

Australian

FISHERIES SURVEYS

REPORT

2000

Economic performance of selected fisheries in 1997-98 and 1998-99

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ABARE

Innovation in Economic Research

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ISSN 1325-8893

ABARE 2001, *Australian Fisheries Surveys Report 2000*, Canberra.

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ABARE is a professionally independent government economic research agency.

Previous fisheries surveys reports

Northern prawn fishery

<i>Years covered</i>	<i>Reference</i>
1980-81 to 1981-82	BAE (1984a)
1986-87 to 1987-88	Collins and Kloessing (1988)
1989-90 to 1990-91	ABARE (1993a)
1990-91 to 1991-92	ABARE (1993b)
1992-93 to 1993-94	ABARE (1996a)
1994-95 to 1995-96	Brown (1997)
1996-97 to 1997-98	ABARE (2000)

East coast prawn fishery

1980-81 to 1982-83	BAE (1985a)
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Eastern tuna and billfish fishery (formerly the east coast tuna fishery)

1989-90 to 1990-91	ABARE (1993a)
1991-92 to 1992-93	ABARE (1994)
1993-94 to 1994-95	ABARE (1996b)
1995-96 to 1996-97	ABARE (1998a)

Southern rock lobster fishery

1981-82 to 1982-83	BAE (1985b)
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Bass Strait scallop fishery

1993-94 to 1994-95	BAE (1985b)
1995-96 to 1996-97	ABARE (1998a)

South east fishery

1978-79 to 1980-81	BAE (1984b)
1985-86 to 1987-88	Geen, Brown and Pascoe (1989)
1989-90 to 1990-91	ABARE (1993a)
1990-91 to 1991-92	ABARE (1993b)
1991-92 to 1992-93	ABARE (1994)
1992-93 to 1993-94	ABARE (1996a)
1994-95 to 1995-96	Brown (1997)

South east nontrawl fishery

1996-97 to 1997-98	ABARE (2000)
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South east trawl fishery

1996-97 to 1997-98	ABARE (2000)
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Southern bluefin tuna fishery

1980-81 to 1981-82	BAE (1986)
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Southern shark fishery

1988-89	Battaglione and Campbell (1991)
1990-91 to 1991-92	ABARE (1993b)
1992-93 to 1993-94	ABARE (1996a)
1993-94 to 1994-95	ABARE (1996b)
1995-96 to 1996-97	ABARE (1998a)

Torres Strait prawn fishery

1989-90	Battaglione, Reid and Collins (1992)
1992-93 to 1993-94	ABARE (1996b)
1994-95 to 1995-96	Brown (1997)
1996-97 to 1997-98	ABARE (2000)

ABARE project 1810

Foreword

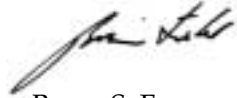
This fisheries surveys report contains detailed estimates of the performance of operators in the fisheries surveyed by ABARE in 2000. Information is included on the eastern tuna and billfish, south east nontrawl, southern shark, Bass Strait central zone scallop, and southern squid jig fisheries.

ABARE has been undertaking economic surveys of selected Commonwealth fisheries since the early 1980s. Detailed information on fleet characteristics and business performance has been collected each year and published in an ongoing series of reports, as outlined opposite.

ABARE survey information is used by fisheries policy makers, managers, researchers and the fishing industry. For example, it is used by the Department of Agriculture, Fisheries and Forestry in assessing the Australian Fisheries Management Authority's performance in managing Commonwealth fisheries. The information is made publicly available so that the industry can also independently

assess the performance of fisheries and the impacts of management policies.

ABARE surveys have been carried out to provide estimates of the financial performance of boats in Commonwealth fisheries. In undertaking these surveys, information has been collected on a basis that is consistent with the approach that the Australian Fisheries Management Authority has used to define and manage the fisheries. This year, the surveys have been extended to include estimates of the economic performance of each surveyed fishery. This new approach can be used to examine the returns from the fishery to the economy as a whole within the policy constraints of safeguarding sustainability and biodiversity.



BRIAN S. FISHER
Executive Director

June 2001

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 co-operation 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 each of the relevant Management Advisory Committees is also greatly appreciated.

Management and research agencies

The Australian Fisheries Management Authority (AFMA) provided the logbook information necessary to select a sample and provide relevant population statistics. In particular, Thim Skousen, Andrew Kettle and Angela Cross provided valuable assistance. David Alden, Marguerite Clarke, James Findlay, David Johnson, Jane Malcolm, Vicki O'Brien, Steve Oliver and Margot Sachse from AFMA also provided valuable assistance.

ABARE staff

David Galeano and Cas Johnson of the Fisheries Economics Section undertook the analyses and compiled the report.

Sample design and estimation were performed by Walter Shafron and Caroline Levantis of the Survey Data Analysis Section. Data were collected, entered and edited by: Janet Anthony, Peter Beath, Sandra Dunn, Ron Godenzi, Bob Hill, Bruce McConnell, Ian Milthorpe, Damo Nambiar, Richard Paton, Lou Sissian, Robin Stafford, Tano Travia and Gary Whitefield of the Data Management and Collection Section. Laurie Cannon, Tony Wain and Paul Phillips of the Data Management and Collection Section carried out survey administration and questionnaire design.

Programming and computer systems support was provided by Shona Lambert, Xue Huynh and Ken Colbert of the Data Management and Collection Section.

Funding

The 2000 surveys of the eastern tuna and billfish, south east nontrawl, southern shark, Bass Strait central zone scallop, and southern squid jig fisheries were funded by the Fisheries Resources Research Fund.

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ABARE fishery surveys

Economic surveys

ABARE has been undertaking economic surveys of selected Commonwealth fisheries since the early 1980s and, for particular fisheries, on a regular basis 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.

The surveys provide a broad range of information on the physical characteristics and financial performance of boats that operate in each fishery. For details on survey methods used and definitions of physical and financial characteristics discussed in the report, see appendix A.

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

Based on logbook and boat registry information collected from licensed fishing operations in Commonwealth fisheries, and supplied by the Australian Fisheries Management Authority (AFMA) and the Queensland Fisheries Management Authority, a representative sample of Commonwealth endorsed boats is selected in each fishery and stratified by type of operation, boat size and catch. 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 cooperate. Sample design and weighting systems have been developed that reduce the impact of nonresponse, but care is sometimes needed when interpreting the information provided by the survey.

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

The information obtained from various sources is reconciled to produce the most accurate description possible of the physical and financial characteristics of each sample boat in the survey. The data presented in the survey reports constitute only a small proportion of the total amount of data collected.

The 2000 surveys

ABARE surveyed five individual Commonwealth fisheries in 2000 — the eastern tuna and billfish fishery, the south east nontrawl fishery, the southern shark fishery, the Bass Strait central zone scallop fishery, and the southern squid jig fishery. This is the first year that ABARE has surveyed the southern squid jig fishery and only the second year it has surveyed the south east nontrawl fishery.

Results for the eastern tuna and billfish, the southern shark, the Bass Strait central zone scallop, and the southern squid jig fisheries for 1997-98 and 1998-99 are presented in this report. The south

east nontrawl fishery was surveyed for the first time last year and the results for 1997-98 were reported in *Australian Fisheries Surveys Report 1999*. Therefore, only the results for the south east nontrawl fishery for 1998-99 are contained in this report. Estimates are presented for all boats endorsed to operate in each fishery and, where possible, for subgroups of boats also. For the southern shark fishery, results are provided for boats with different net endorsements — those with less than six net units or less and ten net units.

Net returns to the fishery

This is the second year that net returns have been estimated for fisheries by ABARE. Prior to the 1999 survey report,

ABARE surveys were targeted at providing information on the financial performance of boats operating in the specified fisheries. For various reasons, such measures do not provide a good indication of the economic performance of the fishery (Rose and Stubbs 2000).

In estimating the economic returns from the fisheries surveyed an additional measure — net returns to the fishery — is included in this report for the eastern tuna and billfish fishery, the Bass Strait central zone scallop fishery, southern squid jig fishery, and the combined south east nontrawl and southern shark fishery. Measures of the overall financial performance of boats operating in each fishery, as reported for previous surveys, are also provided.

Eastern tuna and billfish fishery

Survey results

Average cash receipts in the longline sector of the fishery increased by 29 per cent between 1997-98 and 1998-99 to \$549 800, while cash costs increased by 15 per cent to \$460 600 over the same period.



Boat business debt increased by an estimated 250 per cent during 1998-99 and the average boat business equity ratio was estimated to have been 70 per cent.



Average boat business profit in the longline sector increased from an estimated negative \$12 300 to \$41 600 between 1997-98 and 1998-99 as receipts from tuna and billfish increased with better market opportunities for billfish in the United States.



Consequently, the estimated net returns to the fishery increased strongly between 1997-98 and 1998-99, from negative \$1.2 million to \$4.5 million.



The fishery

The eastern tuna and billfish fishery, while managed as a single fishery, is a complex fishery system involving multiple species and fishing methods. The fishery extends along the entire east coast of Australia, from north of Cape York to the southern limit of the 200 nautical mile Australian Fishing Zone below Tasmania and the border of Victoria and South Australia.

The fishery also encompasses waters around Lord Howe Island (figure A). The fishery is divided into zones partitioned along inshore/offshore boundaries and northern/southern boundaries (Campbell and Miller 1998). There is also a significant recreational sector targeting the same stocks. The relevant state governments manage this recreational sector.

The commercial fishery operates as two distinct sectors, based on fishing method.

A Eastern tuna and billfish fishery management areas



The longline sector, which includes longline and minorline fishing methods, and the nonlongline sector, which uses purse seine and pole fishing methods. Australian longliners have traditionally targeted high value yellowfin tuna for the export market, with big eye tuna and billfish increasing significantly from the mid-1990s. Catches of billfish are now comparable with yellowfin. Bigeye, yellowfin and billfish are generally high value, low catch volume species.

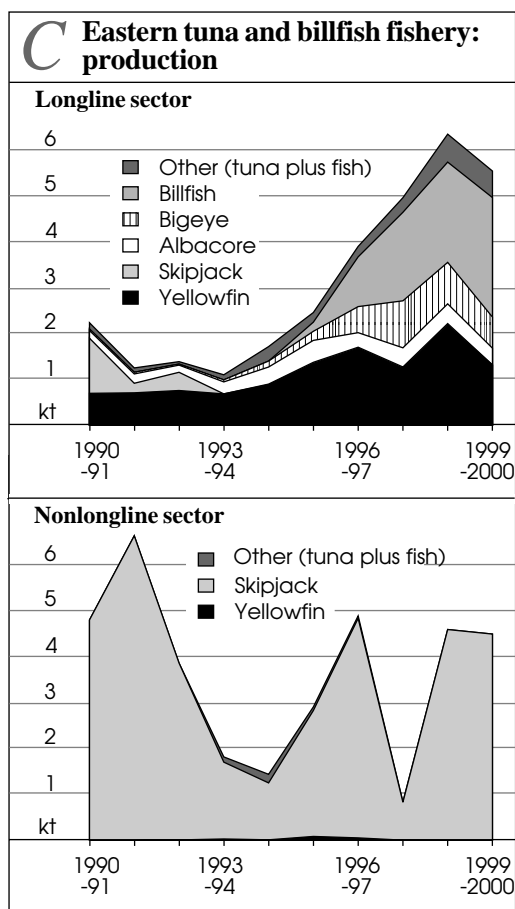
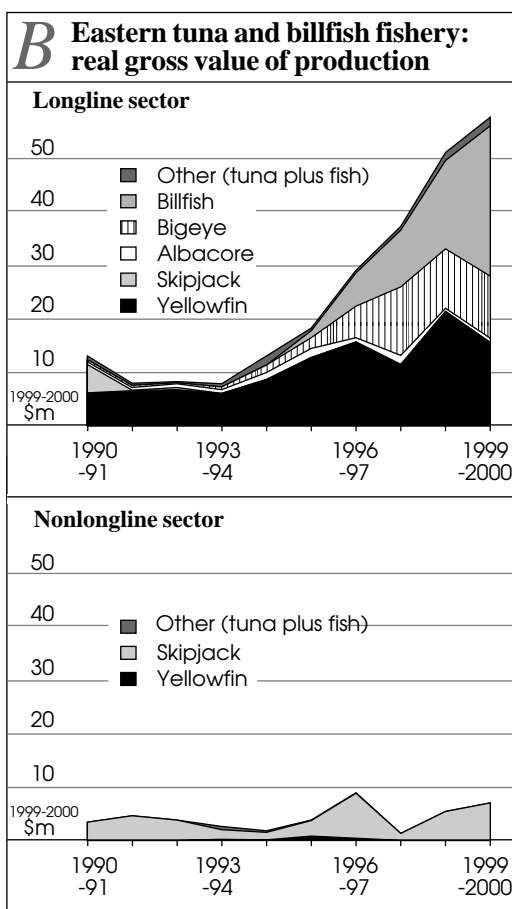
The nonlongline sector targets mainly low value skipjack tuna for the domestic canning industry.

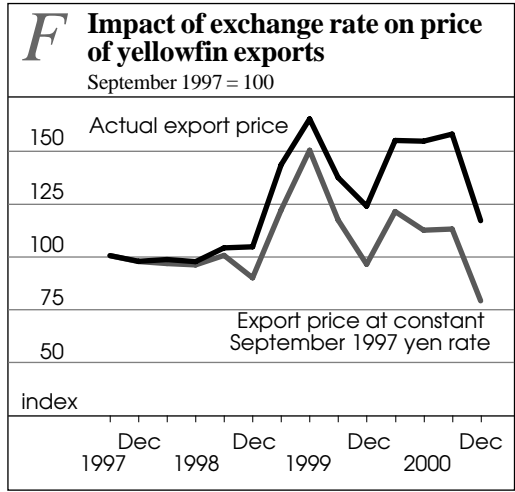
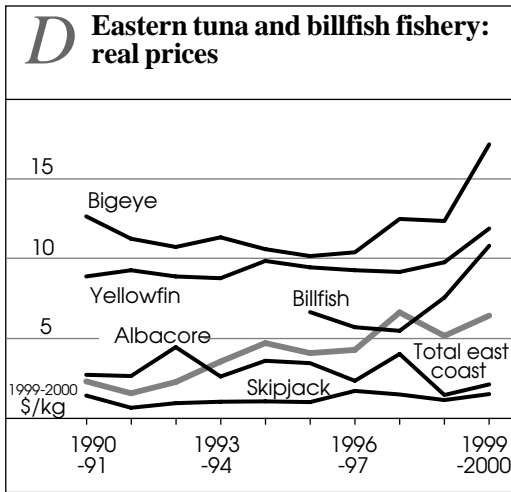
In 1999-2000 the real gross value of the entire fishery was \$64.5 million, rising sharply from the \$10.4 million recorded for 1993-94 (ABARE 2001). It can be seen from figure B that the longline sector of the fishery accounts for the majority of the real value of production in the fishery,

particularly since 1993-94. In 1999-2000, the longline sector accounted for nearly 90 per cent of the value of the entire fishery.

Catch in the entire fishery has increased in recent years, with the volume of fish caught increasing from around 2900 tonnes in 1993-94 to over 10 000 tonnes in 1999-2000 (ABARE 2001). Species caught in the longline and nonlongline sectors are substantially different (figure C), with the majority of the catch in the nonlongline sector being skipjack.

Of the entire fishery in 1999-2000, billfish accounted for 26 per cent of the landed catch by weight but accounted for 44 per cent of the total value of catch. Conversely, skipjack accounted for around 45 per cent of the total catch by weight but accounted for only 11 per cent of the value of catch from the fishery (ABARE 2001).





The real unit values of the fishery, illustrated in figure D, shows that the three main species caught by the longline sector (bigeye, yellowfin, billfish) are the highest real unit value species caught in the fishery, while prices for skipjack tuna, targeted in the nonlongline sector, remained below \$2 a kilogram in real terms. The real unit value for the entire eastern tuna and billfish fishery shows a steady upward trend, mainly because of increases in the real unit values of billfish and bigeye.

