



Dear Stakeholder

Enclosed is a copy of the Report "Economic Impact Of The Striped Marlin Fishery" prepared by Ernst & Young Pty Ltd. The report identifies the importance of the striped marlin fishery to the economy of NSW, and the contribution made by both the commercial and recreational sectors. It makes clear the significant contribution made to coastal regions by this important fishery.

I can advise you that the NSW Minister for Primary Industries has written to his Commonwealth counterpart advising him of the report. The Minister has sought assurances that, in view of the value of the striped marlin fishery to NSW, the Commonwealth take steps to guarantee that the longline fishery will only take the species as a legitimate bycatch of tuna fishing and that the fishery is managed in a sustainable way with proper recognition of the economic and social benefits to NSW.

The study was funded from the recreational fishing fee through the Recreational Fishing Saltwater Trust Fund. In interpreting the findings of the report, I would draw your attention to the caveats and assumptions on which the model is based that are clearly identified by the authors. The findings of the report should be read with those limitations in mind.

I would also stress that views and opinions expressed in the report are those of the consultant and do not reflect the policies of the NSW Department of Primary Industries (NSW DPI) or the NSW Government. While mindful of the report, NSW DPI is not bound or obligated to act on any recommendations contained therein. Further, any errors or omissions in the report are the responsibility of the consultant.

I would like to thank all those who provided information for the expenditure survey, and who assisted Ernst & Young to complete the study.

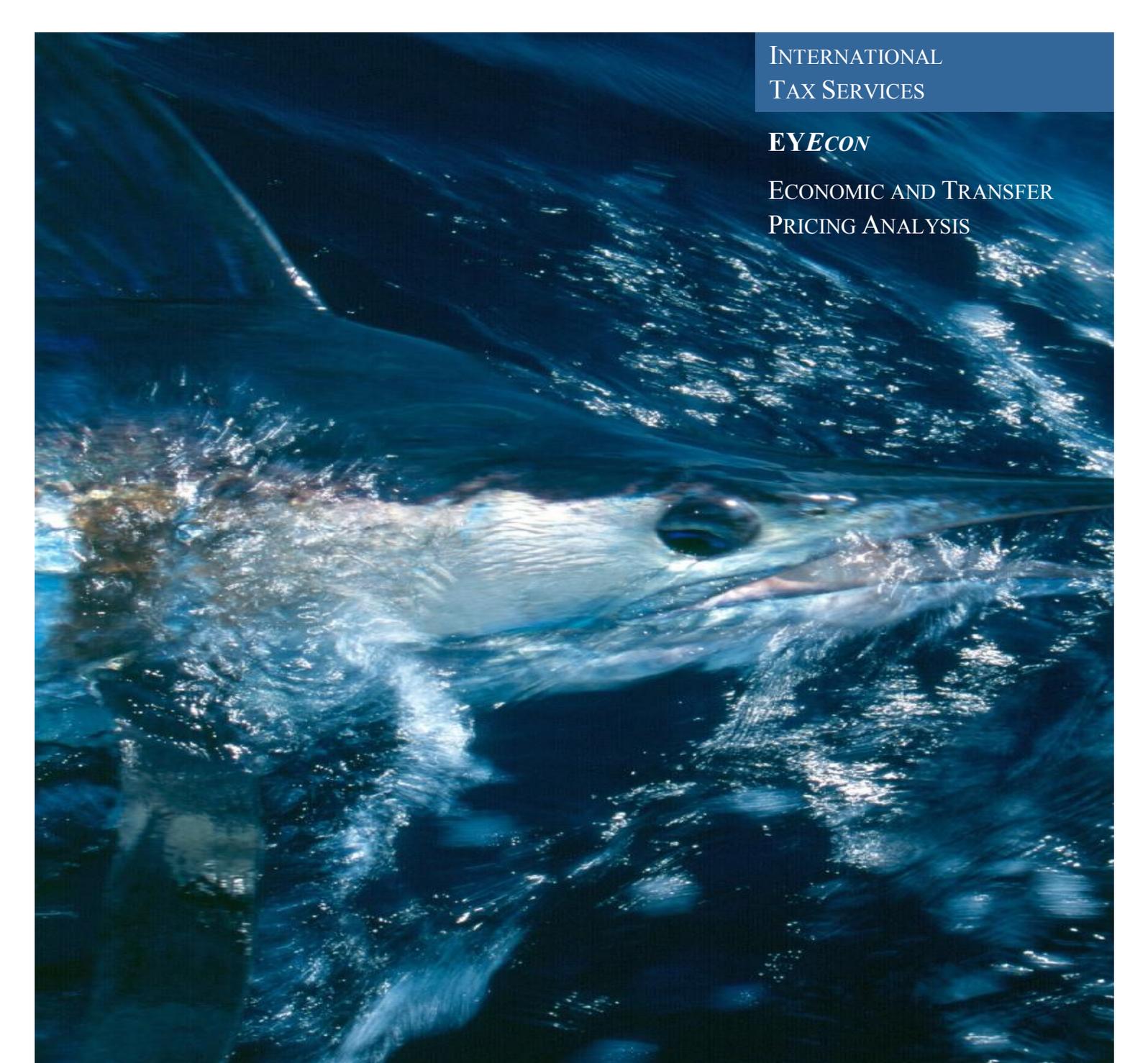
Yours sincerely

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24 December 2004

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Economic Impact of the NSW Striped Marlin Fishery

Preface

Scope of the Report

Ernst & Young's economic consulting group, *EYEcon*, in conjunction with the Centre for Agricultural and Regional Economics (CARE), was commissioned by NSW Fisheries to conduct a detailed study of the economic impact commercial and recreational striped marlin fishing is having on the NSW economy and regional economies.

This report presents the results of that study.

Acknowledgments

The compilation of this report would not have been possible without the generous assistance of the following individuals and organisations:

- John Diplock and Sandra Howarth from NSW Fisheries, who provided data on the recreational and charter boat fisheries and the number of licensed anglers, and entered data obtained from the *NSW Striped Marlin Recreational Fishing Survey* and the *NSW Striped Marlin Charter Boat Fishing Survey* conducted by Ernst & Young;
- Thim Skousen and Rohan Wilson from the Australian Fisheries Management Authority (AFMA), who provided AFMA logbook data on catches in the Eastern Tuna and Billfish (ET&BF) fishery and data on the number of licensed operators;
- David Galeano from the Australian Bureau of Agriculture and Resource Economics (ABARE), who provided the latest financial data on commercial longline operations in the Eastern Tuna and Billfish (ET&BF) fishery;
- Robert Campbell from the CSIRO, for information on gamefish weights;
- Leo Folk from the Australian National Sportfishing Association (ANSA) and Pat Jones from the NSW Game Fishing Association who provided NSW membership data; and
- the recreational anglers and charter boat operators who took the time to complete our survey forms.

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Glossary of Terms

Average costs – the total costs of production divided by the total quantity produced.

Consumer surplus – the difference between what a consumer is willing to pay to purchase a good or service and what that consumer actually pays (i.e. the net benefit a consumer derives from the consumption of a good or service).

Complements in consumption – two goods are complements in consumption if the demand for one good (at a given price) decreases as the price of the other good increases.

Demand curve – the relationship between the quantity demanded of a good or service and its price.

Elasticity of demand – see **price elasticity of demand**.

Elasticity of supply – see **price elasticity of supply**.

Marginal benefit – the additional benefit derived from an additional unit of consumption or production.

Marginal cost – the additional cost associated with producing an additional unit of output.

Producer surplus – the difference between what a producer is paid to supply a good or service and what that producer would have been willing to supply that good or service for (i.e. the net benefit a producer derives from the production of a good or service).

Price elasticity of demand – the percentage change in the quantity demanded of a good or service that occurs as a result of a 1 percent change in the price of that good or service (i.e. the percentage change in the quantity demanded divided by the percentage change in the price).

Price elasticity of supply - the percentage change in the quantity supplied of a good or service that occurs as a result of a 1 percent change in the price of that good or service (i.e. the percentage change in the quantity supplied divided by the percentage change in the price).

Substitutes in consumption – two goods are substitutes in consumption if the demand for one good (at a given price) increases as the price of the other good increases.

Supply curve – the relationship between the quantity supplied of a good or service and its price.

Value added – the value that is added to inputs into the production process by primary factors of production such as land, labour, capital and enterprise (i.e. the difference between the value of output and the value of inputs).

Executive Summary

Ernst & Young's economic analysis group, *EYEcon*, in conjunction with the Centre for Agricultural and Regional Economics (CARE), was commissioned by NSW Fisheries to conduct a detailed study of the economic impact that commercial and recreational striped marlin fishing is having on the NSW economy and regional economies.

This report presents the results of that study.

Objectives of the study

The striped marlin found off NSW's coastline are a valuable resource that is coming under increasing pressure from both commercial and recreational anglers.

Striped marlin are not only a valuable by-catch of the commercial Eastern Tuna and Billfish Fishery (ET&BF), but they are also the main billfish species pursued by recreational anglers who fish off the NSW coastline.

