australian fisheries survey report 2006

results for selected fisheries, 2003-04 and 2004-05

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foreword

Estimates of the performance of operators in the eastern tuna and billfish fishery and the southern and eastern scalefish and shark fishery – which were surveyed by ABARE in 2006 – are given 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 edition in a series of regular fisheries survey reports, which have been published every year since the early 1990s. Funding for these reports is provided by the Fisheries Resources Research Fund.

Phillip Glyde
Executive Director

June 2007

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) 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 provided valuable assistance. Comments on a draft copy of the report were also provided by Wez Norris and Trent Timmis from AFMA, and Kevin McLoughlin from the Bureau of Rural Sciences.

ABARE staff

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

Sample design and estimation was undertaken by Simon Vieira with assistance from David Galeano, Paul Newton and Walter Shafron.

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

Peter Gooday provided comments on the report.

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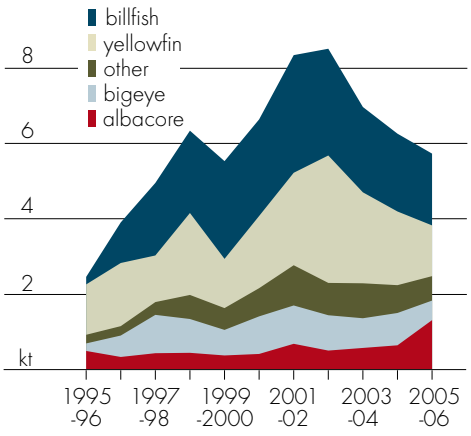
eastern tuna and billfish fishery – longline and minor line

the fishery

The eastern tuna and billfish fishery (ETBF) is a multispecies fishery involving longline and minor line fishing methods. The fishery extends from the tip of Cape York to the South Australian–Victorian border and encompasses the waters around Lord Howe Island and Norfolk Island (map 1). Offshore constitutional settlements have been made with adjacent states (except New South Wales) so that major tuna species are managed by the Commonwealth even inside the usual three nautical mile boundary. Tuna fishing, however, is currently not 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 and Ulladulla.

In December 2005 the fishery was classified as a 'target fishery' for the purposes of the Australian Government's *Securing Our Fishing Future* structural adjustment package. As at August 2006, there were 305 fishing permits in the fishery, of which 231 were authorised to use the longline method. Ninety-nine of these longline permits were recently surrendered during the fishing permit buyback scheme (Abetz 2006).

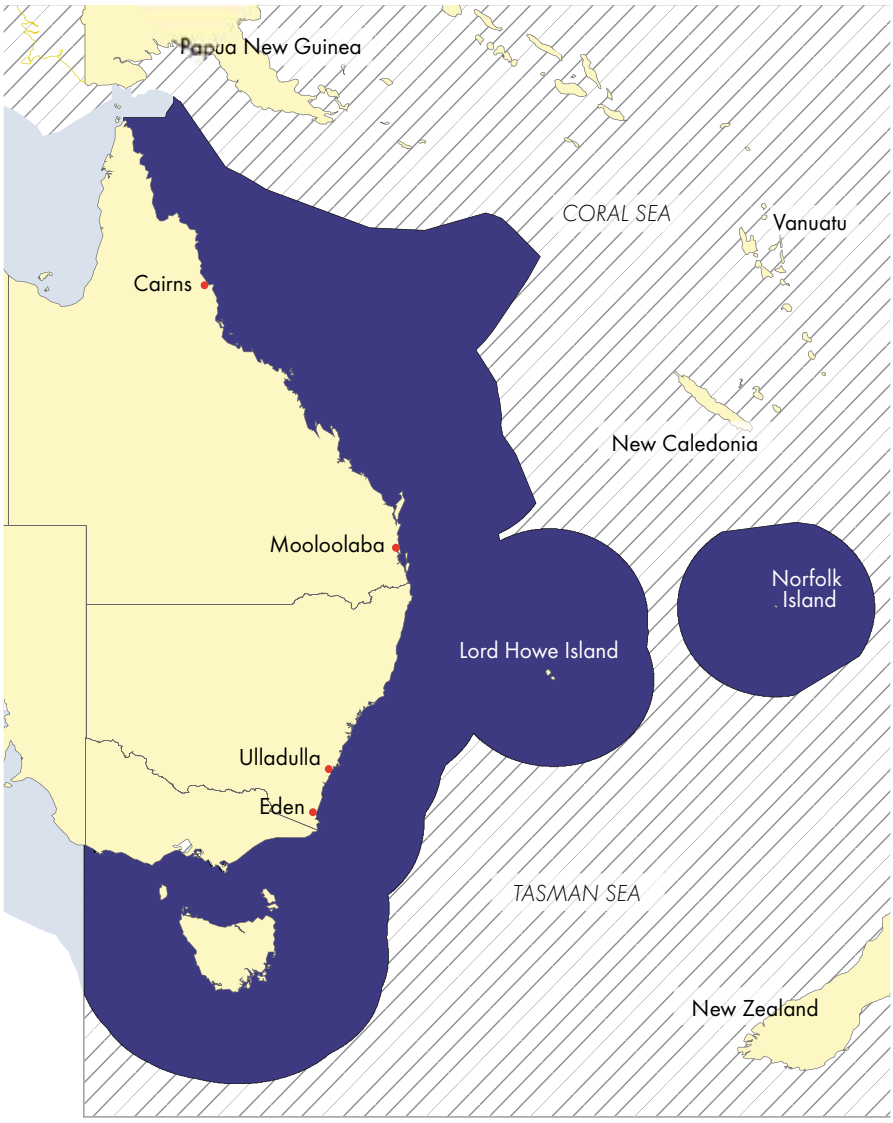
fig A **landed catch**
eastern tuna and billfish fishery, longline and minorline



species landed

The principal species landed in the eastern tuna and billfish fishery are yellowfin tuna, bigeye tuna, albacore tuna and broadbill swordfish (figure A). Species caught as byproduct include striped marlin, pelagic sharks, longtail tuna, rudder fish, black oilfish, dolphinfish, rays bream, moonfish and wahoo. Incidental catches of blue and black

map 1 **location of the eastern tuna and billfish fishery**

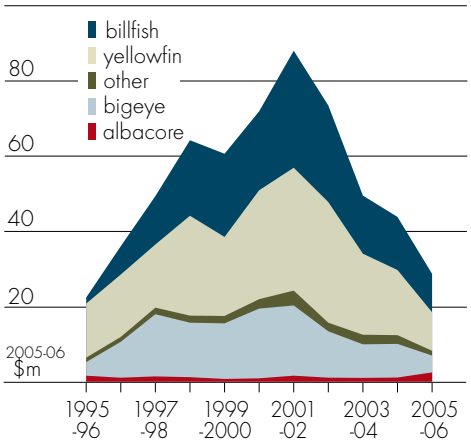


marlin also occur, but these must be returned to the sea under a legislative amendment that came into effect in July 1998, which recognises that these species are the key target species of the game fishing sector. With the exception of albacore, which has recently emerged as a more profitable alternative for many operators in southern Queensland, landings decreased for all principal species in 2005-06.

value of catch

The real gross value of production (GVP) of the longline and minorline sectors in 2005-06 was $28.7 million, down from $43.8 million in 2004-05 (figure B). This was caused by an 8 per cent fall in the total landed catch, declining prices for most species and an increase in the proportion of the total catch made up by albacore, a lower value product. GVP for the fishery has declined steadily from its peak of $88 million in 2001-02, when catches were high and prices relatively high. 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.

fig B **real gross value of production**
eastern tuna and billfish fishery, longline and minorline



biological status of the fishery

yellowfin tuna

status: Uncertain in the eastern tuna and billfish fishery. Overfishing is occurring in the Western and Central Pacific Ocean, but the stock is probably not yet overfished.

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 a fast growing species, reaching maturity at about two years of age. Yellowfin tuna can grow to over 100 kilograms, although the average dressed weight of yellowfin tuna caught by Australian longliners is around 30 kilograms (McLoughlin 2006).

Yellowfin tuna captured in different areas of the eastern tuna and billfish fishery appear to have a common source – most likely the Coral Sea. However, tagging studies indicate that yellowfin tuna also move between the eastern tuna and billfish fishery and the Western and Central Pacific Ocean. While many tagged fish are recovered in areas where they were tagged, even after prolonged periods, it is probable that recruits to stock in the eastern tuna and billfish fishery may come from other regions in the Western and Central Pacific Ocean.

According to McLoughlin (2006), the status of yellowfin tuna in the eastern tuna and billfish fishery is uncertain, although overfishing is occurring in the Western and Central Pacific Ocean and is considered to be close to overfished. 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 (McLoughlin 2006). 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 (McLoughlin 2006).

bigeye tuna

status: Overfishing is occurring in the Western Pacific, but the stock is probably not yet overfished. The status of bigeye in the eastern tuna and billfish fishery is uncertain because the level of mixing between the fishery and the wider Western Pacific has not been quantified (Peter Ward, Bureau of Rural Sciences, personal communication, 14 May 2007).

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.

Recently the catch of bigeye tuna in the Western and Central Pacific Ocean has increased with the expansion of purse seining and record catches by longliners. Purse seine catches have also increased in the Eastern Pacific Ocean, although longline catches have been steadily declining. Stock assessments have indicated that current fishing mortality rates exceed recruitment, but although overfishing is occurring in both regions, overall the stock is probably not yet overfished (McLoughlin 2006).

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, although there could be some isolation from the Western and Central Pacific Ocean (McLoughlin 2006).

Catch rates of bigeye tuna in the eastern tuna and billfish fishery have fluctuated since the mid-1990s. The cause of the decline in catch rate between 1997 and 2000 may have been localised depletions (McLoughlin 2006), although other factors such as oceanographic variation or the influence of fishing on other parts of the stock may have had an impact (Wez Norris, AFMA, personal communication, 18 April 2007). The reason for a record domestic catch in 2001 remains unclear, but it may have been reflected in changes in availability, abundance or catchability (McLoughlin 2006).

broadbill swordfish

status: According to McLoughlin (2006), status is uncertain, with some strong indications of localised depletion in inshore areas. An assessment by Kolody, Campbell and Davies (2006) indicated that the stock's biomass is above the level associated with maximum sustainable yield (MSY) and that fishing mortality is probably below MSY.

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 (McLoughlin 2006).

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 (McLoughlin 2006).

There have been strong indications of localised depletions of swordfish around seamounts off southern Queensland and northern New South Wales. As nominal catch rates have progressively declined nearer the coast, vessels are being forced to fish further offshore (McLoughlin 2006). A quantitative stock assessment was undertaken for the species in the Southern and Western Pacific Ocean in 2006. The assessment estimated that the total stock biomass in 2004 was 70 per cent (range 56–74 per cent) of what it was in 1995. It also indicated that swordfish biomass was probably above levels that would sustain MSY and that fishing mortality is probably below MSY. However, stock projections indicate that biomass levels are declining in the short term but probably to a level above that which is associated with MSY (from 2004 to 2009) (Kolody et al. 2006).

albacore

status: Uncertain in the eastern tuna and billfish fishery but not overfished in the South Pacific and there is no evidence of overfishing.

Albacore mature at about five to six years of age when around 85 centimetres long and can reach 120 centimetres when ten years of age. Albacore caught in the South Pacific constitute a single stock, with juveniles living in the cooler temperate waters of the subtropical convergence zone, with adults living to its north in warmer waters (McLoughlin 2006).