Since 1997-98 the unit values, in Australian dollar terms, of yellowfin, bigeye and billfish have increased steadily, with this increase boosted by a weakening Australian dollar (figure E). The move-

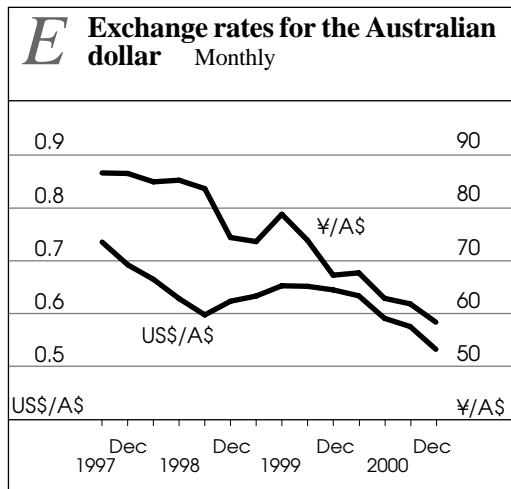
ment in the US dollar is particularly relevant for billfish prices, while the yen is of more importance for tuna prices.

The impact of the depreciating Australian dollar against the yen for yellowfin export prices is illustrated in figure F. As can be seen, exporters of yellowfin to Japan received higher prices over the survey period than if the exchange rate was held constant at the September 1997 rate.

Longline sector

There are currently three major regions of domestic longline activity in the fishery: the southern region of the fishery extending northwards to northern New South Wales, the Cairns region and the southern Queensland region. In the southern region of the fishery, Australian longliners have a long history of targeting premium quality yellowfin and bigeye in cool waters south of Sydney and yellowfin and striped marlin off northern New South Wales, spreading northwards to Brisbane (Campbell 1999).

In recent years the Cairns and southern Queensland regions of the fishery have developed significantly, where bigeye and yellowfin are targeted. The southern Queensland region of the fishery emerged in August 1996 when several longliners moved to the port of Mooloolaba and targeted swordfish. By October 1996 more than twenty longliners operated from that port (Campbell 1999).



In the past four years this section of the fishery has, on average, accounted for 65 per cent of the swordfish caught in the fishery (J. Malcolm, AFMA, personal communication, 6 February 2000). In addition to targeting swordfish, longline operators in the southern Queensland region have also recorded large increases in bigeye and yellowfin catches (Campbell 1999).

Other commercial species caught by domestic longliners include albacore, southern bluefin tuna and striped marlin. However, the Commonwealth manages southern bluefin tuna resources as a separate fishery, the 'southern bluefin tuna fishery'.

Black marlin and blue marlin are also occasionally caught, but domestic longliners developed a voluntary code of practice to discourage the taking of black and blue marlin recognising that these species are the key target species of the game fishing sector. A number of Japanese boats were permitted to operate in the fishery under bilateral agreements or as part of joint venture activities up to 1996-97.

Currently around 230 longline operators are authorised to fish in the eastern tuna and billfish fishery, although only around sixty of these do so on a full time basis. A large body of latent effort exists in the fishery as some operators do not use their pelagic longline entitlements and many operators fish relatively few days in the fishery.

The gross value of the longline sector of the fishery was \$57.6 million in 1999-2000, up 17 per cent from 1998-99 in real terms. As can be seen from figure B, the composition of the value of the catch in the longline sector has changed significantly in recent years. The value of billfish has accounted for 56 per cent of the increase in the real value of production in the longline sector between 1993-94 and 1999-2000. A further 22 per cent and 19 per cent of the increase in the real value of production in the longline sector over that period was attributable to bigeye and yellowfin catches respectively.

The catch in the longline sector increased dramatically from around 1100 tonnes in 1993-94 to over 5500 tonnes in 1999-2000 (ABARE 2001). This dramatic

increase reflects the increased catches of yellowfin, bigeye and billfish. Of these three species, billfish accounted for 59 per cent of the increase in catch between 1993-94 and 1999-2000, and in 1999-2000 accounted for 47 per cent of the total catch from the longline sector.

Purse seine and pole sector

Purse seine operators first started fishing for tuna and other pelagic species in the region in the 1930s. The fishery expanded in the 1970s, although southern bluefin tuna was the primary target species at the time.

It was not until major cutbacks in the southern bluefin tuna quota, and the redirection of southern bluefin tuna to farming for sashimi outlets rather than canning, that attention was directed to purse seining for skipjack.

The purse seine and pole sector, targeting skipjack, operates primarily along the New South Wales south coast and off north eastern Tasmania from November to May when surface temperatures are above 17° Celsius (Caton and McLoughlin 2000).

Although different in fishing method, the seiners often work in conjunction with pole boats and light planes. The planes locate skipjack schools from the air, pole boats then feed the fish to bring them to the surface while the seiners surround the school with the nets.

As with the longline sector, the purse seine sector has a fair degree of latent effort, with many fishing endorsements unused.

The gross value of production in real terms increased by 29 per cent between 1997-98 and 1999-2000, to \$7.0 million. The value of the skipjack catch accounts for nearly the entire value of the nonlongline sector, with yellowfin, other tuna and other fish accounting for minimal value in the nonlongline sector.

The quantity of fish catch in the non-longline sector tends to vary substantially, reflecting the activity levels of operators and the annual variability in skipjack availability off south eastern Australia.

Biological status of the fishery

Over sixty species of finfish are regularly caught in the fishery. Approximately thirty of these are tunas and mackerels, six species are billfish, with the remainder a mix of pelagic sharks and other finfish (Campbell and Miller 1998).

Yellowfin tuna inhabit tropical and subtropical waters where the temperature is greater than 15° Celsius. They are fast growing, reaching maturity at two years and are thought to live for between eight and ten years (Campbell and Miller 1998). They can grow to over 100 kilograms, although the average weight of yellowfin caught by Australian longliners is around 55 kilograms.

Currently the status of yellowfin, bigeye and swordfish stocks in the fishery is uncertain (Caton and McLoughlin 2000). Campbell (1999) notes that yellowfin occurring within the Australian Fishing Zone are likely to be part of the large stock of yellowfin found within the western and central Pacific Ocean that is considered to be only low to moderately fished but the level of mixing between the different fish stocks is unknown.

While the nature of the relationship between the fish found in these two areas remains uncertain, the Fisheries Assessment Group for the eastern tuna and billfish fishery concluded that, based on a number of indicators of abundance, the present catch of yellowfin within the Australian Fishing Zone appears to be sustainable (Campbell 1999).

In assessing the status of bigeye tuna and broadbill swordfish stocks, the Fisheries Assessment Group concluded that given the information presently available it was not possible to determine the impact of present catch levels on the bigeye resources within the eastern Australian Fishing Zone or what a long term sustainable catch level for this region would be (Campbell 1999). The Fisheries Assessment Group cautioned against further increases in effort in the Mooloolaba region as there had been a decline in catch rates for swordfish and that a localised depletion of swordfish stocks in

the region could not be ruled out (Campbell 1999).

Skipjack tuna inhabit tropical and subtropical waters, although the adult fish can be found in cooler waters. Skipjack are highly productive species, growing rapidly to reach maturity after one year. The stock structure is not well known, with adult skipjack commonly traveling long distances. Current stock assessments suggest that the skipjack stock may be underfished, although a degree of uncertainty exists.

Management of the fishery

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

Currently, the commercial fishery is managed by input controls that include limited entry, zoning, boat restrictions, bycatch provisions and gear restrictions. Longline endorsements relate to specific areas of access, with a total of seven categories of endorsements issued. Coinciding with this, vessels fishing within 50 nautical miles of the coast were subject to a maximum size of 32.67 metres.

Purse seine operators have also been subject to limited access arrangements through area specific endorsements relating to four zones. However, with the large amount of latent effort that exists in the fishery, whether these controls have any long term influence on effort in the fishery is questionable.

Boats surveyed

The target population for the survey was defined as vessels that held a Commonwealth tuna permit for the fishery and

that caught more than one tonne of tuna in the survey year.

The total number of vessels eligible for the survey in 1997-98 was 188. The fleet was separated into two sectors, the longline sector and the nonlongline sector. Eighteen vessels were sampled from a population of 143 in the longline sector but only five vessels from a population of 45 in the nonlongline sector were prepared to be surveyed.

In 1998-99, the total eligible population for the fishery was 165 vessels of which 33 longliners were sampled from a population of 146, while in the nonlongline sector, the sample was varied and small from a population of 19.

Reflecting the variation and small sample number of boats in the nonlongline sector, and to protect the confidentiality of the cooperators who did respond to the survey, it was not possible to publish data for the nonlongline sector. Consequently, the survey results of boats operating in the fishery are for the longline sector only.

Financial performance of boats

The population of boats in the fishery changed significantly between 1997-98 and 1998-99. The main change was in the distribution of boats by size, with a number of new more profitable boats entering the fishery in 1998-99. Consequently, some of the changes to financial performance measures between survey years are attributable to this change in the population structure.

The major measures of financial performance of the longline vessels surveyed in the eastern tuna and billfish fishery are provided in tables 1 and 2. The average financial performance of boats operating in the longline sector is presented in table 1, while in table 2 information in triptiles, based on the value of fish sold, is provided. To calculate triptiles, the population was ranked according to the value of fish sales, with the top third of the population being contained in the upper triptile, the middle third containing boats from the middle triptile and the remain-

der in the bottom triptile. The weighted average revenues and costs of operators within each group were then calculated.

Receipts

Average total cash receipts for longline operators in the fishery are estimated to

1 Estimated financial performance of longline boats in the eastern tuna and billfish fishery

Average per boat

	1997-98	1998-99
Receipts		
Tuna receipts	\$ 240 630 (15)	359 690 (11)
Other fish receipts	\$ 141 280 (30)	97 060 (20)
By catch receipts	\$ 29 140 (50)	40 210 (33)
Nonfishing receipts	\$ 16 800 (26)	52 870 (38)
Total cash receipts	\$ 427 850 (14)	549 830 (9)
Costs		
Administration	\$ 11 740 (10)	11 840 (10)
Bait	\$ 14 550 (23)	16 150 (23)
Crew costs	\$ 135 980 (11)	151 700 (9)
Freight and marketing	\$ 26 430 (38)	39 810 (27)
Fuel	\$ 39 360 (9)	31 180 (10)
Ice	\$ 3 140 (24)	3 350 (18)
Insurance	\$ 16 910 (12)	15 640 (8)
Interest paid	\$ 22 020 (19)	22 610 (18)
Leasing	\$ 7 170 (36)	40 040 (36)
Licence fees and levies	\$ 16 580 (16)	16 520 (14)
Repairs and maintenance	\$ 84 600 (20)	84 920 (12)
Other costs	\$ 23 010 (11)	26 830 (18)
Total cash costs	\$ 401 480 (9)	460 580 (9)
Boat cash income	\$ 26 370 (112)	89 250 (28)
<i>less depreciation a</i>	\$ 38 670 (31)	47 700 (20)
Boat business profit	\$ -12 300 (216)	41 550 (70)
<i>plus interest, leasing and rent</i>	\$ 30 090 (12)	63 610 (26)
Profit at full equity	\$ 17 790 (152)	105 160 (26)
Capital (excl. quota and licences)	\$ 474 080 (12)	717 980 (15)
Capital (incl. quota and licences)	\$ na	1 412 000 (12)
Rate of return to boat capital b	% 4 (149)	14.6 (34)
Rate of return to full equity c	% na	7.4 (29)

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

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

2 Estimated financial performance of boats in the eastern tuna and billfish fishery, by triptile

Triptiles based on value of fish sold

	1997-98			1998-99		
	Lower third	Middle third	Upper third	Lower third	Middle third	Upper third
Receipts						
Tuna receipts	72 440 (28)	323 360 (11)	374 440 (10)	108 840 (24)	329 070 (12)	688 300 (12)
Other finfish receipts	12 250 (36)	74 730 (21)	459 440 (14)	31 570 (38)	79 970 (28)	190 810 (27)
Bycatch receipts	68 280 (52)	8 560 (54)	200 (117)	46 280 (53)	65 570 (50)	10 720 (66)
Nonfishing receipts	16 010 (46)	25 990 (25)	2 830 (83)	58 370 (54)	12 690 (46)	81 390 (60)
Total cash receipts	168 980 (19)	432 640 (12)	836 910 (3)	245 060 (25)	487 290 (6)	971 220 (7)
Costs						
Administration	6 730 (13)	13 310 (8)	17 200 (32)	8 280 (18)	9 890 (12)	17 830 (13)
Bait	4 930 (43)	11 660 (32)	34 850 (44)	6 010 (20)	12 200 (29)	31 820 (28)
Crew costs	72 020 (15)	122 600 (12)	261 200 (8)	81 970 (24)	146 230 (12)	240 370 (7)
Freight and marketing	3 830 (69)	63 450 (33)	1 460 (111)	21 540 (47)	47 360 (37)	55 180 (47)
Fuel	18 670 (19)	48 570 (10)	57 450 (22)	14 290 (12)	27 400 (12)	54 810 (13)
Ice	4 110 (36)	3 080 (49)	1 660 (45)	4 630 (21)	4 370 (30)	900 (72)
Insurance	9 140 (20)	21 530 (23)	21 750 (22)	14 520 (15)	12 930 (18)	19 350 (13)
Interest paid	15 940 (34)	11 160 (33)	49 830 (15)	26 610 (29)	17 600 (43)	22 170 (29)
Leasing	520 (77)	17 770 (20)	320 (72)	32 830 (84)	17 210 (31)	68 700 (45)
Licence fees and levies	20 420 (34)	12 970 (8)	16 390 (7)	16 710 (32)	18 750 (20)	14 350 (9)
Repairs and maintenance	16 600 (20)	72 090 (6)	214 860 (7)	51 430 (32)	67 060 (9)	140 820 (17)
Other costs	16 290 (12)	24 090 (26)	32 020 (10)	17 250 (27)	31 860 (28)	33 950 (30)
Total cash costs	189 190 (10)	422 270 (5)	709 000 (10)	296 070 (24)	412 870 (11)	700 240 (10)
Boat cash income	-20 210 (139)	10 370 (421)	127 910 (44)	-51 010 (84)	74 420 (27)	270 980 (13)
<i>less depreciation a</i>	17 770 (25)	24 650 (101)	95 570 (28)	50 640 (35)	17 730 (28)	70 380 (28)
Boat business profit	-37 980 (81)	-14 280 (203)	32 350 (250)	-101 650 (57)	56 700 (36)	200 610 (20)
<i>plus interest, leasing and rent</i>	17 050 (33)	30 340 (20)	50 670 (15)	60 720 (50)	34 850 (24)	92 230 (39)
Profit at full equity	-20 920 (141)	16 060 (176)	83 020 (92)	-40 930 (89)	91 550 (23)	292 830 (14)
Capital (excl. quota and licences)	200 760 (25)	493 950 (21)	881 420 (7)	776 950 (30)	320 320 (18)	994 810 (17)
Capital (incl. quota and licences)	na	na	na	1 593 620 (21)	888 300 (13)	1 651 480 (19)
Rate of return to boat capital b	-10 (117)	3 (173)	9 (97)	-5 (63)	29 (30)	29 (19)
Rate of return to full equity c	na	na	na	-3 (87)	10 (26)	18 (19)

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

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

have increased significantly to around \$549 800 per vessel in 1998-99. The change in the population structure accounted for some of the increase in receipts as well as increased catch and price of yellowfin and billfish, with the price of billfish rising by 38 per cent in 1998-99.

Tuna receipts accounted for 65 per cent of estimated total cash receipts in 1998-99. Other fish receipts accounted for 18 per cent in 1998-99, with bycatch and nonfishing receipts making up the remaining cash receipts. Quota leased out made up a significant proportion of nonfishing receipts in 1998-99.

Costs

Average cash costs for longline boats in the fishery are estimated to have been around \$460 600 in 1998-99. On average, crew costs were the most significant cost for longline operators, estimated to account for around a third of total cash costs. Repairs and maintenance, leasing and fuel costs were also significant cost items in 1998-99.

Quantity of fish sold

Yellowfin tuna contributes the majority of total tuna caught by weight with the estimated average quantity of yellowfin tuna sold in 1998-99 over 22 tonnes per boat (table 3). Other fish, which includes billfish, also contributes a significant propor-

tion of total fish caught by weight in the longline sector of the fishery.

Boat cash income and profit

Average boat cash income for the longline sector of the fishery is estimated to have increased significantly to almost \$89 300 in 1998-99. Cash costs increased in the fishery over the survey period but did so at a slower rate than cash receipts, continuing the trend in the longline sector where boat cash income has been increasing since 1995-96.