The principal objective of this study is to assist NSW Fisheries with the difficult task of managing these competing demands by providing information on the economic impact of:

- commercial and recreational striped marlin fishing on commercial and recreational anglers, the community as a whole, the NSW economy and regional economies within NSW; and
- continuing current, or introducing alternative, striped marlin fisheries management arrangements, on commercial and recreational anglers, as well as the NSW economy and regional economies.

Key Issues

In order to manage Australia's east-coast striped marlin resources efficiently and equitably, two main issues need to be resolved:

- What is the optimum level of catch for striped marlin?
- How should that catch be allocated between alternative commercial and recreational uses?

This study focuses on the second of these key issues – How should the NSW striped marlin catch be allocated between commercial and recreational fishers? This involves the consideration of:

- the supply of, and demand for, striped marlin off the NSW coastline;
- whether there is scope to increase the net benefits the community derives from striped marlin fishing off the NSW coastline by reallocating the catch between commercial and recreational anglers through the introduction of alternative striped marlin fishery management arrangements. This requires consideration of the economic value of striped marlin to both commercial and recreational anglers; and
- the economic impact that such a reallocation of the striped marlin catch would have on commercial and recreational anglers, the community as a whole, and the NSW economy and regional coastal economies.

Summary of Key Results – Supply, Demand and Value of NSW Striped Marlin

	NSW COASTAL REGIONAL AREA												TOTAL NSW		
	Northern and Mid Northern			Hunter and Sydney			Illawarra			Southern					
	2000-01	2001-02	2002-03	2000-01	2001-02	2002-03	2000-01	2001-02	2002-03	2000-01	2001-02	2002-03	2000-01	2001-02	2002-03
SUPPLY OF NSW STRIPED MARLIN	The supply of striped marlin off the NSW coastline is uncertain														
DEMAND FOR NSW STRIPED MARLIN															
Commercial catch - actual (kg)	49,949	45,113	49,680	51,541	42,221	48,961	111,849	93,883	45,099	75,740	101,955	63,208	289,078	283,172	206,947
Recreational catch (kg)															
anglers surveyed (kg)	na	na	7,786	na	na	39,584	na	na	7,936	na	na	26,388	na	na	81,694
estimated total (kg)	na	na	96,885	na	na	601,578	na	na	120,794	na	na	333,900	na	na	1,153,158
Total:															
caught (kg)	na	na	146,565	na	na	650,539	na	na	165,892	na	na	397,108	na	na	1,360,105
released (kg)	na	na	91,908	na	na	584,506	na	na	76,591	na	na	313,324	na	na	1,066,330
killed (kg)	na	na	54,657	na	na	66,033	na	na	89,301	na	na	83,784	na	na	293,775
VALUE OF NSW STRIPED MARLIN															
Gross value of:															
commercial catch (actual)	\$293,365	\$274,041	\$297,846	\$302,718	\$256,469	\$293,538	\$656,926	\$570,294	\$270,381	\$444,847	\$619,326	\$378,953	\$1,697,856	\$1,720,130	\$1,240,717
recreational catch (anglers surveyed)	na	na	\$361,634	na	na	\$1,838,550	na	na	\$368,582	na	na	\$1,225,638	na	na	\$3,794,404
recreational catch (estimated total)	na	na	\$4,500,010	na	na	\$27,941,315	na	na	\$5,610,465	na	na	\$15,508,567	na	na	\$53,560,356
Net value of:															
commercial catch (producer surplus)	\$122,919	\$111,020	\$122,257	\$126,838	\$103,901	\$120,488	\$275,250	\$231,038	\$110,983	\$186,389	\$250,902	\$155,549	\$711,395	\$696,860	\$509,277
recreational catch (anglers surveyed)	na	na	\$100,441	na	na	\$510,644	na	na	\$102,371	na	na	\$340,412	na	na	\$1,053,868
recreational catch (estimated total)	na	na	\$1,249,845	na	na	\$7,760,495	na	na	\$1,558,266	na	na	\$4,307,391	na	na	\$14,875,996
Gross value of an additional kilogram of striped marlin to:															
commercial fishers	\$5.87	\$6.07	\$6.00	\$5.87	\$6.07	\$6.00	\$5.87	\$6.07	\$6.00	\$5.87	\$6.07	\$6.00	\$5.87	\$6.07	\$6.00
recreational anglers	na	na	\$46.45	na	na	\$46.45	na	na	\$46.45	na	na	\$46.45	na	na	\$46.45
Net value of an additional kilogram of striped marlin to:															
commercial fishers	\$2.46	\$2.46	\$2.46	\$2.46	\$2.46	\$2.46	\$2.46	\$2.46	\$2.46	\$2.46	\$2.46	\$2.46	\$2.46	\$2.46	\$2.46
recreational anglers	na	na	\$12.90	na	na	\$12.90	na	na	\$12.90	na	na	\$12.90	na	na	\$12.90

Summary of Key Results – Economic Contribution of Striped Marlin to the NSW Economy and Regional Coastal Economies

REGION	ECONOMIC CONTRIBUTION OF STRIPED MARLIN FISHING TO THE NSW ECONOMY AND REGIONS		
	COMMERCIAL	RECREATIONAL	TOTAL
Northern and Mid Northern			
Output	\$583,909	\$8,325,694	\$8,909,603
Value added	\$250,878	\$2,915,706	\$3,166,584
Household income	\$182,263	\$1,928,618	\$2,110,881
Employment	5	91	96
Hunter and Sydney			
Output	\$548,353	\$61,336,668	\$61,885,021
Value added	\$225,133	\$23,483,687	\$23,708,820
Household income	\$154,680	\$14,224,262	\$14,378,942
Employment	3	386	388
Illawarra			
Output	\$1,313,321	\$9,261,796	\$10,575,116
Value added	\$550,752	\$3,051,211	\$3,601,963
Household income	\$393,452	\$2,057,950	\$2,451,402
Employment	9	89	97
Southern			
Output	\$947,511	\$19,872,495	\$20,820,005
Value added	\$407,619	\$7,287,383	\$7,695,002
Household income	\$304,177	\$5,068,681	\$5,372,858
Employment	7	207	213
Other NSW			
Output	\$1,234,315	\$13,645,721	\$14,880,038
Value added	\$479,642	\$7,654,267	\$8,133,908
Household income	\$273,967	\$2,923,991	\$3,197,958
Employment	10	134	145
TOTAL NSW			
Output	\$4,627,409	\$112,442,374	\$117,069,783
Value added	\$1,914,024	\$44,392,254	\$46,306,277
Household income	\$1,308,539	\$26,203,502	\$27,512,041
Employment	34	907	941

Summary of Key Results – Economic Impact of Alternative Striped Marlin Fishery Management Arrangements

	ECONOMIC IMPACT OF ALTERNATIVE STRIPED MARLIN MANAGEMENT ARRANGEMENTS			
	Continuation of current arrangements	Ban on commercial striped marlin fishing:		Ban on commercial longline fishing within 50nm of the NSW coastline
		off the NSW coastline	within 50nm NSW coastline	
IMPACT ON ANGLERS AND COMMUNITY				
Net cost to commercial fishers	See text	-\$1.24m	-\$0.6m	-\$6.9m
Net benefit to recreational anglers	See text	\$2.67m to \$5.82m	\$0.99m to \$2.16m	\$7.99m to \$9.63m
Net benefit to the community as a whole	See text	\$1.43m to \$4.58m	\$0.34m to \$1.51m	\$1.09m to \$2.73m
IMPACT OF ALTERNATIVE MANAGEMENT ARRANGEMENTS ON CONTRIBUTION OF COMMERCIAL STRIPED MARLIN FISHING TO NSW ECONOMY AND REGIONAL ECONOMIES				
Northern and mid-northern NSW				
Output	0	-\$0.027m	-\$0.028m	-\$8.7m
Value added	0	-\$0.584m	-\$0.464m	-\$9.1m
Hunter and Sydney				
Output	0	-\$0.026m	-\$0.026m	-\$8.1m
Value added	0	-\$0.524m	-\$0.416m	-\$8.2m
Illawarra				
Output	0	-\$0.062m	-\$0.062m	-\$19.5m
Value added	0	-\$1.28m	-\$1.02m	-\$20.1m
Southern NSW				
Output	0	-\$0.044m	-\$0.045m	-\$14m
Value added	0	-\$0.949m	-\$0.754m	-\$14.9m
Total coastal regions				
Output	0	-\$0.159m	-\$0.16m	-\$50m
Value added	0	-\$3.34m	-\$2.65m	-\$52.3m
Total NSW				
Output	0	-\$0.217m	-\$0.218m	-\$68.6m
Value added	0	-\$4.46m	-\$3.54m	-\$69.8m

Key Results

Uncertain supply of striped marlin off the NSW coastline

In view of the migratory nature of striped marlin, **considerable uncertainty surrounds the stock of striped marlin** that can be found off the NSW coastline at any point in time.

