of quota and licences used by the boat business, including the value of, for example, lobster licences.

Nongillnet boats

For the nongillnet sector (predominantly longline and dropline), average total cash receipts rose by around 9 per cent in 2002-03 to $315 000 per boat in 2002-03. Similarly, total boat cash costs are estimated to have risen by 4 per cent over the survey period to an average of $250 000 per boat in 2002-03.

Similar to the gillnet sector, labor costs were the largest single expense, accounting for 45 per cent of total boat cash costs in 2002-03. Together, labor, fuel and repairs and maintenance accounted for 63 per cent of total boat cash costs in 2002-03.

The rate of return to full equity, which measures profit as a percentage of capital value was estimated at 6.4 per cent in 2002-03. It is important to note that this capital value includes the estimated market value of quota and licences used by the boat business, including the value of, for example, lobster licences.

6 Financial performance of the gillnet, hook and trap fleet
Average per boat

		Gillnet boats				Nongillnet boats			
		2001-02		2002-03		2001-02		2002-03	
Shark receipts	$	181 050	(18)	163 672	(17)	19 169	(44)	14 660	(44)
Lobsters receipts	$	128 254	(52)	88 074	(45)	129 518	(46)	129 517	(48)
Other fishing receipts	$	35 360	(37)	37 494	(26)	134 713	(44)	161 446	(40)
Nonfishing receipts	$	9 128	(26)	11 902	(25)	6 184	(18)	9 418	(23)
Total cash receipts	$	353 792	(16)	301 141	(12)	289 584	(21)	315 041	(19)
Administration	$	9 434	(34)	5 847	(23)	14 074	(51)	7 797	(12)
Bait	$	2 104	(51)	1 572	(54)	8 815	(52)	9 227	(58)
Crew costs	$	128 461	(12)	106 455	(10)	106 949	(18)	113 075	(19)
Food	$	3 570	(37)	3 225	(37)	3 272	(58)	3 543	(43)
Fuel	$	34 873	(15)	35 378	(12)	14 113	(26)	20 054	(28)
Insurance	$	9 529	(16)	8 599	(13)	5 663	(14)	7 237	(13)
Interest paid	$	12 810	(34)	9 324	(31)	5 350	(54)	7 189	(40)
Licence fees and levies	$	14 787	(13)	14 254	(13)	10 456	(19)	11 594	(16)
Repairs and maintenance	$	28 742	(16)	29 699	(19)	25 284	(35)	24 580	(35)
Other costs	$	45 541	(22)	31 354	(35)	47 414	(33)	45 931	(35)
Total cash costs	$	289 850	(11)	245 707	(11)	241 389	(20)	250 227	(19)
Boat cash income	$	63 941	(51)	55 434	(38)	48 196	(54)	64 814	(36)
less depreciation **a**	$	13 157	(20)	11 486	(20)	9 127	(28)	10 370	(20)
Boat business profit	$	50 785	(61)	43 948	(44)	39 069	(68)	54 444	(44)
plus interest, leasing and rent	$	41 457	(27)	28 005	(39)	34 171	(38)	31 921	(35)
Profit at full equity	$	92 242	(42)	71 953	(28)	73 239	(34)	86 365	(30)
Capital									
– excluding quota and licences	$	295 396	(11)	301 139	(10)	152 181	(20)	157 910	(20)
– including quota and licences)	$	na		994 525	(28)	na		1 343 272	(45)
Rate of return to boat capital **b**	%	31.2	(41)	23.9	(26)	48.1	(43)	54.7	(41)
Rate of return to full equity **c**	%	na		7.2	(18)	na		6.4	(29)

continued

Economic performance of the fishery

While the results presented in table 6 show changes in the average receipts and costs per boat in the gillnet, hook and trap fishery, they shed little light on the economic performance of the fishery. In this section, some economic performance indicators for the gillnet, hook and trap fishery are outlined, followed by an assessment of AFMA's current management arrangements for the fishery.

Receipts in the fishery were relatively constant over the period 1998-99 to 2002-03 (table 7). However, accounting profit (fishing receipts less cash costs) fell in 2001-02 due to costs increasing as receipts fell.