The increase in boat cash income is mainly attributable to the increased catches of both billfish and yellowfin in the longline sector between 1997-98 and 1998-99 as well as the increased prices received for those two species. It must also be noted that the change in the structure of the population of the longline sector between the two survey years contributed to the substantially larger boat cash income in 1998-99.

Boat business profit which makes an allowance for depreciation was estimated to have increased to around \$41 600 in 1998-99. Profit at full equity also dramatically increased in 1998-99 to an estimated \$105 200. Once again the change in the population structure contributed to this rise.

Rates of return

Despite a large increase in the level of boat capital, the estimated rate of return to boat capital (excluding quota and licences) across the longline sector of the fishery in 1998-99 was 14.6 per cent, a substantial rise from the previous year.

Debt and equity

Not all sampled boats provided information on debt and equity and based on this smaller sample, the estimated average level of debt per boat rose by around 250 per cent from an opening balance of \$128 700 to a closing balance of \$453 900 in 1998-99 (table 4). Of this closing balance, boat purchases accounted for 89 per cent of debt.

Boat business equity provides a measure of the financial ownership of a

3 Estimated quantity of fish sold by longline boats in the eastern tuna and billfish fishery (whole weight)

Average per boat

	1997-98		1998-99	
	kg		kg	
Southern bluefin tuna	2 155	(51)	2 779	(32)
Yellowfin tuna	14 072	(20)	22 351	(17)
Bigeye tuna	1 624	(27)	3 813	(19)
Albacore	2 080	(32)	2 549	(17)
Skipjack tuna	261	(81)	78	(55)
Total tuna	20 192	(15)	31 570	(12)
Other fish	21 939	(28)	15 526	(21)

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

4 Debt and equity of boats in the longline sector of the eastern tuna and billfish fishery in 1998-99 Average per boat

	Longline boats	
Capital (incl. quota and licences) at 30 June	\$ 1 533 160	(15)
Boat business debt at 1 July	\$ 128 710	(42)
Boat business debt at 30 June	\$ 453 930	(23)
Change in debt over year	\$ 325 220	(36)
Boat business equity at 30 June	\$ 1 079 230	(18)
Boat business equity ratio at 30 June	% 70	(8)

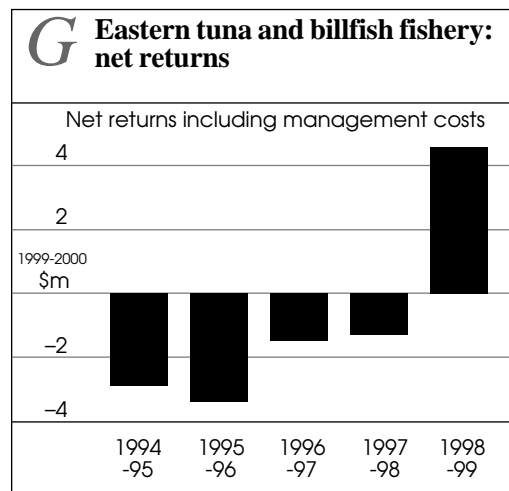
Note: Figures in parentheses are relative standard errors. A guide to interpreting these is included in 'Survey methods and definitions'.

fishing enterprise. The average boat business equity ratio in the eastern tuna and billfish fishery was 70 per cent in 1998-99.

Economic performance of the fishery

In order to provide an indication of the economic performance of the longline sector of the eastern tuna and billfish fishery, the net returns to the longline sector including management costs have been estimated for 1994-95 onwards and the results presented in figure G (see appendix A for calculation details).

In calculating the economic performance of the longline sector, all the receipts and costs of longline operators that earned over 65 per cent of their



revenue from the fishery are included. As a result the estimated receipts and costs in table 5 will differ from those presented in table 1, which include all receipts and costs incurred by all longline boats operating in the fishery.

Of the 143 longline operators in the fishery in 1997-98, 125 qualified to be included in the economic performance analysis, of which 16 were sampled. In 1998-99, 129 longline operators from a population of 146 were eligible, of which 31 were sampled.

As can be seen from table 5, the estimated net returns for the longline sector of the eastern tuna and billfish fishery (inclusive of management costs) rose from negative \$1.2 million in 1997-98 to positive \$4.5 million in 1998-99. The replacement value of capital invested in the longline sector of the fishery increased from an estimated \$43.5 million in 1997-98 to an estimated \$52.8 million in 1998-99. This may reflect a number of factors such as the upgrade of equipment and an increase in the number of operators in the longline sector of the fishery specifically targeting billfish off Mooloolaba.

5 Estimated economic performance of the longline sector of the eastern tuna and billfish fishery

Total for fishery

	1997-98	1998-99
	\$'000	\$'000
Revenue a	51 018 (16)	68 176 (8)
Cash costs a, b	43 869 (10)	52 661 (8)
Capital a, c	43 481 (25)	52 840 (19)
Net returns (excl. management costs)	-577 (744)	5 396 (80)
Commonwealth management costs d	662 na	860 na
Net returns (incl. management costs)	-1 239 (744)	4 537 (80)

a Revenue, costs and capital estimates are totals for boats included in sample (there is no attempt to apportion costs between fisheries). b Cash costs include imputed operator and family labour costs but exclude licence and levy payments and interest payments. c Replacement capital (depreciated capital). Costs to AFMA of managing the fishery (A. Kettle, AFMA, personal communication, April 2001). na Not applicable

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

The large increase in net returns in 1998-99 displayed in figure G and table 5 is mainly attributable to revenue growing at a faster rate than cash costs (32 per cent compared with 18 per cent respectively). The further development of the section of the fishery off Mooloolaba where the catch of billfish increased significantly is expected to have been the main contributor to this growth. In addition, the catch of yellowfin increased significantly. Export returns were also boosted by the weakening of the Australian dollar against the Japanese yen and US dollar.

The low (although not necessarily negative) net returns experienced in the

longline sector of the fishery before 1998-99 might have been expected given the current management regime. The large body of latent effort that has existed in the fishery implies that any above average profits can be competed away relatively quickly through the activation of previous latent effort.

While the development of new markets and sectors of the fishery might be expected to lead to positive net returns in the short term, it is unlikely that, until a management system is implemented that effectively constrains fishing effort, the positive net return estimated for 1998-99 is sustainable in the long term.

South east nontrawl fishery

Survey results

Average receipts per boat across the fishery in 1998-99 were estimated at \$292 500, compared with estimated costs of \$253 300.



Over 80 per cent of the catch in the fishery is comprised of blue eye trevalla, pink ling and blue warehou.



Average boat business profit was an estimated \$28 600 in 1998-99.



Boat business equity for the fishery was estimated at 84 per cent in 1998-99.



It was not possible or meaningful to estimate net returns of the south east nontrawl fishery by itself owing to the overlap between the fishery and the southern shark fishery. For this reason the net return measure provided was for the 'combined' south east nontrawl and southern shark fishery.



The net return of the combined fishery including management costs was negative \$1.2 million in 1998-99. The net returns to fishing (\$0.8 million) were not sufficient to cover management costs that arose from the development and implementation of the ten year fishery plan for the southern shark fishery.

The fishery

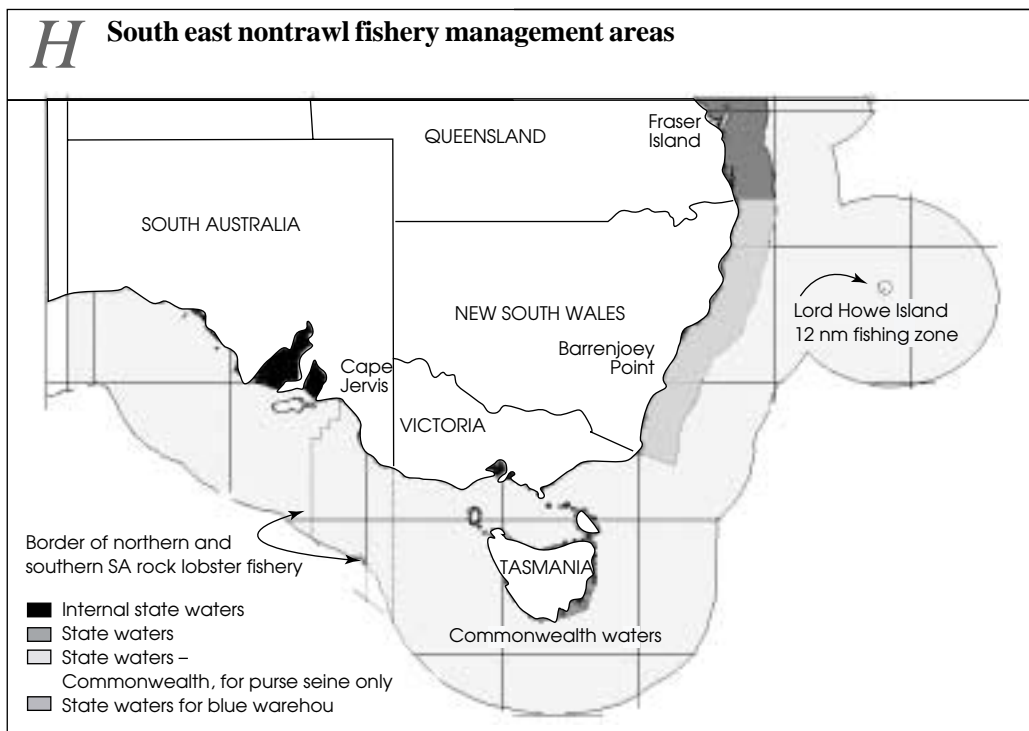
The south east nontrawl fishery is a multi-species fishery situated off the south east coast of Australia. The fishery extends from Sandy Cape in Queensland, around New South Wales, Victoria and Tasmania to the South Australian/Western Australian border (figure H). Off New South Wales and Queensland, waters out to about 80 nautical miles are under state jurisdiction except for purse seining, which is managed by the Commonwealth past a three nautical mile limit off the coast of New South Wales (Tilzey 1998).

The fishery incorporates all fishing methods other than trawl and danish seine, including hook methods, demersal longlining, droplining, troll and handlines. As well, gillnets and a small number of fish traps are used.

While many finfish species can be taken in the nontrawl fishery, three main species, blue eye trevalla, pink ling and blue warehou are the principal species landed, comprising over 80 per cent of nontrawl landings in 1998-99. These three species are, to a certain extent, the only species commonly targeted by the non-trawl operators. However, many of these fishers also operate in other fisheries, such as the southern shark fishery.

Hapuku, bass grouper, dog sharks, gemfish, ling, redfish, ocean perch, blue grenadier and ray's bream are common bycatch of dropliners targeting blue eye trevalla. Other scalefish species commonly taken by demersal gillnetters include spotted warehou, boarfish and silver trevally (Tilzey 1998).

The real gross value of production from the fishery was \$5.6 million in 1999-2000, representing a rise from \$4 million in 1998-99 and \$3.8 million in 1997-98

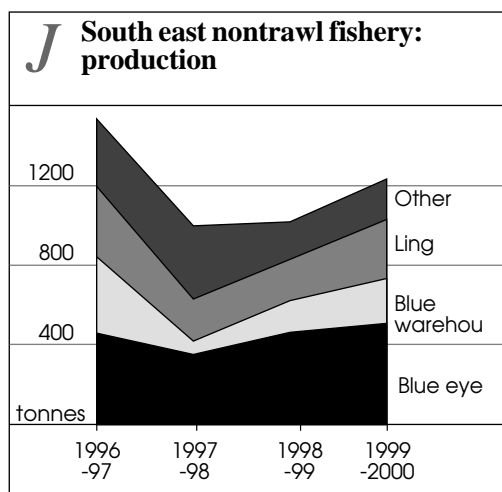
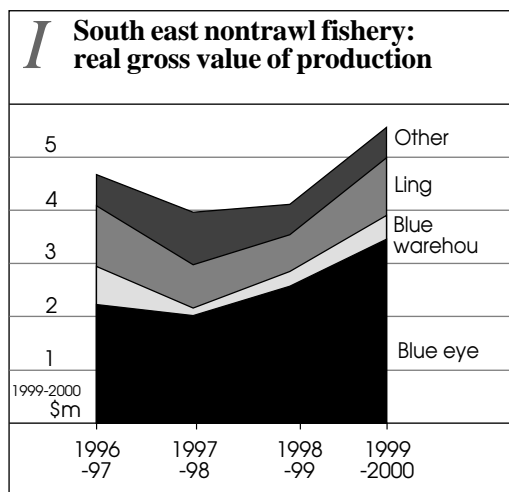


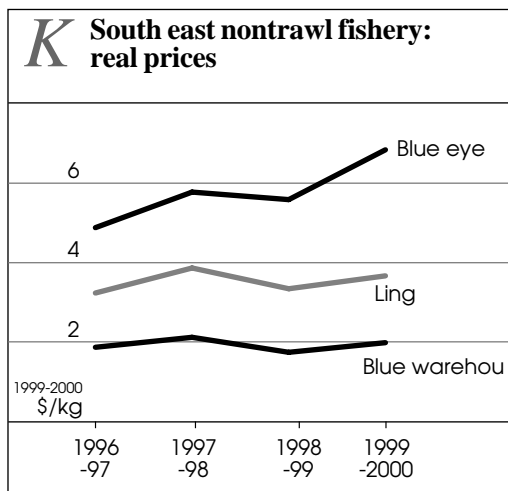
(figure I). Although the real gross value of production of all three key quota species rose over the three years, the real value of the blue eye catch contributed 90 per cent of the rise, increasing from \$2 million in 1997-98 to \$3.5 million in 1999-2000.

The fishery's production rose from 997 tonnes in 1997-98 to 1231 tonnes in 1999-2000, mainly through increased catches of

blue eye and blue warehou (ABARE 2001) (figure J).

In real terms the price of blue eye trended upwards over the four years to 1999-2000, while the real prices of blue warehou and ling remained relatively stable (figure K). In 1999-2000 the real wholesale price of blue eye averaged \$6.82 a kilogram while the real prices of blue warehou and ling peaked in 1997-98.





Biological status of the fishery

The three main quota species in the south east nontrawl fishery are subject to regular stock assessments by the South East Fishery Assessment Group.

Blue eye reach an age of forty years or more and a length of 120 centimetres and are found mostly in depths of 300–550 metres. Fish caught in the south east nontrawl fishery are thought to form part of a common Australian stock, which range from mid New South Wales to south western Western Australia, with the majority of the total catch taken by south east nontrawl operators. Catches have tended to be comprised of young, immature fish, while larger mature fish become vulnerable to line fishing when forming seasonal spawning aggregations. According to the South East Fishery Assessment Group, the status of blue eye is uncertain but stock assessment working groups will be held for the species in 2000-01.

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

The status of ling is uncertain, but there is some evidence to suggest that the fishery (plus other fisheries such as the south east trawl that also target ling) has not had a significant impact on ling abundance but has affected the size structure of the catch (Caton and McLoughlin 2000).

Blue warehou attain a maximum age of about ten years and a length of 65 centimetres and mature at three to four years of age. The 1998 stock assessment of blue warehou suggested that the biomass of the species dropped markedly between 1991 and 1994 and has stabilised (or increased) since then. The 2000 assessment concluded that the stock of blue warehou is uncertain (Caton and McLoughlin 2000).

Details of the nonquota species commonly caught by south east nontrawl operators can be found in Caton and McLoughlin 2000.

Management of the fishery

Under a series of offshore constitutional settlement arrangements, Tasmania has jurisdiction over blue warehou and certain other species taken in state waters, while the Commonwealth has sole jurisdiction of blue warehou taken off Victoria and South Australia (ABARE 2000). The Commonwealth also has sole jurisdiction over blue eye and ling taken off Tasmania, Victoria and South Australia.

The south east nontrawl fishery is managed under a system of output controls namely total allowable catches and input controls in the form of some gear and area restrictions. There are three key species — blue eye, ling and blue warehou — that have been managed by quota arrangements since January 1998. Quotas within the nontrawl fishery are fully transferable. Cross sector leasing of blue eye and ling is permitted between the south east nontrawl fishery and the south east trawl fishery on a temporary basis only.

The individual transferable quota (ITQ) scheme used in the nontrawl fishery forms part of a broader ITQ management strategy for the south east fishery as a whole where sixteen species are managed

by a quota system. A 'global' total allowable catch is determined for the combined trawl and nontrawl sectors of the fishery and is then allocated across the two sectors, with scope for the fishery managers to adjust the total allowable catches each year. In the south east nontrawl fishery, there are plans to implement ITQ management arrangements for the remaining thirteen species during 2000-01.