The Bureau of Rural Sciences has assessed striped marlin stocks in the ET&BF fishery and the wider Pacific Ocean as ‘uncertain’ in its Fishery Status Reports of 2000-2001 and 2001-2002 and that uncertainty was confirmed in its recent report on *Striped Marlin: Biology and Fisheries*. In particular, that report noted that:

- preliminary analysis suggests the overall abundance of striped marlin off the east coast of Australia may have increased slightly over the last 12 years. However, analyses of the subregions within the fishery gave mixed results. While the proportion of fishing operations catching striped marlin increased over this period, in inshore waters the catch rates for striped marlin for these operations/vessels may have declined; and
- striped marlin are vulnerable to longline gear from a relatively young age, and may not be as migratory as once thought, suggesting increased potential for localised depletions.

Increasing commercial demand for striped marlin

Striped marlin are a significant by-catch of Eastern Tuna and Billfish (ET&BF) fishery, which extends the entire length of the east coast of Australia out to the 200 mile limit of the Australian Fishing Zone.

Legally, commercial catches of blue, black and striped marlin off the NSW coastline are classified as a by-catch of the ET&BF fishery since:

- Commonwealth legislation bans commercial fishing for blue and black marlin in the entire Australian Fishing Zone (AFZ). In order to avoid prosecution, commercial operators are required to return any blue or black marlin by-catch to the water immediately, dead or alive; and
- NSW legislation classifies all marlin as a protected species. As a result, striped marlin cannot be landed legally by commercial fishers operating within 3 nautical miles of the NSW coastline. However, Commonwealth licensed commercial fishers are allowed to retain and sell any striped marlin they catch in waters under Commonwealth jurisdiction beyond 3 miles.

The longline sector is responsible for catching most of the striped marlin caught by commercial operators in the ET&BF fishery. There has been a significant and sustained increase in both the number and weight of striped marlin caught by longline fishing operations in the ET&BF fishery since 1993. Specifically:

- the number of striped marlin caught in 2001 was more than 23 times the number caught in 1993; and
- the total weight of the striped marlin catch in 2001 was more than 18 times the weight of the catch in 1993.

It is this significant increase in both the number and weight of striped marlin caught by commercial operators that has prompted this investigation of the possible impacts of alternative striped marlin fishery management arrangements.

As noted in the recent Bureau of Rural Sciences report on *Striped marlin: biology and fisheries*, there are specific instances of commercial operators targeting striped marlin when it is in abundance and the significant increase in the commercial catch of striped marlin, when coupled with the high value of those fish and the low discard rates, also suggests commercial targeting of striped marlin.

AFMA logbook data indicates that:

- there were 84 commercial boats operating in the ET&BF fishery off the NSW coastline in 2001, 70 in 2002, and 56 in 2003;
- over 289 tonnes of striped marlin was caught off the NSW coastline by commercial ET&BF operators in 2001, over 283 tonnes in 2002, and over 206 tonnes in 2003;
- the striped marlin caught off the NSW coastline by commercial fishers comprised approximately 40 percent of the total commercial catch of striped marlin in the ET&BF fishery in 2001, 37 percent in 2002, and 33 percent in 2003;
- over 82 percent of that striped marlin catch was caught off the coast of the Hunter, Sydney, Illawarra and Southern regions of NSW in 2001, 84 percent in 2002, and 76 percent in 2003; and
- over 50 percent of that striped marlin catch is caught within 50 nautical miles of the NSW coastline (71 percent in 2001, 61 percent in 2002, and 52 percent in 2003).

Data obtained from the Australian Quarantine and Inspection Service indicates that:

- over the period 1 July 2001 to 31 August 2002, a total of 25,263 kg of striped marlin was exported from NSW; and
- over the period 1 September 2002 to 23 September 2003, a total of 28,249 kg of striped marlin was exported from NSW.

Once these 'trunked' weights of exported striped marlin have been converted to equivalent 'whole' weights (using a conversion factor of 1.5), this suggests that approximately 13 percent of the NSW striped marlin catch was exported in 2001-02 and 20 percent in 2002-03, with the remainder being sold on the domestic market.

Recreational demand for NSW striped marlin

Striped marlin are also highly prized by recreational anglers who go fishing off the NSW coastline for a wide range of gamefish species including billfish, tunas, sharks and sportfish.

Although marlin are only a by-catch of the commercial ET&BF fishery, marlin are the primary gamefish species targeted by recreational anglers who go gamefishing off the NSW coastline and striped marlin are now the most common species of marlin caught.

In the course of targeting marlin, however, recreational anglers can also expect to catch a certain by-catch of other gamefish species such as tunas, sharks and sportfish. Similarly, recreational anglers who target tuna, sharks and sportfish can also expect to catch the occasional striped marlin, depending on the fishing techniques employed. Striped marlin have increased in importance as a target species for recreational anglers due to an apparent decrease in the availability of yellowfin tuna over the last three years.

Recreational gamefishing comprises three main sectors:

- organised, club-based gamefishing;
- non club-based gamefishing; and
- charter boat gamefishing.

Using data obtained from the *National Recreational and Indigenous Fishing Survey*, the *NSW Striped Marlin Recreational Fishing Survey* and the *NSW Striped Marlin Charter Boat Fishing Survey*, it was estimated that:

- there are over 3,000 recreational anglers fishing for striped marlin who spend most of their time fishing in the Sydney, Hunter and Southern regions;
- most recreational striped marlin anglers are male (97 percent), aged between 30 and 59 years old (78 percent), and earn less than \$150,000 of gross income per annum (80 percent);
- over 46 percent of these recreational anglers have a university degree, college diploma or post graduate education;
- most recreational anglers mainly target marlin (over 92 percent), whereas only 5.4 percent of indicated they primarily targeted tuna and 2.4 percent indicated they mainly targeted sharks;
- most recreational anglers use their own boats to fish for striped marlin (58 percent) and 35 percent used their friends' boats. Only 6.8 percent of the recreational anglers surveyed normally fished for striped marlin from charter boats;
- trolling of lures is the preferred method of fishing for striped marlin (over 60 percent of anglers);
- most recreational fishing for striped marlin is conducted within 50 nautical miles of the NSW coastline (approximately 98 percent);
- a significant proportion of recreational anglers (over 36 percent) and charter boat operators (23 percent) indicated that they would give up gamefishing completely if striped marlin stocks were to fall to a level where they were unlikely to catch a fish;
- recreational anglers were estimated to have caught over 1,000 tonnes of striped marlin in 2002-03, which is higher than the commercial striped marlin catch for the entire ET&BF fishery (750 tonnes); and
- recreational anglers released over 96 percent of their striped marlin catch.

Recreational anglers place a much higher value on striped marlin than commercial fishers

It was estimated that:

- the **gross value** of the commercial catch of striped marlin caught off the NSW coastline to commercial operators was approximately:
 - **\$1.70 million in 2000-01**, or **\$5.87 per kg** ;
 - **\$1.72 million in 2001-02**, or **\$6.07 per kg**; and
 - **\$1.24 million in 2002-03**, or **\$6.00 per kg**;

- the **net value** of the commercial catch of striped marlin caught off the NSW coastline to commercial operators was estimated to range between **\$2.46 per kg** (if a proportion of all costs is allocated to striped marlin fishing except labour, financing, and insurance costs) and **\$4.68 per kg** (if only a proportion of operating costs is allocated to striped marlin fishing). This suggests that the net value of the commercial striped marlin catch to commercial operators ranged between:
 - **\$0.71 million and \$1.35 million in 2000-01;**
 - **\$0.70 million and \$1.32 million in 2001-02;** and
 - **\$0.51 million and \$0.97 million in 2002-03.**

By contrast, recreational anglers place a much higher value on striped marlin than commercial operators. In particular, it was estimated that in 2002-03:

- the **gross value** of striped marlin caught by recreational anglers off the NSW coastline was **over \$53 million, or \$46.45 per kg;**
- the **net value** of striped marlin caught off the NSW coastline to the recreational fishing sector was estimated to range between **\$12.90 per kg** (if a proportion of all costs is allocated to striped marlin fishing except labour, financing, and insurance costs) and **\$28.13 per kg** (if only a proportion of operating costs is allocated to striped marlin fishing). This suggests that the net value of recreational striped marlin catch to recreational fishing sector in 2002-03 ranged between **\$14.9 million and \$32.4 million.**

It is important to note that the estimates of the value of striped marlin to recreational anglers are **conservative** to the extent that they assume that recreational angler demand for striped marlin is a linear function of price (i.e. it is a straight line) and that the income-compensated price elasticity of demand is neither elastic or inelastic, but has a 'unitary' arc elasticity of demand. Available evidence suggests, however, that the price elasticity of demand for striped marlin fishing is relatively inelastic since recreational anglers and charter boat operators do not consider other gamefish species to be close substitutes in consumption for striped marlin. As noted above, over 36 percent of recreational anglers and 23 percent of charter boat operators indicated that they would give up gamefishing completely if it was unlikely that they would catch a striped marlin. As a result, it is likely that the net value of striped marlin to recreational anglers is much higher.

