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Australian fisheries surveys report 2011

Results for selected fisheries
2008–09 to 2010–11

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Foreword

ABARES has released regular fisheries survey reports each year since the early 1990s with less regular surveys also conducted in the 1980s. This current edition provides estimates of financial and economic performance for the Northern Prawn Fishery which was previously surveyed in 2009, and the Bass Strait Central Zone Scallop Fishery (BSCZSF) which was previously surveyed in 2001.

Survey-based estimates are provided for 2008–09 and 2009–10 for the Northern Prawn Fishery, and 2009–10 and 2010–11 for the Bass Strait Central Zone Scallop Fishery. Non–survey based estimates of economic performance in the Northern Prawn Fishery for 2010–11, and a supplementary survey on the key factors influencing economic viability in the BSCZSF are also included.

The ABARES estimates of fishery financial and economic performance are relevant to the needs of fisheries policy makers, managers, researchers and the fishing industry. The Australian Government Department of Agriculture, Fisheries and Forestry can use the information to assess the performance of the Australian Fisheries Management Authority in managing Commonwealth fisheries against their management objectives. Net economic returns provide an important indicator of how well the surveyed Commonwealth fisheries are tracking against the maximum economic yield objective laid out in the Commonwealth Harvest Strategy Policy. This indicator is also represented in the ABARES *Fisheries Status Reports*. The fishing industry can use the results to independently assess the performance of surveyed fisheries and the effect of management policies.

The reports show continued improvement in the net economic returns of the Northern Prawn Fishery. The report also documents survey results for the Bass Strait Central Zone Scallop Fishery for the first time since its reopening in 2009.

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1   Introduction and summary

This report presents estimates of the financial and economic performance of two key Commonwealth fisheries: the Northern Prawn Fishery (NPF) and the Bass Strait Central Zone Scallop Fishery (BSCZSF). For the NPF, survey-based estimates for 2008–09 and 2009–10 and non–survey based estimates for 2010–11 are presented. For the BSCZSF, survey-based estimates for 2009–10 and 2010–11 are presented. A supplementary survey was also undertaken which details operator's perceptions on how key factors affect the economic viability of the BSCZSF. The Torres Strait Prawn Fishery was also scheduled to be surveyed in 2011; however, a reduction in boat numbers combined with low industry participation in the survey meant the survey could not proceed.

A distinction is made throughout the report between financial performance and economic performance. Financial performance estimates are calculated for the average boat in a fishery and include all cash receipts earned and cash costs incurred within the survey period. As such, these estimates reflect the average boat's profit and loss statement for all business activities. The indicator of economic performance presented in the report is net economic returns (NER) reported at the fishery level. The NER estimates differ from financial performance estimates as they relate only to the surveyed fishery in its entirety and include other economic costs, such as depreciation, the opportunity cost of capital and labour.

Each indicator provides different information. Financial performance information can provide a context for trends in the surveyed fishery; for example, positive financial profits at the boat level may reveal how operators continue to operate in a fishery that has experienced negative economic profits. The financial performance estimates are more relevant to the needs of industry operators, who can compare their performance to that of the average boat within the fishery.

Economic performance is most relevant to the needs of fishery managers and policymakers. This is because NER relates to the specific fishery being managed. Moreover, by taking into account all cash receipts, cash costs and economic costs, NER indicates the economic return to society associated with harvesting the fishery resource. For this reason, NER is the key economic performance indicator referred to in the *Fisheries Management Act 1991*. According to the Act, the Australian Fisheries Management Authority (AFMA) is required to maximise NER to the Australian community through its management of Australian fisheries. Although estimates of NER do not reveal how a fishery has performed relative to its maximum potential NER (maximum economic yield) in a given period, interpretation of NER trends and drivers can aid assessment of AFMA's performance against this objective.

Results for the NPF show that favourable stock fluctuations and management settings have turned negative NER into positive returns in recent years. While these recent positive returns are still far lower than the historical peaks in NER, returns at the boat level are more similar. Maintaining a management focus on maximising economic yield will allow the fishery to achieve the highest potential returns possible, on average, for any given operating environment.

For the BSCZSF, results reveal that the low level of profitability that occurred in the fishery in 1997–98 and 1998–99, when the fishery was last surveyed (Galeano et al. 2001), remains in the current survey period. This is despite recent fishery closures. However, a similar NER has been earned with fewer boats (and, therefore, fewer resources) devoted to the fishery. The supplementary survey of operators' perceptions revealed that operators perceive stock levels in the fishery to be a positive influence on the fishery's economic viability, while access to overseas

markets, current management arrangements and the prices they receive for their product are seen as negative influences.

ABARES has surveyed Commonwealth fisheries since the early 1980s and regularly for key Commonwealth fisheries since 1992. The historical time series data that have been collected through these surveys allows construction of a number of economic tools and indicators that measure AFMA's performance against its economic objective. These include productivity indexes, profit decompositions, efficiency analyses and bioeconomic models. A list of earlier fisheries surveys reports is presented at the end of this report.

2 Key results

Northern Prawn Fishery

Financial performance—per boat

Average per boat total cash receipts for the entire fishery remained steady at approximately $1.5 million in both 2008–09 and 2009–10, while average total cash costs per boat fell by 5.5 per cent from $1.3 million in 2008–09 to $1.2 million in 2009–10. Labour, fuel, and repairs and maintenance accounted for about three-quarters of total cash costs in both years. Steady cash receipts and lower cash costs resulted in a 41.6 per cent increase in average boat cash income from $206 000 in 2008–09 to $292 000 in 2009–10.

The average rate of return to full equity (including the value of quota and licences) increased from 6 per cent in 2008–09 to 8 per cent in 2009–10.

Economic performance—fishery as a whole

From 2000–01 to 2004–05, receipts fell more rapidly than costs. As a result, net economic returns in real terms (including management costs) decreased each year to a minimum of –$15.3 million in 2004–05 (2010-11 dollars). Since then, economic performance has improved and in 2009–10 the net economic return for the fishery was $11.9 million.

Non–survey based estimates of net economic returns show that returns to the fishery (including management costs) are estimated to have increased by 81.0 per cent to $21.5 million in 2010-11.

These economic performance results relate only to the revenues earned and costs incurred in the Northern Prawn Fishery and exclude receipts earned and costs incurred through operations in other fisheries.

Bass Strait Central Zone Scallop Fishery

Financial performance—per boat

Financial performance estimates for the average boat in the Bass Strait Central Zone Scallop Fishery include a substantial number of receipts and costs from boat operations in other fisheries. For example, many boats operating in the Bass Strait Central Zone Scallop Fishery also catch squid and rock lobster in other Commonwealth and state fisheries. Average total cash receipts per boat rose by 6.5 per cent from $381 000 in 2009–10 to $406 000 in 2010–11; and average total cash costs per boat increased by 8.8 per cent from $372 000 in 2009–10 to $405 000 in 2010–11. Crew costs, fuel costs, freight and marketing expenses, and repairs and maintenance costs accounted for 67.2 per cent of total cash costs in 2010–11. Average boat cash income was positive but close to zero in both years.

The average rate of return to full equity (including the value of quota and licences) was negative in both years at –1 per cent.

Economic performance—fishery as a whole

The fishery was closed from 2006 to 2008 in response to declining catches and no clear signs that the biomass was recovering (Haddon et al. 2006). It reopened for the 2009 season in June 2009. In 2009–10, net economic returns, including management costs, were –$1.1 million. This

remained negative in 2010–11 but improved by 4.6 per cent to –$1.0 million. These economic performance results relate only to the revenues earned and costs incurred in the Bass Strait Central Zone Scallop Fishery.

3   Northern Prawn Fishery

The fishery

The Northern Prawn Fishery (NPF) is a multi-species fishery located in Australia's northern waters between Cape York in Queensland and Cape Londonderry in Western Australia (Map 1). The key species targeted in the fishery are tiger prawns and banana prawns, which are caught using otter trawls.

Map 1 Area of the Northern Prawn Fishery and relative fishing intensity in 2010
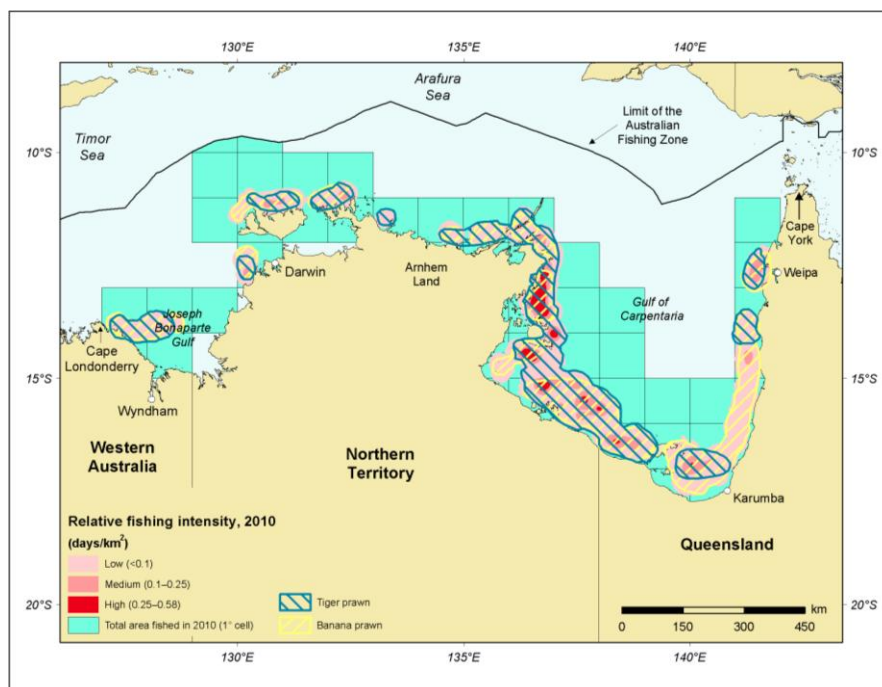
The two species are targeted in two distinct seasons: a banana prawn season and a tiger prawn season. The white banana prawns form aggregations (referred to as 'boils'), which result in significantly lower costs per unit of catch than tiger prawns, where such aggregating behaviour is less common. As a result trawling time per tonne of catch is higher during the tiger prawn season than in the banana prawn season (Woodhams et al. 2011)

Tiger prawn prices are substantially higher than banana prawn prices; for instance, in 2009–10 the average price received by fishers for tiger prawns was $20.40 per kilogram while for banana prawns it was $10.27 per kilogram. However, tiger prawn prices are subject to greater fluctuations. The significant price fluctuations are primarily because a large proportion of the tiger prawn catch is exported (mostly to Japan). As a result, prices are more directly influenced by a number of external factors, including demand in foreign markets and the exchange rate.

The fishery is primarily managed through input controls, mainly in the form of restricted quantities of tradeable units of effort, based on the length of trawl net headrope and seasonal closures (including a ban on daytime trawling in the tiger prawn season). In 2012, the fishery will be moving to an individual transferable quota management regime.

A key feature of AFMA's current harvest strategy (AFMA 2007) is to let the length of each season vary from year to year, based on catch rates falling below a trigger level. For tiger prawns, the trigger level in 2010–11 was average catch levels falling below 350 kilograms per boat per day in the twelfth and thirteenth weeks of the season. If this occurred, the tiger prawn season would

end in the fourteenth week (AFMA 2010a). For banana prawns, the trigger was the average boat's banana prawn catch falling below 500 kilograms per day or the tiger prawn catch exceeding 33 tonnes for the whole five weeks. Either of these occurrences would result in cessation of the banana prawn season at the end of the sixth week (AFMA 2011). Season dates are listed in Table 1.