Similar to the south east trawl quota management system, the ITQ system in the south east nontrawl fishery is conducted using a 'carryover' approach where up to 20 per cent of the total individual quota not harvested in one year may be carried over to the next. Similarly for overcatches of up to 20 per cent of holdings, overcatch may be deducted from the following year's allocation. This means that the total allowable catch agreed in one year may differ from the actual catch, once the carryover / carry-under has been included.

Prior to January 1998, the south east nontrawl fishery was managed exclusively by a combination of input controls (gear and area restrictions) designed to constrain harvesting capacity. However, the ineffectiveness of the input controls in place was evident in the expansion of catches, particularly of blue eye trevalla, in several years leading up to 1998 and was one reason for the decision to implement an ITQ scheme (AFMA 1999a).

During 1998-99, the South East Non-Trawl Fishery Management Advisory Committee conducted a review of the input controls used in the fishery. Following the review, several changes were made to fishing permits, such as the removal of some area restrictions (within the offshore constitutional settlement arrangements) involving hook concession holders and combining the four demersal hook methods.

Boats surveyed

As with previous surveys of the south east nontrawl fishery, the target population of the survey was defined as boats that held

endorsements for the fishery and that caught fish during the survey year. Boats that held endorsements and did not fish during the survey year were excluded from the population.

The south east nontrawl fishery survey was a one year survey covering 1998-99. In that year there were 83 eligible boats, of which 23 were surveyed. The fishery was first surveyed in 1997-98 and the results from that survey are presented in ABARE (2000).

Many boats that operate in the south east nontrawl fishery also operate in other Commonwealth and state fisheries such as the Commonwealth managed southern shark fishery and the state managed lobster fisheries. The activities in these other fisheries had a major influence on the financial performance of the boats operating in the south east nontrawl fishery over the survey period.

Financial performance of boats

The major measures of the financial performance of boats operating in the south east nontrawl fishery during 1998-99 are provided below. The average estimated financial performance of boats operating in the south east nontrawl fishery is shown in table 6, while information on the financial performance of boats, by triptile, is provided in table 7.

To calculate triptiles, the population was ranked according to the value of fish sales, with the top third of the population being contained in the upper triptile, the middle third containing boats from the middle triptile and the remainder in the bottom triptile. The weighted average revenues and costs per boat within each group were then calculated.

Receipts

The estimated average receipts per boat in the fishery in 1998-99 was \$292 500, of which fishing receipts accounted for 94 per cent at \$276 000. Nonfishing receipts includes charter fees and rebate payments and amounted to an estimated \$16 400 in 1998-99.

Costs

Average costs across the fleet were estimated to be \$253 300 in 1998-99, with crew costs the largest expenditure at an estimated \$119 800, contributing nearly half of total cash costs. It was estimated that there was an average of 68 person weeks worked on a boat operating in the south east nontrawl fishery in 1998-99. Other large expenditures in 1998-99 included repairs and maintenance, at an estimated \$32 000 and fuel, at an estimated \$19 200, contributing 13 per cent and 8 per cent respectively to total cash costs.

As expected, in terms of triptiles, total estimated cash costs increased with the

size of the fishing operation, but the rate of increase across triptiles was slower for total cash costs than for total cash receipts, inferring that as the operation grew in size, the boat on average became more profitable.

Boat cash income and profit

Average boat cash income in the south east nontrawl fishery in 1998-99 was estimated at \$39 200 but ranged from an estimated loss of \$3700 in the lower triptile to \$74 300 in the upper triptile.

Boat business profit, which is calculated by allowing for depreciation of capital, followed a similar trend, with the estimated average for the entire fishery being \$28 600, with a negative \$18 100 in the lowest triptile and \$61 400 in the upper triptile.

Profit at full equity is calculated by adding leasing costs, interest charges and rent payments to boat business profit. While these costs affect the financial position of the individual operator, they represent some profits that are redistributed to other investors in the fishery. Profit at full equity was estimated at \$55 100 for the entire fishery and this is the estimated 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. Operators in the upper triptile were estimated to have had the highest profits at full equity, at an estimated \$104 300.

Rates of return

The estimated average rate of return to capital (excluding quota and licences) in the south east nontrawl fishery was an estimated 22.5 per cent in 1998-99. Once again in terms of triptiles, boats in the upper triptile on average had the highest rates of return to boat capital (excluding quota and licences), at 41.2 per cent.

Debt and equity

Not all sampled boats provided information on debt and equity and based on this smaller sample, the estimated average level of debt per boat changed only slightly to a closing balance of \$175 500.

6 Estimated financial performance of boats in the south east nontrawl fishery – all boats

Average per boat

	1998-99	
Receipts		
Fishing receipts	\$ 276 020	(10)
Nonfishing receipts	\$ 16 430	(44)
Total cash receipts	\$ 292 450	(8)
Costs		
Administration	\$ 7 560	(13)
Crew costs	\$ 119 830	(10)
Freight and marketing	\$ 5 540	(45)
Fuel	\$ 19 170	(17)
Insurance	\$ 6 490	(11)
Interest paid	\$ 10 540	(39)
Leasing	\$ 15 540	(29)
Licence fees and levies	\$ 13 540	(12)
Repairs and maintenance	\$ 31 990	(16)
Other costs	\$ 23 080	(12)
Total cash costs	\$ 253 280	(8)
Boat cash income	\$ 39 180	(30)
<i>less depreciation a</i>	\$ 10 630	(21)
Boat business profit	\$ 28 550	(40)
<i>plus interest, leasing and rent</i>	\$ 26 540	(28)
Profit at full equity	\$ 55 090	(23)
Capital (excl. quota and licences)	\$ 244 770	(12)
Capital (incl. quota and licences)	\$ 1 178 220	(17)
Rate of return to boat capital b	% 22.5	(26)
Rate of return to full equity c	% 4.7	(26)

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 'Survey methods and definitions'.

SOUTH EAST NONTRAWL FISHERY

7 Estimated financial performance of boats in the south east nontrawl fishery, by triptile, 1998-99 ^a Triptiles based on value of fish sold

	Lower third	Middle third	Upper third
Receipts			
Fishing receipts	\$ 103 020 (26)	275 890 (2)	398 760 (6)
Nonfishing receipts	\$ 31 330 (74)	5 490 (60)	18 520 (40)
Total cash receipts	\$ 134 350 (18)	281 390 (1)	417 270 (7)
Costs			
Administration	\$ 6 880 (25)	6 270 (28)	9 540 (20)
Crew costs	\$ 57 200 (30)	124 800 (9)	158 460 (8)
Freight and marketing	\$ 2 790 (69)	10 340 (64)	1 930 (67)
Fuel	\$ 11 110 (28)	14 570 (30)	30 200 (19)
Insurance	\$ 6 620 (31)	5 540 (25)	7 510 (14)
Interest paid	\$ 7 610 (20)	10 060 (55)	13 160 (107)
Leasing	\$ 6 320 (51)	9 800 (74)	28 700 (46)
Licence fees and levies	\$ 14 070 (20)	12 800 (12)	14 020 (39)
Repairs and maintenance	\$ 11 750 (27)	28 070 (8)	50 860 (20)
Other costs	\$ 13 650 (17)	24 040 (28)	28 650 (11)
Total cash costs	\$ 138 010 (20)	246 300 (9)	343 020 (11)
Boat cash income	\$ -3 660 (584)	35 090 (58)	74 260 (26)
<i>less depreciation b</i>	\$ 14 420 (38)	6 410 (57)	12 820 (19)
Boat business profit	\$ -18 080 (101)	28 680 (68)	61 440 (31)
<i>plus interest, leasing and rent</i>	\$ 13 930 (26)	20 190 (49)	42 810 (59)
Profit at full equity	\$ -4 150 (431)	48 870 (29)	104 250 (31)
Capital (excl. quota and licences)	\$ 327 910 (33)	186 370 (15)	253 350 (24)
Capital (incl. quota and licences)	\$ 1 016 320 (32)	1 305 700 (22)	1 145 600 (48)
Rate of return to boat capital c	% -1.3 (419)	26.2 (28)	41.2 (27)
Rate of return to full equity d	% -0.4 (409)	3.7 (23)	9.1 (35)

a The format of this table is different from others in this publication, but matches the report on south east nontrawl 1997-98 in the 1999 fish surveys report. **b** Depreciation adjusted for profit or loss on capital items sold. **c** Excluding value of quota and licences. **d** Including value of quota and licences.

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

8 Debt and equity of boats in the south east nontrawl fishery in 1998-99

Average per boat

	All boats
Capital (incl. quota and licences) at 30 June	\$ 1 068 390 (20)
Boat business debt at 1 July	\$ 176 550 (52)
Boat business debt at 30 June	\$ 175 500 (52)
Boat business equity at 30 June	\$ 892 890 (24)
Boat business equity ratio at 30 June	% 84 (10)

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

Boat business equity provides a measure of the financial ownership of a fishing enterprise. The estimated average boat business equity ratio in the south east nontrawl fishery was around 84 per cent in 1998-99.

Economic performance of the fishery

It was not possible to generate economic performance indicators for 1997-98 and 1998-99 for the south east nontrawl fishery because of the degree of overlap between the fishery and the southern

shark fishery. Under current management arrangements, many southern shark fishers catch south east nontrawl species as bycatch.

Where southern shark fishers land nontrawl quota species as bycatch (pink ling, blue eye trevalla or blue warehou), the catches are regarded for management purposes as south east trawl catch, despite being caught while targeting southern shark. Similarly, south east trawl fishers may land as bycatch shark that would otherwise be regarded for management purposes as shark fishery catch, had it been landed by a shark operator.

This blurring of boundaries between the southern shark and south east trawl fisheries means it is currently not possible to isolate the fishing effort and catch directed solely at the south east trawl fishery. As this is needed to determine the fishing costs attributable to the nontrawl fishery, it is not possible to report on the net returns to these fisheries individually. As a result, the south east nontrawl and southern shark fisheries have been

surveyed simultaneously so that a net return measure for the 'combined' fishery can be provided.

This difficulty in assessing the economic performance of the south east trawl fishery is symptomatic of a broader management problem. The potential to fully integrate the two fisheries to overcome problems of bycatch and management inefficiency has already been proposed by fisheries managers (see AFMA 1999d as an example).

In order to provide an indication of the economic performance of the combined south east nontrawl fishery and southern shark fishery, the net returns to the combined fisheries have been estimated (see appendix A for calculation details) and are presented in table 9.

In calculating the economic performance of the combined shark and south east nontrawl fishery, all receipts and costs of operators that earned greater than 65 per cent of their revenue from the combined fisheries were included. There were 67 boats that were eligible to be included in the economic performance analysis and of these, 19 were sampled.

As can be seen from table 9, estimated net returns for the combined fisheries after allowing for management costs was negative \$1.2 million. Management costs for the two fisheries in 1998-99, especially for the southern shark fishery, included the cost of developing and implementing the ten year plan. Without these additional management costs, the net return would have been higher in that year.

However, the level of uncertainty about the status of fish stocks also affects the net returns of the combined fishery. If stocks have been fished down below their sustainable level, as considered for school sharks, then the net return should be lower to reflect the selling of that part of the fish stock that will not be available in the future.

9 Estimated economic performance of the combined south east nontrawl and southern shark fisheries

	1998-99	
	(\$'000)	
Receipts a	15 304	(10)
Costs a, b	13 280	(8)
Capital (excl. quota and licences) a, c	6 461	(17)
Net returns (excl. management costs)	826	(92)
Commonwealth management costs d	2 055	na
Net returns (incl. management costs)	-1 229	(92)

a Revenue, costs and capital estimates are totals for boats included in sample (there is no attempt to apportion costs between fisheries). **b** Cash costs include imputed operator and family labor costs but exclude licence and levy payments and interest payments. **c** Replacement capital (depreciated capital). **d** Costs to AFMA of managing the fishery (A. Kettle, AFMA, personal communication, April 2001) **na** Not applicable.

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

Southern shark fishery

Survey results

For the fishery as a whole, average total cash receipts fell slightly to \$270 100 in 1998-99, but average total cash receipts in the ten net units category rose by 9 per cent to \$328 500.



Average cash costs per boat fell to \$232 600 in 1998-99, with costs falling more for boats with six net units or less. Boat business profit was estimated to be higher in the six net units or less category in 1998-99 despite falling to \$24 200 from \$35 500 in 1997-98.



Average debt across the fishery was increased by 13 per cent during 1998-99 to \$164 700. The boat business equity ratio for 1998-99 was 87 per cent.



The net returns of the individual southern shark fishery were not estimated, owing to the overlap between the southern shark fishery and the south east nontrawl fishery.



The net returns for the 'combined' fishery were estimated at negative \$0.1 million in 1998-99.



The fishery

The southern shark fishery is located in Commonwealth waters off the Victorian, Tasmanian and South Australian coasts (figure L).

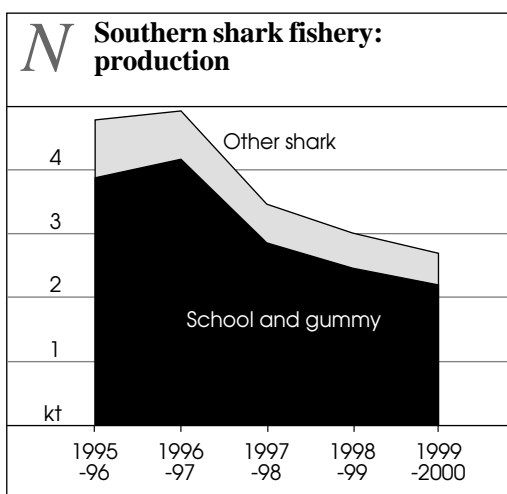
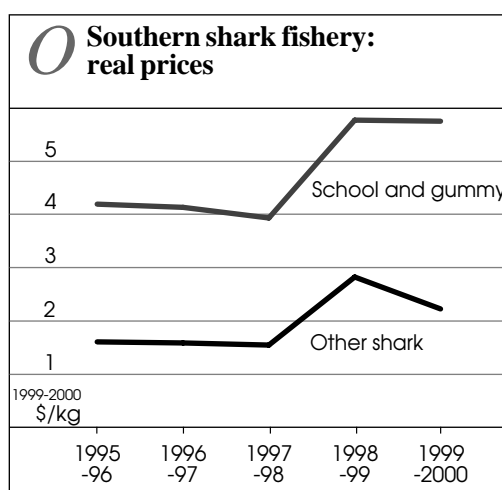
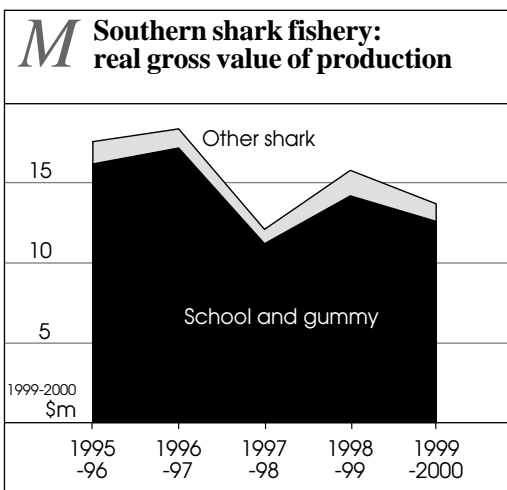
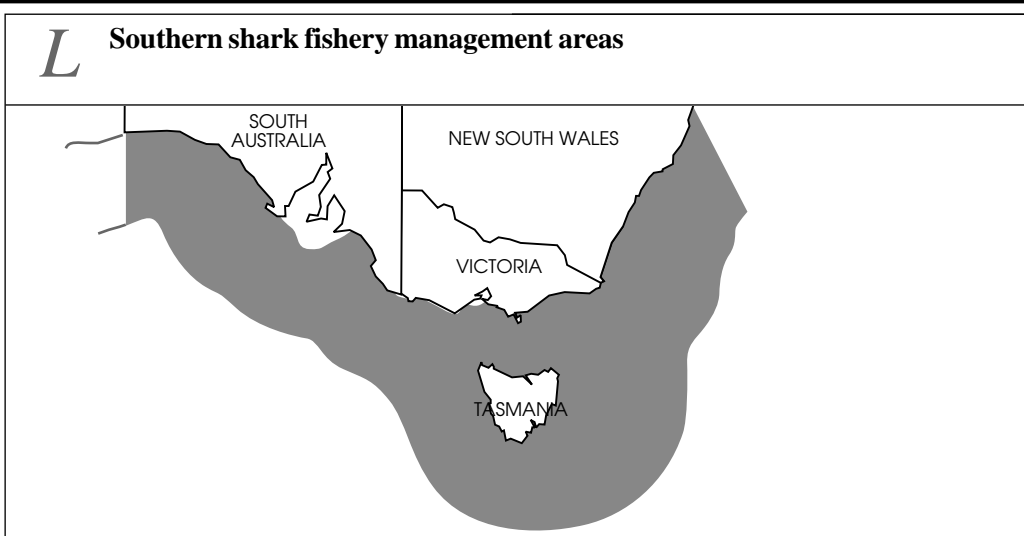
The operators in the fishery primarily target school (*Galeorhinus galeus*) and gummy sharks (*Mustelus antarcticus*), but catch all species of demersal shark. Sharks are taken using hook and demersal gill-net fishing methods, with the catch primarily for the domestic market.