It is also important to note that the **estimates of the gross and net values of striped marlin to both commercial and recreational anglers are based on a range of simplifying assumptions** that are set out in this report and therefore should be **interpreted with caution.**

Since the net value of striped marlin to recreational anglers is much higher than it is to commercial anglers, there are potential net benefits to the community as a whole from reallocating more of the striped marlin catch away from commercial operators to recreational anglers.

Recreational fishing has a much greater impact on the NSW economy and regional economies than commercial fishing

Commercial and recreational striped marlin fishing in NSW:

- generates \$117 million in output;
- contributes \$46.3 million to value added (Gross State Product);
- provides \$27.5 million in household income; and

- creates 941 jobs in the NSW economy.

The impact of recreational striped marlin fishing far outweighs that of commercial striped marlin fishing, given the number of people involved in recreational fishing in NSW, their associated spending and the type of equipment involved in recreational marlin fishing (e.g. boats and fishing gear).

Commercial striped marlin fishing is only a small part of the overall ET&BF industry. As a result, it only contributes a relatively small component to the economic activity of commercial fishing vessels in terms estimated sales and costs incurred by commercial fishing operators.

Scope for introducing alternative striped marlin fisheries management practices

Since recreational anglers place a much higher net value on an additional striped marlin than commercial fishers, there are:

- net costs to the community from continuing current striped marlin fisheries management practices; and
- potential net benefits to the community from introducing alternative striped marlin fisheries management arrangements that seek to reallocate some of the striped marlin catch from commercial to recreational uses.

This report examines the potential economic impact of four alternative striped marlin fisheries management arrangements:

- a continuation of the current striped marlin fisheries management arrangements;
- a ban on striped marlin fishing off the NSW coastline;
- a ban on commercial fishing for striped marlin within 50 nautical miles of the NSW coastline; and
- a ban on commercial longline fishing within 50 nautical miles of the NSW coastline.

In particular, it examines the potential economic impact that those alternative management arrangements would have on:

- commercial and recreational anglers, and the community as a whole; and
- the NSW economy and regional economies.

Net costs to the community from continuing current striped marlin fisheries management practices

At first sight, given the considerable uncertainty currently surrounding the total supply of striped marlin off the NSW coastline, it might appear that the best course of action would be to continue current striped marlin fisheries management arrangements until a more accurate assessment can be made of the stocks off the NSW coastline.

On closer inspection, however, it is apparent that such an approach potentially:

- imposes an annual net cost on the community as a whole, since the net benefit of a kilogram of striped marlin to recreational anglers (\$12.90 to \$28.13 per kg) is significantly higher than it is to commercial fishers (\$2.46 to \$4.68 per kg). As a result, the community is not deriving as great a net benefit from the current striped marlin catch as it would if a greater proportion of the catch was allocated to recreational anglers. This means that every kilogram of striped marlin caught by

commercial anglers generates a net loss to the community equal to the additional net benefit that would have been generated had that striped marlin been caught by a recreational angler (i.e. \$10.44 to \$23.45 per kg). That is, there is an opportunity cost to the community of approximately \$2.2m to \$4.9m per annum associated with continuing current striped marlin management arrangements;

- threatens the sustainability of the striped marlin fishery in the medium to long term for both commercial and recreational anglers. Over 36 percent of recreational anglers and 23 percent of charter boat operators surveyed indicated that they would give up gamefishing offshore completely if the stocks of striped marlin off the NSW coastline fell to such a level that it was unlikely that they would catch a striped marlin. This would impose a net cost on the community between \$5.2m and \$11.2 million each year; and
- adversely affects those coastal regional economies of NSW that rely on commercial and recreational striped marlin fishing as an important source of income and employment (Hunter, Sydney, Illawarra and Southern NSW).

Potential net benefits to the community from implementing alternative fisheries management practices

In view of the net costs potentially arising from a continuation of the current striped marlin management arrangements, we have sought to estimate the net benefits that the community as a whole would derive from implementing a number of other striped marlin management arrangements including:

- a ban on striped marlin fishing off the NSW coastline;
- a ban on commercial fishing for striped marlin within 50 nautical miles of the NSW coastline; and
- a ban on commercial longline fishing within 50 nautical miles of the NSW coastline.

Net community benefit from a ban on commercial fishing for striped marlin off the NSW coastline

If a ban was imposed and enforced on commercial fishing for striped marlin off the NSW coastline and all of the striped marlin caught and released alive by commercial operators were caught in the same year by recreational anglers, the potential net benefit to the community would have been:

- \$2.03 million to \$6.43 million in 2000-01;
- \$1.93 million to \$6.25 million in 2001-02; and
- \$1.43 million to \$4.58 million in 2002-03.

In practice, however, the actual magnitude of the net benefit (or net cost) to the community arising from the imposition of a ban on commercial striped marlin fishing off the NSW coastline will depend on the extent to which that ban increases the number of striped marlin actually caught by recreational anglers for a given effort and increases the number of recreational anglers fishing for striped marlin.

Each kilogram of striped marlin released by commercial operators would cost them a maximum of \$6 based on the weighted average price received by commercial operators for a kilogram of striped marlin in 2002-03, whereas each additional kilogram of striped marlin caught by recreational anglers

would produce a net benefit of:

- \$12.90 if all of the costs they incur have to increase in order to catch those marlin (i.e. when recreational anglers have no excess capacity to catch additional striped marlin); or
- \$28.13 per kilogram if they only have to increase operating costs in order to catch those additional striped marlin (i.e. when recreational anglers have excess capacity to catch additional striped marlin).

That is, each kilogram of striped marlin reallocated to recreational anglers would generate a net benefit to the community of \$6.90 to \$22.13.

This means that the imposition of a ban on commercial fishing for striped marlin within 50 miles of the NSW coastline would have to increase the recreational catch of striped marlin by around 4.9 percent to 15.6 percent in order to recover the net cost incurred by commercial striped marlin fishers.

The magnitude of the actual net benefit will depend on the extent to which recreational catches of striped marlin increase exceeds that 'break even' level. The higher the resulting growth in striped marlin captured by recreational anglers, the higher the net benefit to the community.

Net community benefit from a ban on commercial fishing for striped marlin within 50 nautical miles of the NSW coastline

Since, most recreational anglers fish for striped marlin within 50 nautical miles of the NSW coastline (over 95 per cent) and a large proportion of the commercial catch of striped marlin is caught inside that 50 mile limit (71% in 2001, 61% in 2002, and 52% in 2003), there is significant scope to reduce direct competition between the commercial and recreational striped marlin anglers by banning commercial fishing for striped marlin within 50 nautical miles of the NSW coastline.

If a ban was imposed and enforced on commercial fishing for striped marlin within 50 nautical miles of the NSW coastline and all of the striped marlin caught and released alive by commercial operators within the 50 mile limit were caught in the same year by recreational anglers, the potential net benefit to the community would have been:

- \$0.68 million to \$2.89 million in 2000-01;
- \$0.54 million to \$2.41 million in 2001-02; and
- \$0.34 million to \$1.51 million in 2002-03.

Once again, the magnitude of the actual net benefit (or net cost) to the community arising from the imposition of a ban on commercial striped marlin fishing within the 50 mile limit will depend on the extent to which that ban increases the number of striped marlin actually caught by recreational anglers for a given effort and increases the number of recreational anglers fishing for striped marlin.

Each kilogram of striped marlin reallocated to recreational anglers would generate a net benefit to the community of \$6.90 to \$22.13.

This means that the imposition of a ban on commercial fishing for striped marlin within 50 miles of the NSW coastline would have to increase the recreational catch of striped marlin by around 2.5 percent to 8.1 percent in order to recover the costs incurred by commercial operators each year. Once again, the magnitude of the actual net benefit will depend on the extent to which recreational catches of striped marlin increase exceeds that 'break even' level.

Net community benefit from a ban on commercial longline fishing within 50 nautical miles of the NSW coastline

In view of the difficulties associated with enforcing a ban on commercial striped marlin fishing within 50 nautical miles of the NSW coastline, an alternative approach would be to ban all commercial longline fishing within the 50 nautical mile limit.

Like a ban on commercial fishing for striped marlin within 50 nautical miles of the NSW coastline, banning commercial longline fishing within that 50 nautical mile limit also has the potential to increase the number of striped marlin caught by recreational anglers. Indeed, it has the potential to produce an even greater increase in the supply of striped marlin to recreational anglers since such a ban would not result in the death of striped marlin following their capture and release by commercial operators within the 50 nautical mile limit.

In addition, banning commercial longline fishing within 50 nautical miles of the NSW coastline also has the potential to increase the recreational catch of tuna and swordfish. This means that, in order to estimate the net benefit the community would derive from such a ban, it is necessary to have information not only on the net benefit recreational anglers would derive from catching additional striped marlin, but also the net benefit they would derive from catching additional tuna and swordfish.