Table 1 Northern Prawn Fishery season dates and duration

Financial year	**2008–09**	**2009–10**	**2010–11**
Tiger prawn season			
	1 August – 28 November 2008	25 July – 5 December 2009	1 August – 29 November 2010
duration	120 days	134 days	121 days
Banana prawn season			
	27 March – 5 June 2009	31 March – 10 June 2010	31 March – 24 June 2011
duration	71 days	72 days	86 days

Note: Season start and end dates have been taken as full days.

Source: Australian Fisheries Management Authority at www.afma.gov.au

The NPF was the first fishery in Australia to use biomass at maximum economic yield (MEY) as its management target (Woodhams et al. 2011). For tiger prawn stocks, this is currently implemented by setting management limits according to the outputs of a bioeconomic model and harvest strategy. The most recent bioeconomic model estimated that tiger prawn spawning stock levels were below that which would achieve MEY but above maximum sustainable yield levels at the end of 2009 (AFMA 2010b).

The fishery underwent significant downsizing following the Australian Government's *Securing our Fishing Future program* (which included a structural adjustment package) concluded in December 2006. The Australian Government purchased 43 Class B Statutory Fishing Rights (SFRs) and 18 365 gear SFRs from the fishery, representing a reduction of 45 per cent and 34 per cent, respectively (Abetz 2006). In line with this SFR reduction, boat numbers decreased from 77 in 2006 to 51 in 2007 (Larcombe & Begg 2008). Boat numbers are still significantly lower than before the structural adjustment, with 54 boats in operation on 52 boat permits during 2010–11.

For a more in-depth overview of the fishery, including its history, management arrangements, biological and economic status, see Woodhams et al. (2011).

Catch

In 2009–10, total catch in the fishery increased by 14.3 per cent compared with 2008–09, to 7 465 tonnes (Figure 1).The combined tiger and banana prawn catch generally accounts for around 90 per cent of the fishery's total catch. The remainder consists mainly of endeavour prawns, with some king prawn and non-prawn catch.

Historically, banana prawn catches have been highly variable and in recent years have been significantly higher than average. The 2006–07 banana prawn catch (landings based on logbook data) of 2674 tonnes was the lowest since 1999–2000, while the 2009–10 banana prawn catch was more than double this figure at 5771 tonnes. This increase continued into 2010–11 with banana prawn catches increasing by 28.6 per cent to 7423 tonnes.

In 2009–10, tiger prawn catch totalled 1274 tonnes representing a 24.5 per cent increase compared with the 2008–09 catch of 1024 tonnes—the lowest catch on record. Tiger prawn catches in 2010–11 increased by 27.7 per cent to 1627 tonnes.

Figure 1 Northern Prawn Fishery, landings based on log book data, 2000–01 to 2010–11
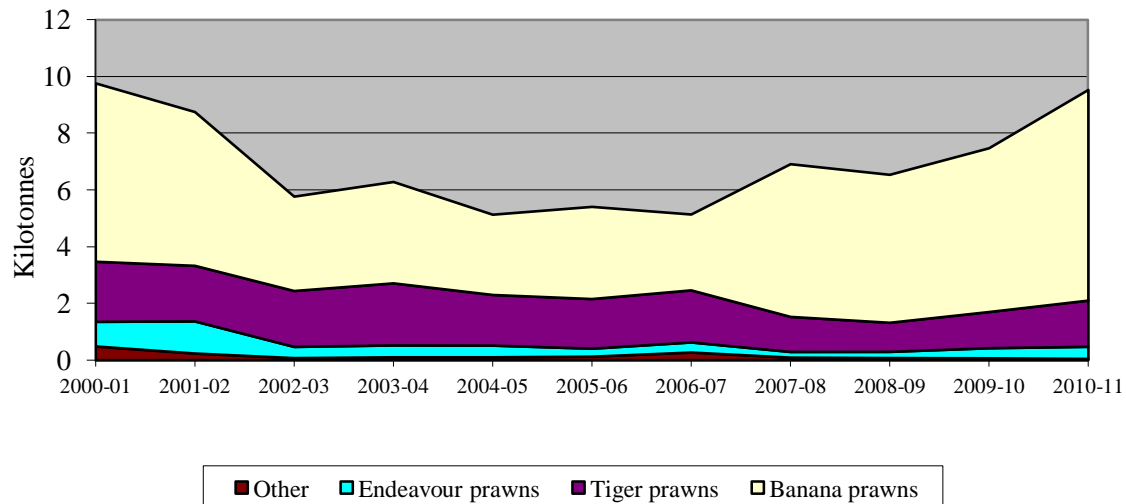
Gross value of production

Real gross value of production (GVP) for the NPF peaked in 2000–01 at $218.7 million (2010–11 dollars) (Figure 2). In 2000–01 to 2006–07, real GVP followed a downward trend. This trend reversed in 2007–08 following a 12.9 per cent increase in GVP from 2006–07. GVP increased to $91.6 million in 2009–10, a 17.3 per cent increase on 2008–09. This increase was driven largely by an increase in banana prawn landings, for which the real GVP increased by 24.6 per cent between 2008–09 and 2009–10.

Figure 2 Northern Prawn Fishery, real gross value of production, 2000–01 to 2009–10
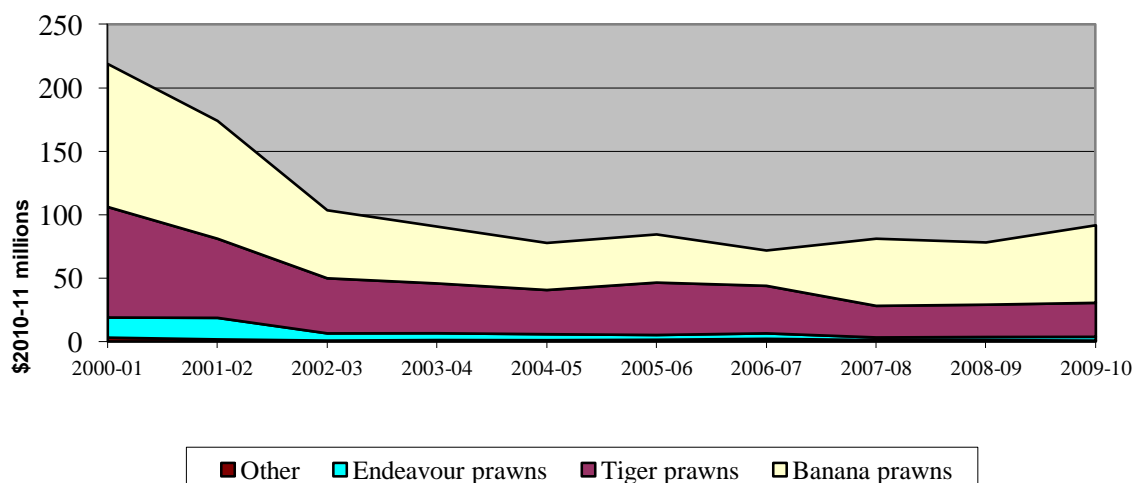
Survey results

Boats surveyed

The 2011 NPF survey collected data for 2008–09 and 2009–10. For the purpose of the survey, the target population was defined as boats that caught prawns in the NPF in either of the two financial years. If a surveyed boat changed ownership during the period it was counted as a new entity. Therefore the survey population may exceed the number of boats which fished in a given year. For 2008–09, 31 boats were sampled out of the survey population of 55 boats. In 2009–10, 34 boats were surveyed out of a population of 55.

Boat-level financial performance

Survey-based estimates of average boat-level financial performance are presented in Table 2. Many boats that operate in the NPF also operate in other fisheries such as the Torres Strait Prawn Fishery, the North West Slope Trawl Fishery and the Queensland East Coast Otter Trawl Fishery. Any receipts earned and costs incurred by these boats while operating in these other fisheries are included in the financial performance measures in Table 2. As such, these estimates reflect the average boat's profit and loss statement for all business activities. Definitions of items contained in Table 2 are included in Appendix A.

Receipts

Average seafood receipts and total cash receipts per boat stayed relatively constant between 2008–09 and 2009–10 at around $1.5 million.

Costs

Average total cash costs per boat decreased between survey years, from $1.3 million per boat in 2008–09 to $1.2 million per boat in 2009–10.

The key cost components for the average boat in 2009–10 were labour (31.8 per cent of total cash costs), fuel (25.6 per cent), and repairs and maintenance (17.2 per cent). Labour costs increased by 2.7 per cent to $397 000 per boat in 2009–10 in line with increased seafood receipts, of which crew are generally paid a proportion. Fuel costs fell by 21.4 per cent to $319 000 per boat in 2009–10, largely as a result of a decrease in the price of fuel. Repairs and maintenance costs remained steady at around $215 000 per boat.

The net result was overall costs fell by 5.5 per cent, due primarily to reduced fuel costs.

Boat cash income and boat business profit

Boat cash income (total cash receipts less total cash costs) increased by 41.6 per cent, from $206 000 per boat in 2008–09 to $292 000 per boat in 2009–10. This increase was driven largely by the 5.5 per cent decrease ($73 000) in costs between years.

Boat business profit (boat cash income less an allowance for depreciation) also increased, from $170 000 per boat in 2008–09 to $257 000 per boat in 2009–10.

Profit at full equity (boat business profit excluding amounts paid for interest, leasing and rent) increased from $210 000 per boat in 2008–09 to $286 000 per boat in 2009–10. While these costs affect the operator's financial performance, they represent profits redistributed to other investors in the fishery. Profit at full equity represents the average return to the operator had the boat and capital (including quota and licences) been fully owned by the operator.

Table 2 Financial performance of boats operating in the Northern Prawn Fishery (average per boat)

		2008–09		2009–10	
Revenue					
Seafood receipts	$	1 451 485	(6)	1 491 121	(5)
Non-fishing receipts	$	75 068	(31)	48 251	(21)
Total cash receipts	$	1 526 553	(4)	1 539 371	(4)
Costs					
Administration	$	13 105	(10)	15 154	(10)
Labour	$	386 704	(5)	397 005	(3)
Freight and marketing	$	57 098	(10)	64 492	(8)
Fuel	$	406 137	(3)	319 204	(3)
Insurance	$	36 016	(5)	39 013	(4)
Interest paid	$	12 653	(27)	8 334	(19)
Licence fees and levies	$	32 373	(2)	39 176	(4)
Packaging	$	50 203	(4)	47 864	(4)
Repairs and maintenance	$	215 522	(5)	214 984	(6)
Other	$	85 985	(4)	83 600	(6)
Total cash costs	$	1 320 144	(2)	1 247 168	(3)
Boat cash income	$	206 410	(22)	292 203	(13)
less Depreciation [a]	$	36 334	(9)	35 026	(8)
Boat business profit	$	170 075	(27)	257 178	(14)
plus Interest leasing and rent	$	40 121	(23)	29 232	(18)
Profit at full equity	$	210 196	(20)	286 410	(12)
Capital (excl. quota and license)	$	909 984	(5)	896 091	(5)
Capital (incl. quota and license)	$	3 648 877	(4)	3 652 054	(3)
Rate of return to boat capital [b]	%	23	(22)	32	(16)
Rate of return to full equity [c]	%	6	(22)	8	(13)
Population	no.	55		55	
Sample	no.	31		34	

Note: **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. Figures in parentheses are relative standard errors (RSEs). For any given standard error, an RSE will be higher for estimates closer to zero. A guide to interpreting RSEs is included in Appendix A.