Gummy and school sharks accounted for 81 per cent of the catch between 1970 and 2000, with the majority of the shark caught by gillnetters. Sharks are also caught as bycatch by operators of other Commonwealth and state fisheries.

The fishery generally operates year round but is reliant on the weather conditions. The larger boats have the ability to fish in almost any conditions whereas the smaller boats tend to concentrate their effort in summer and autumn when the seas are calmer.

There were 122 gillnet and 38 hook permits valid in the fishery during the 1999-2000 season. However, not all shark permits are fished against all of the time. During poor rock lobster seasons or closures, many rock lobster fishers holding shark permits begin shark fishing. This contributes to an upsurge in shark fishing effort during these periods. Conversely a large number of shark gillnetters also target scale fish as a part of the south east nontrawl fishery.

While much of the shark product is sold as flake on the domestic market, other products have developed in recent years including shark liver oil, fins and cartilage.



The real gross value of production from the fishery trended downwards between 1995-96 and 1999-2000. In the latter year it was \$13.8 million, down by 22 per cent in real terms compared with 1995-96 (figure M).

Production in the southern shark fishery fell by 43 per cent between 1995-96 and 1999-2000 (figure N) to 2726 tonnes (ABARE 2001). The drop in production is mainly attributable to the fall in the catch of school sharks (M. Sachse, AFMA, personal communication, May 2001).

The real prices of school and gummy sharks peaked in 1998-99 (figure O).

Biological status of the fishery

Sharks generally live for a long time, with gummy sharks living to around sixteen years of age, and school sharks to over fifty years. School sharks, however, are slower to mature and are much less productive than gummy sharks. This coupled with a long gestation period and slow growth rates make school sharks especially prone to stock collapse from overfishing.

School sharks are highly nomadic, moving throughout the waters of southern Australia. A second stock of school sharks, found on the continental shelf around New Zealand, may also inhabit the waters of the southern shark fishery but there is evidence to suggest that the two stocks form individual genetic pools. Further stocks of school sharks are located in many parts of the world including western Europe, the east coast of South America, the west coast of North America and southern Africa.

The Southern Shark Fishery Assessment Group (SharkFAG) conducted a scientific assessment in July 1999 and concluded that the mature biomass at the beginning of July 1997 was between 12 and 18 per cent of the 1927 level. At this level, the catch is considered to be unsustainable and the reliability of this assessment is considered to be high (Caton and McLoughlin 2000). In addition SharkFAG has calculated that the constant catch required from 2002 for the mature biomass at the start of 2011 to exceed that at the start of 1996 with 80 per cent confidence is 317 tonnes.

Gummy sharks are endemic to waters of the continental shelf and slope off southern Australia and, unlike school sharks, show no clear movement patterns.

SharkFAG has recently conducted an assessment of gummy sharks where the study divided the fishery into three sub-areas of Bass Strait, South Australia and Tasmania. The reason for this is that there are thought to be multiple populations (stocks) of gummy sharks in the southern shark fishery. However, there is no scientific evidence to suggest that each region

in the fishery should be managed separately.

Gummy shark stocks are considered to be sustainable at the current catch levels, with the 1999 assessments indicating that pup production in Bass Strait is estimated to be between 45 and 78 per cent of the level prior to fishing. Pup production off South Australia is estimated to be between 72 and 89 per cent of the level prior to fishing.

Management of the fishery

The Commonwealth, Victorian, Tasmanian and South Australian governments manage the southern shark fishery. From 1 January 2001 the Commonwealth under an offshore Constitutional Settlement Agreement has jurisdiction for school and gummy shark to the high water mark but excluding the bays, gulfs and inlets.

Until recently, the fisheries management methods have focused on the use of input controls (limited entry, and gear restrictions such as minimum and maximum mesh sizes) in an attempt to control catch per unit of effort. There have also been some output controls, namely bycatch and catch limits.

In 1988, a gillnet amalgamation scheme was implemented to create a limited entry gillnet fishery where gillnet endorsements based on units of fishing capacity were issued to fishers with a history of fishing in the southern shark fishery. Depending on their catch history, operators were either allocated category 'A' endorsements for six units of net, or category 'B' endorsements for five units or less of net. A single net unit was defined as a monofilament gillnet with a headrope length of 600 metres and the net 20 meshes deep, where a mesh was a single square of net not less than 15 centimetres wide.

In the first two years, fishers were allowed to amalgamate two class 'A' licences into a special 'A10' category. Subsequent reductions and redefining of nets occurred in 1991, 1993 and 1997 to arrive at the arrangements pertinent to the 1999-2000 season, where a net unit is defined as 420 metres in length and

a maximum mesh size of 165 millimetres.

In 1994 the hook sector was brought under management. Depending on catch history, fishers were allocated either 1000 or 2000 hook permits if they met certain entry criteria.

Under the Offshore Constitutional Settlement Agreement the fishery is managed by a combination of some input (gear and area restrictions and nontransferable permits) and output controls, namely individual transferable quotas (ITQs). The Southern Shark Allocation Advisory Panel was established to advise the Australian Fisheries Management Authority on the apportioning and allocation of school and gummy shark ITQs to operators both in the southern shark fishery and operators outside the southern shark fishery.

Boats surveyed

For the purpose of the survey, the population was defined as boats that held endorsements for the southern shark fishery that caught shark in the survey years. Boats that held endorsements for the fishery but did not fish for sharks in the survey years were excluded from the survey population.

The target population of the survey was divided into two sectors on the basis of the number of net units allocated under the current management plan: six units or less and ten units. Further disaggregation of the fleet was not possible due to confidentiality constraints.

Based on logbook data, there were 114 boats that fished the southern shark fishery in 1997-98 and 106 that fished in 1998-99. For the six net units or less category there were 76 boats in the population in 1997-98, of which 12 were sampled. For the same category in 1998-99 there were 69 boats in the population of which 16 were sampled. In the ten net units category, there were 38 boats in the population in 1997-98, of which 9 were sampled and 37 boats in the population in 1998-99, of which 11 were sampled. There were no hook operators sampled from the fishery.

Financial performance of boats

Many operators in the southern shark fishery also operate in other fisheries such as the south east nontrawl fishery, Bass Strait scallop fishery and various state fisheries. The activities in these other fisheries were a major influence on the financial performance of boats operating in the southern shark fishery over the survey period.

Receipts

Average total cash receipts per boat for all operators in the fishery were estimated at around \$270 100 in 1998-99, a decrease of around 3 per cent from 1997-98 (table 9). Shark and lobster receipts dominated operator incomes, accounting for an estimated 45 per cent and 36 per cent of total cash receipts in 1998-99.

In the six net units or less category, total cash receipts were estimated at \$238 800 in 1998-99, down 11 per cent from 1997-98. As mentioned earlier, many shark fishers operate in other fisheries. This is more evident in the six net units or less category as these operators were estimated to have on average earned more than 60 per cent of their income from lobster in 1997-98 and 1998-99. Shark receipts contributed an estimated 20 per cent to total cash receipts, as shark fishing is generally a part time or seasonal activity for operators in this category.

Operators with ten net units were estimated to have had the highest total cash receipts in 1998-99, at around \$328 500, up 9 per cent from 1997-98. Ten net unit operators were estimated to have earned no income from lobster operations over the survey period. Instead, these operators were estimated to have earned around 75 per cent of their cash receipts from shark in 1997-98 and 1998-99. The remainder of cash receipts in the ten net units category were derived from other fishing receipts and scallop receipts.

Quantity of fish sold

For the total fishery, shark catches accounted for the majority of the catch in the fishery. Of the shark species, gummy

SOUTHERN SHARK FISHERY

shark consistently contributed around 70 per cent of the total shark caught, by weight, in the fishery (table 11).

Costs

Average total cash costs per boat were estimated to have been around \$232 600 in 1998-99. This represents a drop in total boat cash costs of around 5 per cent from the previous year. Crew costs were the highest expenditure, accounting for 50 per cent of expenditure in 1998-99. Repairs and maintenance, and fuel also consti-

tuted significant proportions of total cash costs at 12 per cent and 9 per cent respectively in 1998-99.

Total cash costs for boats in the six net units or less category fell by 9 per cent to an estimated \$200 500. This fall is mainly attributable to the fall in crew costs over the survey period.

The total cash costs for boats in the ten net units category fell by less than 1 per cent over the survey period to an estimated \$292 660 in 1998-99. While crew costs rose significantly in 1998-99, repairs

10 Estimated financial performance of boats in the southern shark fishery – 6 units or less and 10 units Average per boat

	6 units or less		10 units	
	1997-98	1998-99	1997-98	1998-99
Receipts				
Shark receipts	\$ 54 410 (23)	52 920 (29)	228 520 (11)	246 230 (8)
Lobsters receipts	\$ 181 450 (24)	150 700 (26)	na	na
Scallops receipts	\$ na	7 640 (74)	16 210 (65)	25 550 (54)
Squid receipts	\$ na	na	na	6 090 (88)
Other fishing receipts	\$ 20 550 (73)	18 970 (70)	44 610 (73)	37 380 (65)
Nonfishing receipts	\$ 11 350 (38)	8 590 (47)	11 430 (32)	13 200 (31)
Total cash receipts	\$ 267 760 (13)	238 820 (14)	300 770 (12)	328 450 (7)
Costs				
Administration	\$ 6 220 (20)	6 650 (20)	6 740 (18)	5 610 (14)
Bait	\$ 7 370 (19)	6 870 (18)	na	na
Crew costs	\$ 111 930 (11)	103 440 (13)	129 370 (9)	139 820 (6)
Food	\$ 1 650 (37)	1 930 (31)	4 800 (22)	4 840 (16)
Freight and marketing	\$ 850 (67)	1 110 (63)	12 780 (43)	13 390 (36)
Fuel	\$ 18 540 (23)	16 570 (19)	24 000 (13)	27 060 (12)
Insurance	\$ 6 420 (24)	6 220 (25)	10 970 (17)	11 700 (14)
Interest paid	\$ 11 160 (43)	11 050 (39)	7 870 (75)	11 690 (50)
Licence fees and levies	\$ 15 560 (12)	12 280 (11)	16 130 (8)	15 670 (14)
Repairs and maintenance	\$ 26 540 (21)	23 070 (16)	48 160 (15)	39 900 (16)
Other costs	\$ 13 540 (29)	11 320 (22)	34 120 (70)	22 980 (49)
Total cash costs	\$ 219 770 (12)	200 490 (12)	294 930 (11)	292 660 (8)
Boat cash income	\$ 47 990 (35)	38 330 (41)	5 840 (355)	35 780 (30)
less depreciation a	\$ 12 470 (30)	14 140 (23)	11 520 (20)	15 680 (28)
Boat business profit	\$ 35 520 (44)	24 190 (64)	-5 680 (359)	20 110 (58)
plus interest, leasing and rent	\$ 16 980 (44)	15 950 (41)	7 920 (75)	12 160 (49)
Profit at full equity	\$ 52 500 (36)	40 140 (45)	2 240 (713)	32 270 (33)
Capital (excl. quota and licences) \$	306 300 (22)	321 360 (21)	436 710 (21)	457 030 (16)
Capital (incl. quota and licences) \$	na	1 370 700 (15)	na	965 600 (10)
Rate of return to boat capital b %	17 (45)	13 (52)	1 (720)	7 (41)
Rate of return to full equity c %	na	3 (35)	na	3 (39)

Continued ⇨

and maintenance and other costs fell, resulting in stable total cash costs over the survey period.

10 Estimated financial performance of boats in the southern shark fishery – all boats

Average per boat *continued*

	All boats	
	1997-98	1998-99
Receipts		
Shark receipts	\$ 111 760 (11)	120 320 (10)
Lobsters receipts	\$ 121 680 (24)	98 160 (26)
Scallops receipts	\$ 5 340 (65)	13 890 (44)
Squid receipts	\$ na	2 120 (88)
Other fishing receipts	\$ 28 480 (52)	25 390 (48)
Nonfishing receipts	\$ 11 370 (27)	10 200 (29)
Total cash receipts	\$ 278 630 (10)	270 070 (8)
Costs		
Administration	\$ 6 390 (14)	6 290 (14)
Bait	\$ 4 940 (19)	4 470 (18)
Crew costs	\$ 117 670 (8)	116 120 (8)
Food	\$ 2 690 (20)	2 940 (16)
Freight and marketing	\$ 4 780 (38)	5 390 (33)
Fuel	\$ 20 340 (15)	20 230 (12)
Insurance	\$ 7 920 (15)	8 130 (14)
Interest paid	\$ 10 070 (37)	11 270 (31)
Licence fees and levies	\$ 15 750 (8)	13 460 (9)
Repairs and maintenance	\$ 33 660 (13)	28 940 (11)
Other costs	\$ 20 320 (41)	15 390 (27)
Total cash costs	\$ 244 530 (8)	232 630 (8)
Boat cash income	\$ 34 100 (38)	37 440 (29)
less depreciation a	\$ 12 150 (22)	14 680 (18)
Boat business profit plus interest, leasing and rent	\$ 21 950 (56)	22 770 (48)
	\$ 13 990 (38)	14 630 (32)
Profit at full equity	\$ 35 940 (38)	37 390 (33)
Capital (excl. quota and licences)	\$ 349 250 (16)	368 660 (14)
Capital (incl. quota and licences)	\$ na	1 229 450 (11)
Rate of return to boat capital b	% 10 (44)	10 (38)
Rate of return to full equity c	% na	3 (27)

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

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

Boat cash income and profit

Average boat cash income for the entire southern shark fishery rose by 10 per cent over the survey years to an estimated \$37 400 in 1998-99. However, boat cash income in the six net units or less category fell by an estimated 20 per cent to \$38 300

11 Estimated quantity of fish sold by boats in the southern shark fishery

(whole weight) Average per boat

	6 units or less	
	1997-98	1998-99
	kg	kg
Gummy shark	6 735 (32)	6 479 (37)
School shark	2 041 (42)	1 200 (39)
Other or unspecified shark	2 861 (64)	3 713 (66)
Total shark	11 637 (23)	11 393 (29)
Other finfish	420 (91)	0 na
Lobsters	6 291 (25)	5 305 (26)
Scallops a	0 na	561 (74)
Squid	0 na	0 na
	10 units	
	1997-98	1998-99
	kg	kg
Gummy shark	42 362 (15)	40 772 (11)
School shark	8 449 (61)	9 843 (51)
Other or unspecified shark	4 711 (42)	6 298 (31)
Total shark	55 521 (14)	56 912 (9)
Other finfish	30 002 (89)	23 788 (83)
Lobsters	na	na
Scallops a	1 318 (65)	2 232 (55)
Squid	0 na	4 405 (88)
	All boats	
	1997-98	1998-99
	kg	kg
Gummy shark	18 469 (13)	18 436 (12)
School shark	4 152 (43)	4 213 (42)
Other or unspecified shark	3 470 (40)	4 614 (37)
Total shark	26 091 (12)	27 264 (10)
Other finfish	10 163 (86)	8 294 (83)
Lobsters	4 219 (25)	3 455 (26)
Scallops a	434 (65)	1 144 (44)
Squid	0 na	1 536 (88)

a Meat weight. na Not applicable.