In the absence of detailed information on the net value that recreational anglers place on yellowfin tuna, bigeye tuna, albacore, broadbill swordfish, and southern bluefin tuna, we have assumed for the purposes of evaluating this option that recreational anglers would derive the same net benefit from catching tuna and swordfish as commercial fishers. That is, it is assumed that there is no net gain or loss to the community associated with reallocating a proportion of the commercial longline tuna and swordfish catch to recreational anglers.

Under this assumption, it is estimated that if all of the striped marlin, tuna and swordfish that would otherwise have been caught by commercial longline operators within 50 nautical miles of the NSW coastline were caught in the same year by recreational anglers, the imposition of such a ban on commercial longline fishing within 50 nautical miles of the NSW coastline would result in a net benefit to the community of:

- \$1.99 million to \$5.1 million in 2000-01;
- \$1.62 million to \$4.25 million in 2001-02; and
- \$1.09 million to \$2.73 million in 2002-03.

In practice, the actual magnitude of the net benefit (or net cost) to the community arising from the imposition of a ban on commercial longline fishing within the 50 mile limit will depend on the extent to which:

- the ban increases the number of striped marlin, tuna and swordfish actually caught by recreational anglers for a given effort and increases the number of recreational anglers fishing for those species. For example, since each kilogram of striped marlin reallocated to recreational anglers would generate a net benefit to the community of \$6.90 to \$22.13, the recreational striped marlin catch would have to increase by around 2.5 percent to 8.1 percent in order to offset the net benefits that commercial longline operators would otherwise have derived from catching striped marlin within 50 nautical miles of the NSW coastline. If the ban produced an even greater increase in the recreational catch of striped marlin, the increased net benefits to recreational anglers would help offset the net benefits commercial longline operators would forgo as a result

of not being able to fish for tuna and swordfish within 50 nautical miles of the NSW coastline;
and

- the net benefits recreational anglers derive from catching tuna and swordfish are greater than, or less than, the net benefits that commercial longline operators derive from catching those fish. It is estimated that commercial longline operators derive an average net benefit of around \$14.96 per kilogram of tuna and swordfish. This means that if recreational anglers derived a net benefit of say \$20 per kg from catching tuna and swordfish, in 2002-03 they would have had to catch at least 39 per cent of the tuna and swordfish that would otherwise have been caught by commercial longline operators in order to offset the net benefits that commercial longline operators would otherwise have derived from catching tuna and swordfish within 50 nautical miles of the NSW coastline. By contrast, if the net benefit recreational anglers derive from catching tuna and swordfish is less than that derived by commercial longline operators, they would have to catch a much higher proportion of the tuna and swordfish that would otherwise have been caught by those commercial longline operators in order to offset the net benefit commercial longline operators would have derived from that catch. For example, if the net benefit recreational anglers derive from catching tuna and swordfish is say \$10 per kilogram on average, then in 2002-03 recreational anglers would have had to catch around 79 per cent of the tuna and swordfish that would otherwise have been caught by commercial longline operators.

Impact of alternative striped marlin management arrangements on the NSW economy and regional economies

Any alternative striped marlin fishery management arrangements that reallocate a significant proportion of the total catch from commercial fishers to recreational anglers inevitably will reduce the level of economic activity in the commercial fishing sector of the NSW economy and regional economies, primarily in the Illawarra region, followed by Southern region, the Northern and Mid Northern regions and the Sydney and Hunter regions.

At the same time, however, this would be offset by the expansionary effect of an increase in recreational striped marlin fishing activity.

In theory, implementation of a ban or partial ban on commercial fishing for striped marlin off the NSW coastline has the potential to:

- increase the probability of recreational anglers catching a striped marlin to some extent;
- reduce the costs of catching striped marlin; and
- expand recreational demand for striped marlin by reducing the search costs associated with finding marlin, thereby increasing regional expenditure on striped marlin fishing trips, boats, fishing gear, travel and accommodation.

That is, it has the potential to expand economic activity in the recreational fishing sector of the economy. However, it is difficult to determine the nature and extent of that expansion, since it depends on the magnitude of the reduction in costs of catching striped marlin and the magnitude of the resultant expansion in recreational fishing activity and regional expenditure.

This makes it difficult to assess the net impact that banning commercial fishing for striped marlin will have on both the overall level of economic activity in the NSW economy and coastal regional economies without making certain assumptions regarding the extent to which such a ban will increase the level of recreational fishing and expenditure.

For this reason, this report focuses primarily on estimating:

- the impact that a reduction in commercial striped marlin fishing would have on the NSW economy and regional economies; and
- the percentage increase in value added by the recreational fishing sector that would be required in order to offset the estimated decrease in value added by the commercial fishing sector.

In particular, it is estimated that:

- a ban on commercial fishing for striped marlin off the NSW coastline would reduce the value added by the commercial striped marlin fishing sector of the economy by \$4.5 million. This would be offset if such a ban increased the value added by the recreational striped marlin fishing sector by at least 9.5 percent;
- a ban on commercial fishing for striped marlin within 50 nautical miles of the NSW coastline would reduce the value added by the commercial striped marlin fishing sector of the economy by \$3.5 million. This would be offset if such a ban increased the value added by the recreational striped marlin sector by at least 7.7 percent; and
- a ban on commercial longline fishing within 50 nautical miles of the NSW coastline would reduce the value added by the commercial striped marlin fishing sector of the economy by \$69.8 million. This would require an expansion in the value added by the recreational striped marlin sector by more than 154 percent to offset.

It is important to note, however, that the decision as to whether or not to implement such bans should not be made on the basis of whether those bans would produce an overall increase in the level of economic activity in the NSW economy or regional coastal economies. Rather, such a decision should be based on an assessment of the extent to which such bans could be expected to produce an overall net benefit for the community as a whole. This involves an evaluation of the extent to which the reduction in the producer surplus of commercial operators is expected to be more than offset by an increase in the consumer and producer surplus of recreational anglers.

Methodology

This study uses two main analytical methods to address the key issues outlined above:

- cost-benefit analysis, which is used to determine:
 - whether the current striped marlin catch is allocated efficiently between the commercial and recreational fishing sectors of the economy (i.e. allocated in a manner that produces the greatest net benefits for the community as a whole). This involves determining the economic value of striped marlin to commercial and recreational anglers under current fisheries management practices (i.e. the net economic benefit that commercial and recreational anglers currently derive from striped marlin); and
 - the extent to which alternative striped marlin fisheries management practices, such as the imposition of restrictions on commercial fishing for NSW striped marlin, would increase economic efficiency. This involves estimating the extent to which the economic gains to recreational anglers from the imposition of constraints on commercial fishing for NSW striped marlin would be sufficient to offset the economic losses incurred by commercial fishers; and

- economic input-output analysis, which is used to determine:
 - the significance of both commercial and recreational striped marlin fishing to the NSW economy and coastal economies, under current striped marlin fisheries management practices; and
 - the impact that alternative striped marlin fisheries management practices, such as restrictions on commercial fishing for striped marlin, would have on the NSW economy and regional economies.

The report uses data from a number of sources:

- commercial striped marlin fishing data were obtained from:
 - the Australian Fisheries Management Authority (AFMA), which provided logbook catch data for the ET&BF fishery as well as data on the number and regional location of licensed operators; and
 - the Australian Bureau of Resource Economics' (ABARE) Australian Fisheries Surveys Report 2002, which provides data on the revenues and costs of longline operations in the ET&BF fishery;
- data on exports of striped marlin from NSW were obtained from the Australian Quarantine and Inspection Service (AQIS); and
- recreational striped marlin fishing data were obtained from:
 - the *National Recreational and Indigenous Fishing Survey*, which provided information on the number of trips made off the NSW coastline by recreational anglers;
 - NSW Fisheries data obtained from its *Gamefish Tournament Monitoring Program*, catch data supplied by charter boat operators, and data on the number of licensed recreational anglers;
 - Ernst & Young's *NSW Striped Marlin Recreational Fishing Survey* which obtained catch and expenditure data from recreational anglers who went fishing for striped marlin off the NSW coastline over the survey period (1 May 2002 to 30 April 2003); and
 - Ernst & Young's *NSW Striped Marlin Charter Boat Fishing Survey* which obtained revenue and cost data from charter boat operators who took anglers fishing for striped marlin off the NSW coastline over the survey period (1 May 2002 to 30 April 2003).

1. Introduction

1.1 Background

Striped marlin (*Tetrapturus audax*) is a species of billfish widely distributed in tropical, subtropical and temperate waters of the Indian and Pacific Oceans that is popular with both:

- commercial fishers, who consider striped marlin to be an increasingly valuable by-catch of the eastern tuna and billfish (ET&BF) fishery; and
- recreational anglers, who consider striped marlin to be a highly prized gamefish renowned for its spectacular fighting characteristics.

Over the last decade, however, significant increases in both the number of fishers and the size of the catch of striped marlin off the NSW coastline have raised concerns about the long-term viability of this valuable resource.

NSW Fisheries has the difficult task of managing these competing commercial and recreational demands for striped marlin. It is responsible not only for the regulation of recreational fishing for striped marlin off the NSW coastline, but also for commercial striped marlin fishing within the 3 mile limit. Management of the striped marlin commercial fishery outside the 3 mile State limit is the responsibility of the Commonwealth Government.