There has been no stock assessment of the albacore caught in the eastern tuna and billfish fishery (McLoughlin 2006). The South Pacific Community developed a stock assessment model for albacore in the South Pacific and although estimated biomass is well above the level required to produce MSY, declining catch rates of several fleets in recent years is of concern given the lack of understanding of the mechanisms determining the local abundance and availability of albacore (McLoughlin 2006).

marlins

status: Uncertain in the eastern tuna and billfish fishery and wider Pacific Ocean.

Striped marlin, blue marlin and black marlin are highly migratory species that are distributed throughout the tropical and subtropical waters of the Pacific Ocean. Although the stock structure for each of these species is uncertain, there is evidence to suggest that black and blue marlins have a single genetic stock, while striped marlin form several semi-independent stocks in the Pacific Ocean (McLoughlin 2006).

In eastern Australia the landing and sale of striped marlin is permitted but legislation requires the release of blue and black marlin caught by commercial operators. Nevertheless, mortality of hooked blue and black marlins by longliners is estimated to be at least 30 per cent (McLoughlin 2006).

A stock assessment for striped marlin in the South West Pacific Ocean was performed in 2006. The assessment was largely preliminary and uncertainty surrounded some of the key parameters used in the assessment models – in particular natural mortality and growth. Some tentative conclusions drawn from the assessment were that catches were comparable to most model estimates of MSY

and that there is no indication that current catches are having a negative impact on the stock's productivity. At the same time, however, some model scenarios suggested that current catches exceeded MSY and that biomass was below the MSY level. The status of the stock therefore remains uncertain and catches should not be increased (Langley et al. 2006).

No reliable stock assessment is currently available for blue and black marlins in the eastern tuna and billfish fishery or the wider Pacific. There is evidence, however, to suggest that catch levels of black and blue marlin have declined since the 1970s.

management of the fishery

The eastern tuna and billfish fishery incorporates both commercial and recreational fishing activities. For the commercial sector a series of Offshore Constitutional Settlement agreements have been negotiated by the Commonwealth and state governments (except New South Wales). Under these agreements, the Australian Government is responsible for the management of the major tuna and billfish species, while the state governments are responsible for the management of the small tuna and tuna-like species typically found on the continental shelf. The state authorities are also responsible for the management of the recreational fishing sector.

Although most fishing in the fishery occurs within a few hundred kilometres of the coast of New South Wales and southern Queensland, the major target species are part of migratory stocks in the Western and Central Pacific Ocean. The Western and Central Pacific Fisheries Commission (WCPFC) assumes responsibility for the regional management of these species. As a participating member, Australia is committed to introducing management arrangements to give effect to WCPFC decisions in domestic waters as well as on the high seas.

A management plan for the commercial sector of the fishery was adopted in October 2005 following several years of consultation with the fishery's management advisory committee and industry representatives. Under the *Eastern Tuna and Billfish Fishery Management Plan 2005,* annual fishing permits are to be replaced by statutory fishing rights (SFRs) (AFMA 2005a). This will allow AFMA to more effectively control effort in the fishery by restricting the number of branchline clips (hooks) available to longline operators on a yearly basis. Minor line SFRs will also be introduced, defining the maximum number of lines that may be used at any one

time in the fishery. Operators in both sectors will also need an additional permit to operate in the Coral Sea Zone, formerly Zone E. All other management zones in the fishery have been removed under the new management plan.

Holders of longline SFRs will be allocated individual transferable effort (ITE) units as a proportion of total allowable effort (TAE). These ITE units will be transferable – temporarily and permanently. Provisions exist in the management plan to also allow operators to transfer a proportion of their unused effort in a given season to the next season, and, similarly, for operators to use more than their allocated effort units in a particular season by debiting their entitlement for the following year. However, AFMA must announce that such an allowance is being made in any given season for such transfers to be allowed.

The TAE will be determined at the start of each fishing season and will define the maximum number of effort units that can be used in the fishery. The number of effort units expended when a longline set is made will depend on the number of branchline clips used and the area of the fishery in which the vessel is operating:

effort units expended = branchline clips x subarea factor

Subarea factors will be set for various geographic divisions of the fishery. These will allow AFMA to control effort spatially. For example, by adjusting the subarea factor, AFMA may be able to discourage fishing in areas showing signs of localised depletion.

Two methods have been specified for monitoring operators' effort once the TAE has been determined and the ITE units have been allocated:

- 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 management plan it is an offence to leave port with more than the nominated number of branchline clips onboard the vessel.
- clip monitoring method: this requires the operator to install approved clip monitoring equipment that counts the number of hooks used in a fishing operation. The amount is then deducted from the fisher's allocation. Operators are also required to fit a vessel monitoring system (VMS) that allows AFMA to track the location of fishing operations.

To date, effort has been focused on developing the technology required for the clip nomination method. It is acknowledged that the clip monitoring method would provide greater flexibility to industry, but would come at greater cost.

The allocation of statutory fishing rights in the ETBF was due to commence in 2006. However, AFMA identified the need for amendments to the management plan, including some that were required following the announcement of the Australian Government's *Securing Our Fishing Future* structural adjustment package in December 2005. The current provisions in the management plan do not prevent fishers who surrender their fishing permit under the buyback scheme from subsequently applying for and receiving SFRs (AFMA 2006a). AFMA expects to determine the plan amendment in mid-2007 and it will take a minimum of nine months to implement the plan once the amendment is through and any appeals have been finalised.

Once SFRs have been allocated under the new management plan, a limit on hook numbers will come into effect. The initial aim is to set a total allowable effort of 7.8 million clips (AFMA 2006b). Using subarea factors this will allow for 9.5 million hooks to be set in the fishery, comprising 7 million hooks in the mainland and Lord Howe Island area and up to 2.5 million hooks in the remaining area of the fishery (table 1). In the meantime, the commercial fishery continues to be managed by annual fishing permits according to transitional arrangements provided for in the management plan.

table 1 **proposed hook limits under the new management plan for the eastern tuna and billfish fishery**

zone	number of hooks expected to be set	subarea factor	number of clips decremented
mainland and Lord Howe Island AFZ	7 000 000	1.0	7 000 000
Norfolk Island region	600 000	0.7	420 000
remaining WCPFC areas	1 900 000	0.2	380 000
total	9 500 000		7 800 000

species specific management arrangements

Specific management arrangements also apply for operators targeting southern bluefin tuna, broadbill swordfish and albacore in the fishery.

southern bluefin tuna

Eastern tuna and billfish fishery permits do not allow fishing for southern bluefin tuna. Therefore, vessels fishing in southern parts of the fishery are required to hold minimum amounts of southern bluefin tuna quota at certain times of the year (generally June–November). The boundaries for these restricted access areas vary throughout the season, but typically apply between Coffs Harbour and Eden. Varying levels of observer coverage are also required, depending on the initial level of quota held by each operator. In 2006, a minimum quota holding of 500 kilograms was required for both the core and buffer zones.

broadbill swordfish

For the 2006 season, the AFMA board agreed to manage broadbill swordfish using a competitive total allowable catch (TAC) of 1400 tonnes. To ensure that the TAC is not exceeded, cumulative catch trigger limits are applied for specified periods. If the cumulative catch trigger is exceeded then all permits will be made subject to a ten swordfish trip limit until catches are reduced to an acceptable level. These interim measures apply until the cessation of the transitional management arrangements under the new Eastern Tuna and Billfish Fishery Management Plan (Rundle 2005). The same management arrangements apply for the 2007 season (Rundle 2006).

albacore tuna

New management arrangements were implemented for albacore in January 2007. A competitive TAC of 3200 tonnes was set for 2007. Any vessel is allowed to fish in the area, but those that are not permitted to target albacore are subject to a 200 albacore trip limit (Wez Norris, AFMA, personal communication, 11 May 2007). If the TAC is reached, the area will be closed to all fishing. These management arrangements currently apply as an interim measure while the management plan is being implemented (Bodsworth 2006).

ministerial direction

As part of the *Securing our Fishing Future* initiative, the Australian Government issued a formal direction to AFMA to take immediate action in all Commonwealth fisheries to:

- cease overfishing and recover overfished stocks
- avoid further species groups being overfished
- manage the broader environmental impacts of fishing.

In doing so, AFMA must take a more 'strategic, science based approach' to setting catch and/or effort levels through the development and implementation of a Commonwealth Harvest Strategy Policy (AFMA 2006b).

Key aspects of the direction relevant to the eastern tuna and billfish are:

- the implementation of output controls in the form of individual transferable quotas (ITQs) by 2010 unless a strong case is made to the Minister that this would not be cost effective or would be otherwise detrimental
- an evaluation of whether boat permits and/or SFRs are an impediment to autonomous adjustment and, if so, phase these out by 2010
- to minimise incentives for discarding by ensuring it is factored into the setting of catch limits and
- to manage the broader environmental impacts of fishing, including on threatened species or those otherwise protected under the *Environment Protection and Biodiversity Conservation Act 1999*.

AFMA has indicated that output controls will not be considered for the fishery until 2008 in order to allow enough time under the existing management plan for information to be collected about the cost effectiveness of ITQs (AFMA 2006b).

As per the requirements of the direction, the Australian Government Department of Agriculture, Fisheries and Forestry is currently finalising a national harvest strategy policy that will apply to all fisheries. Fisheries with an international component are exempt from the need to develop a fishery specific harvest strategy policy if the relevant regional fisheries management organisation has an acceptable scientific process that sets a sustainable catch level. In the absence of a sustainable TAC set by the WCPFC, the eastern tuna and billfish fishery will be required to develop a fishery specific harvest strategy over the coming year, consistent with the national framework being developed by DAFF.

boats surveyed

For the purpose of the survey, the target population was defined as longline endorsed eastern tuna and billfish boats that recorded a catch of greater than 1 tonne of tuna and/or billfish in the survey years. In 2003-04 the population was 132 vessels, of which 23 were sampled. In 2004-05 the population was 112 vessels, of which 27 were sampled.

The population was further divided into two subgroups – 'broadbill boats' and 'nonbroadbill boats'. Broadbill boats were defined as boats that caught more than 10 tonnes of broadbill swordfish, while nonbroadbill boats were defined as those that caught less than 10 tonnes. In 2003-04 the total population comprised 46 broadbill boats, of which 15 were sampled, and 86 nonbroadbill boats, of which eight were sampled. In 2004-05 the total population was 39 broadbill boats, of which 15 were sampled, and 73 nonbroadbill boats, of which 12 were sampled.

financial performance of the fishery

Key measures of the financial performance of the entire fishing fleet plus the financial performance of broadbill and nonbroadbill boats are contained in table 2. Definitions of items contained in table 2 are included in appendix A.

Many boats that operate in the eastern tuna and billfish fishery also operate in other fisheries, such as the southern bluefin tuna 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 2.

receipts

Average per boat total cash receipts for the entire fishery increased from approximately $508 000 in 2003-04 to almost $606 000 in 2004-05. This occurred despite slightly lower landings in 2004-05, since the number of boats operating in the fishery that year fell by more than the percentage decrease in catch. Boats operating in the fishery also operate in the southern bluefin tuna fishery, and an increase in the quantity of southern bluefin tuna sold directly from the fishery (rather than farmed) from 75 tonnes in 2003-04 to 204 tonnes in 2004-05 is also likely to have contributed to an increase in average total cash receipts.