While accounting 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

6 Financial performance of the gillnet, hook and trap fleet *continued*
Average per boat

		All boats			
		2001-02		**2002-03**	
Shark receipts	$	121 141	(17)	103 384	(16)
Lobsters receipts	$	128 722	(37)	104 841	(33)
Other fishing receipts	$	72 129	(33)	87 642	(31)
Nonfishing receipts	$	8 038	(19)	10 897	(18)
Total cash receipts	$	330 030	(13)	306 765	(11)
Administration	$	11 151	(30)	6 636	(13)
Bait	$	4 588	(40)	4 669	(48)
Crew costs	$	120 500	(10)	109 133	(10)
Food	$	3 460	(31)	3 353	(28)
Fuel	$	27 190	(13)	29 179	(12)
Insurance	$	8 098	(13)	8 048	(9)
Interest paid	$	10 049	(29)	8 460	(25)
Licence fees and levies	$	13 184	(11)	13 178	(10)
Repairs and maintenance	$	27 462	(16)	27 628	(17)
Other costs	$	46 234	(19)	37 252	(25)
Total cash costs	$	271 916	(10)	247 536	(10)
Boat cash income	$	58 114	(39)	59 229	(26)
less depreciation **a**	$	11 666	(17)	11 034	(15)
Boat business profit	$	46 449	(47)	48 194	(31)
plus interest, leasing and rent	$	38 761	(22)	29 589	(27)
Profit at full equity	$	85 210	(30)	77 784	(20)
Capital					
– excluding quota and licences	$	242 395	(10)	243 191	(9)
– including quota and licences	$	na		1 135 621	(26)
Rate of return to boat capital **b**	%	35.2	(31)	32.0	(21)
Rate of return to full equity **c**	%	na		6.8	(17)

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'.

depreciation expense, the opportunity cost of owner and family labor and the opportunity cost of capital. To calculate net returns, these three costs are included and interest and leasing charges are added back in, as these items represent some profits that have been redistributed to other investors in the fishery. Management charges are also added, as management costs collected as a part of the surveys only represent industry's contribution. Deducting these management costs allows for total management costs, both industry recoverable and nonrecoverable management costs, to be subsequently included as a cost.

I **Net returns and accounting profit**
Gillnet, hook and trap fishery

Once these adjustments have been made, net returns (including management costs) are low, and in some years negative. Net returns (including management costs) averaged –$0.1 million between 1998-99 and 2002-03 (table 7). Figure I shows net return and accounting profit for the fishery over the five years to 2002-03. It shows that while accounting profits have been positive, net returns (including management costs) for the entire fishery have fluctuated around zero. It is important to note that the receipts and costs contained in table 7 and figure I include only those receipts and costs attributable to the gillnet, hook and trap fishery.

7 **Economic return in the gillnet, hook and trap fishery**
Total for fishery in 2004-05 dollars

	1998-99		1999-2000		2000-01		2001-02		2002-03	
	$m		$m		$m		$m		$m	
Receipts										
Fishing income	18.4	(10)	20.5	(15)	19.2	(15)	17.4	(18)	18.1	(18)
Cash costs										
Operating costs	13.5	(8)	15.5	(17)	14.0	(16)	15.0	(20)	14.7	(20)
Accounting profit	5.0	(23)	5.0	(23)	5.2	(23)	2.3	(62)	3.3	(25)
Noncash costs										
Owner and family labor	4.9	(15)	4.0	(14)	3.8	(15)	2.1	(22)	2.0	(19)
Opportunity cost of capital	0.5	(17)	0.7	(17)	0.6	(19)	0.5	(19)	0.4	(16)
Depreciation	0.9	(16)	1.0	(17)	1.0	(19)	0.7	(18)	0.7	(16)
plus interest, leasing and management fees	2.4	(15)	3.1	(23)	2.6	(20)	3.2	(24)	2.4	(25)
Net return (excluding management costs)	1.0	(92)	2.5	(32)	2.5	(43)	2.2	(48)	2.8	(35)
Management costs	2.3	na	2.2	na	2.3	na	2.4	na	2.4	na
Net return (including management costs)	–1.3	(92)	0.3	(32)	0.2	(43)	–0.2	(48)	0.4	(35)

na Not applicable.
Note: Figures in parentheses are relative standard errors. A guide to interpreting these is included in 'Survey methods and definitions'.

At estimated net returns of zero, fishers are covering all operating costs, depreciation expense, the opportunity cost of owner and family labor and the opportunity cost of capital. However, at this point, the return being generated for the use of the fish stock as an input is zero. AFMA's economic efficiency objective is to maximise the long run net returns generated from a fishery, not maximise accounting profit.