1.2 Objectives of the Study

Ernst & Young's economic analysis group, *EYEcon*, in conjunction with the Centre for Agricultural and Regional Economics (CARE), was commissioned by NSW Fisheries to conduct a detailed study of the economic impact that commercial and recreational striped marlin fishing are having on the NSW economy and regional economies.

The primary objective of this study is to provide NSW Fisheries with information to help it manage these competing commercial and recreational demands for striped marlin.

In particular, as outlined in the Terms of Reference for the project, which are set out in Annex 1, the study is intended to provide information on, and analyse:

- the NSW commercial and recreational striped marlin fisheries and their management;
- the economic value of the NSW striped marlin catch to the commercial and recreational fishing sectors, under current management arrangements;
- the economic impact¹ of the striped marlin fisheries on the NSW economy and regional economies, under current management arrangements; and
- the economic impact of alternative management arrangements for the striped marlin fishery in NSW, including banning or modifying the commercial fishery for this species, with particular regard to regional communities and recreational fishing.

¹ For the purposes of this report, the term 'economic impact' is used to refer to both economic and social impacts (e.g. impact on regional employment).

1.3 Report Structure

The remainder of this report is structured into 6 main sections:

- **Section 2, Key Issues and Methodology**, briefly outlines the key issues governments need to resolve in order to manage striped marlin resources more efficiently and equitably and provides an overview of the methodology we have used to analyse those key issues. More detailed information on that methodology and the results of our analysis is provided in the following sections.
- **Section 3, Supply of Striped Marlin off the NSW Coast**, outlines the considerable uncertainty currently surrounding the supply of striped marlin off the NSW coastline.
- **Section 4, Commercial Demand for Striped Marlin**, provides information on the commercial fleet operating in the Eastern Tuna and Billfish (ET&BF) fishery, including Australian Fisheries Management Authority (AFMA) data on commercial catches of striped marlin off the NSW coastline.
- **Section 5, Recreational Demand for Striped Marlin**, provides information on the recreational fleet operating off the NSW coastline, including:
 - NSW Fisheries data on the number of licensed anglers in NSW;
 - *National Recreational and Indigenous Fishing Survey* data on participation of anglers in offshore fishing in NSW;
 - NSW Fisheries *Gamefish Tournament Monitoring Program* data on numbers of catch composition and proportion of offshore anglers involved in fishing for billfish;
 - Gamefishing Association of Australia and Australian National Sportfishing Association of Australia data on NSW club membership; and
 - *NSW Striped Marlin Recreational Fishing Survey* and *NSW Striped Marlin Charter Boat Fishing Survey* data compiled by Ernst & Young, which includes information on recreational angler demographics (age, gender, income, location), fishing preferences, billfish catch composition and striped marlin catch.
- **Section 6, Economic Value and Significance of NSW Striped Marlin Fishing**, estimates the:
 - economic value of NSW's striped marlin catch to both commercial and recreational fishers; and
 - economic impact that fishing for striped marlin off the NSW coastline has on the NSW economy and regional coastal economies, under current management arrangements.
- **Section 7, Economic Impact of Alternative Striped Marlin Management Arrangements**, examines the impact of alternative striped marlin fisheries management arrangements on commercial and recreational anglers, the overall community, the NSW economy and regional coastal economies. The four alternative management scenarios considered are:
 - a continuation of current striped marlin fisheries management arrangements;
 - a ban of commercial fishing for striped marlin off the NSW coastline;
 - a ban on commercial fishing for striped marlin within 50 nautical miles of the NSW coastline; and
 - a ban on commercial longline fishing within 50 nautical miles of the NSW coastline.

2. Key Issues and Methodology

2.1 Key Issues

In order to manage the striped marlin resource efficiently and equitably, governments have to resolve two main issues:

- **What is the maximum sustainable (i.e. ‘optimal’) level of catch for striped marlin?;** and
- **How should that catch be allocated between alternative commercial and recreational uses?**

The main focus of this study is on the second of these key issues – How should the NSW striped marlin catch be allocated between commercial and recreational fishers?

In particular, this study is intended to provide NSW Fisheries with the information it needs to address the following key issues:

- **How is the NSW striped marlin catch currently allocated to the commercial and recreational fishing sectors of the economy?** This issue is addressed in sections 3, 4 and 5 of this report:
 - Section 3 outlines information on the **supply of striped marlin** off the NSW coastline; and
 - Sections 4 and 5 respectively outline information on **commercial and recreational demand for striped marlin** (i.e. the manner in which the catch is allocated currently to the commercial and recreational sectors of the economy).
- **What is the economic value and significance of striped marlin fishing to NSW?** These issues are addressed in section 6 of the report:
 - Section 6.1 looks at the **economic value** of striped marlin to the commercial and recreational fishing sectors of the economy. This information is central to determining whether the striped marlin catch is currently allocated efficiently between the commercial and recreational sectors of the economy; and
 - Section 6.2 looks at the **economic significance** of commercial and recreational fishing to the NSW economy and regional coastal economies.
- **What would be the economic impact of introducing alternative striped marlin fisheries management arrangements on the commercial and recreational anglers, the NSW economy and regional economies?** This issue is addressed in section 7:
 - Section 7.1 considers the impact of alternative striped marlin fisheries management arrangements on the commercial and recreational anglers and the community as a whole. The key issue here is whether the introduction of restrictions on commercial fishing for striped marlin off the NSW coastline would increase economic efficiency. That is, would the gains experienced by the recreational anglers be more than sufficient to offset any losses experienced by the commercial fishers?
 - Section 7.2 of the report considers the economic impact of alternative striped marlin fisheries management arrangements on output, value added, income and employment in the NSW economy and regional economies along the NSW coastline.

2.2 Methodology

This study uses two main analytical methods to address the key issues outlined above:

- cost-benefit analysis; and
- economic input-output analysis.

2.2.1 Cost-benefit analysis

Cost-benefit analysis is used in this study to determine:

- **whether the current striped marlin catch is efficiently allocated between the commercial and recreational fishing sectors of the economy.** As outlined below, this involves determining the economic value of striped marlin to commercial and recreational anglers under current fisheries management practices (i.e. the net economic benefit that commercial and recreational anglers currently derive from striped marlin); and
- **the extent to which alternative striped marlin fisheries management practices, such as the imposition of restrictions on commercial fishing for NSW striped marlin, would increase economic efficiency.** This involves estimating the extent to which the economic gains to recreational anglers from the imposition of constraints on commercial fishing for NSW striped marlin would be sufficient to offset the economic losses incurred by commercial fishers.

Is the striped marlin catch allocated efficiently?

Is NSW's striped marlin catch efficiently allocated at the moment between the commercial and recreational fishing sectors of the economy, or is there is scope to increase economic efficiency by reallocating that catch between these two groups?

In order to answer this key question, information is required on the respective economic values that commercial and recreational anglers attach to an additional striped marlin. In general, if commercial and recreational fishers place different values on the capture of an additional striped marlin, then there is scope, in theory, to increase economic efficiency by reallocating the striped marlin catch between these two groups².

For example, if commercial fishers place a higher value on additional striped marlin than recreational anglers, there is scope to increase economic efficiency by reallocating some striped marlin away from recreational anglers to commercial fishers. This is because the resultant gain to commercial fishers would be more than sufficient to offset any losses to recreational anglers. That is, there would be a net gain to the community as a whole since commercial anglers could afford to compensate recreational anglers for their losses and still be better off.

Alternatively, if recreational anglers place a higher value on additional striped marlin than commercial fishers, there is scope to improve economic efficiency by reallocating some of the striped marlin catch away from commercial fishers to recreational anglers. Once again, such a reallocation has the potential to increase the net benefits the community derives from NSW striped marlin catch, since the gains to recreational anglers would be more than sufficient to offset any losses to commercial fishers.

² Section 7 considers the extent to which it is possible, in practice, to achieve such a reallocation of striped marlin between commercial and recreational uses.

In either case, this process of reallocating striped marlin should continue until the value that commercial and recreational fishers place on an additional striped marlin is the same. Once this point is reached, the allocation of the catch between commercial and recreational uses is optimal.

What is the economic value of NSW striped marlin to commercial fishers?

What value do commercial fishers place on the striped marlin they catch off the NSW coastline?

Although all marlin, including striped marlin, are protected from commercial fishing by the *Fisheries Management Act 1994*³, commercial fishers:

- are permitted to keep and sell their striped marlin by-catch; and
- have some degree of control over the amount of that by-catch (e.g. by setting longlines at shallower depths to increase the probability of catching striped marlin) and, as noted in the Bureau of Rural Sciences report on *Striped marlin: biology and fisheries*, ‘...there is little doubt that the species is deliberately targeted by some fleets in some time area strata’.