In 2004-05 average total cash receipts per boat were estimated to be approximately $902 000 for broadbill boats and $447 000 for nonbroadbill boats.

costs

For the fishery as a whole, average per boat total cash costs increased from $537 000 in 2003-04 to $577 000 in 2004-05. Over this period, average total cash costs rose by 3 per cent for broadbill boats and 13 per cent for nonbroadbill boats.

Labour costs were the highest single expense for the average boat in the fishery in both 2003-04 and 2004-05. As crews are generally paid a percentage share of revenue, average per boat labour costs increased to an estimated $141 000 per boat in 2004-05 and accounted for 24 per cent of total cash costs. Labour costs include payments to skipper and crew as well as shore based labour and the opportunity cost of owner and family labour (see appendix A for more detail).

Fuel was the second highest cost item on average in the fishery, at an estimated cost of almost $98 000 per boat in 2004-05, or 17 per cent of total cash costs. Fuel expense was much larger per boat in the broadbill fleet at $151 000 per boat in 2004-05 compared with $70 000 in the nonbroadbill fleet in the same year. Freight and marketing expenses were the third highest cost item, estimated at an average of around $77 000 a boat in 2004-05.

The majority of other cost components for the whole fleet remained relatively constant between 2003-04 and 2004-05. Together labour, fuel and freight and marketing expenditure accounted for 55 per cent of total cash costs for all boats in 2004-05.

boat cash income and profit

Although total cash costs are estimated to have increased on average in the fishery in 2004-05, the increase in total cash receipts was proportionally higher. Average per boat cash income for the entire fishery is estimated to have increased from an average loss of $28 400 in 2003-04 to a positive income of $28 600 per boat in 2004-05.

Average boat business profit, however, which is boat cash income less an allowance for depreciation, remained negative across the entire fishery in 2004-05, despite improving from a loss of $78 100 to a loss of $19 500 per boat.

Profit at full equity, which is boat business profit plus interest, leasing and rent, is estimated to have increased from an average loss of nearly $42 900 per boat in 2003-04 to a profit of $12 600 per boat in 2004-05. 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 operators. 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 based 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) for the average vessel increased between the two survey years from a negative return of 5.8 per cent in 2003-04 to a positive return of 1.7 per cent in 2004-05.

table 2 **financial performance of boats operating in the eastern tuna and billfish fishery** average per boat

		broadbill				nonbroadbill	
		2003-04		2004-05		2003-04	
seafood receipts	$	761 327	(8)	856 712	(9)	325 768	(15)
nonfishing receipts	$	47 424	(16)	45 491	(16)	21 787	(30)
total cash receipts	$	808 751	(7)	902 203	(8)	347 555	(16)
administration	$	15 361	(7)	16 645	(8)	16 075	(14)
bait	$	79 338	(8)	86 899	(10)	6 036	(40)
crew costs	$	162 801	(8)	199 644	(7)	99 553	(16)
freight and marketing expenses	$	138 398	(9)	133 922	(11)	47 425	(26)
fuel	$	129 926	(6)	150 574	(10)	51 912	(19)
insurance	$	25 404	(5)	22 607	(8)	25 177	(19)
interest paid	$	42 856	(20)	37 345	(20)	14 489	(56)
licence fees and levies	$	13 932	(18)	16 986	(29)	24 561	(33))
packaging	$	72 827	(14)	89 057	(18)	4 246	(94)
repairs and maintenance	$	117 143	(9)	99 751	(8)	37 932	(11)
other costs	$	67 098	(12)	40 310	(17)	33 643	(28)
total cash costs	$	865 084	(5)	893 741	(7)	361 050	(12)
boat cash income	$	- 56 333	(43)	8 462	(261)	- 13 495	(151)
less depreciation **a**	$	50 834	(13)	73 813	(11)	49 072	(25)
boat business profit	$	- 107 167	(20)	- 65 351	(36)	- 62 567	(37)
plus interest, leasing and rent	$	64 236	(13)	47 590	(14)	19 701	(40)
profit at full equity	$	- 42 931	(47)	- 17 761	(111)	- 42 866	(47)
capital							
- excl. quota and licences	$	1 017 415	(7)	987 993	(7)	593 267	(18)
- incl. quota and licences	$	1 225 757	(6)	1 158 535	(5)	1 211 678	(18)
rate of return							
- to boat capital **b**	%	-4.2	(50)	-1.8	(115)	-7.2	(49)
- to full equity **c**	%	-3.5	(50)	-1.5	(114)	-3.5	(50)

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.
Note: Figures in parentheses are relative standard errors. A guide to interpreting these is included in appendix A.

For vessels in the broadbill fleet, the rate of return to boat capital was negative in both survey years, at –4.2 per cent per boat in 2003-04 and –1.8 per cent in 2004-05. For the nonbroadbill fleet, the rate of return to boat capital increased considerably from a negative return of 7.2 per cent per boat in 2003-04 to a positive return of 4.8 per cent per boat in 2004-05, reflecting the substantial improvement in average profit at full equity per boat in 2004-05.

table 2 **financial performance of boats operating in the eastern tuna and billfish fishery** average per boat *continued*

		nonbroadbill		all boats			
		2004-05		2003-04		2004-05	
seafood receipts	$	389 581	(16)	477 554	(8)	552 243	(9)
nonfishing receipts	$	57 751	(45)	30 721	(16)	53 482	(32)
total cash receipts	$	447 332	(15)	508 275	(8)	605 724	(8)
administration	$	13 400	(14)	15 827	(9)	14 530	(9)
bait	$	18 549	(30)	31 580	(9)	42 349	(11)
crew costs	$	109 768	(14)	121 594	(9)	141 064	(8)
freight and marketing expenses	$	46 449	(28)	79 128	(11)	76 909	(13)
fuel	$	69 515	(17)	79 099	(9)	97 741	(10)
insurance	$	19 607	(18)	25 256	(12)	20 652	(11)
interest paid	$	13 352	(49)	24 374	(25)	21 707	(23)
licence fees and levies	$	16 039	(11)	20 857	(25)	16 369	(13)
packaging	$	10 479	(47)	28 145	(15)	37 841	(17)
repairs and maintenance	$	48 235	(24)	65 536	(7)	66 174	(12)
other costs	$	42 601	(22)	45 302	(15)	41 803	(16)
total cash costs	$	407 994	(15)	536 698	(6)	577 138	(8)
boat cash income	$	39 337	(93)	– 28 423	(56)	28 586	(87)
less depreciation **a**	$	34 273	(19)	49 686	(16)	48 041	(11)
boat business profit	$	5 064	(708)	– 78 109	(22)	– 19 455	(127)
plus interest, leasing and rent	$	23 759	(38)	35 221	(17)	32 058	(20)
profit at full equity	$	28 824	(118)	– 42 888	(35)	12 602	(184)
capital							
– excluding quota and licences	$	598 368	(14)	741 076	(10)	734 041	(8)
– including quota and licences	$	1 035 704	(14)	1 216 584	(12)	1 078 475	(9)
rate of return							
– to boat capital **b**	%	4.8	(117)	–5.8	(36)	1.7	(183)
– to full equity **c**	%	2.8	(116)	–3.5	(37)	1.2	(182)

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.
Note: Figures in parentheses are relative standard errors. A guide to interpreting these is included in appendix A.

The rate of return to full equity includes the value of quota and licences in addition to boat 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.

The estimated value of quota and licences attached to each boat fell by 28 per cent between the two survey years to $344 000 in 2004-05. This resulted in a total capital value of $1.08 million in 2004-05. This value includes the estimated market value of quota and licences used by the boat, including the value of endorsements in other fisheries, for example, state licences. The rate of return to full equity, which incorporates these endorsement values, increased from –3.5 per cent in 2003-04 to 1.2 per cent in 2004-05.

For both the broadbill fleet and the nonbroadbill fleet, the rate of return to full equity was –3.5 per cent per boat in 2003-04. For boats in the broadbill fleet, the rate of return to full equity improved only slightly in 2004-05, remaining negative at –1.5 per cent. While for the nonbroadbill fleet, the rate of return to full equity improved considerably and was positive at 2.8 per cent per boat in 2004-05.

economic performance of the fishery

The results presented in table 2 show changes in the average receipts and costs of boats that operated in the fishery in 2003-04 and 2004-05. However, they shed little light on the economic performance of the fishery as a whole as they include receipts earned and costs incurred from operations in other fisheries and no allowance is made for the opportunity costs of capital employed in the fishery. Table 3 shows boat cash profit and net returns generated from the eastern tuna and billfish fishery.

Since the early 1990s, receipts in the fishery gradually increased with the expansion of the fishery and reached a peak of $96.3 million in 2001-02 (in 2005-06 dollars). However, receipts have since fallen steadily and, in 2004-05, total fishing receipts from the fishery were $58 million.

Boat cash profit, which is fishing income less cash costs, also steadily increased for a period in the 1990s, reaching a peak of $16.3 million in 1998-99 (in 2005-06 dollars), but has fallen away dramatically since 2000-01 to be around zero in 2004-05.

table 3 **boat cash profit and net returns in the eastern tuna and billfish fishery** total for fishery in 2005-06 dollars

		1994-95		1995-96		1996-97		1997-98		1998-99		1999-00	
fishing receipts	$m	20.4	(13)	24.3	(14)	43.5	(14)	70.1	(15)	82.4	(9)	76.5	(11)
cash costs	$m	19.6	(13)	22.6	(14)	37.0	(13)	58.2	(11)	66.1	(9)	61.5	(11)
boat cash profit	$m	0.8	(76)	1.7	(37)	6.5	(76)	11.9	(41)	16.3	(32)	15.0	(21)
less owner and family labour	$m	1.8	(12)	3.0	(20)	5.1	(14)	10.0	(11)	9.7	(13)	9.2	(19)
less opportunity cost of capital	$m	1.3	(15)	1.7	(22)	2.1	(20)	4.1	(21)	4.3	(19)	4.2	(22)
less depreciation	$m	2.2	(15)	2.6	(21)	3.5	(19)	6.2	(21)	7.5	(19)	6.3	(22)
plus interest, leasing and management fees	$m	2.4	(15)	2.5	(15)	3.4	(13)	7.6	(8)	12.3	(19)	7.5	(18)
net return – excl. management costs	$m	-2.1	(35)	-3.1	(36)	-0.8	(134)	-0.7	(744)	7.1	(75)	2.8	(94)
management costs	$m	1.1	na	1.0	na	0.9	na	0.9	na	1.2	na	1.3	na
net return – incl. management costs	$m	-3.2	na	-4.1	na	-1.6	na	-1.6	na	5.9	na	1.5	na
number of active boats	no.	84		94		118		143		146		143	

		2000-01		2001-02		2002-03		2003-04		2004-05	
fishing receipts	$m	88.7	(8)	96.3	(7)	77.4	(5)	64.8	(11)	58.3	(14)
cash costs	$m	72.8	(7)	86.1	(8)	82.0	(5)	69.1	(11)	58.5	(14)
boat cash profit	$m	15.9	(22)	10.2	(24)	-4.6	(49)	-4.3	(71)	-0.1	(1292)
less owner and family labour	$m	10.8	(12)	6.3	(19)	4.4	(14)	3.7	(24)	2.5	(18)
less opportunity cost of capital	$m	4.1	(12)	4.6	(15)	5.1	(8)	4.8	(15)	3.2	(14)
less depreciation	$m	7.0	(12)	6.7	(15)	8.3	(8)	6.9	(15)	5.0	(15)
plus interest, leasing and management fees	$m	10.3	(13)	6.0	(11)	6.5	(7)	7.6	(19)	5.1	(18)
net return – excl. management costs	$m	4.2	(85)	-1.5	(215)	-15.9	(14)	-12.2	(18)	-5.7	(28)
management costs	$m	1.4	na	2.3	na	2.7	na	2.9	na	2.5	na
net return – incl. management costs	$m	2.8	na	-3.8	na	-18.7	na	-15.1	na	-8.3	na
number of active boats	no.	132		141		138		132		112	

na Not applicable.
Note: Figures in parentheses are relative standard errors. A guide to interpreting these is included in appendix A.