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

12 Debt and equity of boats in the southern shark fishery in 1998-99

Average per boat

		6 units or less	10 units	All boats
Capital (incl. quota and licences) at 30 June	\$	1 373 360 (16)	1 033 740 (9)	1 251 400 (11)
Boat business debt at 1 July	\$	137 400 (31)	161 120 (49)	145 910 (27)
Boat business debt at 30 June	\$	164 490 (32)	165 070 (46)	164 700 (26)
Change in debt over year	\$	27 100 (66)	3 960 (125)	18 790 (62)
Boat business equity at 30 June	\$	1 208 870 (16)	868 670 (13)	1 086 700 (12)
Boat business equity ratio at 30 June	%	88 (4)	84 (9)	87 (4)

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

between 1997-98 and 1998-99. This was mainly caused by the fall in lobster receipts over the survey period.

Conversely, boat cash income in the ten units category rose from an estimated \$5800 in 1997-98 to an estimated \$35 800 in 1998-99. This increase was attributable to the increase in both shark and scallop receipts.

Boat business profit provides a measure of the return to the operator after allowing for the depreciation of capital. In 1998-99, the average boat in the fishery was estimated to have made a profit of \$22 800, up marginally from 1997-98. Boat business profit fell by 32 per cent to an estimated \$24 200 in 1998-99 in the six net units or less category and profit increased from negative \$5700 to positive \$20 100 between 1997-98 and 1998-99 in the ten net units category.

Rates of return

The estimated average rate of return to boat capital (excluding quota and licences) for all boats in the southern shark fishery was estimated to be 10.1 per cent in 1998-99. The estimated rate of return to full equity (including quota and licences) in 1998-99 was 3.0 per cent.

Higher boat business profits in the six net units category combined with lower invested boat capital (excluding quota and licences) led to estimated rates of return to boat capital (excluding quota and licences) being much higher in the six net units or less category than in the ten net units category.

Within the six net units or less category, the return to boat capital fell between 1997-98 and 1998-99 to an estimated 12.5 per cent from 17.1 per cent. The fall in lobster receipts over the survey period contributed substantially to this result.

In the ten net units category, the return to boat capital (excluding quota and licences) increased over the survey period from an estimated 0.5 per cent in 1997-98 to an estimated 7.1 per cent in 1998-99.

Debt and equity

Not all sampled boats provided information on debt and equity and based on this smaller sample, the estimated average level of debt per boat for the total fishery increased to \$164 700 (table 12). Business debt for boats in the six net units or less category rose to an estimated average of \$164 500 per boat, while boats in the ten unit category had a closing debt of nearly \$165 100. Boat business equity provides a measure of the financial ownership of a fishing enterprise. The estimated average boat business equity ratio in the southern shark fishery was around 87 per cent in 1998-99.

Economic performance of the fishery

As the economic performance of the southern shark fishery and the south east nontrawl fishery were combined, the economic performance results can be found in the chapter on the south east nontrawl fishery.

Bass Strait central zone scallop fishery

Survey results*

Average cash receipts per boat in the fishery increased by 18 per cent between 1997-98 and 1998-99 to \$202 200, mainly through increased lobster and squid receipts.



Cash costs in the fishery increased by an estimated 8 per cent between 1997-98 and 1998-99 to \$186 300



Average boat business profit (which makes an allowance for depreciation) was estimated to have been negative \$1300 in 1998-99, an improvement from negative \$11 000 in 1997-98.



The level of debt fell during 1998-99 to an average of \$34 700 per boat, with the boat business equity ratio estimated at 96 per cent in 1998-99.



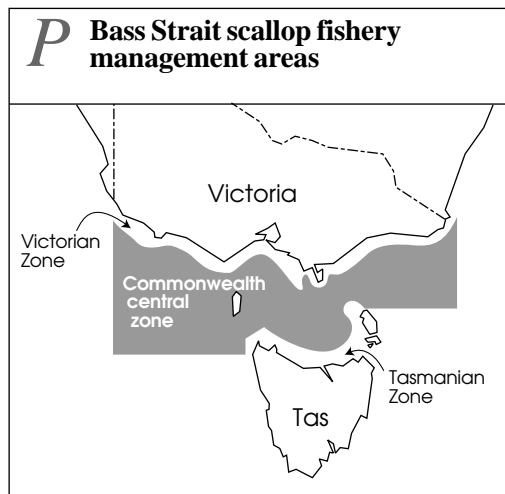
The net returns for the fishery were negative in both 1997-98 and 1998-99 at -\$1.1 million and -\$0.7 million respectively.



The fishery

The Bass Strait scallop fishery is located in both state and Commonwealth waters off Victoria and Tasmania and is divided into three zones (figure P). The Victorian fishing zone generally extends 20 nautical miles off the coast except around Wilson's Promontory where a 3 nautical mile limit applies, while the Tasmanian fishing zone generally extends 20 nautical miles off the coast toward Bass Strait and 200 nautical miles off the remainder of the state's coastline. The Commonwealth managed central zone fishery is the area between the two state fisheries.

The principal target species in the central zone fishery is the commercial scallop (*Pecten fumatus*), with doughboy scallops (*Chlamys asperrimus*) also occasionally taken. However, reflecting the small size and difficulty in processing,



*This survey is based on boats that operate in the Commonwealth central zone fishery. Many of these boats also operate in the Tasmanian and Victorian zones.

markets have not yet been developed for the latter species. The principal fishing method is a towed scallop harvester.

Scallops have been commercially caught in Tasmanian waters since the 1940s. But it was not until the 1970s that scallop concentrations were discovered in the now Victorian and central zone fisheries off Lakes Entrance in eastern Victoria.

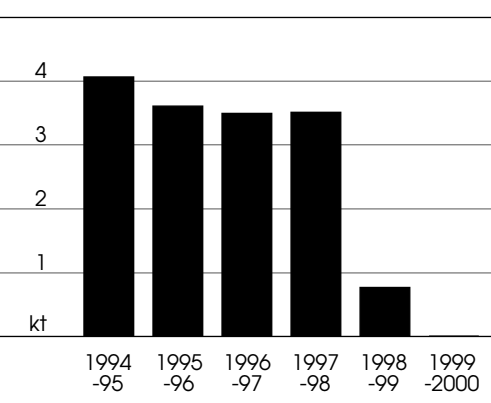
Scallops are primarily fished in winter, with operators targeting squid and rock lobster, using relevant concessions, in summer (Bass Strait Scallop Consultative Committee 1997, as in ABARE 1998a).

The central zone fishery was closed to fishing in the 1999-2000 season to allow stocks to rebuild. However, subject to catch limits and the closure of the only known scallop bed east of Flinders Island, the fishery was opened to allow a three month commercial survey in late 2000. Only those operators who had held fishing permits on 31 May 1999 (the last time fishing concessions were valid) were eligible for the grant of a permit in 2000-01.

The gross value of production of the central zone fishery has fallen markedly in recent years (figure Q) primarily owing to the drop in production. In 1998-99 the gross value of production fell to \$1.7 million from \$8 million in 1996-97 and a high of around \$14 million in 1995-96 (ABARE 2001).

Production in the central zone fishery fell dramatically over the five years to

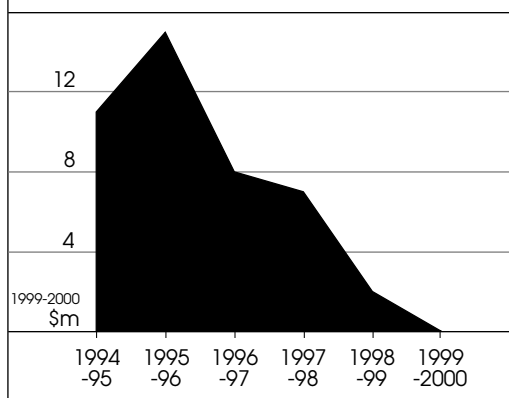
R Central zone scallop fishery: production Shell weight



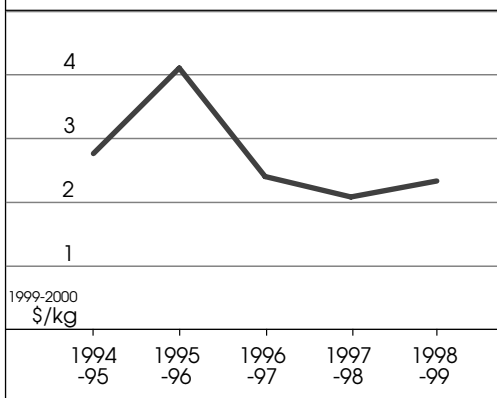
1999-2000 (figure R). In 1994-95, production was 4062 tonnes. By 1998-99 it had fallen to 763 tonnes (ABARE 2001). As the fishery was closed to commercial fishing in 1999-2000, there was no catch in the central zone fishery in that year.

The main markets for scallops are France, Hong Kong, the United States and the domestic market, but in 1995-96, the world market weakened, leading to lower export prices and strong import competition on the domestic market (AFMA 1999b). This contributed to reduced fishing effort and consequently lower catches with declining stocks, this trend continued in 1996-97 and 1997-98. The catch per unit effort also fell in 1998-99 to the lowest level since the introduction of the Com-

Q Central zone scallop fishery: real gross value of production



S Central zone scallop fishery: real prices Shell weight



monwealth Scallop Logbook program in 1993. It fell to 2 bags an hour dredged compared with nearly 5.5 bags an hour dredged in 1997-98 (AFMA 1999b).

As can be seen from figure 5, the per unit price of scallops (in real terms) taken from the central zone fishery peaked in 1995-96 and has remained relatively stable since 1996-97.

Biological status of the fishery

Scallops are found naturally from the mid north coast of New South Wales, along the south coast including the east and northern coasts of Tasmania and all the way around the continent to Shark Bay in Western Australia.

Scallops are characterised by sharp recruitment fluctuations and a wide and patchy distribution. Spawning generally occurs over a long period between winter and spring but the exact timing varies between areas. Growth rates can also vary markedly between areas, with maturity being reached in the first year and spawning occurring in the second year. Reflecting variability in natural abundance, growth, mortality and meat yield, traditional stock assessment is extremely difficult.

During the 1980s there was intense fishing of the central zone fishery scallop stocks and when a bed was located, it was quickly fished until it had been removed. By the late 1980s, stocks were severely depleted. Abundance in the fishery improved in the early 1990s (Caton and McLoughlin 2000). Responding to declining catch and catch rates in the 1998-99 season, the Australian Fisheries and Management Authority imposed a fishery closure for the 1999-2000 season. It is believed that stocks are still suffering from the overfishing in the 1980s and Caton and McLoughlin (2000) suggest that the beds require a longer period to fully recover from this overfishing.

The only known bed of commercial scallops in the central zone fishery that have reached the minimum legal size is in an area east of Flinders Island that was the subject of a scientific survey in 2000.

However, in recent years there has been little searching of other areas that have historically supported scallop beds.

Management of the fishery

Management of the Bass Strait scallop fishery is divided between the Commonwealth and the states of Victoria and Tasmania in accordance with Offshore Constitutional Settlement Agreements between the Commonwealth and states introduced in 1986. Under these arrangements, the Bass Strait scallop fishery has been managed as three separate zones: two state zones managed by the respective state governments and the central zone which is managed by AFMA with advice from the newly formed Bass Strait Central Zone Scallop fishery Management Advisory Committee (ScallopMAC) and its predecessor the Bass Strait Central Zone Scallop Fishery Consultative Committee.

Fishery management

Since the Offshore Constitutional Settlement Agreement was made, the central zone fishery has been managed by a combination of input and output controls. The input controls include limited entry, season and area closures. In 1991 the Bass Strait Scallop Consultative Committee was formed. That same year the Australian Fisheries Service, in consultation with the consultative committee, developed the Bass Strait Scallop Preliminary Management Plan to manage the Bass Strait central zone scallop fishery. Management restrictions used were: limited entry (but with no reduction in endorsements); transferability restrictions; a catch limit of 100 bags per fortnight; and a minimum shell size of 80 millimetres at their widest point (this is the size at which scallops are likely to have spawned twice). There was also usually a summer closure that allowed spat to settle and grow without disruption.

Over the 1991-96 period the same basic management framework was applied in the central zone fishery, but the Bass Strait Scallop Consultative Committee (1997, as in ABARE 1998a) has noted that these

management arrangements act as an impediment to industry restructure, primarily because of the nontransferability of the quota system. To improve economic efficiency, a transferable quota system has been proposed.

In October 1998 an independent Allocation Advisory Panel appointed by AFMA provided recommendations on the allocation of fishing concessions and the allocation of quota for the central zone fishery.

A statutory plan of management is currently being developed for the central zone fishery in consultation with operators and other stakeholders in the fishery. A draft is expected to be released in mid-2001 for public feedback.

Under the draft management plan, the holder of each fishing permit on the eligibility date will receive a Boat Statutory Fishing Right and an equal allocation of Quota Statutory Fishing Rights. Boat and quota rights will be fully transferable. Both a boat and quota right will be required for operation in the fishery until 2004 after which time a quota right alone will be necessary.

Management of the two state zones

The Bass Strait scallop fishery is divided into three zones and for completeness of this report the management regimes of the two state zones are presented below because it is recognised that some boats operating in the central zone fishery also operate in the two state zones.

Tasmania

The current Tasmanian fishery management arrangements were implemented in June 2000. The fishery is now managed through a combination of input and output controls. The input controls include limited entry (117 licences), size limits, season and area closures. These input controls are similar to those pertinent to the central zone.

On output controls, instead of fishers being restricted to landing their scallops in standard bags, they are now permitted to do so by weight. Each scallop unit specified on a scallop licence will be allo-

cated a weight value of 500 kilograms, which will be fixed for the life of the plan (five years). The kilogram value is not related to the amount of mature fish that may or may not be available in any given year — but it does limit the maximum potential annual catch for the fleet. The units are fully transferable but there are maximum and minimum unit holding restrictions.

Victoria

The Victorian scallop fishery is being managed by a number of means that include limiting entry (94 licences); season closure (typically December to April); and monthly catch limits. For the fishery to continue in a given season, 80 per cent of scallops caught must be greater than 70 millimetres in shell height, and there must be less than 120 individual scallop meats to the kilogram.

Fisheries managers and industry representatives meet during the season to consider any changes to the existing management of the fishery.

Boats surveyed

The target population of the Bass Strait scallop fishery survey was defined as boats that held endorsements for the Commonwealth managed central zone and caught scallops within the survey years. Boats that held Commonwealth endorsements and did not fish during the survey period were excluded from the population.

As mentioned previously, many boats that operate in the central zone also operate in the Victorian and/or Tasmanian zones. Unfortunately, as the survey is based only on the Commonwealth controlled zone, it was not possible to divide the fleet into the three separate zones for the purposes of reporting the results.

The number of active vessels in the Commonwealth fishery has fallen significantly in recent years from 91 in 1996-97, to 57 in 1997-98 and then down to 42 in 1998-99. For the survey years, 1997-98 and 1998-99, the number of boats sampled was 16 and 18 respectively.

Financial performance of boats

It should be noted that operators in the central zone scallop fishery also operate in other fisheries, targeting other species such as squid and rock lobster. This mainly reflects the seasonal nature of the fishery. The fishing techniques and equipment required to target these other species are quite different, requiring, in many cases, boats to be reregged. The activities in these other fisheries had a major influence on the financial performance of the boats operating in the central zone scallop fishery over the survey period.

Receipts

Average total cash receipts per boat in the fishery were estimated at around \$202 200 in 1998-99, an increase of about 18 per cent from 1997-98. In 1998-99, scallop receipts accounted for around 58 per cent of revenue (table 13), compared with 66 per cent in 1997-98. As with previous scallop fishery surveys (ABARE 1998a), lobster and squid receipts were estimated to constitute a significant proportion of total cash receipts, accounting for 11 per cent and 16 per cent respectively, with the proportion that each species contributes to total cash receipts increasing between 1997-98 and 1998-99.

Costs

Average total cash costs per boat were estimated to have been around \$186 300 in 1998-99. This represents an increase in total boat cash costs of around 8 per cent from the previous year. Crew costs were the highest expenditure in both survey years, accounting for 42 per cent and 46 per cent of expenditure in 1997-98 and 1998-99 respectively. Crew costs rose by 17 per cent to \$85 300 between 1997-98 and 1998-99. Repairs and maintenance, and fuel, oil and grease also constituted significant proportions of total costs in 1998-99, at 15 per cent and 10 per cent respectively, but both these cost items were estimated to be lower in 1998-99 than 1997-98. Insurance became increasingly significant in 1998-99, accounting for 9 per cent of total cash costs.