The **gross value of NSW striped marlin to commercial fishers** is equal to what they can sell it for to fish processors and wholesalers. This depends, in turn, on what fish processors and wholesalers are prepared to pay for those fish, which is determined, in turn, by the amount that fish retailers, and ultimately fish consumers, are prepared to pay for those fish.

In practice, fish processors and wholesalers will not be prepared to pay any more for striped marlin caught off the NSW coastline, or anywhere else in Australia, than the cost of obtaining similar quality fish from overseas.

Similarly, commercial fishers will not be willing to supply striped marlin on the domestic market for prices less than what they could obtain for their catch on world markets, less the costs of transport and insurance.

In addition, since the total quantity of striped marlin caught and consumed in Australia represents only a very small proportion of the total volume of striped marlin traded in world markets, it is reasonable to assume that any changes in the domestic supply and demand for striped marlin will not affect prevailing world prices for striped marlin.

Overall, this means that it is reasonable to assume that the prices prevailing in Australian markets for striped marlin caught in NSW and other Australian States will be determined primarily by the prices prevailing in world markets, expressed in Australian dollars, less the costs of freight and insurance. That is, commercial fishers, fish processors, wholesalers and retailers are all price takers. They have little option other than to accept the prevailing market prices for striped marlin in Australia, which are set by prevailing world prices for striped marlin.

This situation is illustrated in Figure 1, which indicates that there is unlimited aggregate demand (i.e. the sum of domestic demand plus export demand) for NSW striped marlin at the prevailing market price, which is determined by the prevailing world price for striped marlin. That is, it is assumed that there are numerous perfect substitutes in consumption for striped marlin (e.g. swordfish and other fish species). In practice, however, the actual elasticity of demand for striped marlin may be less than perfectly elastic if consumers do not consider other fish species are perfectly substitutable. The actual elasticity of demand by Australian consumers for striped marlin is an issue that warrants further investigation.

³ See section 4.2.2 for a discussion of these regulations.

Under these assumptions, the gross value to commercial fishers of each kilogram of striped marlin caught off the NSW coastline will be equal to its prevailing domestic market price (i.e. P), which will be determined by the price paid for striped marlin on world markets (less the costs of freight and insurance). As a result, the total gross value of NSW striped marlin to commercial fishers can be estimated by multiplying the domestic market price for a kilogram of striped marlin by the total weight of striped marlin they catch off the NSW coastline (i.e. $P \times Q$, which is equal to the area OPAQ).

As discussed further in section 6.1.1, however, it is possible that the quality of NSW striped marlin sold on export markets may be consistently higher than the quality traded on domestic markets, due to the practice of fish processors only selecting the highest grade fish for export. This means that the prices received for striped marlin on export markets may exceed the prices received for striped marlin sold on the domestic market. As a result, this report estimates the gross value of striped marlin caught by commercial fishers off the NSW coastline using a weighted average of NSW striped marlin sold on:

- domestic markets. The gross value of NSW striped marlin sold on domestic markets has been determined using the prices paid for striped marlin on the Sydney fish market; and
- export markets. This gross value of exported NSW striped marlin has been estimated using AQIS data on NSW striped marlin exports and Japanese import price data (the main market for Australian striped marlin).

In order to supply striped marlin, however, commercial fishers have to incur significant costs. Commercial fishing for tuna and billfish involves significant capital costs (e.g. suitable boats, longline gear, satellite navigation equipment etc) and operating costs (e.g. fuel, labour, bait, ice etc).

As a result, estimates of the gross value of NSW striped marlin will tend to overstate the actual value of those fish to commercial fishers.

A more accurate and useful estimate of the actual value of NSW striped marlin to commercial fishers is the net value of that catch.

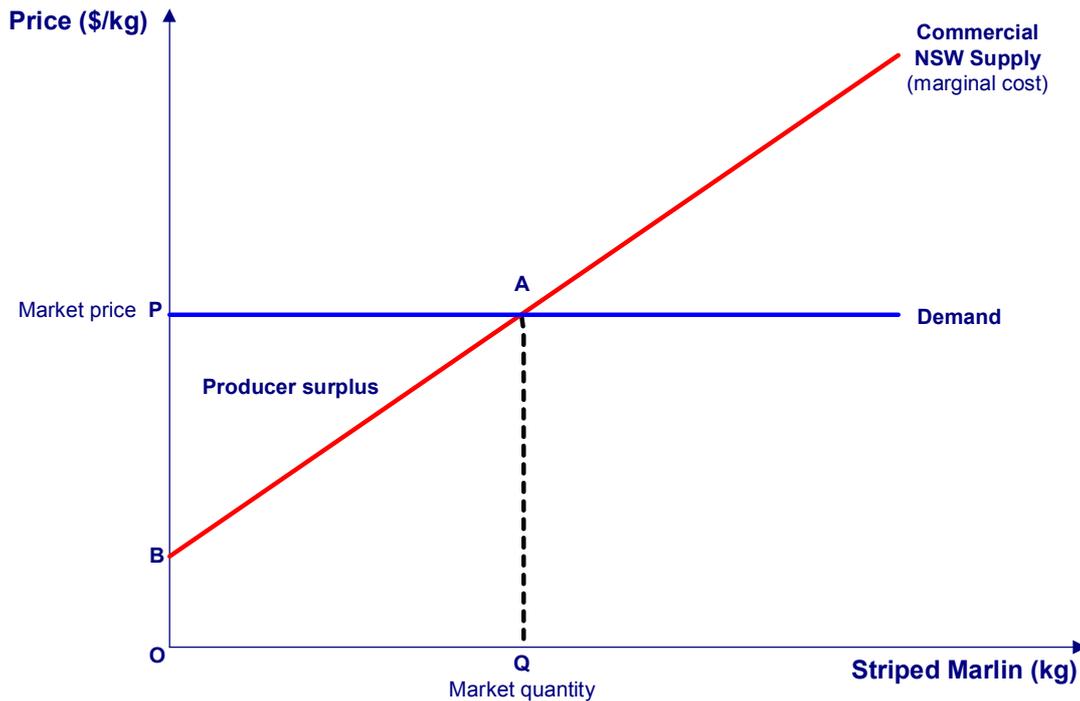
The **net value of striped marlin to commercial fishers** is equal to the revenue raised from the sale of those fish (i.e. as illustrated in Figure 1 by the area OPAQ under the aggregate demand function for striped marlin, which indicates that each additional kilogram of fish can be sold at the prevailing market price P) less the costs associated with catching those fish (as illustrated in Figure 1 by the area OBAQ under the domestic supply function). This net value is illustrated in Figure 1 by the area PAB, which is the 'producer surplus' that commercial fishers derive from catching striped marlin off the NSW coastline.

The actual position and shape of the supply function will depend on a range of factors including:

- the production technologies used to locate and catch striped marlin. Over time, the emergence of new fishing technologies such as satellite water temperature charts and GPS positioning systems will have tended to reduce the time taken to locate striped marlin and make the supply of striped marlin more responsive to changes in its price; and
- the availability of close substitutes or complements in production. Up to a certain level, commercial catches are an unavoidable by-catch of the tuna fishery. That is, striped marlin are by-products of tuna fishing, which means that tuna and striped marlin are 'complements' in production. However, as noted by Bromhead (2003), there is little doubt that some fleets are deliberately targeting the species. Commercial fishers are able to increase the proportion of striped marlin they catch through the use of longlines with shallower set hooks. In addition, they also have the option of discarding striped marlin for higher value tuna if they so desire. In particular, commercial fishers will not be willing to supply an additional marlin unless the price they receive for that marlin is sufficient to cover the additional marginal cost of catching that

striped marlin, which tends to increase as the quantity of marlin caught increases. As a result, it is reasonable to expect that the commercial supply of striped marlin will increase as the price of striped marlin rises in relation to the prices of species such as tuna.

Figure 1: Commercial demand and supply of NSW striped marlin



As discussed further in section 6.1.1 of the report, we have estimated the net value of NSW striped marlin to commercial fishers by:

- calculating the gross value of the striped marlin that commercial fishers caught off the NSW coastline in the manner briefly outlined above; and
- deducting the estimated cost of catching that marlin, which is estimated using ABARE data on average boat costs and AFMA data on the number of boats operating off the NSW coastline.

The **net value of an additional kilogram of striped marlin to commercial fishers** is equal to the additional revenue obtained from the sale of that fish (i.e. as illustrated in Figure 1 by the aggregate demand function, which indicates that each additional kilogram of fish can be sold at the prevailing market price) less the marginal cost associated with catching that additional kilogram of striped marlin (as illustrated in Figure 1 by the supply function, which indicates the additional cost of catching an additional kilogram of striped marlin).

As discussed further in section 6.1.1 of the report, we have estimated the net value of an additional kilogram of NSW striped marlin to commercial fishers by dividing the estimated net value of striped marlin caught by commercial operators off the NSW coastline by the total weight of those striped marlin, expressed in kilograms.

What is the economic value of NSW striped marlin to recreational anglers?

What value do recreational anglers place on the striped marlin they catch off the NSW coastline?