While boat cash profit (which is presented in table 3) sheds light on the cash position of a fishery, unlike net returns, 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 labour and the opportunity cost of capital. To calculate net returns, these costs need to be deducted from boat cash profit. The value of interest and quota/permit leasing costs then needs to be added into the net returns equation as these items represent profits that have been redistributed to other investors in the fishery and should not be counted as costs in the calculation of net returns. Finally, total management costs (both recoverable and nonrecoverable) must be deducted. Boat cash profit already includes some management costs that appear in individual fishers' accounts. To avoid double counting, these costs are added back into the net returns equation and total fishery management costs (both recoverable and nonrecoverable) which are provided by AFMA are then deducted. This calculation is specified as:

$$NR = R - CC - OC - DEP - OWNFL + ILR + accMC - totMC$$

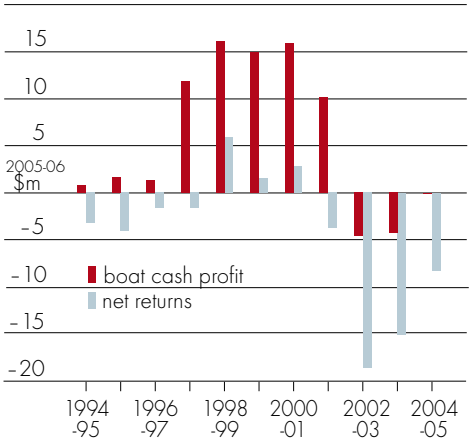
where:

NR	net returns
R	total cash receipts
CC	cash costs
OC	opportunity cost of capital
DEP	depreciation
OWNFL	owner and family labour
ILR	interest and quota/permit leasing costs
accMC	management costs from fisher's accounts
totMC	total management costs.

Once these adjustments have been made, net returns (including management costs) are calculated. Net returns (including management costs) between 1994-95 and 2001-02 were between –$4.1 in 1995-96 and $5.9 million in 1998-99 (figure C). The peak in 1998-99 coincided with the development of the swordfish component of the fishery. However, since the early 2000s, net returns have fallen dramatically. This has been driven by higher diesel costs, lower export prices partly as a consequence of the appreciation of the Australian dollar, and probable localised depletions of the inshore swordfish stock.

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.

fig C **boat cash profit and net returns**
total for eastern tuna and billfish fishery



southern and eastern scalefish and shark fishery

the fishery

The southern and eastern scalefish and shark fishery (SESSF) covers an area that extends south from southern Queensland around Tasmania and west to Cape Leeuwin in Western Australia. Within this area, complex jurisdictional arrangements exist between the Australian Government and state governments over management of the fishery.

The fishery was established in 2003 following AFMA's implementation of the *Southern and Eastern Scalefish and Shark Fishery Management Plan 2003*. The management plan provided for the merger of three previously separate Commonwealth fisheries. They are now managed as separate sectors within the southern and eastern scalefish and shark fishery. These include:

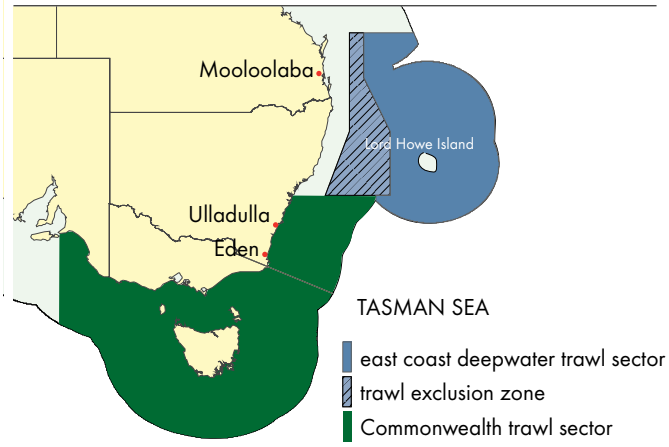
- Commonwealth trawl sector
- gillnet, hook and trap sector
- Great Australian Bight trawl sector.

In 2006, ABARE conducted an economic survey of the three sectors of the southern and eastern scalefish and shark fishery. However, results are provided in this report only for the Commonwealth trawl and gillnet, hook and trap sectors, given the insufficient number of willing participants in the Great Australian Bight trawl sector.

Commonwealth trawl sector

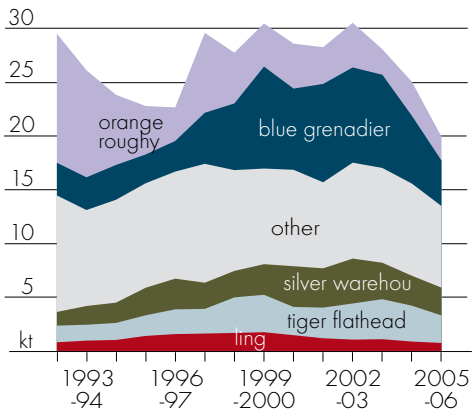
Previously managed as the south east trawl fishery, the Commonwealth trawl sector is one of Australia's oldest commercial fishing sectors, initially operating off Sydney in the early 1900s (DEH 2003). It is the largest sector in the southern and eastern scalefish and shark fishery and supplies the majority of fresh fish to markets in New South Wales, Victoria, Tasmania and South Australia (Smith and Wayte 2004).

map 2 **location of the Commonwealth trawl sector**
southern and eastern scalefish and shark fishery



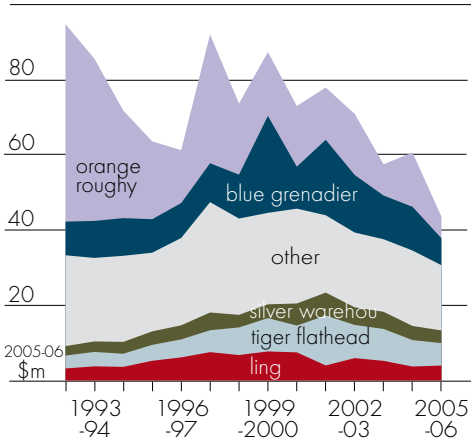
Ninety-five vessels operated in the Commonwealth trawl sector in the 2004-05 financial year. Vessels operate in the southern waters of the Australian Fishing Zone between Sandy Cape in southern Queensland and Cape Jervis in South Australia (map 2). Otter trawling is the dominant fishing method used although a sizable Danish seine fleet operates out of Lakes Entrance, Victoria (Smith and Wayte 2004).

fig D **landed catch**
Commonwealth trawl sector



Over 100 species of finfish and invertebrates are captured in the Commonwealth trawl sector although only 20 species are targeted (Smith and Wayte 2004). In 2005-06 total landings were almost 20 000 tonnes, 35 per cent less than in 2002-03 when the catch peaked at 30 600 tonnes (figure D). The 2005-06 catch included 4230 tonnes of blue grenadier, 2560 tonnes of tiger flathead, 2220 tonnes of orange

fig E **real gross value of production**
Commonwealth trawl sector



roughy, 2590 tonnes of silver warehou and 740 tonnes of ling. These five species made up 62 per cent of the total catch.

The real gross value of production (GVP) for the sector in 2005-06 was just under $44 million, 54 per cent less than in 1992-93. This is mainly the result of a steep decline in the total catch of orange roughy over this period (figure E). In 2005-06, blue grenadier, tiger flathead, orange roughy, silver warehou and ling accounted for 60 per cent of total gross value of production.

gillnet, hook and trap sector

This sector of the fishery consists of what were previously the south east nontrawl fishery and the southern shark fishery. Both fisheries had been in operation for long periods of time prior to being merged into the gillnet, hook and trap sector; the south east nontrawl fishery has operated since the early 1900s and the southern shark fishery since 1927 (AFMA 2004).

map 3 **location of the Commonwealth gillnet hook and trap sector**
southern and eastern scalefish and shark fishery

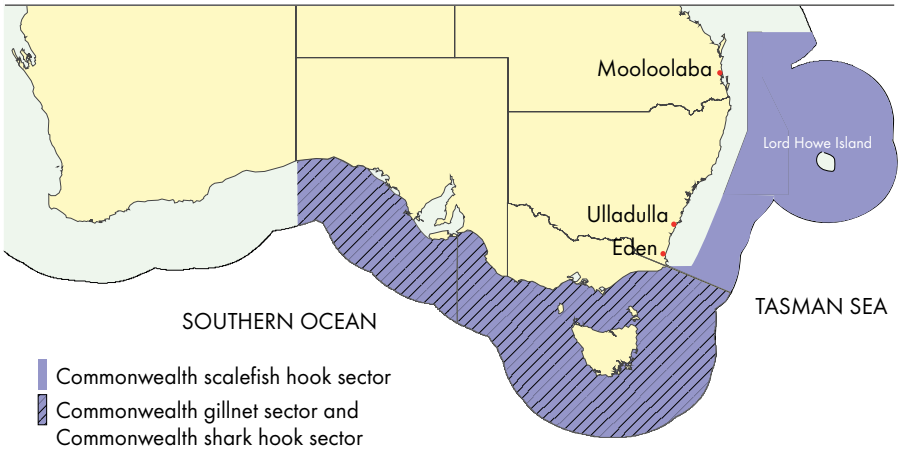


fig F **landed catch** (whole weight)
gillnet, hook and trap sector

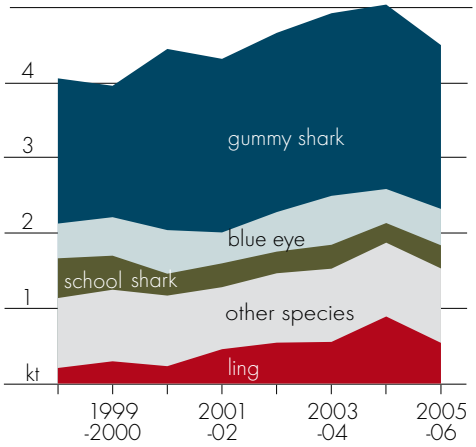
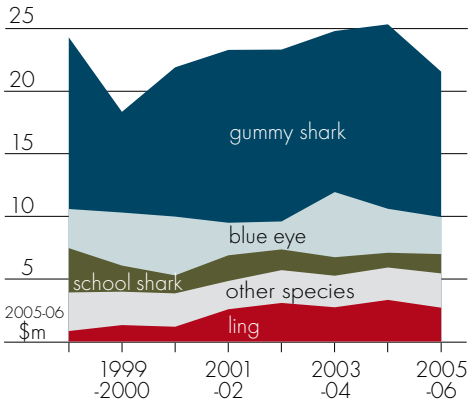


fig G **real gross value of production**
gillnet, hook and trap sector



The sector extends south from southern Queensland to the South Australian – Western Australian border and includes waters to the south of Tasmania (map 3). Gear types used in the sector include demersal gillnets, droplines, demersal longlines and traps. However, operators are only permitted to use gear types that are specified on their boat statutory fishing rights or fishing permit (AFMA 2004).