Rates of return

The estimated average rate of return to boat capital (excluding the value of quota and licenses) for the average boat was 23 per cent in 2008–09 and 32 per cent in 2009–10. In order to allow the financial performance of all boats to be compared, irrespective of the operators' equity in the business, rates of return are calculated assuming operators own all capital assets. The average rate of return to full equity across the fishery increased from 6 per cent in 2008–09 to 8 per cent in 2009–10. The rate of return to full equity includes the value of quota and licences in addition to other capital, and therefore provides an indication of the return to total capital invested in the business. It reflects changes in the value of capital, quota and licences, as well as changes in profitability.

Fishery-level economic performance

The boat-level estimates in Table 2 are not an accurate indicator of fishery-level economic performance, as they include receipts and costs attributable to operations in other fisheries and also exclude some key economic costs.

Boat cash profit (Table 3) measures the difference between cash receipts and cash costs in a fishery, revealing the cash position of the fishery. Net economic returns, reveals economic profitability because it incorporates depreciation costs, the opportunity cost of capital and of labour, and treats all interest and leasing expenditure as an economic return to external investors in the fishery. Furthermore, NER includes the total amount spent on managing the fishery, rather than just the management fees recovered from operators. For these reasons, it is considered a more accurate indicator of fishery-level economic performance relative to the financial performance estimates (Table 2). A more detailed explanation of net economic return is included in Appendix A.

Before 2008–09, boat cash profit was following a decreasing trend, given large declines in total fishing receipts relative to fishing costs. Following a peak in total fishing receipts of $232.6 million (2010–11 dollars) in 2000–01, receipts declined to a low of $71.7 million in 2006–07. Cash receipts recovered by 2008–09 to an estimated level of $83.2 million. Total receipts rose by 1.1 per cent in 2009–10 to $84.1 million. However, boat cash profit increased by 80.5 per cent from $8.3 million in 2008–09 to $15.0 million in 2009–10, as a result of a 7.7 per cent fall in operating costs.

The real NER (including management costs) followed a similar trend to boat cash profit since 2000–01 and became negative for the first time in 2004–05 (Figure 3). The declining trend reversed in 2005–06 and NER became positive in 2007–08. The trend of increasing NER continued in 2008–09, when NER (including management costs) was $4.8 million. NER increased by 150.9 per cent to $11.9 million in 2009–10.

The improvement in NER since 2005–06 occurred with a significant decline in cash costs. In 2008–09, cash costs were $83.2 million, and they rose to $84.1 million in 2009–10, representing an increase of 1.1 per cent. Capital costs also fell, with depreciation and the opportunity cost of capital being lower in 2009–10 than in 2008–09. Table 3 shows a time series of boat cash profit and net economic returns for the fishery since 1992–93.

Table 3 Real boat cash profit and net economic returns in the Northern Prawn Fishery 1992–93 to 2009–10

		1992–93		1993–94		1994–95		1995–96		1996–97		1997–98	
Receipts													
Fishing income	$m	172.3	(4)	193.7	(4)	216.3	(8)	184.4	(3)	172.8	(3)	207.2	(2)
Cash costs													
Operating costs	$m	129.7	(4)	141.5	(6)	148.7	(6)	145.1	(3)	131.5	(3)	142.0	(2)
Boat cash profit	$m	42.6	(8)	52.2	(11)	67.6	(12)	39.3	(10)	41.2	(9)	65.3	(4)
less													
– owner and family labour	$m	9.4	(11)	12.4	(8)	4.5	(13)	3.8	(15)	5.3	(20)	5.5	(18)
– opportunity cost of capital	$m	6.6	(6)	5.8	(5)	6.7	(5)	8.0	(7)	7.0	(7)	6.7	(6)
– depreciation	$m	4.7	(15)	9.7	(5)	9.6	(5)	11.0	(6)	10.1	(7)	10.8	(6)
plus interest, leasing and management fees	$m	9.8	(10)	11.6	(7)	12.0	(14)	13.5	(9)	15.4	(8)	15.7	(6)
Net economic returns													
Net return (excluding management costs)	$m	31.6	(11)	36.0	(16)	58.8	(15)	29.9	(16)	34.2	(12)	58.0	(5)
Management costs	$m	na		na		na		0.5	na	0.4	na	0.5	na
Net return (including management costs)	$m	na		na		na		28.4	na	32.8	na	56.5	na
Survey population	no.	129		132		133		134		128		130	

		1998–99		1999–00		2000–01		2001–02		2002–03		2003–04	
Receipts													
Fishing income	$m	191.7	(3)	152.8	(4)	232.6	(3)	169.0	(4)	132.7	(4)	102.7	(5)
Cash costs													
Operating costs	$m	144.7	(3)	119.5	(4)	147.8	(3)	121.7	(4)	104.0	(4)	90.2	(5)
Boat cash profit	$m	47.0	(7)	33.3	(14)	84.8	(6)	47.3	(7)	28.6	(12)	12.5	(25)
less													
– owner and family labour	$m	4.4	(18)	5.1	(21)	5.0	(18)	4.4	(20)	1.8	(32)	1.5	(29)
– opportunity cost of capital	$m	6.4	(8)	5.1	(8)	4.6	(9)	3.8	(9)	2.8	(13)	2.5	(13)
– depreciation	$m	9.2	(8)	8.2	(9)	6.6	(9)	6.0	(9)	3.3	(21)	2.8	(29)

plus interest, leasing and management fees	$m	17.6	(8)	12.8	(6)	9.7	(21)	8.1	(9)	7.4	(12)	7.6	(12)
Net economic returns												
Net return (excluding management costs)	$m	44.6	(7)	27.7	(16)	78.2	(6)	41.2	(7)	28.1	(12)	13.2	(22)
Management costs	$m	1.7	na	2.1	na	2.2	na	1.7	na	1.9	na	2.6	na
Net return (including management costs)	$m	42.9	na	25.6	na	76.0	na	39.5	na	26.1	na	10.7	na
Survey population	no.	133		130		118		118		101		98	

		2004–05		2005–06		2006–07		2007–08		2008–09		2009–10	
Receipts													
Fishing income	$m	88.9	(5)	90.2	(6)	71.7	(9)	82.7	(3)	83.2	(5)	84.1	(5)
Cash costs													
Operating costs	$m	95.0	(4)	92.7	(5)	67.4	(7)	68.8	(2)	74.9	(2)	69.1	(3)
Boat cash profit	$m	−6.1	(38)	−2.4	(75)	4.3	(58)	14.0	(16)	8.3	(43)	15.0	(14)
less													
– owner and family labour	$m	1.3	(31)	1.1	(29)	0.9	(23)	0.7	(18)	1.3	(32)	1.3	(24)
– opportunity cost of capital	$m	4.4	(14)	3.3	(14)	2.6	(11)	1.8	(8)	1.5	(9)	1.3	(8)
– depreciation	$m	6.2	(14)	5.2	(14)	4.2	(11)	2.8	(8)	2.1	(9)	2.0	(8)
plus interest, leasing and management fees	$m	5.2	(15)	4.3	(18)	3.3	(10)	2.3	(11)	4.0	(13)	3.7	(7)
Net economic returns													
Net return (excluding management costs)	$m	−12.8	(23)	−7.8	(24)	−0.1	(1732)	11.0	(18)	7.4	(44)	14.2	(14)
Management costs	$m	2.5	na	2.2	na	3.1	na	2.4	na	2.6	na	2.3	na
Net return (including management costs)	$m	−15.3	na	−10.0	na	−3.2	na	8.5	na	4.8	na	11.9	na
Survey population	no.	96		86		77		55		55		55	

Note: na = not applicable. Figures in parentheses are relative standard errors (RSEs). For any given standard error, an RSE will be higher for estimates closer to zero. A guide to interpreting RSEs is included in Appendix B. Management costs before 1995–96 are unavailable. All values in 2010–11 dollars.

Figure 3 Real boat cash profit and net economic return (including management costs) for the Northern Prawn Fishery, total for the fishery, 1995–96 to 2009–10
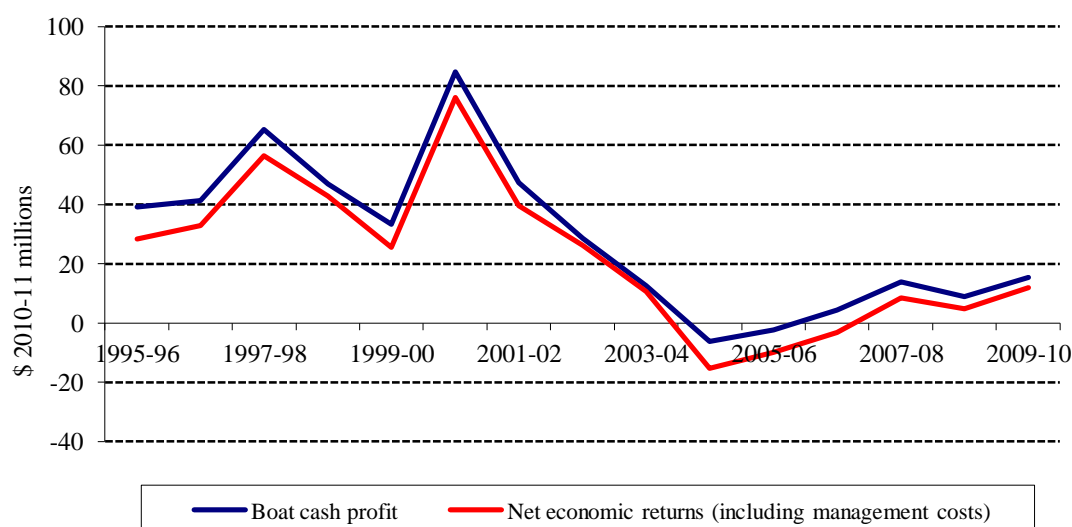
Non–survey based results

Survey-based estimates of economic performance for the NPF in 2010–11 will not be available until 2013. However, preliminary estimates of the fishery's economic performance in 2010–11 have been calculated using the techniques presented in Appendix C. These techniques use historical survey data and available information on fishery catch, effort and prices for all years up to and including 2010–11.

Preliminary estimates of fishery-level economic performance

Non–survey based estimates of net economic returns for 2010–11 are presented in Table 4, along with survey-based estimates of 2009–10 for comparison. Note that the breakup of revenues and costs in Table 3 differs to that in Table 4 given the different approach taken to estimating each cost component. Summary statistics relevant to the 2010–11 preliminary estimates for the NPF are provided in Appendix D.

Cash receipts and cash costs are expected to have risen between 2009–10 and 2010–11. Cash receipts are estimated to have risen by 21.8 per cent to $102.4 million in real terms, while adjusted cash costs are estimated to have risen by 13.9 per cent to $75.9 million. It is anticipated that NER, including management costs, increased by 81.0 per cent as a result of a greater increase in receipts than in costs.