There may be a few explanations for the low net returns in the gillnet, hook and trap fishery. First, it might be that the correct management tool and/or level of catch/effort are not being used and that changes to either or both of these could improve net returns. Alternatively, it might be that the fishery is being managed optimally and that the net returns shown in table 7 and figure I are the highest achievable. Similarly, the correct management tool and catch/effort levels might have been implemented, but because of previous overfishing of the stock and the slow growing nature of the stock, improved net returns are not likely to be realised until stock levels increase in the future.

Assessment of current management arrangements

While it appears that the most appropriate management tool has been implemented in the fishery, there has been no quantitative economic assessment of optimal TACs for maximising economic efficiency. However, in line with biological assessments, TACs across the entire south east fishery for the main target species in the gillnet, hook and trap fishery have fallen since 2003 (table 8). Given that some of the stocks have been classified as biologically overfished or overfishing is occurring in some areas, the TACs appear to be heading in the correct direction. What is unclear is whether further TAC reductions are required to improve net returns.

Transferability of quota is a key factor contributing to the effectiveness of an ITQ system (Elliston et al. 2004). Transferability of quota allows for fishing effort to move from less

8 Agreed total allowable catches (TACs) and biological stock status of main target species in the gillnet, hook and trap fishery

	Agreed TAC			
Species	**2003**	**2004**	**2005**	**2004 biological status**
	tonnes	tonnes	tonnes	
Gummy shark	1 800	1 800	1 800	Not overfished
School shark	309.6	309.6	275	Overfished
Blue eye trevalla	690	690	621	Not overfished, but localised overfishing may be occurring
Ling	2 160	1 800	1 400	Not overfished west of Bass Strait, but overfishing probably occurring east of Bass Strait

na Not applicable.
Source: TAC data from AFMA web site and biological status from Caton and McLoughlin (2004).

efficient operators to more efficient operators. Kompas and Che (2001) show that increases in the volume of quota traded are associated with improvements in economic efficiency in the south east fishery. Except for blue eye trevalla, the merging of the gillnet, hook and trap fishery with the Great Australian Bight trawl and south east trawl fisheries allows for permanent transfers of quota between the trawl and gillnet, hook and trap sectors. As restrictions on quota are removed, increased quota trade should result in improved economic efficiency as quota flows to the more efficient operators.

However, the existence of undercatch/overcatch provisions impedes quota market operations (Elliston et al. 2004). For instance, overcatch may deter trade in the quota market by allowing fishers to catch in excess of their entitlements in a year without leasing or buying quota. Similarly, AFMA (2003) points out that the use of undercatch provides an ongoing opportunity to work outside the quota market.

If TACs are binding (that is, if fishers catch the TAC), there may be justification to allow a very small amount of overcatch, perhaps one or two per cent, to avoid the necessity to prosecute fishers for small excess catches when quota is not available at the end of a season. It is difficult to justify on economic grounds, the undercatch provisions that enable fishers to carry surplus quota into future fishing seasons.

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 that 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 2004 surveys

ABARE surveyed three fisheries in 2004 — the eastern tuna and billfish fishery, the gillnet, hook and trap fishery and the southern squid jig fishery. Information was collected for the 2001-02 and 2002-03 financial years. However, in the southern squid jig fishery, an insufficient number of operators were willing or able to participate in the survey for both financial years. Therefore, it is not possible to present results for that fishery in this report. This report contains estimates of the financial and economic performance of the eastern tuna and billfish fishery and the gillnet hook and trap fishery.

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 logbook data.

That is,

$$\sum w_i x_i = X$$

where w_i is the weight for boat i; x_i is the catch for boat i; and X is the total catch for the target population.

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

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.

continued

Box 1: Definitions of key variables *continued*

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 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 of 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).

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:

$$(\$9605/\$25\,000) \times 100 = 38\%.$$

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. ABARE's survey staff are experienced in surveying 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 is to pursue maximising the economic efficiency of each of its 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 the data needed to calculate net returns and productivity indexes. In addition, survey data provide some of the necessary data to construct bioeconomic models. While productivity indexes are currently being developed for the eastern tuna and billfish fishery, they have not been developed for the gillnet, hook and trap fishery. Results of the productivity indexes for the eastern tuna and billfish fishery are expected to be released in the second half of 2005. Bioeconomic models have not yet been fully developed for either fishery — this is work in progress.

This section outlines how net returns are calculated using ABARE survey data. The actual estimates of net returns for the eastern tuna and billfish fishery and gillnet, hook and trap fishery are presented in the fishery survey results chapters.

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 — 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 due to 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 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 ABARE rate 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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