In 2005-06, 114 vessels operated in this sector and landed 4500 tonnes (whole weight), 11 per cent less than in 2004-05 (figure F). Landings of gummy shark accounted for 48 per cent of total landings. Other species that have historically dominated the landed catch include ling, blue eye trevalla and school shark.

Following a peak in 2004-05, gross value of production for the sector declined by 15 per cent in 2005-06 to $21.5 million (figure G). Landings of gummy shark accounted for 54 per cent of this value.

biological status of the fishery

The Bureau of Rural Sciences (BRS) publishes the most recent stock assessment results for the main target species of all Commonwealth fisheries in its annual *Fisheries Status Report* (McLoughlin 2006). Because of the large number of species targeted in the fishery, only the biological status of the six key scalefish species and the two key shark species are described in detail here. A brief description of the status of each of the quota species in the fishery is presented in table 4.

table 4 **biological status of major species in the southern and eastern scalefish and shark fishery**

species	status
blue eye trevalla	Not overfished but localised overfishing may be occurring
blue grenadier	Not overfished but further TAC reductions are needed to maintain spawning biomass at the target reference point until adult recruitment occurs
blue warehou	Western stock not overfished; eastern stock overfished and overfishing may still be occurring
eastern school whiting	Not overfished for the main Jervis Bay–Portland stock; probably underfished for other stocks
flathead	Not overfished but annual landings in excess of 3000 tonnes may constitute overfishing
gemfish – eastern stock	Overfished; probable overfishing through bycatch mortality; there are no signs of stock recovery
gemfish – western stock	Uncertain
jackass morwong	Not overfished
john dory	Uncertain
mirror dory	Uncertain
ocean perch	Uncertain
orange roughy – eastern	Overfished and overfishing occurring
orange roughy – southern	Overfished
orange roughy – western	Overfished and overfishing is occurring
orange roughy – Cascade	Not overfished but overfishing is occurring
pink ling	Not overfished but overfishing is occurring
redfish	Overfished and growth overfishing is occurring
royal red prawn	Uncertain
school shark	Overfished
gummy shark	Not overfished
sawshark and elephant fish	Uncertain
deepwater shark	Upper slope species overfished; uncertain if overfishing is occurring; mid slope species not overfished; uncertain if overfishing is occurring
silver trevally	Overfished and overfishing is occurring
spotted warehou	Not overfished
ribaldo	Uncertain
smooth oreo dory	Uncertain on Cascade Plateau, overfished elsewhere
other oreo dories	Overfished

Source: McLoughlin (2006)

scalefish species

For the Commonwealth trawl sector, the total scalefish catch in 2004 declined by 11 per cent from the previous year, despite a record number of total hours trawled in the year. The ongoing increase in trawl hours over the past decade and the decline in catch per unit of effort that has been associated with it was threatening the sustainability of the sector (McLoughlin 2006). However, the recent reduction in boat numbers operating in the sector is expected to alleviate the problem.

For the gillnet, hook and trap sector in 2004, the total scalefish catch was 38 per cent higher than in 2003. This increase was driven predominately by an increased catch of pink ling by autolongliners and a doubling of effort in terms of hook numbers from 2003 to 2004 (McLoughlin 2006).

blue eye trevalla

status: Not overfished but localised overfishing may be occurring.

Conventional stock assesment modelling of the blue eye trevalla stock to date has proven unsuccessful. Therefore, no quantitative assessment has yet been completed. All indicators, however, suggest that the stock is fully fished. A decline in the unstandardised trawl catch rate since 2001 suggests that population has declined. Whether or not overfishing is occurring remains uncertain (McLoughlin 2006).

blue grenadier

status: Not overfished but further reductions in total allowable catch (TAC) are needed to maintain spawning biomass at the target reference point until adult recruitment occurs.

AFMA's target is to maintain the spawning biomass above 40 per cent of the reference point – the average spawning biomass between 1978 and 1988. The most recent assessment (2004-05) estimated that the female spawning biomass in 2004 was at 44 per cent of this reference point (McLoughlin 2006). The recommended TAC was reduced to 5000 tonnes in 2005 (McLoughlin 2006), 3730 tonnes in 2006 and was further reduced for 2007 but was then adjusted to 4113 tonnes for the extended 2007 season. The 2007 season will run for sixteen months from January 2007 to April 2008; TACs have been adjusted for the longer season accordingly (AFMA 2006e). Further TAC reductions will be required to maintain the spawning biomass above the target level, as there has been no strong recruitment in recent years. The 2004-05 assessment also showed that a strong cohort was spawned in 2003 but will not enter the spawning biomass until they are seven years old (McLoughlin 2006).

flathead

status: Not overfished but annual landings in excess of 3000 tonnes may constitute overfishing.

A 2004-05 stock assessment estimated spawning biomass to be at 40 per cent of its unfished level. Annual long term sustainable yield for flathead was also estimated to range between 2200 and 2800 tonnes (McLoughlin 2006). Catches of 3603 tonnes in 2004 and 3004 tonnes in 2005 were above this range (AFMA 2006a). A TAC of 3000 tonnes was set in 2006 and was then reduced in 2007. However, following adjustment for the extended season the 2007 TAC was set at 4020 tonnes (AFMA 2006c).

pink ling

status: Not overfished but overfishing is occurring.

Current pink ling stock levels are high enough to be deemed not overfished. However, a continuation of recent catch trends will lead to overfishing (McLoughlin 2006). A 2004-05 stock assessment suggested a long term sustainable yield of between 1200 and 1400 tonnes but recent catches prior to 2005 exceeded 1600 tonnes. Indeed, trawl catch rates of pink ling have been below AFMA's target reference point since 2000 and indicate overfishing. Consequently, a reduced TAC of 1400 tonnes was introduced in 2005 (McLoughlin 2006). This was further reduced to 1200 tonnes in 2006 and was to be maintained at this level in 2007 but was adjusted to 1537 tonnes for the extended season (AFMA 2006c). These reduced TACs will ease fishing mortality but growth overfishing remains a problem. Increased autolonglining for pink ling in recent years has resulted in the capture of larger and older fish relative to what was previously caught by trawl methods (McLoughlin 2006).

orange roughy

status: All stocks overfished except for Cascade Plateau stock which is not overfished.

Orange roughy are a slow growing, long lived species that have a low reproductive rate. They also form spawning aggregations that can be easily targeted and are therefore highly vulnerable to overfishing. Currently, stocks are heavily depleted following high catches in the late 1980s and early 1990s and continued overfishing since then. Stocks are currently managed under four separate zones (McLoughlin 2006).

Eastern zone orange roughy are classed as overfished. An assessment in 2002 indicated a stock biomass of 7–13 per cent of the prefishery biomass. AFMA's immediate management goal is a biomass level greater than 20 per cent of the limit reference point. Despite this, the allocated TAC in 2005 was 738 tonnes and in 2006 the recommended TAC was 700 tonnes (McLoughlin 2006). In 2007, the TAC has been reduced to a limit of 27 tonnes that has been adjusted for the extended 2007 season and applies only for bycatch purposes.

Southern zone orange roughy are also classed as overfished. An assessment of the stock in 2000 showed that AFMA's target reference point could not be met even under a zero TAC scenario. More recently, however, catches per shot increased between 2001 and 2003. This may indicate that the stock is recovering (McLoughlin 2006). A TAC of 100 tonnes applied to the zone in 2005 (McLoughlin 2006). This was reduced to 10 tonnes in 2006 before being increased slightly in 2007 to a final adjusted TAC for the extended 2007 season of 40 tonnes, which exists only for bycatch purposes in the CTS (AFMA 2006c).

Western zone orange roughy are also classed as overfished and overfishing is continuing despite evidence suggesting that a zero TAC should be implemented (McLoughlin 2006). A TAC of 487 tonnes was set in 2005 and reduced to 250 tonnes in 2006 and reduced again in 2007 to a TAC adjusted for the extended 2007 season and for bycatch purposes only of 61 tonnes (AFMA 2006c).

The orange roughy stock in the Cascade Plateau zone is currently classed as not overfished, although current effort levels are excessively high and overfishing is occurring (McLoughlin 2006). A 2004 assessment estimated the stock biomass at between 36 and 60 per cent of prefishery biomass. The same assessment calculated a long term sustainable yield for the stock of between 200 and 400 tonnes (McLoughlin 2006). Despite this estimate, the zone's allocated TAC was exceptionally high in 2005 at 1326 tonnes. It has since been reduced to 700 tonnes in 2006 and further to 483 tonnes for the extended 2007 season (AFMA 2006c).

spotted (silver) warehou

status: Not overfished

Spotted warehou tend to school and are therefore mainly caught by trawl method. Catches of the species peaked in 2002 at 4100 tonnes but have declined since. Modelling results from 2004 indicate that the current biomass is at 60 per cent of the unfished level. Results also indicated that the stock biomass could drop below the target reference level of 40 per cent of the unfished biomass, with a 50 per cent

probability if combined annual landings and discards are greater than 5500 tonnes over a five year period. While not currently classed as overfished careful monitoring of the species is required as the low prices paid for the species encourages heavy discarding (McLoughlin 2006). The 2006 TAC was 4400 tonnes and was reduced to a level adjusted for the extended 2007 season of 4117 tonnes (AFMA 2006c).

shark species

Sharks commonly exhibit low fecundity, are long lived and mature at a late age. These characteristics mean that they are highly vulnerable to overfishing. The four quota managed shark species targeted in the gillnet, hook and trap sector are school shark, gummy shark, elephant fish and saw shark (McLoughlin 2006). (Various deepwater shark species are also caught in the fishery but are mainly caught in the trawl sector.) Discussion here is limited to the two main species – school shark and gummy shark.

school sharks

status: Overfished

School shark stocks are estimated to have a long term potential yield of 950 tonnes. The TAC, however, is set much lower to allow stock recovery from previous overfishing since the mid–1980s. Prior to 2001, AFMA's objective for the species was to achieve a spawning biomass by 2011 greater than that which prevailed in 1996. However, an assessment in 2001 estimated spawning biomass levels of between 9 and 14 per cent of prefishery levels and showed that the objective could not be achieved by 2011 even with zero catch. The target date was subsequently changed to 2024. A TAC schedule sets out future changes to the TAC required to achieve the objective. Following 2007, a constant annual TAC of 240 tonnes will be proposed (McLoughlin 2006).

gummy sharks

status: Not overfished

Recent stock assessments suggest that gummy shark is probably not overfished. Assessments indicate a long term potential yield for the species is 1800 tonnes. Stock assessments are based on gummy shark pup production in three separate populations located in Bass Strait, South Australia and Tasmania. The 2000 assessment indicated that production of gummy shark pups as a proportion of virgin levels was 74 per cent for the Bass Strait population, 76 per cent for the South Australian population and uncertain for the Tasmanian population due to

a lack of data, although probably comparable to the other two populations. While no reference point exists, stabilising pup production above 40 per cent of virgin levels has been suggested as a possible target. The latest 2004 assessment indicates that pup production has been in gradual decline since the 1980s but is still above the proposed 40 per cent target (McLoughlin 2006). The TAC for the extended 2007 season has been set to 2467 tonnes (AFMA 2006c).

management of the fishery

Management of the fishery is predominately based on output controls in the form of individual transferable quotas (ITQs) and total allowable catches (TACs). These were first introduced in the former south east trawl fishery (SETF) for gemfish and orange roughy in 1988 and 1990 respectively (Smith and Wayte 2004). In 1992, AFMA further expanded ITQ management in the SETF to a total of sixteen target species; partly in response to worsening economic conditions across the fishery (Smith and Wayte 2004). Then in 1998, ITQ management was expanded to the nontrawl sector to cover catches of blue eye trevalla, blue warehou and ling given increasing catches of these species in that sector (McLoughlin 2006). ITQ management of all quota managed species in the SETF was then expanded to the nontrawl sector with the setting of 'global TACs' in 2001. Twenty-two scalefish species or species groups are now managed under global TACs in all sectors of the fishery using ITQ SFRs (McLoughlin 2006).