Fuel costs represented the largest cost increase, rising by 21.8 per cent up to $21.9 million. This was partly driven by increased fuel prices. All other operating costs also rose, due to a number of factors including the increase in catch and revenue. Table 5 shows the key drivers of economic performance in this fishery.

Table 4 Preliminary non–survey based estimates of real net economic returns for the Northern Prawn Fishery in 2010–11, total for fishery and total per boat

		2009–10	2010–11	Percentage change
Fishery level				
Cash receipts	$m	84.1	102.4	21.8%
less Operating costs[a]				
Fuel	$m	18.0	21.9	21.8%
Labour (incl. owner and family labour)	$m	22.4	24.6	9.9%
Materials	$m	7.0	7.8	12.2%
Services	$m	10.3	11.3	10.6%
Repairs and maintenance	$m	9.0	10.2	13.2%
Total adjusted operating costs	$m	66.6	75.9	13.9%
less Capital costs				
Opportunity cost of capital	$m	1.3	0.4	9.5%
Depreciation	$m	2.0	1.9	–2.2%
Net economic returns (excl. management costs)	$m	14.2	24.2	63.1%
less Management costs	$m	2.3	2.6	14.6%
Net economic returns	$m	11.9	21.5	80.6%
Boat level				
Population	No.	55	54	–1.8%
Net economic return per boat (excl. management costs)	$'000	258.7	447.4	72.9%
Net economic return per boat	$'000	217.1	398.9	83.7%

Note: a excludes interest, leasing and management costs and includes owner and family labour. All values are in 2010–11 dollars.

Table 5 Key drivers of change in net economic returns in the Northern Prawn Fishery between 2009–10 and 2010–11

	2009–10	2010–11	Variable percentage change
Active boat numbers	54	54	0%
Total catch (tonnes)	7 506	9 520	26.8%
Average price per kilogram ($)	11.26	10.49	–7.0%
Banana prawn season effort – boat days	2 502	2 529	1.1%
Banana prawn season effort – trawl hours	10 035	8 531	–15.0%
Tiger prawn season effort – boat days	5 707	5 521	–3.3%
Tiger prawn season effort – trawl hours	67 076	64 505	–3.8%
Banana prawn season oil price (A$/bbl)	85	104	21.9%
Tiger prawn season oil price (A$/bbl)	81	84	3.2%

Note: All 2010–11 estimates are preliminary and are those that were used for the preliminary estimate analysis. As a result they may differ from published results for these years. Prices are in real terms (2010–11 dollars). Catch is derived from Australian Fisheries Management Authority logbook data. Active boat numbers may differ from the population due to boats that have changed ownership being counted as a new boat in the population. Oil prices are calculated as the six-monthly average of daily world trade weighted prices. Banana prawn season average prices are the average from January to June, and tiger prawn season average prices are the average from July to December.

Figure 4 Real revenue, costs and net economic returns (including management costs) in the Northern Prawn Fishery, total for fishery, 1995–96 to 2010–11
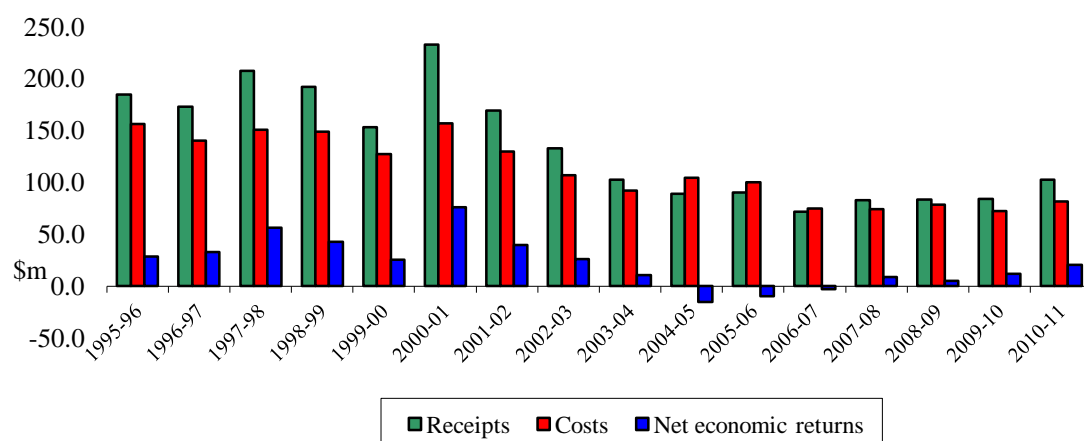
Note: All values are in 2010–11 dollars. 2010–11 estimates are preliminary.

Overall the NPF has undergone substantial change over the last decade. The $76.0 million peak in net economic returns in 2000–01 (Figure 4) occurred in a vastly different operating environment compared to the current survey period. In 2000–01, a relatively large fleet size of 118 boats earned 40 per cent of its revenue from tiger prawns and 52 per cent from banana prawns. Prices for each species were also much higher in real terms reflecting a more favourable exchange rate for Australian prawn exporters at that time.

Since 2000–01, fleet size has more than halved, the less valuable banana prawns now make up a much higher proportion of the fishery's revenue (67 per cent in 2009–10) and a higher exchange rate and greater competition on international markets mean that prawn prices are now far lower in real terms. Prices for tiger prawn in 2009–10 were $21.03 per kilogram (49 per cent lower than in 2000–01 in real terms) and $10.59 per kilogram for banana prawn (41 per cent lower in real terms).

Despite these changes, favourable banana prawn stocks and management settings have turned negative net economic returns (between 2004–05 and 2006–07) into positive returns, resulting in an expected net economic return in 2010–11 of $21.5 million. While this is still far lower than the peak net economic return that occurred in 2000–01, returns at the boat level are more similar. Although external factors such as prawn prices and stock variability will continue to affect the economic returns earned in the fishery, maintaining a management focus on MEY will allow the fishery to achieve the highest potential return possible, on average, for any given operating environment.

4   Bass Strait Central Zone Scallop Fishery

The fishery

The BSCZSF is located in the Bass Strait between the Tasmanian and Victorian state scallop fisheries (these state fisheries generally extend to three nautical miles from the coastline). The fishery targets commercial scallops using dredges to fish dense aggregations (beds) of scallops.

Map 2 Bass Strait Central Zone Scallop Fishery and relative fishing intensity in 2009
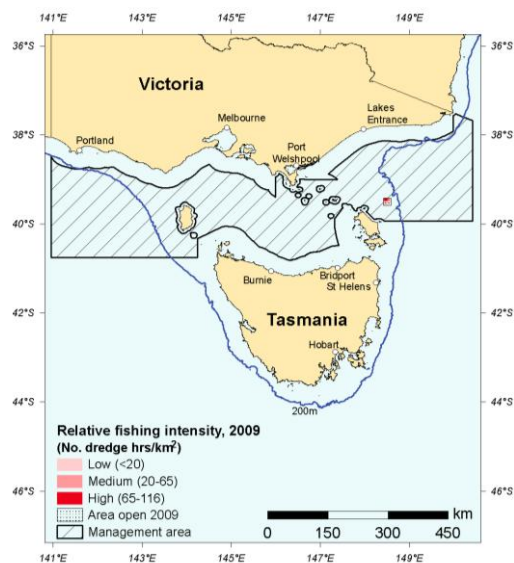
Biomass levels in this fishery have historically been highly volatile and fishery closures have been instituted to facilitate rehabilitation of the scallop beds during times of low biomass levels. Active boat numbers have declined from 38 in 1998 to 18 in 2010–11. Operators generally also fish in the Southern Squid Fishery and state rock lobster fisheries in the vicinity of the BSCZSF. Operators will generally also own entitlements to fish in state scallop fisheries (Tasmania and Victoria); however, these state scallop fisheries were closed in 2009–10 and 2010–11.

Under the BSCZSF harvest strategy implemented in 2009, this fishery is regulated through spatial management. All areas of the fishery are closed unless two or more separate areas of at least 5 x 5 nautical miles are viable for operation, based on scallop density and size or spawning history. Of the viable areas, at least 40 per cent, containing 500 tonnes of biomass must be closed to fishing.

In 2004, the fishery changed to an individual transferable quota system. In 2006, the Australian Government's *Securing our Fishing Future program* removed 11 licenses from the fishery. Linked to this package was a ministerial direction to AFMA, a key feature of which was to cease all overfishing. As a result, the fishery was closed for the 2006, 2007 and 2008 seasons. The fishery was reopened in 2009 and generated the highest GVP since 1997–98. In 2010, the fishery was opened earlier (Table 6) and with a higher total allowable catch.

Table 6 Bass Strait Central Zone Scallop Fishery, season dates and duration

Scallop season	2009	2010	2011
	1 June – 31 December 2009	1 April – 31 December 2010	27 June – 31 December 2011
duration	214 days	275 days	188 days
financial years	2008–09 (30 days); 2009–10 (184 days)	2009–10 (91 days); 2010–11 (184 days)	2010–11 (4 days); 2011–12 (184 days)

Note: Season start and end dates have been taken as full days. Financial years run from July 1 to June 30.

Source: Date ranges from the Australian Fisheries Management Authority website at www.afma.gov.au

Catch

Historically, the fishery has experienced sporadic catch (Figure 5). In recent years, this is largely reflective of fishery closures. In 1997–98, total catch was 3508 tonnes (based on catch disposal records). This fell to 763 tonnes in 1998–99, which was then followed by three years of zero catch as a result of fishery closure. Relatively low catches were recorded during the operating years between 2001–02 and 2006–07, after which the fishery adopted a zero total allowable catch for three years. In 2009–10, catch was 2091 tonnes, up from 594 tonnes in 2008–09, during which the zero total allowable catch limit was lifted. Catch remained relatively constant in 2010–11, with 2110 tonnes of scallops caught.

Figure 5 Bass Strait Central Zone Scallop Fishery: scallop landings based on catch disposal records, 1997–98 to 2010–11
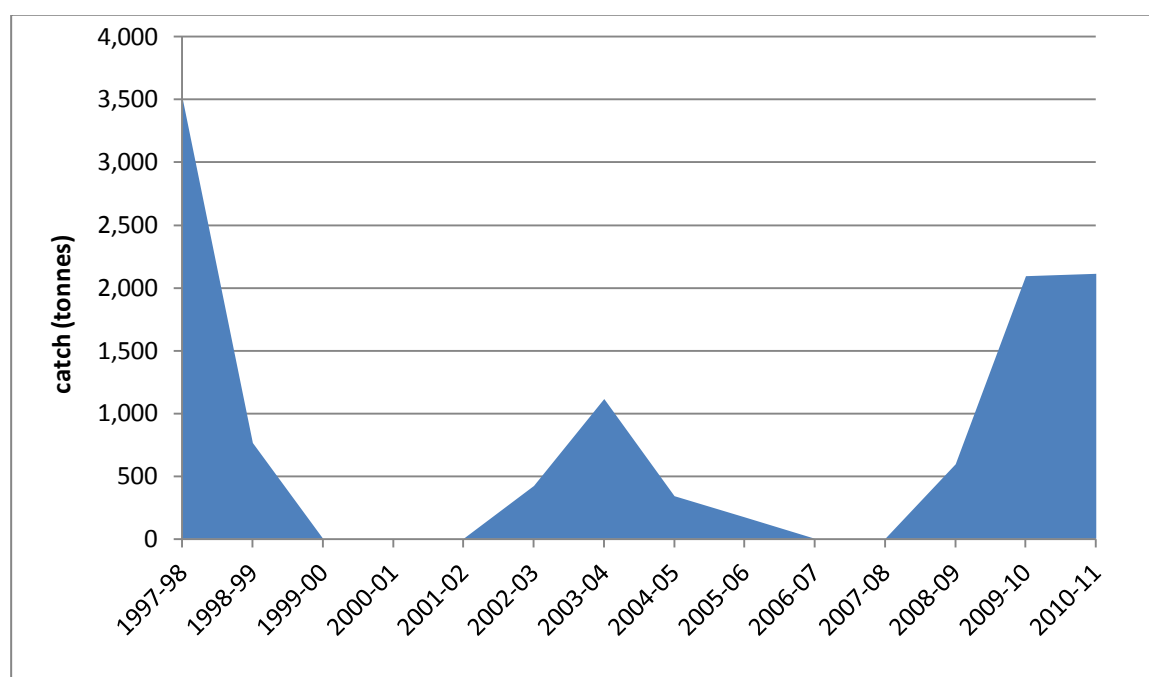
Data source: AFMA logbook data

Gross value of production

GVP in the fishery has closely mirrored catch as the average price received in the fishery has remained relatively constant in recent years. GVP was $1.2 million in 2008–09 and included the value of catch from the start of the 2009 season. This increased to $3.6 million in 2009–10 which captured the value of catch for the remainder of the 2009 season and the beginning of the 2010 season. GVP figures for 2010–11 have not yet been finalised but it is estimated that GVP decreased slightly between 2009–10 and 2010–11.