Quantity of fish sold

The quantity of scallops sold per boat fell by 13 per cent from 1997-98 to 1998-99 to an average of 9147 kilograms of meat weight (table 14). Note that the quantity

13 Estimated financial performance of boats in the central zone scallop fishery – all boats

Average per boat

	1997-98	1998-99
Receipts		
Shark receipts	\$ 5 360 (83)	6 700 (62)
Lobsters receipts	\$ 4 990 (80)	22 200 (41)
Scallops receipts	\$ 113 900 (9)	117 740 (12)
Squid receipts	\$ 18 800 (39)	32 550 (16)
Other fishing receipts	\$ 20 550 (83)	17 660 (83)
Nonfishing receipts	\$ 7 740 (24)	5 380 (32)
Total cash receipts	\$ 171 340 (13)	202 220 (13)
Costs		
Administration	\$ 4 250 (16)	4 410 (15)
Bait	\$ 0 na	340 (86)
Crew costs	\$ 72 680 (11)	85 270 (12)
Food	\$ 4 410 (17)	3 660 (13)
Freight and marketing	\$ 0 na	0 na
Fuel	\$ 20 580 (13)	18 580 (11)
Insurance	\$ 6 610 (20)	16 210 (35)
Interest paid	\$ 4 220 (37)	2 370 (30)
Licence fees and levies	\$ 11 290 (15)	12 080 (12)
Repairs and maintenance	\$ 29 170 (12)	27 600 (14)
Other costs	\$ 20 020 (61)	15 760 (44)
Total boat cash costs	\$ 173 220 (13)	186 280 (12)
Boat cash income	\$ -1 890 (367)	15 940 (46)
<i>less depreciation a</i>	\$ 9 160 (32)	17 230 (17)
Boat business profit	\$ -11 040 (50)	-1 290 (589)
<i>plus interest, leasing and rent</i>	\$ 5 570 (40)	4 930 (26)
Profit at full equity	\$ -5 470 (109)	3 640 (204)
Capital (excl. quota and licences)	\$ 340 010 (13)	368 950 (13)
Capital (incl. quota and licences)	\$ na	674 820 (11)
Rate of return to boat capital b	% -2 (107)	1 (205)
Rate of return to full equity c	% na	1 (204)

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

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

14 Estimated quantity of fish sold by boats in the central zone scallop fishery (whole weight) Average per boat

	1997-98	1998-99
	kg	kg
Total shark	1 575 (83)	1 639 (61)
Other finfish	16 419 (83)	13 615 (86)
Lobsters	217 (80)	623 (41)
Scallops a	10 536 (10)	9 147 (11)
Squid	15 290 (39)	24 916 (16)

a Meat weight.

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

of scallop sold is based on meat weight as the conversion from shell weight to meat weight varies over the years and during the season. Using an average conversion factor of 8.4, the shell weight of scallops sold in 1998-99 would be nearly 77 tonnes.

Squid sales, by weight, make up the next largest component of fish sold by boats in the fishery, with squid sales rising by 63 per cent over the survey period to almost 25 tonnes per boat.

Boat cash income and profit

Average boat cash income for the central zone scallop fishery in 1998-99 was an estimated \$15 900 compared with a loss of \$1900 in 1997-98. This was caused by significant increases in lobster and squid receipts, while costs increased at a much lower rate.

Boat business profit provides a measure of return to the operator by accounting for the depreciation of capital. In 1998-99, the average boat in the central zone scallop fishery was estimated to have made a business loss of \$1300. At full equity, the average profit was an estimated \$3600 in 1998-99. Both these profit figures represent an improvement from 1997-98.

Rates of return

The estimated average rate of return to capital (excluding quota and licences) in the central zone scallop fishery was 1 per cent in 1998-99, which is up from negative 1.6 per cent in 1997-98. This increase is mainly attributable to the increased catch and value of squid and lobster in 1998-99.

15 Debt and equity of boats in the central zone scallop fishery, 1998-99 Average per boat

	All boats	
Capital (incl. quota and licences) at 30 June	\$	903 790 (9)
Boat business debt at 1 July	\$	46 640 (22)
Boat business debt at 30 June	\$	34 740 (21)
Change in debt over year	\$	-11 910 (26)
Boat business equity at 30 June	\$	869 050 (10)
Boat business equity ratio at 30 June	%	96 (1)

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

The estimated rate of return to full equity in 1998-99 was 0.5 per cent.

Debt and equity

Not all sampled boats provided information on debt and equity and based on this smaller sample, the estimated average level of debt per boat declined by 26 per cent to a closing balance of \$34 700 in 1998-99 (table 15).

Boat business equity provides a measure of the financial ownership of a fishing enterprise. The estimated average boat business equity ratio in the Bass Strait scallop fishery was around 96 per cent in 1998-99 compared with 92 per cent in 1996-97. This increase in the equity ratio is the result of a lowering of debt and an increase in capital.

Economic performance of the fishery

To provide an indication of the economic performance of the Bass Strait central zone scallop fishery, the net returns to the fishery have been estimated (see appendix A for calculation details) and presented in table 16. The net returns to the fishery measure includes only the costs and receipts attributable to the Bass Strait central zone scallop fishery. As a result, the estimated receipts and costs in table 16 will differ from those presented in table 13 that include all receipts and costs incurred by boats operating in the fishery, including costs and receipts incurred while operating in other fisheries, such as

16 Estimated economic performance of the central zone scallop fishery in 1998-99

Total for fishery

	1997-98		1998-99	
	\$		\$	
Revenue a	6 368	(24)	1 886	(30)
Cash costs a, b	6 044	(22)	1 694	(14)
Capital a, c	5 949	(58)	2 074	(28)
Net returns (excl. management costs)	-683	(53)	-184	(34)
Commonwealth management costs d	421	na	485	na
Net returns (incl. management costs)	-1 104	(53)	-669	(34)

a Revenue, costs and capital estimates are apportioned according to total receipts received from the central zone scallop fishery. **b** Cash costs include imputed operator and family labor costs but exclude licence and levy payments and interest payments. **c** Replacement capital (depreciated capital). **d** Costs to AFMA of managing the fishery (A. Kettle, AFMA, personal communication, April 2001) **na**. Not applicable.

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

the southern squid jig fishery or state lobster fisheries.

As can be seen from table 16, the estimated net returns (including management costs) of the central zone scallop fishery were negative in both survey years but showed an increase from negative \$1.1 million in 1997-98 to negative \$0.7 million in 1998-99, despite a dramatic fall in revenue from \$6.4 million to \$1.9 million over the same period. The improvement in the net returns is the result of cash costs falling by a relatively greater amount than revenues and the value of replacement capital falling from \$5.9 million in 1997-98 to \$2.1 million in 1998-99.

The uncertainty surrounding the status of scallop stocks implies that the estimates presented here may be overestimates of the actual net returns of the Bass Strait central zone scallop fishery.

Southern squid jig fishery

Survey results

The southern squid jig fishery was surveyed for the first time by ABARE in 2000.



Average receipts across the fishery in 1998-99 were estimated at \$117 500 per boat, a fall of 13 per cent from 1997-98.



Estimated average cash costs also fell significantly — by 22 per cent to \$122 000 in 1998-99.



Average boat business profit improved in 1998-99 despite still being negative at -\$25 700.



Boat business equity across the fleet was 94 per cent.



The net returns for the fishery were estimated to have been negative \$1.3 million and negative \$1.1 million in 1997-98 and 1998-99 respectively.



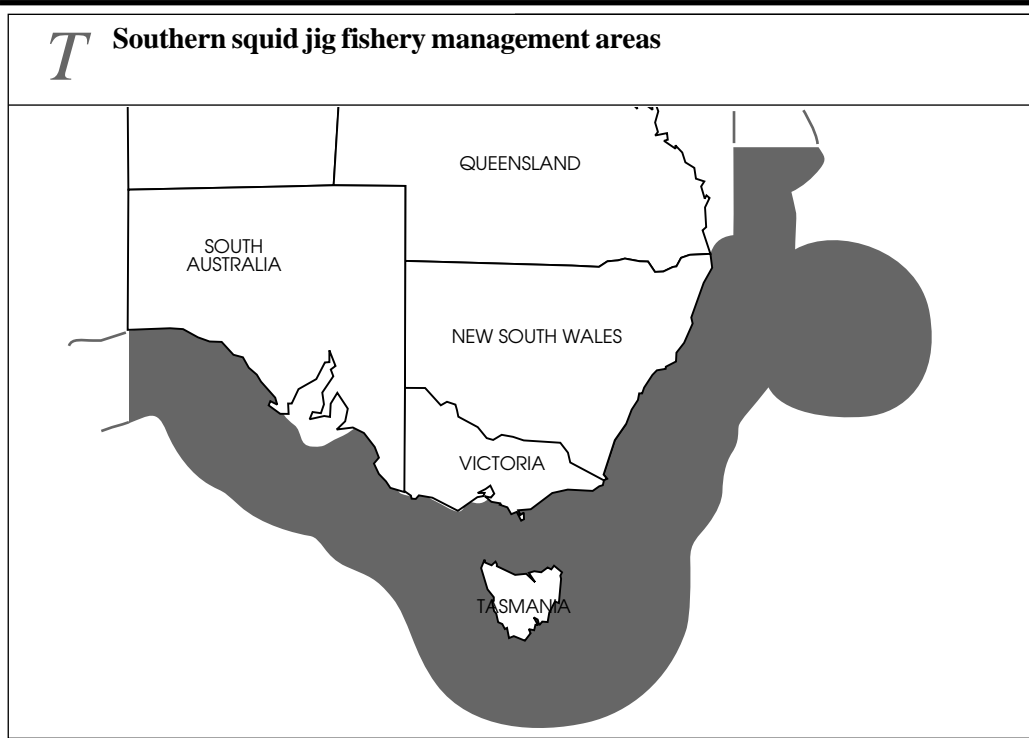
The fishery

The southern squid jig fishery management area includes Commonwealth waters greater than 3 nautical miles from the territorial baselines of New South Wales, Victoria, South Australia, Tasmania and Queensland up to Sandy Cape (adjacent to Fraser Island) (figure T). The majority of the management area, however, is not fished, with the major jig fishing grounds located in Bass Strait just outside Port Phillip Bay and south east of Portland in western Victoria.

The fishery is seasonal, with the fishing grounds outside Port Phillip Bay fished in February and early March. In recent years, significant squid catches have also been taken off southern New South Wales and eastern Victoria. The grounds in western Victoria are fished between January and June, with the majority of squid jigged in April and May (Caton and McLoughlin 2000).

As at 31 August 1999 there were 84 fishing permits, with 58 fishing permits attached to boats currently authorised to jig for squid in southern Australian waters and a further 26 permits not attached to a boat. Many of these permit holders, however, hold endorsements for other fisheries, such as the scallop, shark and lobster fisheries, and have tended to only jig for squid opportunistically during closures or unproductive periods in other fisheries.

The principal target species is arrow (or Gould's) squid (*Nototodarus gouldi*) which is taken using jigging methods. The bycatch involved in arrow squid jigging is usually very small, with other varieties of squid constituting less than 1 per cent of the catch. Occasionally schools of



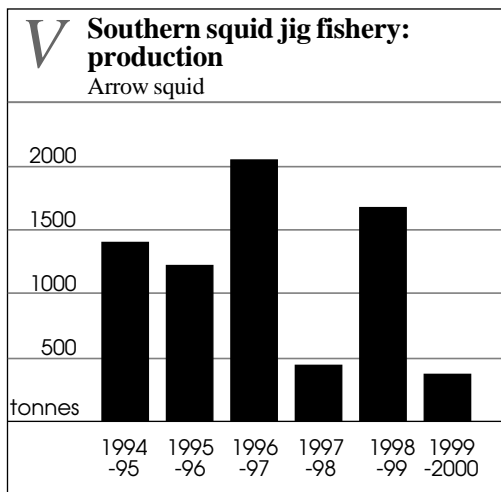
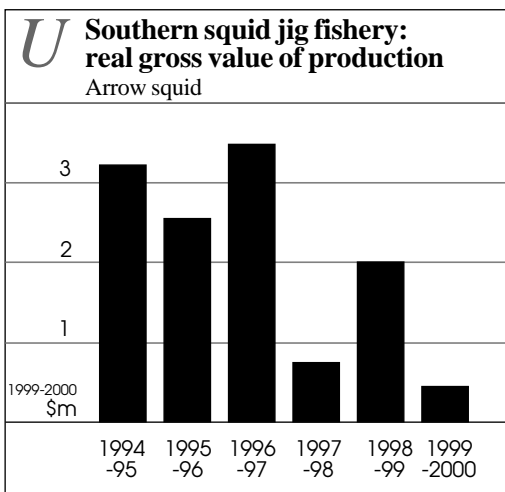
pelagic sharks become entangled and are retained by fishers.

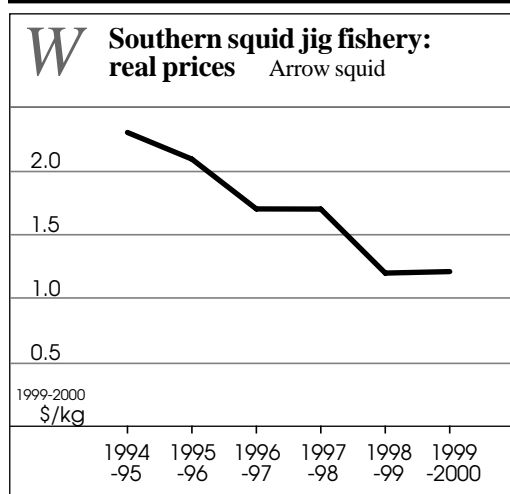
The real gross value of the 1999-2000 catch was \$443 000, supplying the domestic market only. The real gross value of the fishery fluctuated over the previous six years but trended downwards (figure U).

In 1999-2000, the jig catch of arrow squid was only 366 tonnes, less than 22 per cent of the previous years catch and

less than 18 per cent of the 1996-97 catch of 2046 tonnes (figure V) (ABARE 2001).

The demand for squid in Australia has been steadily increasing since the 1970s, with this increased demand being met from imports of fresh, chilled or frozen product. Imports exceeded 11 000 tonnes in 1999-2000, and despite the impact of the falling value of the Australian dollar, import prices have remained low. These





low world prices have affected domestic prices, which have fallen over recent years (figure W). The low price for squid is also a factor in determining whether fishers operate and/or invest in the jig fishery, and is likely to have contributed to some jiggers withdrawing from the industry and the small catch in 1999-2000.

Biological status of the fishery

Although very little is known about the biology and the status of stocks of arrow squid, research indicates that they are short lived, reaching a maximum age of twelve to eighteen months. Arrow squid tend to aggregate in large schools near the seabed during the day and disperse to some extent at night. During the fishing season the schools appear to not move too far, making them an easier target for jiggers.

Limited research has been undertaken to determine the biological status of the fishery, squid growth rates and recruitment. In addition, little is known about the relationship between the stocks and environmental factors, although it is thought that the variable recruitment is caused by environmental factors.

As the resource is short lived and environmentally driven, traditional stock assessment is difficult, but using the available information it is thought that the current catch in the fishery is sustainable

and possibly underfished in some areas (AFMA 1999a).

The Fisheries Research and Development Corporation is funding a three year project that aims to examine growth rates, age structure, genetics and general life history of arrow squid in Australian waters. This information will then be incorporated into future stock assessments to determine suitable levels of fishing. Reliable catch per unit effort data are also required to estimate stock abundance (AFMA 1999c).

Management of the fishery

There is no specific management plan for the southern squid jig fishery. The Australian Fisheries Management Authority manages the fishery with precautionary input controls that aim to limit the number of operators in the fishery. This precautionary approach has been adopted by AFMA because of the lack of information currently available on stock abundance. Of the 58 fishing permits attached to boats, only 37 were fished against in the 1999 season, slightly more than in the 1998 season but still below the 43 fished against in 1996. This means that there is a large body of latent effort present in the fishery.

The Squid Management Advisory Committee (SquidMAC) established in April 1998, is the peak advisory body for the southern squid jig fishery. Management policies are developed in conjunction with SquidMAC, which has membership drawn from industry, state government, AFMA, research and environmental sectors.

A discussion paper on future management arrangements for the fishery will be released for public comment in 2001. Arising from the discussion paper, it is anticipated that the AFMA board will determine a policy statement on future management arrangements for the fishery to be implemented later in the same year.