The major shark species taken in the fishery (excluding deepwater shark) were previously managed in the southern shark fishery. ITQs were first introduced into this fishery for school and gummy shark in 2001 and then saw shark and elephant fish in 2002. These species are now managed with annual quota permits in the fishery. In 2008, however, management of these species will move to quota SFRs given the recent resolution of legal action taken by permit holders against AFMA challenging the initial shark quota allocation process (AFMA 2006d).

For each species managed with quota in the fishery, an agreed TAC is set by AFMA using scientific advice from the *SESSF Resource Assessment Groups* (SESSRAG) and in consultation with the relevant management advisory committees (AFMA 2005b). Each quota SFR or permit entitles it's owner to a specified share of this agreed TAC. Using this agreed TAC, an actual TAC is arrived at that incorporates all provisions for over and undercaught quota across the fishery from the previous year (AFMA 2005b). In 2005, the agreed and actual TAC were equal given that no overcatch/undercatch allowance was made on the previous year's quota catches (Shoulder 2004). A 10 per cent overcatch/undercatch

table 5 **total allowable catches**
southern and eastern scalefish and shark fishery

species	2006 TAC	extended 2007 season* TAC
	tonnes	tonnes
alfonsino	500	576
bight redfish	1 400	3 338
blue eye trevalla	560	785
blue grenadier	3 730	4 113
blue warehou	650	313
deepwater flathead	3 000	2 109
flathead	3 000	4 020
gemfish–eastern	100	121
gemfish–western	167	200
jackass morwong	1 200	1 171
john dory	190	237
mirror dory	634	788
ocean perch	500	585
orange roughy		
– cascade zone	700	483
– albany/esperance	212	52
– east	720	27
– south	10	40
– west	250	61
oreo basket	200	190
oreo smooth – cascade	100	93
oreo smooth – other	50	52
pink ling	1 200	1 537
redfish	900	896
ribaldo	165	257
royal red prawn	500	556
school whiting	1 500	978
silver trevally	270	191
spotted (silver) warehou	4 400	4 117
deepwater shark basket–east	92	21
deepwater shark basket–west	108	10
elephant fish	130	123
gummy shark	1 700	2 467
saw shark	434	410
school shark	257	352

* The extended 2007 season runs from January 2007 to April 2008.

allowance was put on catches in 2005 to be carried forward to 2006 (AFMA 2005b), and once again on 2006 catches for TACs in 2007 (AFMA 2006e). The agreed TACs for 2006 and the extended 2007 season are contained in table 5.

To ensure that TACs are not exceeded, catches must be reconciled against quota holdings. Previously, quota reconciliation in the fishery was only required on 31 December for the entire year. In 2006 an additional quota reconciliation period was introduced for catches up to 31 August (Shoulder 2006). In 2007, quarterly quota reconciliation every four months has been introduced in conjunction with an extended sixteen month season that runs from January 2007 to April 2008 (AFMA 2006f). The 2008 season and all seasons that follow will then run for twelve months from May to April (AFMA 2006e).

An important change to the way TACs are set in the fishery was introduced in 2005, with the implementation of a harvest strategy framework. The framework provides a more strategic approach to determining TACs and specifies how TACs should be altered when the stock declines or rises below or above

certain levels. It also requires that the TAC accounts for discards and catches from other jurisdictions and/or fisheries.

In addition to output controls, a variety of input controls are also used to manage the fishery. Controls include limited entry, seasonal and area closures, catch size limits, catch possession limits per trip for some species and a variety of gear restrictions. In the Commonwealth trawl sector minimum mesh size limits apply of 90 millimetres for demersal trawl nets, 38 millimetres for Danish seine nets and between 40 and 60 millimetres for royal red prawn nets. In the gillnet, hook and trap sector, the use of gillnets is not allowed south of the 41°S and in waters deeper than 200 metres. Gillnets must not be greater than 4200 metres in length and net mesh size must fall within the size range of 15–16.5 centimetres inclusive. No hook limits apply in Commonwealth waters for hook and line operators in the gillnet, hook and trap sector (with the exception of automatic longline operators) (AFMA 2005).

Automatic longlining is a relatively new method of fishing used in the gillnet, hook and trap sector. Ten vessels are currently permitted to use this fishing technique in the fishery (Trent Timmis, AFMA, personal communication, 26 March 2007). The method is a form of demersal longlining where some stages have become automated so that an increased numbers of hooks can be set. Automatic longline operators must abide by specific rules on where and when they operate. Also, in accordance with the *Threat Abatement Plan for the Incidental Catch (or bycatch) of Seabirds During Oceanic Longlining Operations*, automatic longline operators are required to comply with additional restrictions, including an upper hook limit of 15 000 hooks, mandatory use of bird scaring tori lines, observer coverage and integrated computer vessel monitoring system (ICVMS) requirements (AFMA 2005).

Bycatch has historically been a major issue for the southern and eastern scalefish and shark fishery, particularly in the Commonwealth trawl sector where discard rates of 35 per cent previously prevailed (DEH 2003). Sector specific bycatch action plan currently apply in the fishery. However, in 2007, AFMA will be releasing a single bycatch action plan for the fishery to replace the sector specific bycatch action plans. Currently in draft form, it provides guidelines that aim to improve bycatch data and reduce bycatch in the fishery (AFMA 2005).

The fishery has been undergoing major changes recently following a number of Australian Government initiatives. In November 2005, the Australian Government announced the $220 million *Securing Our Fishing Future Initiative*. As part of the initiative, $150 million was set aside for a voluntary tender process for fishing businesses to exit the industry (DAFF 2006). The first round of the tender process was

completed in September 2006 and resulted in 142 boat SFRs being bought out of the fishery (Abetz 2006). A second round tender process was run between October and November 2006 and a further 23 boat permits were bought out. The final result was a 46 per cent reduction in the number of SFRs in the fishery (Abetz 2006).

A Direction from the Minister of Fisheries, Forestry and Conservation to AFMA was announced in December 2005 shortly after the announcement of the *Securing Our Fishing Future Initiative*. The key objectives of the direction are to cease overfishing and to manage the broader environmental impacts of Commonwealth fisheries. Potential strategies identified to achieve these goals include phasing out boat SFRs, minimising incentives to discard, improving monitoring, establishing catch surveys and implementing spatial closures (AFMA 2006e). Some of these strategies have already been pursued to some degree in the fishery but potential changes for the future include the introduction of stock recovery plans, management of regional stocks and nonquota species management.

results for the Commonwealth trawl sector

boats surveyed

The survey of the Commonwealth trawl sector covered the three years 2002-03, 2003-04 and 2004-05. For each year, the target population was defined as boats endorsed to fish in the sector that had caught in excess of 1000 kilograms.

For 2002-03, 20 vessels were sampled from a population of 100 vessels. For 2003-04, 25 vessels were sampled from a population of 97 and for 2004-05, 27 vessels were sampled from a total population of 91.

The sector can be further broken down into subsectors based on fishing method – Danish seine and trawl. However, with an insufficient sample size in the Danish seine fleet in 2002-03, subsector results are only reported for 2003-04 and 2004-05 in order to protect the confidentiality of cooperators.

financial performance of the fishery

Key measures of the financial performance of the sector's fishing fleet are contained in tables 6 and 7. Table 6 contains financial performance values for all boats in the sector for all three survey years. Table 7 contains results for the Danish seine and trawl sectors for 2003-04 and 2004-05. Definitions of items contained in these two tables are outlined in appendix A.

receipts

Average total cash receipts per boat varied little over the three survey years and were around $628 000 in 2004-05. Receipts may include receipts accrued from landings in other fisheries, including state fisheries.

Within both subsectors reported in table 7, total cash receipts were also relatively constant between survey years. Cash receipts were substantially higher for vessels in the trawl sector at an average of around $709 000 a boat in 2004-05, compared with $300 000 a boat for the same year in the Danish seine sector.

table 6 **financial performance of all boats operating in the Commonwealth trawl sector** average per boat

		2002-03		2003-04		2004-05	
seafood receipts	$	571 764	(14)	543 479	(11)	566 455	(18)
nonfishing receipts	$	48 848	(13)	60 796	(13)	62 018	(16)
total cash receipts	$	620 612	(14)	604 275	(11)	628 473	(17)
administration	$	13 764	(15)	12 714	(11)	11 996	(14)
crew costs	$	183 956	(13)	170 216	(10)	183 774	(17)
freight and marketing expenses	$	107 628	(15)	96 972	(12)	90 121	(16)
fuel	$	115 407	(11)	120 513	(11)	140 832	(14)
insurance	$	17 598	(14)	19 625	(15)	18 036	(16)
interest paid	$	14 697	(23)	13 396	(25)	11 422	(26)
licence fees and levies	$	20 020	(23)	14 885	(13)	13 701	(13)
repairs and maintenance	$	67 048	(13)	67 448	(13)	72 133	(13)
other costs	$	64 900	(20)	63 581	(18)	76 982	(32)
total cash costs	$	605 018	(11)	579 352	(9)	618 997	(16)
boat cash income	$	15 594	(163)	24 923	(84)	9 476	(174)
less depreciation **a**	$	19 885	(15)	20 291	(21)	21 097	(14)
boat business profit	$	– 4 291	(608)	4 632	(468)	– 11 621	(134)
plus interest, leasing and rent	$	33 150	(17)	48 027	(22)	60 832	(39)
profit at full equity	$	28 860	(94)	52 658	(46)	49 211	(71)
capital							
– excl. quota and licences	$	351 505	(12)	376 337	(14)	325 565	(22)
– incl. quota and licences	$	1 284 094	(12)	1 247 626	(11)	1 278 498	(14)
rate of return							
– to boat capital **b**	%	8.2	(93)	14.0	(47)	15.1	(55)
– to full equity **c**	%	2.2	(94)	4.2	(46)	3.8	(61)

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.
Note: Figures in parentheses are relative standard errors. A guide to interpreting these is included in appendix A.

table 7 **financial performance of Danish seine and trawl boats operating in the Commonwealth trawl sector** average per boat

		Danish seine				trawl			
		2003-04		2004-05		2003-04		2004-05	
seafood receipts	$	257 419	(8)	287 968	(11)	613 160	(13)	635 123	(20)
nonfishing receipts	$	26 327	(45)	12 508	(25)	69 192	(13)	74 226	(16)
total cash receipts	$	283 746	(7)	300 475	(11)	682 352	(12)	709 349	(19)
administration	$	6 986	(17)	3 269	(24)	14 109	(12)	14 148	(14)
crew costs	$	101 172	(11)	121 994	(9)	187 035	(11)	199 008	(20)
freight and marketing expenses	$	49 703	(18)	41 663	(20)	108 487	(13)	102 070	(17)
fuel	$	36 224	(15)	37 614	(11)	141 045	(11)	166 283	(15)
insurance	$	14 244	(19)	10 934	(12)	20 936	(18)	19 787	(18)
interest paid	$	4 101	(92)	3 403	(77)	15 660	(26)	13 399	(28)
licence fees and levies	$	5 533	(50)	7 256	(16)	17 163	(14)	15 290	(14)
repairs and maintenance	$	22 097	(12)	22 919	(25)	78 495	(14)	84 267	(14)
other costs	$	20 598	(16)	19 456	(17)	74 052	(19)	91 166	(34)
total cash costs	$	260 656	(11)	268 508	(9)	656 982	(10)	705 419	(17)
boat cash income	$	23 090	(63)	31 968	(63)	25 370	(101)	3 930	(506)
less depreciation **a**	$	18 587	(33)	13 028	(27)	20 706	(25)	23 087	(16)
boat business profit	$	4 503	(411)	18 940	(119)	4 663	(570)	- 19 157	(97)
plus interest, leasing and rent	$	7 955	(56)	9 400	(37)	57 788	(23)	73 514	(40)
profit at full equity	$	12 458	(155)	28 340	(83)	62 451	(48)	54 357	(80)
capital									
– excl. quota and licences	$	260 709	(20)	190 576	(24)	404 502	(15)	358 849	(25)
– incl. quota and licences	$	1 009 694	(12)	1 264 606	(11)	1 305 584	(13)	1 281 923	(17)
rate of return									
– to boat capital **b**	%	4.8	(152)	14.9	(72)	15.4	(49)	15.1	(61)
– to full equity **c**	%	1.2	(156)	2.2	(84)	4.8	(48)	4.2	(67)

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.