Figure 6 Bass Strait Central Zone Scallop Fishery: real gross value of production, 1997–98 to 2010–11
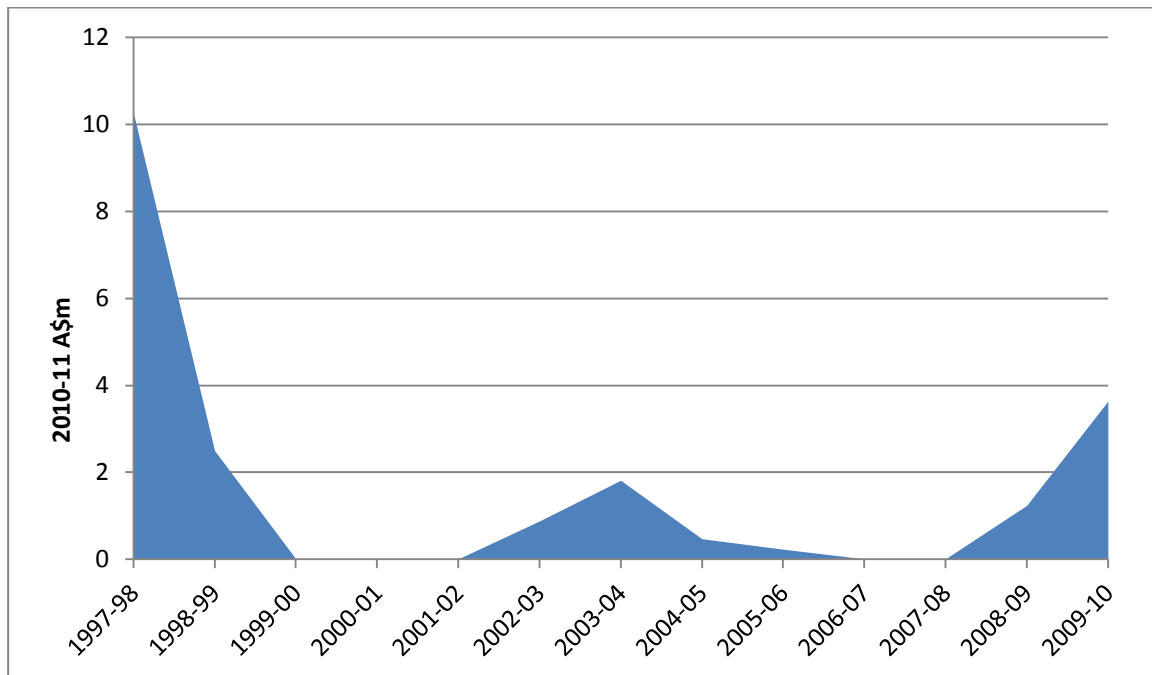
Source: ABARES data

Survey results

Boats surveyed

The objective of the 2011 survey of the BSCZSF was to collect survey data for 2009–10 and 2010–11. The target population was accordingly defined as boats that caught in excess of 20 tonnes of scallops in the BSCZSF in each of those years, as boats that caught less than that amount spent minimal time in the fishery and were likely to spend a larger proportion of their time in other fisheries. This approach also overcame some sampling issues. This approach excluded six boats in 2009–10, and 1 boat in 2010–11, representing 2.7 per cent and 0.9 per cent of total catch respectively. In 2009–10, the survey population was 20 boats, of which eight were sampled. In 2010–11, the population was 17, of which seven were sampled.

As outlined in Table 6, survey results for 2009–10 capture the activities of both the 2009 and 2010 seasons. Given that around two-thirds of the BSCZSF fishing time in 2009–10 occurred in the 2009 season, the results represent the operating environment of the 2009 season to a greater degree.

The survey of the BSCZSF encountered a number of issues that affected the quality of the data collected and the robustness of the resulting estimates. The BSCZSF is generally made up of small operators who operate in many different fisheries. While allocating revenues and costs across fisheries is often complicated, ABARES uses all available data to ensure they are apportioned as accurately as possible. As this is the first ABARES survey of the fishery since 2000–01, the number of boats sampled was not as large as for fisheries that ABARES surveys regularly. Furthermore, as the 2010–11 figures were collected so early in 2011–12, financial accounts were not always available for 2010–11. In such cases, operator estimates were collected. For these reasons data collected for this fishery may not be as reliable as data collected for other fisheries that ABARES surveys regularly.

Boat-level financial performance

Key measures of boat-level financial performance are presented in Table 7 and are included in Appendix A. Many boats that operate in the BSCZSF also operate in other fisheries, such as the Southern Squid Fishery and rock lobster fisheries. It should be noted that any receipts earned and costs incurred by these boats while operating in these other fisheries are included in the financial performance measures presented in Table 7.

Receipts

Average seafood receipts per boat increased by 3.3 per cent from $373 000 in 2009–10 to $385 000 in 2010–11. Total cash receipts increased by 6.5 per cent to $406 000 per boat in 2010–11.

Costs

Average total cash costs per boat increased between survey years; from $372 000 per boat in 2009–10 to $405 000 per boat in 2010–11.

The key cost components for the average boat in 2010–11 were labour (42.5 per cent of total cash costs), fuel (15.3 per cent), and repairs and maintenance (9.4 per cent). Labour costs, which include the value of paid and unpaid labour, increased by 10.0 per cent to $172 000 per boat in 2010–11. A large proportion of this was associated with the value of unpaid labour. Fuel costs rose by 36.9 per cent to $62 000 per boat in 2010–11 in line with increases in the price of diesel in 2010–11. Repairs and maintenance costs decreased from $45 000 in 2009–10 to $38 000 in 2010–11.

The net result of the changes in all cost categories was an 8.8 per cent increase in total cash costs.

Boat cash income and boat business profit

Boat cash income (total cash receipts less total cash costs) decreased from $9000 per boat in 2009–10, to $1000 in 2010–11. This decrease was driven by total costs increasing at a greater rate than total revenues between the two years.

Boat business profit, which is boat cash income less an allowance for depreciation, was negative in both years, decreasing from –$29 000 per boat in 2009–10 to –$37 000 in 2010–11.

Profit at full equity decreased from –$13 000 per boat in 2009–10 to –$23 000 in 2010–11. This profit measure is calculated by removing interest, leasing and rent costs. While these costs affect the operator's financial position, they represent profits that have been redistributed to other investors in the fishery. Profit at full equity represents the average return to the operator had that operator fully owned the boat and capital (including quota and licences).

Rates of return

The estimated average rate of return to boat capital (excluding the value of quota and licenses) for the average boat was –2 per cent in 2009–10 and –3 per cent in 2010–11. In order to allow the financial performance of all boats to be compared, irrespective of the operators' equity in the business, rates of return are calculated assuming the operators own all capital assets. The average rate of return to full equity across the fishery was relatively constant at –1 per cent in both 2009–10 and 2010–11. The rate of return to full equity includes the value of quota and licences in addition to other capital, and therefore provides an indication of the return to total

capital invested in the business. It reflects changes in the value of capital, quota and licences as well as changes in profitability.

Table 7 Financial performance of boats operating in the Bass Strait Central Zone Scallop Fishery (average per boat)

		2009–10		2010–11	
Revenue					
Seafood receipts	$	373 048	(40)	385 346	(57)
Non-fishing receipts	$	8 264	(46)	20 608	(88)
Total cash receipts	$	381 313	(40)	405 954	(57)
Costs					
Administration	$	7 160	(45)	8 485	(34)
Leasing	$	10 062	(76)	6 318	(96)
Labour	$	156 405	(35)	172 040	(54)
Freight and marketing expenses	$	13 282	(30)	12 190	(43)
Fuel	$	45 388	(33)	62 146	(49)
Insurance	$	14 391	(31)	17 177	(44)
Interest paid	$	4 914	(81)	6 419	(125)
Licence fees and levies	$	31 653	(38)	35 774	(50)
Packaging	$	8 444	(107)	5 977	(137)
Repairs and maintenance	$	45 231	(43)	38 001	(53)
Other	$	35 516	(50)	40 694	(64)
Total cash costs	$	372 447	(34)	405 222	(48)
Boat cash income	$	8 866	(442)	731	(7273)
less Depreciation[a]	$	38 033	(23)	37 375	(39)
Boat business profit	$	–29 168	(125)	–36 644	(131)
plus Interest, leasing and rent	$	15 930	(65)	14 059	(94)
Profit at full equity	$	–13 238	(316)	–22 585	(249)
Capital (excl. quota and license)	$	720 991	(29)	691 672	(62)
Capital (incl. quota and license)	$	1 677 857	(28)	1 823 017	(49)
Rate of return to boat capital [b]	%	–2	(121)	–3	(578)
Rate of return to full equity [c]	%	–1	(57)	–1	(101)
				0	
Population	no.	20		17	
Sample	no.	8		7	

Note: **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. Figures in parentheses are relative standard errors (RSEs). For a given standard error, the RSE will be higher for mean estimates closer to zero. A guide to interpreting RSEs is included in Appendix A.

Fishery-level economic performance

The boat-level estimates presented in Table 7 indicated the financial performance of the average boat in the BSCZSF in 2009–10 and 2010–11. The measure is not an accurate indicator of fishery-level economic performance as it includes receipts and costs attributable to operations in other fisheries and excludes some key economic costs.

Table 8 shows receipts, costs and key measures of fishery-level profitability; namely, the boat cash profit and net economic returns derived from the BSCZSF. Boat cash profit measures the difference between cash receipts and cash costs in a fishery, revealing the fishery's cash position. Net economic returns, on the other hand, reveals economic profitability because it incorporates depreciation costs, the opportunity cost of capital and of labour, and treats all interest and leasing expenditure as an economic return to external investors in the fishery. Furthermore, it includes the total amount spent on managing the fishery, rather than just the management fees recovered from operators. As such it is a better measure of fishery economic performance. A more detailed explanation of net economic return is included in Appendix A.