Boats surveyed

This is the first time that the southern squid jig fishery has been surveyed by ABARE. The target population of the

survey was defined as boats that held endorsements for the southern squid jig fishery and that caught squid within the survey years. Boats that held endorsements but did not fish during the survey period were excluded from the population.

Based on logbook data, the number of active vessels in the southern squid jig fishery in 1997-98 was 31, of which 10 were sampled, and in 1998-99 there were 40 active vessels in the fishery, of which 14 were sampled.

It should be noted that operators in the southern squid jig fishery also operate in other fisheries, targeting other species such as scallops, sharks and lobsters. This mainly reflects the seasonal nature of the fishery. The fishing techniques and equipment required to target these other species is quite different, requiring, in many cases, boats to be rigged. The activities in these other fisheries had a major influence on the financial performance of the boats operating in the southern squid jig fishery over the survey period.

Financial performance of boats

Receipts

Average total cash receipts per boat in the fishery were estimated at around \$117 500 in 1998-99, down 13 per cent from an estimated \$134 500 in 1997-98 (table 17). While receipts from squid increased slightly over the two years, this was not enough to offset the declines in receipts for scallops and lobster.

Squid receipts rose to \$49 250 in 1998-99 and accounted for 42 per cent of total cash receipts, up from 34 per cent in 1997-98. Nevertheless, for both years, scallop receipts were on average higher than squid receipts for boats operating in this fishery.

In 1997-98, scallop receipts averaged an estimated \$65 000 and accounted for 48 per cent of total cash receipts of boats operating in the southern squid jig fishery. In 1998-99, scallop receipts fell to an estimated average \$49 800 and accounted for 42 per cent of total cash receipts. The large decline in scallop receipts was

associated with the poor scallop catch of 1998-99.

Quantity of fish sold

The estimated quantity of squid sold per boat rose marginally to 38 tonnes in 1998-

17 Estimated financial performance of boats in the southern squid jig fishery – all boats Average per boat

	1997-98	1998-99
Receipts		
Shark receipts	\$ 0 na	3 720 (83)
Lobsters receipts	\$ 15 420 (70)	9 330 (55)
Scallops receipts	\$ 64 970 (41)	49 830 (31)
Squid receipts	\$ 46 220 (24)	49 250 (31)
Other fishing receipts	\$ 0 na	750 (75)
Nonfishing receipts	\$ 7 910 (35)	4 580 (58)
Total cash receipts	\$ 134 520 (30)	117 460 (26)
Costs		
Administration	\$ 4 450 (14)	3 670 (14)
Bait	\$ 0 na	0 na
Crew costs	\$ 60 960 (26)	46 260 (27)
Food	\$ 3 920 (26)	2 790 (19)
Freight and marketing	\$ 140 (147)	20 (127)
Fuel	\$ 29 850 (19)	19 310 (17)
Insurance	\$ 7 520 (20)	12 540 (47)
Interest paid	\$ 4 900 (29)	2 010 (50)
Licence fees and levies	\$ 13 710 (14)	10 860 (13)
Repairs and maintenance	\$ 27 300 (35)	17 780 (17)
Other costs	\$ 3 640 (24)	6 750 (36)
Total cash costs	\$ 156 380 (21)	121 990 (19)
Boat cash income	\$ -21 860 (64)	-4 530 (261)
<i>less depreciation a</i>	\$ 21 890 (26)	21 180 (26)
Boat business profit	\$ -43 750 (30)	-25 710 (36)
<i>plus interest, leasing and rent</i>	\$ 5 900 (35)	4 170 (52)
Profit at full equity	\$ -37 860 (37)	-21 540 (49)
Capital (excl. quota and licences)	\$ 343 520 (6)	308 140 (30)
Capital (incl. quota and licences)	\$ na	508 520 (20)
Rate of return to boat capital b	% -11 (41)	-7 (69)
Rate of return to full equity c	% na	-4 (60)

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

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

18 Estimated quantity of fish sold by boats in the southern squid jig fishery (whole weight) Average per boat

	1997-98	1998-99
	kg	kg
Total shark	0 na	886 (83)
Lobsters	671 (70)	259 (55)
Scallops a	6 425 (43)	6 352 (51)
Squid	37 387 (23)	38 012 (30)

a Meat weight. na Not applicable.

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

99. Squid sales by weight make up the largest component of fish sold by boats in the fishery, but squid and scallop receipts were nearly identical in 1998-99 (table 18). This highlights the high unit value of scallops and the importance of the scallop catch to boats operating in the southern squid jig fishery. It should be noted that the quantity of scallops sold in table 18 is presented in meat weight, not shell weight.

Costs

For the fishery as a whole, average total cash costs per boat were estimated to have been around \$122 000 in 1998-99, down 22 per cent from 1997-98. Crew costs fell by 24 per cent to \$46 300 in 1998-99 and was the highest expenditure, accounting for 38 per cent of expenditure in 1998-99. Repairs and maintenance costs fell by 35 per cent over the survey period and accounted for 15 per cent of total cash costs in 1998-99. Fuel costs also constituted a significant proportion of total costs in 1998-99, at 16 per cent. The average expenditure on fuel in 1998-99 fell by 35 per cent compared with 1997-98, mainly reflecting the reduced effort and catch in the scallop fishery. This is reflected in average weeks worked per boat, which fell 22 per cent to 32 weeks in 1998-99.

Boat cash income and profit

Average boat cash income for the southern squid jig fishery in 1998-99 was estimated at around negative \$4500. This is an improvement from 1997-98 when average boat cash loss was around

\$21 900. Boat business profit provides a measure of return to the operator by accounting for the depreciation of capital. In 1998-99, average boat business profit in the southern squid jig fishery was estimated at negative \$25 700. Boat business loss in 1997-98 was estimated to be \$43 800. At full equity, the average loss was an estimated \$21 500 in 1998-99.

Rates of return

The estimated average rate of return to capital in the southern squid jig fishery was -11 per cent in 1997-98 and improved marginally to -7 per cent in 1998-99. The slight improvement in the negative rate of return in 1998-99, compared with 1997-98 reflected cash costs falling by a greater amount relative to cash receipts.

Debt and equity

Not all sampled boats provided information on debt and equity and based on this smaller sample, the estimated average level of debt per boat declined by 16 per cent from an opening balance of \$45 150 to a closing balance of \$37 760. As a measure of the financial ownership of the fishing enterprise, the estimated average boat business equity ratio in the southern squid jig fishery was around 94 per cent in 1998-99.

Economic performance of the fishery

To provide an indication of the economic performance of the southern squid jig fishery, the net returns to the fishery have been estimated (see appendix A for calculation details) and presented in table 19. The net return to the fishery measure includes only the costs and receipts attributable to the southern squid jig fishery. As a result, the estimated receipts and costs in table 19 will differ from those presented in table 17 that include all receipts and costs incurred by boats operating in the fishery, including costs and receipts incurred while operating in other fisheries, such as Bass Strait scallop fishery or southern shark fishery.

As can be seen from table 19, the estimated net returns of the southern squid

19 Debt and equity of boats in the southern squid jig fishery in 1998-99

Average per boat

	All boats
Capital (incl. quota and licences) at 30 June	\$ 673 250 (9)
Boat business debt at 1 July	\$ 45 150 (20)
Boat business debt at 30 June	\$ 37 760 (19)
Change in debt over year	\$ -7 390 (34)
Boat business equity at 30 June	\$ 635 490 (10)
Boat business equity ratio at 30 June	% 94 (1)

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

jig fishery (inclusive of management costs) were negative in both survey years at -\$1.3 million and -\$1.1 million in 1997-98 and 1998-99 respectively. Revenue in the fishery increased by 68 per cent between 1997-98 and 1998-99 to an estimated \$2 million while costs rose by around 41 per cent over the same period.

The replacement value of capital in the fishery fell over the survey period by 8 per cent to an estimated \$4.59 million. The

20 Estimated economic performance of the southern squid jig fishery in 1997-98 and 1998-99

Total for fishery

	1997-98	1998-99
Revenue a	\$ 1 169 (24)	1 970 (30)
Cash costs a, b	\$ 1 497 (22)	2 116 (14)
Capital a, c	\$ 5 005 (58)	4 586 (28)
Net returns (excl. management costs)	\$ -1 177 (53)	-987 (34)
Commonwealth management costs d	\$ 147 na	99 na
Net returns (incl. management costs)	\$ -1 324 (53)	-1 086 (34)

a Revenue, costs and capital estimates are apportioned according to total receipts received from the southern squid jig fishery. **b** Cash costs include imputed operator and family labour costs but exclude licence and levy payments and interest payments. **c** Replacement capital (depreciated capital). **d** Costs to AFMA of managing the fishery (A. Kettle, AFMA, personal communication, April 2001) **na** Not applicable.

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

marginal improvement in the estimated net returns of the fishery is the result of revenue increasing by a larger proportion than costs over the survey period and a lowering of capital in the fishery.

Appendix A

Survey methods and definitions

Collecting survey data

ABARE surveys are designed and samples selected on the basis of information supplied by the Australian Fisheries Management Authority. Information on catch, effort and boat characteristics for Commonwealth fisheries is obtained from AFMA.

Because it is not possible to survey all the boats in a fishery, a sample of boats is selected based on their 'representativeness' of the fleet. Where possible, boats are classified into subgroups according to the type of fishing method that they use (for instance, longline boats, purse seine boats, trawlers, etc) or according to the size of their operations (say, big producers, medium size producers and small producers). A number of representative boats from each subgroup is then targeted for survey.

The owners of the sample boats targeted for survey are contacted by ABARE and face to face interviews are conducted. Interviewers ask for information on the physical and financial details of the fishing business. In a number of instances, the skipper of the boat may also be interviewed. In general, information is collected for the preceding two financial years and major Commonwealth fisheries are surveyed every two years.

Definitions of key variables

Cash receipts are the financial inflows to the boat during the year 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).

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.

Cash costs include the payments made for both permanent and casual hired labor and payments for materials and services (including payments on capital items subject to leasing, rent, interest, licence fees and repairs and maintenance). Capital and household expenditures are excluded.

Labor costs are usually the highest cash cost in the fishing operation. Labor costs include wages, salaries and an estimated value for owner/partner, family and unpaid labor. Labor costs cover the cost of labor involved in boat related aspects of the fishing business, such as crew or

onshore administration costs, but do not cover the cost of onshore labor involved in processing the fisheries products.

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

This method would have little impact on fishing operations that rely only on nonowner/partner/family labor, nor would it have little impact on the estimated value of labor where the owner/partner/family labor is paid at rates similar to those paid for similar labor on other boats.

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

Depreciation costs have been estimated using the diminishing value method based on the current replacement cost and age of each item. The rates applied are the standard rates allowed by the Commissioner of Taxation. For items purchased or sold during the survey year, depreciation is assessed as if the transaction had taken place at the midpoint of the year. This method of calculating depreciation is also used in other ABARE industry surveys. A comparison with the method used to calculate depreciation in ABARE fish surveys prior to 1995 is contained in ABARE (1996a).

Boat business profit is boat cash income less depreciation.

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

Capital is the value placed on the assets employed by the surveyed boat business. It includes the value of the boat, hull, engine and other onboard equipment (including gear). Estimates are also reported of the value of quotas and endorsements held by the surveyed boat.

Estimates of the value of capital are based on the market value of capital and are usually obtained at interview but in some cases quota and endorsement values are obtained from industry sources.

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

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

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

Debt information was collected at interview. Change in debt over the year is calculated as the difference between debt at 1 July and the following 30 June.

Boat business equity is derived by deducting the boat business debt from the value of capital employed in, and owned by, the fishing business.

The equity ratio is boat business equity expressed as a percentage of capital employed in the fishing business. The debt and equity figures shown are averages for those boats for which information on debt was available.

Net returns to the fishery are estimated as the gross revenue earned in a single fishery, less an estimate of the fishing costs incurred in that fishery including management costs, less the full annualised cost of capital.

Apportioning boat receipts and costs among fisheries

Many boats operate in more than one fishery during the course of a year. To provide estimates of the economic returns from an individual fishery, it may be necessary to apportion boat receipts and costs among the fisheries.

Apportioning fishing receipts to particular fisheries is generally straightforward as information on sales by major species can generally be used to calculate the receipts associated with a fishery. Calculating the costs of a fishing operation that are attributable to a fishery can be more difficult. Costs have been apportioned to a fishery based on the proportion of total fishing revenue associated with that fishery.

The net return to the fishery is defined as:

$$\sum_{i=1}^n R_i - \sum_{i=1}^n p_i (OC_i - (d_i + r)K_i) - M$$

where

R_i = total cash receipts attributable to the fishery, excluding any receipts from leasing or sales of licences or quota for boat i ;

p_i = proportion of total fishing receipts attributable to the fishery for boat i ;

OC_i = total cash costs less interest paid on debt less expenditure on leasing or purchase of licences or quota for boat i ;

K_i = value of capital associated with boat i (depreciated replacement value);

d_i = depreciation rate for boat i (depreciation less capital appreciation associated with boat i divided by K_i);

r = real interest rate (assumed at 7 per cent for calculations in this report);

M = costs of managing the fishery;

n = number of boats operating in the fishery.

Sample weighting

Because the sample sizes for each sector of a fishery are not necessarily proportional to the actual population sizes of the sector, the estimates presented in this report are all calculated by appropriately weighting the data collected from each sample boat. The sample weights are derived by comparing the total numbers of boats in the target populations and total catches from the annual logbook data

collected from AFMA, with the corresponding numbers and catch details of the boats in the various survey samples (ABARE 1996b).

Different sample weights are used in the estimates for the different years because of differences in population numbers and outputs, as well as in sample numbers and outputs between years. Technical details of the method of weighting used are given in Bardsley and Chambers (1984).

Reliability of estimates

Only a small proportion of the total number of boats in a particular fishery are sampled to produce the survey estimates. The differences between these estimates and the values that would have been obtained if information had been collected from all the boats (population or census values) are called sampling errors.

The more boats there are in the sample, the smaller the sampling error is likely to be. For example, boat group estimates are likely to have greater sampling errors than fisherywide estimates.

To indicate the reliability of the survey estimates sampling errors have been calculated. These 'relative standard errors', expressed as a percentage of the survey estimates 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

To obtain the standard error from the relative standard error, multiply the relative standard error by the survey estimate and divide by 100. If average total cash receipts are estimated to be \$690 000 with a relative standard error of 6 per cent, this yields a standard error of \$41 400.

There is roughly a two in three chance that a survey estimate is within one standard error of the value which would have been obtained had all boats in the target population been surveyed (the census value). There is roughly a nineteen in twenty chance that a survey estimate is within two standard errors of the census value.

Thus, in the above example, there is an approximately two in three chance that the census value is between \$648 600 and \$731 400 and an approximately nineteen in twenty chance that the census value lies between \$607 200 and \$772 800.

Comparing estimates

When comparing estimates between years, or between different industries it is important to recognise that the differences are also subject to sampling error.

As a rough rule of thumb, a conservative estimate (an overestimate) of the standard error of the difference can be constructed by adding the squares of the estimated standard errors (not the relative standard errors) of the component estimates, and then taking the square root of the result.

For example, suppose that the average total cash receipts were estimated in one year to be \$100 000 and in the next year to be \$125 000 — a difference of \$25 000 — and that the relative standard errors are given as 6 and 8 per cent respectively. The standard error of the difference can be estimated as:

$$\sqrt{[(0.06 (\$100\,000))^2 + (0.08 (\$125\,000))^2]} = \$11\,662.$$

Hence, the relative standard error of the difference is:

$$(\$11\,662 / \$25\,000) \times 100 = 47 \text{ per cent.}$$

When comparing estimates for change from year to year it should be noted that there may be changes in fishing industry populations from one year to the next. If these population changes are substantial, differences in estimates may be more due to changes in the population than to changes in the variables themselves.

There may also be differences in data quality between the two estimates being compared: final estimates are more reliable than preliminary estimates because the final data have been cross checked against a greater number of external data sources, lowering the probability of non-sampling errors.

Nonsampling errors

The values obtained in a survey are affected by errors other than those related directly to the sampling procedure. For example it may not be possible to obtain information from certain types of boats, respondents may provide inaccurate information or the respondent may differ from non-respondents in a variable being surveyed.

ABARE's experience in conducting surveys has resulted in procedure designs aimed at minimising nonsampling errors. However, when drawing inferences from estimates derived from sample surveys, users of survey data should bear in mind that both sampling and nonsampling errors do occur.

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