Note: Figures in parentheses are relative standard errors. A guide to interpreting these is included in appendix A.

costs

Like receipts, average total cash costs in the Commonwealth trawl sector showed little variation over the three year survey period. Average total cash costs per boat in 2004-05 were $619 000.

Crew costs, followed by fuel costs and then freight and marketing expenses were the largest cost items over all three survey years and together accounted for 67 per cent of total cash costs in 2004-05. As crew are normally paid on a share basis, movements in crew costs follow movements in fishing receipts. Crew costs therefore remained fairly constant over the survey period. Also, repairs and maintenance costs remained stable over the survey period, at an average of between $67 000 and $72 000 per boat a year. Average fuel costs on the other hand increased over the three survey years by 22 per cent – from $115 000 a boat in 2002-03 to $141 000 per boat in 2004-05. Freight and marketing costs decreased by 16 per cent over the survey period. This may be a consequence of the decline in landings that occurred over the survey period.

At the subsector level, average total cash costs were $705 000 a boat in the trawl sector in 2004-05 compared with a much lower $269 000 a boat in the Danish seine sector for the same year. Average costs per boat increased slightly more for the trawl sector between 2003-04 and 2004-05, with an increase of 7 per cent, in comparison to the Danish seine sector's 3 per cent rise. The observed cost increase in the trawl sector was largely driven by an 18 per cent increase in fuel costs. Fuel costs showed little change for the Danish seine sector.

boat cash income and profit

Average boat cash income, or the difference between total cash receipts and total cash costs, in the Commonwealth trawl sector fell from $25 000 per boat in 2003-04 to $9500 per boat in 2004-05.

Boat business profit, which is boat cash income less an allowance for depreciation, was negative in both 2002-03 and 2004-05, with average values per boat of around –$4300 and –$11 600 respectively, and was only slightly positive in 2003-04 at $4600.

Average profit at full equity per boat, which is boat business profit plus interest, leasing and rent, was $49 000 in 2004-05, similar to that in 2003-04. However, in 2002-03 profit at full equity was noticeably lower, at $29 000 per boat. While interest, leasing and rent costs affect the financial position of the operator, they represent some profits that have been redistributed to other investors in the fishery.

These values for profit at full equity therefore represent the average return that would have been earned by a business unit in the sector had the boat and capital (including quota and licences) been fully owned by the operator.

At the subsector level, average boat cash income in the Danish seine sector increased from $23 000 per boat in 2003-04 to just under $32 000 per boat in 2004-05. Boat business profit remained positive in both 2003-04 and 2004-05 for the Danish seine sector and was $19 000 a boat in the latter year. Average profit at full equity was $28 000 per vessel in 2004-05.

For the trawl sector, average boat cash income fell from $25 400 per boat in 2003-04 to just under $4000 per boat in 2004-05, while boat business profit decreased from $4700 per boat to a negative value of $19 000 per boat. Average profit at full equity was $54 000 per boat for trawlers in 2004-05, substantially higher than for Danish seiners in the same year because of the higher interest, leasing and rent expenses added in the trawl sector.

rates of return

The rate of return to boat capital is based 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) for the average vessel in the Commonwealth trawl sector increased between the first two survey years from 8.2 per cent in 2002-03 to 14 per cent in 2003-04. It remained relatively stable in 2004-05 at 15 per cent.

At the subsector level, the rate of return to boat capital in the Danish seine sector was relatively low in 2003-04 at 4.8 per cent but increased considerably in 2004-05 to almost 15 per cent. This was caused by receipts increasing by a larger amount relative to costs and lower boat capital values and depreciation in 2004-05. Conversely, the rate of return to boat capital in the trawl sector moved little between the two survey years and was 15 per cent in 2004-05.

The rate of return to full equity includes the value of quota and licences in addition to boat 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.

The estimated value of quota and licences attached to each boat remained relatively stable over the three survey years and was $953 000 a boat in 2004-05. This value includes the estimated market value of quota and licences used by the boat, including the value of endorsements outside the sector, for example, state licences. The rate of return to full equity, which incorporates these endorsement values, increased from 2.2 per cent in 2002-03 to 4.2 per cent in 2003-04 and then fell slightly in 2004-05 to 3.8 per cent. These rates of return to full equity are quite low and reflect the high estimated values of quota and licence endorsements owned by operators in the Commonwealth trawl sector.

At the subsector level, the rate of return to full equity moved little between 2003-04 and 2004-05 in both sectors and was higher in the trawl sector for both years. In 2004-05, the rate of return to full equity was 4.2 per cent in the trawl sector and 2.2 per cent in the Danish seine sector.

economic performance of the fishery

The results presented in tables 6 and 7 show changes in the average receipts and costs of boats that operated in the Commonwealth trawl sector in the three survey years. However, they shed little light on the economic performance of the whole sector as they include receipts and costs earned and incurred from operations in other fisheries and no allowance is made for the opportunity cost of capital employed in the sector. Table 8 shows boat cash profit and net returns generated from the sector as a whole. Only receipts and costs earned and incurred in the sector are included.

Receipts in the sector declined over the three year survey period. Receipts fell by 8 per cent between 2002-03 and 2003-04 from $58.7 million to $53.8 million and then by a further 6 per cent to $50.7 million in 2004-05.

Boat cash profit, which is fishing income less cash costs, also declined over the survey period but more rapidly. In the first survey year the CTS had a total boat cash profit of $3.6 million. In 2003-04, it fell by 30 per cent to $2.5 million and then declined by a further 64 per cent to $0.9 million.

While boat cash profit (which is presented in table 8) sheds light on the cash position of a fishery, unlike net returns, 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 labour and the opportunity cost of capital. To calculate net returns, these costs need to be deducted from boat cash profit. The value of interest and quota/permit leasing costs then needs to be

table 8 **boat cash profit and net returns in the Commonwealth trawl sector**
total for fishery sector in 2005-06 dollars

		1996-97		1997-98		1998-99		1999-00		2000-01	
fishing receipts	$m	73.6	(16)	80.3	(16)	65.5	(13)	72.0	(15)	78.0	(12)
cash costs	$m	65.9	(14)	68.0	(13)	57.9	(13)	64.8	(14)	67.4	(12)
boat cash profit		7.7	(46)	12.3	(43)	7.5	(35)	7.2	(55)	10.6	(24)
less owner and family labour	$m	6.8	(9)	7.1	(10)	4.5	(12)	4.7	(13)	6.5	(13)
less opportunity cost of capital	$m	2.9	(11)	2.5	(11)	1.9	(12)	1.7	(15)	1.8	(11)
less depreciation	$m	4.0	(10)	3.9	(11)	2.7	(11)	2.7	(13)	2.4	(9)
plus interest, leasing and management fees	$m	11.4	(24)	10.2	(21)	4.9	(14)	5.0	(15)	5.7	(14)
net return – excl. management costs	$m	5.4	(108)	9.0	(63)	3.3	(89)	3.1	(142)	5.6	(56)
management costs	$m	2.5	na	3.5	na	3.1	na	3.4	na	3.0	na
net return – incl. management costs	$m	2.9	na	5.5	na	0.2	na	-0.3	na	2.5	na
number of active boats	no.	109		109		103		101		106	

		2001-02		2002-03		2003-04		2004-05	
fishing receipts	$m	75.9	(14)	58.7	(16)	53.8	(13)	50.7	(20)
cash costs	$m	69.3	(14)	55.1	(14)	51.3	(12)	49.8	(19)
boat cash profit		6.6	(46)	3.6	(68)	2.5	(84)	0.9	(154)
less owner and family labour	$m	5.9	(16)	7.0	(13)	5.9	(13)	5.3	(15)
less opportunity cost of capital	$m	1.5	(10)	1.4	(16)	1.4	(15)	1.2	(15)
less depreciation	$m	2.3	(9)	2.1	(15)	2.3	(16)	1.9	(15)
plus interest, leasing and management fees	$m	6.1	(18)	5.3	(16)	6.0	(20)	6.5	(36)
net return – excl. management costs	$m	3.1	(96)	-1.6	(145)	-1.1	(200)	-1.0	(269)
management costs	$m	2.7	na	3.3	na	3.1	na	3.3	na
net return – incl. management costs	$m	0.4	na	-5.0	na	-4.2	na	-4.3	na
number of active boats	no.	97		100		97		91	

na Not applicable.
Note: Figures in parentheses are relative standard errors. A guide to interpreting these is included in appendix A.

added into the net returns equation as these items represent profits that have been redistributed to other investors in the fishery and should not be counted as costs in the calculation of net returns. Finally, total management costs (both recoverable and nonrecoverable) must be deducted. Boat cash profit already includes some management costs that appear in individual fishers' accounts. To avoid double counting, these costs are added back into the net returns equation and total fishery management costs (both recoverable and nonrecoverable) which are provided by AFMA are then deducted. This calculation is specified as:

$$NR = R - CC - OC - DEP - OWNFL + ILR + accMC - totMC$$

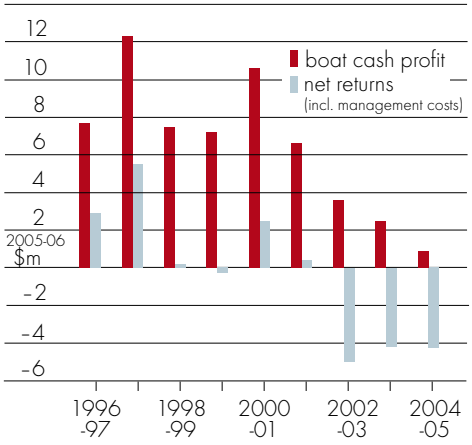
where:

NR	net returns
R	total cash receipts
CC	cash costs
OC	opportunity cost of capital
DEP	depreciation
OWNFL	owner and family labour
ILR	interest and quota/permit leasing costs
accMC	management costs from fisher's accounts
totMC	total management costs.