The 2009 season was the first in which the BSCZSF was open since 2005. This meant 2009–10 was the first financial year not affected by fishery closures. Real net economic returns (including management costs) increased by 4.6 per cent between the two surveyed years, from –$1.1 million in 2009–10 to –$1.0 million in 2010–11. In real terms net economic returns (including management costs) from the last survey of the fishery were at –$1.6 million in 1997–98 and –$1.0 million in 1998–99 (Galeano et al. 2001).

Boat cash profit declined from $0.4 million to $0.1 million between 2009–10 and 2010–11 as a result of receipts falling at a greater rate (10 per cent) than operating costs (2.8 per cent) (Table 8). Falls in the cost of owner and family labour, depreciation and the opportunity cost of capital resulted in net economic returns (excluding management costs) remaining relatively constant but negative between the two years at –$0.7 million.

Table 8 Real boat cash profit and net economic returns in the Bass Strait Central Zone Scallop Fishery

		2009–10		2010–11	
Receipts					
Fishing income	$m	4.0	(31)	3.6	(49)
Cash costs					
Operating costs	$m	3.6	(25)	3.5	(40)
Boat cash profit	$m	0.4	(95)	0.1	(415)
less					
- owner and family labour	$m	0.8	(25)	0.6	(35)
- opportunity cost of capital	$m	0.4	(23)	0.3	(29)
- depreciation	$m	0.6	(22)	0.4	(30)
plus interest, leasing and management fees	$m	0.6	(32)	0.5	(42)
Net return (excluding management costs)	$m	–0.7	(56)	–0.7	(67)
Management costs	$m	0.4	na	0.4	na
Net return (including management costs)	$m	–1.1	na	–1.0	na
Number of active boats	no.	20		17	

Note: na = not applicable. All values in 2010–11 dollars. Figures in parentheses are relative standard errors (RSEs). For a given standard error, the RSE will be higher for mean estimates closer to zero. A guide to interpreting RSEs is included in Appendix A.

These results reveal that the low level of profitability that occurred in the fishery in 1997–98 and 1998–99 when the fishery was last surveyed (Galeano et al. 2001) remained in the current survey period. This was despite recent fishery closures. However, a similar return has been

earned with fewer boats (and, therefore, fewer resources) being devoted to the fishery: 18 boats in 2010–11 compared with 42 in 1998–99.

Supplementary survey

In the 2011 survey, operators in the BSCZSF were asked about their perceptions of factors affecting economic viability of the fishery. They were asked about the effects of nine key factors external to their business operation—factors over which they have no direct control (Figure 7). The results do not necessarily reflect the views of ABARES but are a representation of the supplementary survey results. They may not be indicative of all operators' views as they were drawn from a relatively small sample of only five operators representing six boats out of a population of 18 in 2010–11.

Figure 7 Operators' perceptions of the effect of key economic variables on the economic viability of the Bass Strait Central Zone Scallop Fishery
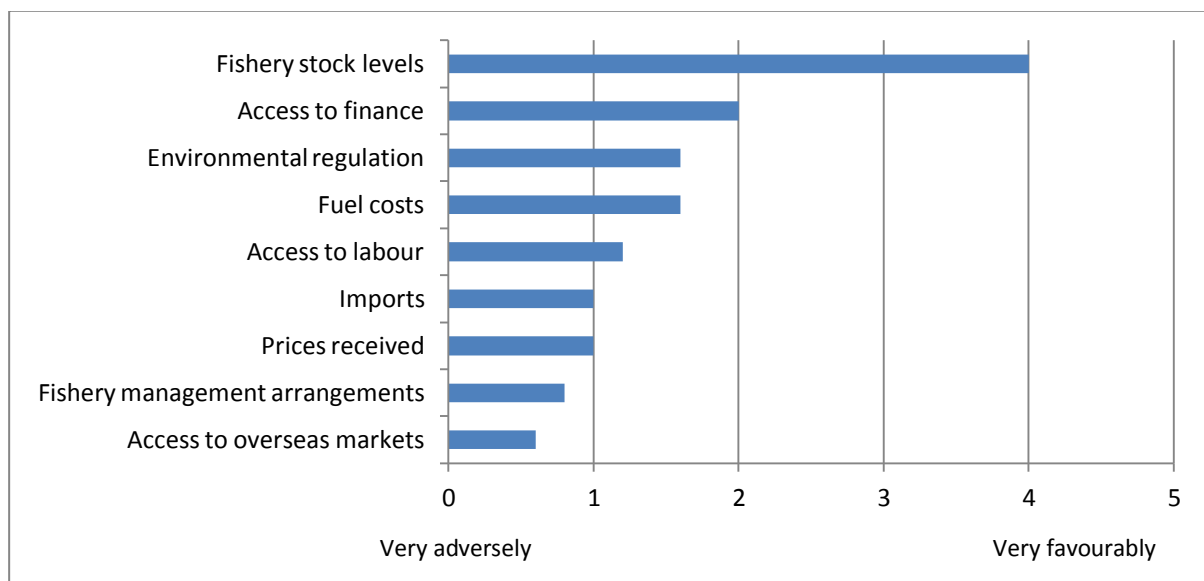
Of the factors being considered, fishery stock levels were rated as having the highest favourable effect on economic viability. This reflected most respondents' belief that current biomass levels in the fishery are healthy. Factors seen as having a moderately adverse effect on the economic viability of fishing businesses were access to finance, environmental regulation, fuel costs and access to labour. Of these, access to labour was proposed as having the most adverse effect on fishing businesses. This was reported to be largely the result of an inability to retain employees year round because of short, irregular seasons and fishery closures. The irregularity of activity in the fishery was also reported as having been the reason many processors left the industry.

The factors of most concern in the fishery for the surveyed period included import competition, prices received, fishery management arrangements and access to overseas markets. All survey respondents reported current management arrangements adversely affecting the economic viability of the fishery. Opportunities to export to overseas markets were also reported as having deteriorated. Reasons cited included an inability to regularly supply sufficient volumes, lack of processors, lack of infrastructure and appreciation of the Australian dollar.

Appendix A: Survey definitions

This appendix provides definitions of key financial performance variables, net economic returns (NER) and the ABARES method of calculating NER. Use of NER as an indicator of economic performance is then briefly discussed.

Financial performance

The definitions of key variables used in the analysis of boat-level financial performance are provided below.

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

For most 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 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 cooperative or agency pays the crew directly for the catch; the owner's financial records might include only the revenues received after the crew's share has been deducted.

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

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

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

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

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

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

Boat business profit is boat cash income less depreciation.

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

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

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

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

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

Net economic returns

Net economic returns are the long-run profits from a fishery after all costs have been met, including fuel, crew costs, repairs, the opportunity cost of family and owner labour, fishery management costs, depreciation and the opportunity cost of capital.

More specifically, a fishery's net economic return for a given time period can be defined as:

$$NR = R - CC - OWNFL + ILR - OppK - DEP + recMC - totM$$

$$\underbrace{}_{\substack{\text{cash} \\ \text{receipt}}} \underbrace{}_{\substack{\text{operating} \\ \text{costs}}} \underbrace{}_{\substack{\text{capital} \\ \text{cost}}} \underbrace{}_{\substack{\text{management} \\ \text{costs}}}$$

Where:

NR   =   net returns

R   =   total cash receipts attributable to the fishery, excluding leasing income

CC   =   total cash costs attributable to the fishery, including recovered management costs

OWNFL =   imputed cost of owner and family labour

ILR   =   interest and quota/permit leasing costs

OppK   =   opportunity cost of capital

DEP   =   depreciation

recMC   =   recovered management costs

totMC   =   total management costs.

Note that recovered management costs are those management costs paid by industry through management fees and are included in total cash costs (CC). These costs are removed (as indicated by '+ recMC') to prevent double counting given that these costs are a component of total management costs. Similarly, interest and quota/permit leasing costs are removed (indicated by '+ ILR') as these costs at the fishery level represent revenues that have been redistributed to external investors in the fishery.

The method of collecting data for each component and then calculating an estimate is outlined in the last section of this appendix.

Survey-based estimation of net economic returns

Fish sale receipts

Fish sale receipts are usually taken from fishers' financial accounts. Where a fisher operates in more than one fishery, they are asked to indicate what proportion of total fish sales is attributable to the fishery being surveyed. Any freight or marketing costs must also be deducted. This provides an estimate of net fishing receipts that incorporates only the 'beach price' that has been received for the catch; that is, the price received for fish at its first landing point.

Income received from leasing out quota and licenses is not included as income in calculating net economic returns. This item represents a redistribution of profits among investors in the fishery. Also, the amount a fisher earns from leasing out quota and licenses relates to the amount of profits the fishery is generating. Including leasing revenue would therefore result in double counting.

Operating costs

Operating costs include day-to-day operational expenses incurred in order to harvest fish in the fishery. Cash costs (CC) are a component of operating costs that includes those cost items that are easily identified in fishers' accounts, such as fuel, repairs and gear replacement.

Labour costs are often specified in fishers' accounts as wages. However, in calculating net returns, an estimate of the opportunity cost of labour is needed. The opportunity cost of labour is the wage that could have been earned performing a similar role elsewhere. Where a market wage is paid, it is assumed to represent the opportunity cost of labour and is included in the cash costs component of operating costs. The opportunity cost of owner and family labour is not easily identifiable in fishers' accounts. Often owners and their families are involved in operating a boat, either as skippers and crew or onshore as accountants and shore managers. While some will be paid market value for their labour, some will not be paid at all and others paid very high amounts, often as 'director fees' or 'manager fees'. In these cases, ABARES survey officers ask survey respondents to estimate the market value of owner and family labour—that is, the amount that would need to be paid to employ a non-family member to fulfil the same position. This amount is entered as a component of operating costs (OWNFL).

Quota and license leasing costs and interest expenses are included in cash costs. However, these costs must be removed from calculation of net returns for the same reason they are excluded from income (see 'Fish sale receipts' above).

Capital costs

To calculate capital costs, an estimate of the value of capital is needed. ABARES survey officers ask fishers to provide information for all capital items associated with the fishing business (including hull, engine, onboard equipment, vehicles and sheds). Information collected for each item includes the year the capital item was manufactured and an estimate of what it would cost to replace that item with a new equivalent item. By accounting for previous depreciation and inflation, these data are used to estimate the total value of capital invested in the fishery for the survey year.

As mentioned, capital costs include the opportunity cost of capital (OppK) and depreciation (DEP). The opportunity cost of capital is the return that could have been earned if capital was invested elsewhere, rather than in the fishery. This cost is not identifiable in fishers' accounts. A real interest rate that represents the long-term average rate of return that could be earned on an investment elsewhere is applied to the value of capital in the fishery. For fisheries surveys, ABARES uses a rate of 7 per cent per year.

Depreciation expense is the cost of capital becoming less valuable over time as a result of wear and tear and obsolescence. Depreciation expense is not consistently identifiable in fishers' accounts, so ABARES calculates the annual depreciation of boats based on the capital inventory list collected during the surveys (described above) and predetermined depreciation rates for each capital item type.