Once these adjustments have been made, net returns (including management costs) for the sector show a decreasing trend over the period from 1996-97 to 2004-05, as shown in figure H, which compares net returns and boat cash profit. Net rents are quite low in all years and are negative for four of the nine years in which surveys have been conducted. Average net returns over the period were –$0.3 million.

For all three of the years covered in the current survey, net returns were negative. In 2002-03 net returns were at a record low of approximately –$5 million. Net returns then improved slightly in 2003-04 to –$4.2 million before decreasing only marginally to –$4.3 million. So while vessels operating in the sector were making positive cash profits, the inclusion of noncash costs shows that the fishery was making losses over the three survey years. Furthermore, these negative net returns and falling cash profits over the survey period were maintained despite historically high levels of trawl effort.

fig H **boat cash profit and net returns**
total for Commonwealth trawl sector



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, fishery managers have a role to play in ensuring that a fishery is able to maximise profits subject to these external factors.

results for the gillnet, hook and trap sector

boats surveyed

The survey of this sector of the fishery covered 2003-04 and 2004-05. For each year the target population was defined as boats endorsed to fish in the sector that had caught in excess of 1750 kilograms. In 2003-04, 13 vessels were sampled from a population of 107 vessels and in 2004-05, 15 from a population of 98.

The sector can be further broken down into subsectors based on fishing method – gillnet and nongillnet. However, as sample sizes were too small to protect the confidentiality of cooperators, only the aggregated results for both survey years can be reported.

financial performance of the fishery

Key measures of the financial performance of the sector's fishing fleet are contained in table 9. Definitions of items contained in table 9 are outlined in appendix A.

receipts

Average total cash receipts increased by 22 per cent over the survey period from $282 000 in 2003-04 to $344 000 per boat in 2004-05. This occurred in line with the increase in landings that occurred over this period. However, receipts here include receipts accrued from landings in other fisheries, including state lobster fisheries.

costs

Average total cash costs per boat also increased between the two survey years from an average of $243 000 per boat in 2003-04 to around $314 000 per boat in 2004-05 – an increase of approximately 29 per cent.

Crew costs, followed by leasing, repairs and maintenance and then fuel costs were the largest costs items and together accounted for 71 per cent of total cash costs in 2004-05. All cost items increased by some degree between the two survey years, most notably, average fuel costs which increased by 46 per cent to an average per boat of over $30 000 in 2004-05.

table 9 **financial performance of boats operating in the gillnet, hook and trap sector** average per boat

		2003-04		2004-05	
seafood receipts	$	272 097	(23)	317 015	(14)
nonfishing receipts	$	9 800	(43)	26 650	(26)
total cash receipts	$	281 897	(23)	343 665	(13)
administration	$	6 501	(27)	9 014	(16)
bait	$	3 802	(63)	8 393	(44)
crew costs	$	97 372	(25)	120 021	(14)
freight and marketing expenses	$	8 995	(73)	10 054	(50)
fuel	$	20 795	(22)	30 329	(16)
insurance	$	8 759	(32)	12 557	(18)
interest paid	$	9 820	(53)	15 810	(41)
leasing	$	31 802	(41)	39 790	(34)
licence fees and levies	$	11 008	(31)	15 244	(23)
repairs and maintenance	$	26 961	(39)	33 209	(27)
other costs	$	17 194	(18)	19 888	(7)
total cash costs	$	243 008	(24)	314 310	(13)
boat cash income	$	38 889	(29)	29 355	(37)
less depreciation **a**	$	9 927	(33)	16 194	(28)
boat business profit	$	28 962	(35)	13 161	(86)
plus interest, leasing and rent	$	41 622	(32)	55 600	(24)
profit at full equity	$	70 584	(24)	68 761	(21)
capital					
– excl. quota and licences	$	141 504	(28)	240 299	(27)
– incl. quota and licences	$	617 246	(33)	765 190	(19)
rate of return					
– to boat capital **b**	%	49.9	(17)	28.6	(32)
– to full equity **c**	%	11.4	(26)	9.0	(21)

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.

Note: Figures in parentheses are relative standard errors. A guide to interpreting these is included in appendix A.

boat cash income and profit

Average boat cash income refers to the difference between total cash receipts and total cash costs. In 2004-05, boat cash income fell by approximately 25 per cent from $39 000 per boat in 2003-04 to around $29 000 per boat in 2004-05.

Boat business profit, which is boat cash income less an allowance for depreciation, decreased by around 55 per cent between 2003-04 and 2004-05 to approximately $13 000 per boat.

Profit at full equity, which is boat business profit plus interest, leasing and rent, was stable between survey years and was $69 000 per boat in 2004-05. Profit at full equity 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) decreased from 50 per cent in 2003-04 to 29 per cent in 2004-05. These high rates of return are largely the result of the low value of boat and equipment capital in the sector – in particular, the value of fishing boats used in the 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.

The estimated average value of quota and licences attached to each boat was around $476 000 in 2003-04 and $525 000 in 2004-05. This includes the estimated market value of quota and licences used by the boat, including the value of endorsements in other fisheries – for example, lobster licences. The rate of return to full equity, which incorporates these endorsement values, decreased only slightly between survey years, from 11 per cent to 9 per cent in 2004-05.

economic performance of the fishery

The results presented in table 9 show changes in the average receipts and costs of boats that operated in the fishery in 2003-04 and 2004-05. 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 10 shows boat cash profit and net returns generated from the gillnet, hook and trap sector. Only receipts and costs earned and incurred in the sector are included.

Total fishing receipts in the sector were relatively stable between 1998-99 and 2002-03. In 2003-04, however, total fishing receipts increased substantially to a value of $27.8 million, followed by a slight drop in 2004-05 to $26.5 million.

Boat cash profit, which is fishing income less cash operating costs, also increased in 2003-04 from the previous year by around 60 per cent to a value of $7.4 million for the sector before falling to a value of around $4.5 million – a decrease of around 39 per cent.

While boat cash profit (which is presented in table 10) sheds light on the cash position of a fishery, unlike net returns, 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 labour and the opportunity cost of capital. To calculate net returns, these costs need to be deducted from boat cash profit. The value of interest and quota/permit leasing costs then needs to be added into the net returns equation as these items represent profits that have been redistributed to other investors in the fishery and should not be counted as costs in the calculation of net returns. Finally, total management costs (both recoverable and nonrecoverable) must be deducted. Boat cash profit already includes some management costs that appear in individual fishers' accounts. To avoid double counting, these costs are added back into the net returns equation and total fishery management costs (both recoverable and nonrecoverable) that are provided by AFMA are then deducted. This calculation is specified as:

$$NR = R - CC - OC - DEP - OWNFL + ILR + accMC - totMC$$

where:

NR	net returns
R	total cash receipts
CC	cash costs

OC opportunity cost of capital
DEP depreciation
OWNFL owner and family labour
ILR interest and quota/permit leasing costs
accMC management costs from fishers' accounts
totMC total management costs.

Once these adjustments have been made, net returns (including management costs) show an increasing trend over the period from 1998-99 to 2004-05 (figure I). Prior to the current survey period, net returns were generally low and were even negative in one year. Net returns have increased in the two most recent survey years. In 2003-04, net returns (including management

table 10 **boat cash profit and net returns in the gillnet, hook and trap sector**
total for sector in 2005-06 dollars

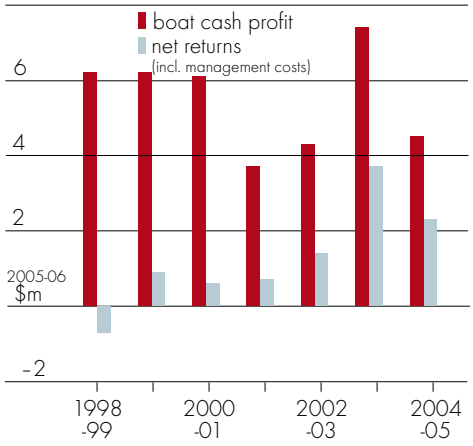
		1998 -99	1999 -2000	2000 -01	2001 -02	2002 -03	2003 -04	2004 -05
fishing receipts	$m	21.7 (12)	23.5 (14)	21.8 (13)	22.8 (17)	22.6 (18)	27.8 (25)	26.5 (20)
cash costs	$m	15.3 (11)	17.2 (16)	15.5 (15)	19.0 (20)	18.0 (21)	20.4 (28)	21.9 (21)
boat cash profit		6.3 (20)	6.3 (19)	6.3 (19)	3.8 (37)	4.6 (19)	7.4 (24)	4.5 (26)
less owner and family labour	$m	5.6 (17)	4.7 (14)	4.5 (14)	3.1 (17)	2.7 (16)	4.7 (26)	4.3 (19)
less opportunity cost of capital	$m	0.7 (14)	0.7 (16)	0.6 (15)	0.6 (19)	0.5 (18)	0.8 (30)	0.9 (31)
less depreciation	$m	1.2 (14)	1.1 (15)	1.1 (16)	0.9 (18)	0.8 (17)	1.1 (32)	1.5 (32)
plus interest, leasing and management fees	$m	2.7 (15)	3.4 (19)	3.1 (18)	4.0 (22)	3.2 (23)	5.4 (31)	6.4 (23)
net return – excl. management costs	$m	1.6 (55)	3.2 (26)	3.0 (34)	3.2 (34)	3.8 (27)	6.1 (28)	4.2 (28)
management costs	$m	2.3 na	2.3 na	2.4 na	2.5 na	2.5 na	2.4 na	2.0 na
net return – incl. management costs	$m	–0.7 na	0.9 na	0.6 na	0.7 na	1.4 na	3.7 na	2.3 na
number of active boats	no.	133	126	123	127	131	118	107

na Not applicable.
Note: Figures in parentheses are relative standard errors. A guide to interpreting these is included in appendix A. Previous estimates of net returns in the GHTS excluded boats from the analysis that had derived less than 65 per cent of their total revenue from the GHTS. This method has been changed to include all boats operating in the sector. Receipts and costs are now apportioned based on the proportion of revenue derived from the GHTS.

costs) peaked at $3.7 million before dropping to $2.3 million in 2004-05 – a decrease of 38 per cent. This compares with an average over the period 1998-99 to 2002-03 of $0.6 million.

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, fishery managers have a role to play in ensuring that a fishery is able to maximise profits subject to these external factors.

fig 1 **boat cash profit and net returns**
total for gillnet, hook and trap sector



A appendix

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 January and July 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 2006 surveys

ABARE surveyed two fisheries in 2006 – the eastern tuna and billfish fishery and the southern and eastern scalefish and shark fishery. Information was collected for the 2003-04 and 2004-05 financial years for both fisheries. For the Commonwealth trawl sector of the southern and eastern scalefish and shark fishery information was also collected for the 2002-03 financial year.

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.

That is, $\sum w_i x_i = X$

where w_i is the weight for the boat i

x_i is the catch for the 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.

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 labour 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.

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

On many boats, the costs of labour 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 labour provided. To allow for this possible underestimation, all owner/partner and family labour 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.

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 effort by multiplying the relative standard effort 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 has 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. The survey staff are generally very experienced and undergo rigorous presurvey 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.

B appendix

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 net economic returns to the Australian community from the management of Australian fisheries. Maximising the economic efficiency of a fishery involves maximising the economic returns from the use of the natural resources (the fish stock). As part of monitoring 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 and maintenance, the opportunity cost of capital, depreciation and opportunity cost of family and owner labour. 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 returns are regularly close to zero or negative is probably not being managed effectively. A positive trend may suggest that 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 or 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 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 labour 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 labour, 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 labour, 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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