Management costs

Management costs are incurred to ensure the fishery continues operating and are therefore costs associated with harvesting fish in the fishery. Management costs are made up of two components: recovered management costs and non-recovered management costs. Recovered management costs (recMC) are those costs recovered from fishers and appear in the accounts of fishers as payments of management fees or levies. Non-recovered management costs are those management costs not charged to fishers, but instead are covered by the managing body or government. Calculation of net economic returns requires deduction of total management costs, which is the sum of these two components.

Total cash costs (CC) includes an estimate of recovered management costs based on management levy expenses contained in fishers' accounts. As this estimate of recovered management costs is based only on a sample of the fishery, it may not be consistent with the actual value of management costs recovered from the entire fishery. AFMA is able to provide an estimate of total management costs for each fishery—that is, the sum of both recovered and non-recovered management costs. For these reasons, recovered management costs from fishers' accounts are ignored (as indicated by +recMC in the net returns equation). Then, total management costs (totM) as supplied by AFMA are used to estimate net economic returns.

# Net economic returns and economic performance

AFMA fishery managers require information on fisheries' performance against the objective of maximising net economic returns from use of fish stocks—an objective commonly referred to as MEY. If a fishery is operating at MEY, effort, catch and stocks are at levels where the difference between discounted revenues and costs, and therefore profits, are maximised. The term

'discounted' simply means the difference in the value of a dollar earned today relative to a dollar in the future is accounted for. If income can be generated from a dollar today (for example, by putting it in a bank account to earn interest), the rate at which future revenues should be discounted is positive. Therefore, assuming a positive discount rate, revenue earned today (from harvesting fish, for example) is more valuable than revenue earned in the future.

The concept of MEY is best explained using a static single period model (Box A1). A static model (as opposed to a dynamic model, described above) is simplistic as it ignores the relative value of future profits by assuming a discount rate of zero, and it does not account for the dynamic transition path to MEY or uncertainty (Kompas et al. 2009).

Box A1 Static single period model of maximum economic yield
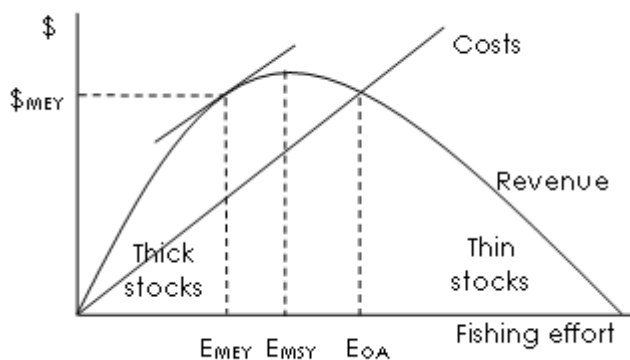
The relationship between stock biomass, effort and different levels of sustainable catch in dollar terms (price multiplied by catch) is shown by the total revenue curve. This is derived from a biological stock–recruitment relationship, translated into effort units. Every point along this curve represents an effort and catch combination that is biologically sustainable. Setting effort at E_{MSY} means the maximum sustainable yield (MSY) is harvested, generating the largest total revenue. Although total revenue is maximised at E_{MSY}, this is not where total profits are maximised.

The total cost curve gives the cost of applying each effort level. MEY is the level of catch that maximises profit—the difference between total revenue and total cost. This occurs at E_{MEY} with a corresponding catch value of $\$_{MEY}$. This is where net economic returns are maximised. It is also where the optimal amount of society's scarce resources is allocated to the fishery, including fishing boats and labour. Each effort level will also correspond with a given stock biomass level. It should be noted that the biomass level associated with MEY (BMEY) is a key reference point for managing Commonwealth fisheries.

Typically, a fishery will not gravitate to the effort level associated with MEY without intervention from a fishery manager. Instead, effort is most likely to settle at a point known as the open access equilibrium (E_{OA}). In an open access fishery, all fishers, acting in their own interest, are induced to fish more because they do not take into account the effect of their fishing activity on other fishers in the fishery. That is, one fisher's decision to increase fishing effort further depletes stocks so that harvesting costs increase for all. A fisher has no incentive to reduce effort to conserve stocks because the benefits of doing so will be captured by other fishers. At E_{OA}, net economic returns are zero and fish stocks are thinner.

MEY and E_{MEY} are influenced by changes in fish prices, which stretch or compress the total revenue curve, and the costs of fishing, which pivot the total cost curve about the origin. Higher fish prices would shift MEY to the right and vice versa, while higher fishing costs per unit of effort would shift MEY to the left and vice versa.

The major factors that influence MEY include costs (which are a function of input use and input prices), output prices, stock biomass, the stock–recruitment relationship and discount rates. It is difficult to understand how these factors vary over time and interact to affect the effort level associated with MEY. Consequently, estimating the level of effort that will lead to MEY in a given period typically requires a bioeconomic model that combines the economic, biological and management characteristics of a fishery (Gooday & Galeano 2003). Bioeconomic models are complex and data-intensive, and in many cases will not be available. In such cases, other indicators can be used to broadly assess a fishery's performance relative to MEY in a given period.

The estimates of net economic returns presented in this report are an example of one such indicator. Estimates of net economic returns cannot be used in isolation to reveal how a fishery has performed relative to MEY. However, if the key drivers of changes in net economic returns are understood, it may be possible to infer whether a fishery is moving towards or away from MEY. The major drivers of net economic returns are broadly the same factors that influence MEY.

Below are examples of different scenarios associated with a positive trend in a fishery's net economic return. The implications of that positive trend depend on what factors are driving the trend. If it is assumed that effort and/or catch limits in a fishery are binding and all other factors are held constant, then if net economic returns in a fishery are increasing:

- a reduction in effort (for example, in boat numbers) will mean a fishery has moved toward MEY

- a long-term increase in a fishery's stock biomass (as opposed to short-term increases because of natural stock variability) will mean a fishery has moved toward MEY; such a change could be driven by previous catch reductions that allow stocks to rebuild

- because of an increase in catch prices or a decrease in input costs, then fishery performance relative to MEY cannot be determined unless the state of the fishery is known relative to MEY before the change, as is explained in Box A2.

Box A2 Interpreting changes in net economic returns when driven by price or cost changes

It is assumed that fishery managers have effectively controlled effort at a given level (using some form of input control, for example). The effect of an increase in fish price is considered according to two scenarios.

Under the first scenario, effort levels are fixed at E_{S1}, below the level associated with MEY_0. This means that, under current economic conditions, if effort levels were to increase the fishery would move closer to MEY_0. Under the second scenario, the opposite is true and effort levels are set beyond MEY_0 at E_{S2}—net economic returns will increase with a reduction in effort.
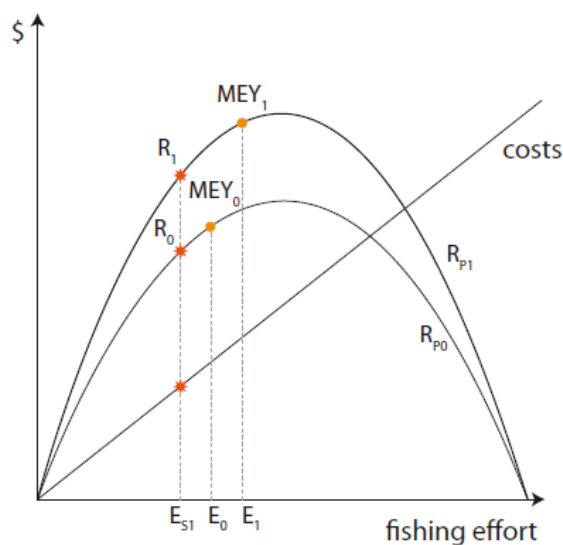
An increase in fish price is represented by an upward shift in the revenue curve from R_0 to R_1. A number of key changes occur following such a price increase. First, net economic return increases at any fixed effort level given that greater amounts of revenue can be earne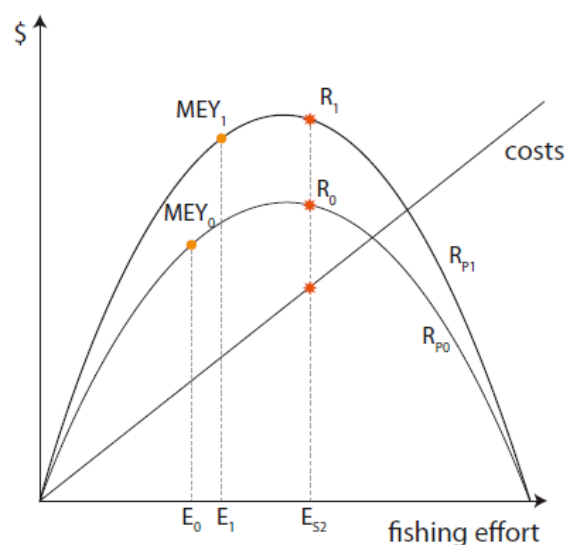d for the same cost. Second, MEY also increases for the same reason, as indicated by MEY_1. However, the increased wedge between revenue and costs also means that MEY_1 is now associated with a higher level of effort (E_1). It is this change that has different implications for each scenario.

Under the first scenario, the increase in price results in MEY_1 being further away from the fixed effort level ES_1. However, under the second scenario, the price increase results in the new MEY_1 being closer to the fixed effort level E_{S2}.

Change in costs produce similar results, with the change represented by a movement in the cost curve rather than the revenue curve.

Complicating the link between changes in net economic returns and MEY is that, in most cases, all factors (effort levels, stocks, prices, costs) are changing over time. Each factor's effect on net economic returns in terms of magnitude and direction is also always changing. If the magnitude of change in one factor outweighs all other changes (for example, a massive effort reduction following a boat buyback scheme), it may be easier to draw some conclusions. But generally interpretation will not be this simple.

To better assess a fishery's performance in the absence of a bioeconomic model, analysis of net economic returns can be undertaken in conjunction with other economic and biological indicators. In particular, economic indicators such as productivity indexes, profit

decompositions and stochastic frontier analysis can provide greater clarity. For example, if biological indicators suggest harvests are sustainable, a positive trend in both net economic returns and total factor productivity (the ratio of outputs produced to inputs used) over time would generally indicate a fishery is moving towards MEY.

For more information on the concept of MEY and assessing fishery performance against the MEY objective, see Kompas et al. (2009) and Gooday & Galeano (2003).

Appendix B: Survey methods

Collecting economic survey data

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

Survey information is made publicly available so the performance of fisheries and the impact of management policies can be independently assessed.

ABARES surveys are designed and samples selected on the basis of information AFMA supplied. This information includes data on the volume of catch, fishing effort and boat characteristics.

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

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

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

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

Sample weighting

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

That is,

$$\sum w_i = P \quad \text{and} \quad \sum w_i x_i = X$$

Where:

w_i is the weight for the ith boat

P is the number of boats in the population

x_i is the catch for the ith boat

X is the total catch for the target population.

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

Reliability of estimates

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

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

Use of relative standard errors

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

There is roughly a two-in-three chance that the 'census value' (the value that would have been obtained if all boats in the target population had been surveyed) is within one standard error of the survey estimate. There is roughly a 19-in-20 chance that the census value is within two standard errors of the survey estimates. Thus, in this example, there is approximately a two-in-three chance that the census value is between $94 000 and $106 000, and approximately a 19-in-20 chance that the census value is between $88 000 and $112 000.

Comparing estimates

When comparing estimates across groups or years, it is important to recognise that the differences are also subject to sampling error. As a rule of thumb, a conservative estimate of the standard error of the difference can be constructed by adding the squares of the estimated standard errors of the component estimates and then taking the square root of the result.

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

$$\sqrt{(0.06 * \$100\,000)^2 + (0.06 * \$125\,000)^2} = \$9\,605$$

so the relative standard error of the difference is:

$$(\$9\,605 / \$25\,000) * 100 = 38\%$$

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

Non-sampling errors

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

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

Appendix C: Non–survey based estimation of net economic returns

The ABARES fisheries economic surveys program involves collection of survey data biannually. An implication of this approach is that there is a delay in reporting survey results for individual fisheries. Fishing business operators are given an extended timeframe in which to submit their fishing business income details to the Australian Taxation Office for a given financial year. As a result, a boat's financial statements will often not be finalised for up to nine months after end of financial year. Additionally, considerable time is needed to collect financial data and estimate survey results. As a result, the normal delay for publication of survey results is either one or two years, depending on whether a financial year is the first or second year in a given survey.

To address this issue, ABARES has developed a non–survey based method of estimating net economic returns for financial years where survey data are not yet available. It allows more timely estimation and reporting of net economic return estimates that can better inform both industry and government decision-making. This method is intended to complement collection of data and publication of results normally undertaken through the fisheries surveys.

The method first involves defining the revenue and cost components in calculation of net economic returns. Historical survey data are then used to establish relationships between each component and more readily available indicators such as fish prices and fishery catch and effort. Where no significant relationships can be estimated, component trends over time are used. These relationships are then used to calculate preliminary estimates of each component for the non-survey year. Calculation of net economic returns is the same as outlined in the previous appendix. More detail on calculating each component is below.

Method

The method used to calculate non–survey based estimates of net economic return for a non-survey year (that is, a year for which no survey data are available) is similar to that used by Wood et al. (2008). Following this general method, varying approaches are used to calculate each component of net economic return. Estimation approaches may also differ across fisheries given the unique characteristics of individual fisheries. In all cases, each component is estimated based on an assumed sample of the population and a set of corresponding assumed weights. This assumed sample represents those boats that are expected to be sampled for 2010–11 in the next survey in 2013.

Details of the estimation process unique to calculating 2010–11 estimates for the Northern Prawn Fishery (NPF) are below. Where relevant, summary statistics related to these estimations are provided in Appendix D.

Cash receipts

GVP has a close relationship with cash receipts, which is used to calculate net economic returns in a non-survey year. ABARES calculates GVP at the end of every financial year for all Commonwealth fisheries. This calculation uses AFMA landings data and average yearly prices of key species obtained from fish markets and industry contacts. The product of estimated landings and beach prices by species is an approximation of GVP.

Fish sales receipts, net of freight and associated marketing costs, are about equal to an operator's GVP. As a result, GVP is a viable proxy for cash receipts. For some fisheries, including

the NPF, a consistent discrepancy exists between historical estimates of fish sale receipts and GVP. In such cases, GVP is used to estimate fish sale receipts under the assumption that a similar discrepancy will prevail in the non-survey year.

Final estimates of GVP in the NPF for 2010–11 were not available, so preliminary estimates of GVP had to be made using preliminary catch and price data.

Operating costs

Accurate calculation of operating costs for a non-survey year depends on obtaining preliminary estimates of three key expenses: fuel, labour and repairs, and maintenance. These three cost items on average account for between 75 and 80 per cent of an operator's total operating costs. In addition, preliminary estimates were made for other materials and other service costs.

Fuel

Fuel is typically one of the most expensive cost items for a boat operator. Accurately estimating fuel expenditure in a non-survey year requires information on fuel consumption and the price at which the fuel was purchased. The quantity of fuel consumed by a boat in a given period will be influenced by effort, gear size and boat characteristics such as hull size and engine power. A boat's fuel expenditure is the product of fuel consumption and the fuel price. A relationship between fuel expenditure and effort and fuel price can then be derived using regression analysis. Once observed, this relationship is used to predict fuel expenditure given the total effort expended and the average fuel price in the non-survey year.

The NPF is a trawl-based fishery, for which trawl hours can be used as an indicator of effort. However, the relationship between fuel use and trawl hours in this fishery is complicated by two key considerations. First, the dual season characteristic of the fishery (distinct banana prawn and tiger prawn seasons) required that a different approach be taken to estimating fuel costs. The different trawl methods used further complicate the difference between seasons. In the banana prawn season, boats generally expend a significant amount of fuel reaching a location of high prawn density; boats then encircle the stock to achieve catch. In the tiger prawn season, a more traditional trawling approach is generally used. Therefore, the relationship between trawl hours and fuel use may differ significantly between the banana and tiger prawn seasons. As a result, trawl hours were not used in estimating fuel expenditure.

The second consideration relevant to estimating fuel use in the NPF relates to the price fishery operators paid for diesel. Recently operators jointly negotiated with fuel suppliers to bulk purchase fuel at relatively low prices. As a result, using an Australian average price for diesel may not be consistent with the price negotiated in 2008–09. Information about negotiated diesel price and what proportion of operators benefitted from the negotiations was not available. A per litre diesel price was assumed based on ABARES estimates of the Australian average off-road diesel price and by adjusting this price to exclude rebates.

Boat length was used as a proxy for gear size more generally; total catch was used as a revealed effort proxy; and the off-road diesel price, adjusted for rebates, was used as a proxy for regressors of fuel expenditure.

Labour

Labour is also among the most costly expense items for a boat operator. In most fisheries, the skipper and the crew are paid a share of the boat's fishing revenues. Therefore, the historical relationship between cash receipts—in addition to fishing days in each season—and labour

costs can be used to estimate labour costs in a non-survey year once cash receipts have already been estimated for that year, and effort data have been received.

Repairs and maintenance

Boat operators generally address repairs and maintenance as needed. Significant repairs or major overhauls are unlikely to be done annually. At the boat level, this expense item can be expected to vary considerably from year to year. However, at the fishery level it is reasonable to expect that the average repairs and maintenance costs will be more stable and the numbers of operators undertaking major overhauls will be approximately constant from year to year. Often, there is no obvious relationship between this expense item and other key variables such as catch or effort. As a result, lagged average repairs and maintenance expenditure, and average cash receipts as a proxy for ability to undertake costly repairs, were used as regressors for average repairs and maintenance expenditure in the non-survey year.

Other material costs

Other material costs relate to items such as bait, ice, electricity and packing materials, but exclude fuel, and repairs and maintenance that are estimated separately. A relationship between average material costs and average total catch was estimated on an annual basis. This formed the basis for the 2010–11 estimate of average material costs for the fishery.

Other service costs

Other service costs include items such as freight, marketing, packing charges and aerial spotting fees, but exclude interest, leasing and management fees. These costs were estimated using the historical relationship between average cash receipts and the average of other service costs over 12 years. Based on this, other service costs were estimated for the average boat in the fishery for 2010–11.

Interest, leasing and management fees

Interest and leasing fees represent a redistribution of profits to investors in the fishery. As such, they are not costs at the fishery level and should be removed from calculation of net economic returns. Management fees for the purpose of NER estimation are taken from AFMA (recovered and non-recovered) and include all the costs involved with managing the fishery, not just those recovered from industry. These are also removed from calculation of net economic returns so total management costs (recovered management fees and non-recovered management costs) can be deducted. As a result, for estimating net economic returns in non-survey years, these costs and fees are not estimated and are excluded from estimation of operating costs.

Opportunity cost of capital and depreciation

Capital values, the opportunity cost of capital and depreciation expenses were estimated for each boat in the assumed sample for each fishery, assuming a depreciation rate equal to that in the most recent survey year and a capital upgrade rate (an assumed capital investment amount). All boat-level estimates were then weighted up to a total estimate for the fishery using weights calculated for individual boats in the 2010–11 assumed sample.

Management costs

Total management costs (recovered and non-recovered) for 2010–11 were based on AFMA's budgeted estimates.

Appendix D: Non–survey based estimates—regression results

This appendix contains summary statistics for regressions formulated to estimate individual components of net economic returns in 2010–11. Relationships were estimated using survey and supplementary data up to and including 2009–10. The estimated relationships were used to extrapolate to 2010–11 given known or assumed values of the relevant explanatory variables for 2010–11. All monetary values are in 2010–11 dollars.

Results for Northern Prawn Fishery

Total cash receipts				
R^2 =	0.71			
F p value =	0.000			
	coefficient	standard error	t-statistic	p-value
GVP	1.01	0.00815	124.5	0.00

Fuel expenditure				
R^2 =	0.56			
F p value =	0.000			
	coefficient	standard error	t-statistic	p-value
intercept	−117 515.1	28 685.1	−4.10	0.00
boat length	10 315.5	1 230.8	8.38	0.00
tiger prawn season (real fuel price x fishing days)	21.4	1.46	14.6	0.00
banana prawn season (real fuel price x fishing days)	15.5	2.95	5.26	0.00

Labour				
R^2 =	0.79			
F p value =	0.000			
	coefficient	standard error	t-statistic	p-value
intercept	26 085.9	13 903.5	1.88	0.06
total cash receipts	0.203	0.00519	39.2	0.00
banana season fishing days	528.2	238.7	2.21	0.03
tiger season fishing days	210.0	127.2	1.65	0.01

Average repairs and maintenance costs				
R^2 =	0.82			
F p value =	0.001			
	coefficient	standard error	t-statistic	p-value
intercept	−3 176.5	30 512.3	−0.104	0.92
average cash receipts	0.0361	0.0165	2.18	0.06
average repair expenditure (1 year lag)	0.708	0.143	4.97	0.00

Average other service costs				
R^2 =	0.61			
F p value =	0.003			
	coefficient	standard error	t-statistic	p-value
intercept	87 744.2	18 407.7	4.77	0.00
average total cash receipts	0.0595	0.0151	3.95	0.00

Average other materials costs				
R^2 =	0.77			
F p value =	0.000			
	coefficient	standard error	t-statistic	p-value
intercept	36 940.9	9 192.7	4.02	0.00
average total catch	0.542	0.0945	5.74	0.00

Previous fishery survey reports

Northern Prawn Fishery

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1980–81 to 1982–83
BAE 1985, 'BAE report on south-eastern prawn fishery', *Australian Fisheries*, vol. 44, no. 1, pp. 36–7.

Eastern Tuna and Billfish Fishery

(Formerly the East Coast Tuna Fishery)
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ABARE 2003, *Australian Fisheries Surveys Report 2002*, Australian Bureau of Agricultural and Resource Economics, Canberra.

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ABARE 2005, *Australian Fisheries Surveys Report 2004*, Australian Bureau of Agricultural and Resource Economics, Canberra.

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ABARE 2007, *Australian Fisheries Surveys Report 2006*, Australian Bureau of Agricultural and Resource Economics, Canberra.

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ABARE 2007, *Australian Fisheries Surveys Report 2008*, Australian Bureau of Agricultural and Resource Economics, Canberra.

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ABARES 2009, *Australian Fisheries Surveys Report 2010*, Australian Bureau of Agricultural and Resource Economics and Sciences, Canberra.

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(Formerly the South East Non-Trawl Fishery and the Southern Shark Fishery)

1988–89
Battaglene, T & Campbell, D 1991, 'Economic survey of the southern shark fishery', *Australian Fisheries*, vol. 50, no. 5, pp. 12–15.

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