Recreational anglers are both consumers and producers of 'caught' striped marlin. As a result, the **gross value of NSW striped marlin to recreational anglers** is equal to the sum of the gross value of benefits that recreational anglers derive from:

- **consuming striped marlin.** Unlike commercial fishers, who seek marlin primarily for monetary gain, fishing regulations prevent recreational anglers from selling striped marlin. As a result, recreational anglers seek to catch striped marlin in order to enjoy a range of non-monetary benefits including;
 - the challenge of catching striped marlin;
 - the satisfaction of scoring points in a gamefishing competition;
 - the satisfaction of tagging and releasing a fish to increase scientific knowledge of the species; and
 - the enjoyment of consuming fish they have caught themselves or giving away their catch to friends;
- **producing striped marlin.** Like commercial fishers, all recreational anglers are engaged in the process of producing (i.e. catching) striped marlin to varying degrees. At one end of the spectrum there are those anglers who have purchased their own boats and fishing gear and use their own expertise to locate striped marlin. At the other end of the spectrum, there are those anglers who choose to hire, rather purchase, most of the necessary equipment. Even those anglers, however, are engaged in the production process in that they are prepared to pay to work, in effect, as a crew member involved in catching striped marlin.

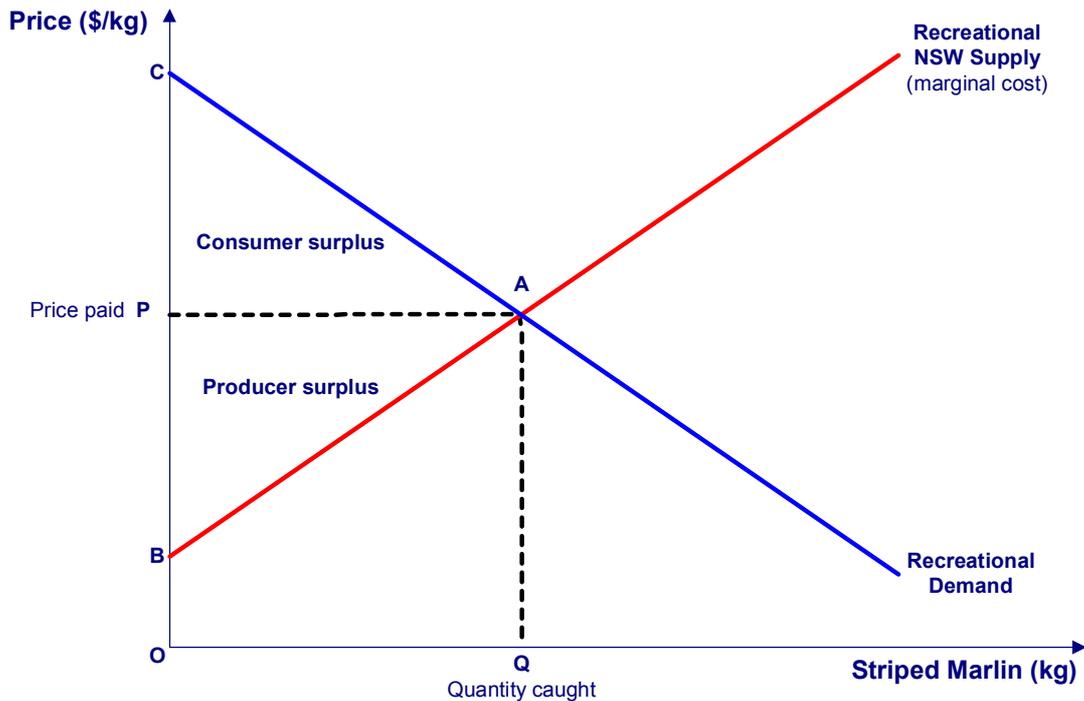
The gross value that recreational anglers derive from consuming an additional NSW striped marlin is equal to the amount they would be willing to pay to catch that striped marlin. This is illustrated in Figure 2 by the demand function, which indicates the willingness of recreational anglers to pay to consume increasing amounts of striped marlin.

The precise position and shape of that function will depend on a number of factors including:

- angler preferences; and
- the availability of substitutes (e.g. other billfish and tuna).

The total gross value of NSW striped marlin to recreational anglers is equal to what they are willing to pay for the quantity they currently catch (Q), which is illustrated by the area OCAQ in Figure 2.

Figure 2: Recreational demand and supply of NSW striped marlin



As discussed further in section 6.1.2, we have estimated the gross value that recreational anglers derive from the ‘consumption’ of NSW striped marlin by estimating:

- **the gross value of striped marlin fishing to NSW charter boat operators** using NSW Fisheries charter boat data and data obtained from the *NSW Striped Marlin Charter Fishing Survey* conducted by Ernst & Young for NSW Fisheries; and
- **the gross value of striped marlin to recreational anglers who own their own boats, or share the use of friend’s boats**, using data obtained from NSW Fisheries *Gamefish Tournament Monitoring Program* and the NSW Striped Marlin Recreational Fishing Survey which was conducted by Ernst & Young for NSW Fisheries.

Like commercial fishers, however, recreational anglers also have to incur significant costs in order to catch striped marlin. Striped marlin fishing is an expensive sport requiring significant inputs of capital equipment (e.g. boats equipped for the rigors of gamefishing offshore, gamefishing rods and reels etc) and significant operating costs (e.g. fuel). As a result, the gross value of the entire recreational striped marlin catch to recreational anglers will overstate its actual value in view of the significant costs that have to be incurred to travel to and from and catch those striped marlin. Net values provide a more accurate estimate of the actual values of NSW striped marlin consumed and produced by recreational anglers.

The **net value of the recreational catch of NSW striped marlin to recreational anglers** is equal to the difference between what recreational anglers would be willing to pay to catch those fish and what they actually pay to catch those fish.

This is illustrated in Figure 2 by the area ABC, which is made up of:

- the **consumer surplus** derived by recreational anglers, which is depicted in Figure 2 by the area PAC. This is equal to the gross value of striped marlin to recreational anglers (area OCAQ) less the costs those anglers would have to incur if they were to charter a boat and fishing gear (area OPAQ); and
- the **producer surplus** derived by recreational anglers, which is depicted in Figure 2 by the area PAB. This is equal to any net profits that recreational anglers derive from supplying their own boats and fishing gear plus any net profits derived by the charter boat sector from taking recreational anglers striped marlin fishing off the NSW coastline.

As discussed further in section 6.1.2, the approach used by this study to estimate the net value of NSW striped marlin to recreational anglers involves estimating the:

- **consumer surplus** derived by recreational anglers by assuming that the income-compensated price elasticity of demand for striped marlin is neither price elastic or inelastic (i.e. it is assumed that recreational angler demand for striped marlin is a linear function of price and has a ‘unitary’ arc elasticity of demand); and
- **producer surplus** derived by:
 - charter boat operators who take recreational anglers striped marlin fishing off the NSW coastline; and
 - recreational anglers who either use their own boats, or friends boats, to go fishing for striped marlin off the NSW coastline.

It is important to note that this approach provides a **conservative estimate** of the net value of striped marlin to recreational anglers since it assumes the income-compensated price elasticity of demand of recreational anglers for striped marlin is neither elastic nor inelastic (i.e. it is assumed that recreational angler demand for striped marlin is a linear function of price and had a ‘unitary’ arc elasticity of demand). Responses provided by respondents to the *NSW Striped Marlin Recreational Fishing Survey* suggest that recreational anglers do not consider other gamefish species to be close substitutes for striped marlin. The more inelastic the price elasticity of demand, the greater the consumer surplus associated with catching striped marlin.

In order to obtain a more accurate estimate of the net value of striped marlin to recreational anglers in the future, it is recommended that NSW Fisheries should:

- require recreational anglers to indicate on their fishing license application forms whether or not they intend fishing for striped marlin. This would provide NSW Fisheries with a much more accurate indication of the numbers, and geographic distribution, of those recreational anglers who are currently participating in striped marlin fishing, than can be obtained from the surveys of recreational anglers and charter boat operators conducted for the purposes of this study; and
- conduct a random survey of those recreational anglers who have indicated an intention to go striped marlin fishing to determine their price elasticity of demand for striped marlin fishing. At the moment, it is difficult to use random statistical sampling techniques to survey recreational striped marlin anglers, since those anglers comprise a relatively small proportion of the total number of recreational anglers and their identities are unknown. As a result, it would be necessary to survey a very large proportion of licensed recreational anglers in order to obtain sufficiently large number of responses from recreational striped marlin anglers. Once the identities of licensed recreational striped marlin anglers are known, however, much more accurate, random, statistical sampling techniques could be used. In particular, consideration

should be given to conducting a random sample of recreational striped marlin anglers to determine their willingness to pay to catch striped marlin.

What is the impact of alternative striped marlin fisheries management arrangements on commercial and recreational fishers?

What impact would the introduction of alternative striped marlin fisheries management arrangements have on commercial and recreational anglers? Would the net benefits recreational anglers derive from those restrictions be sufficient to offset any net losses incurred by commercial fishers?

Section 7 of this report estimates the impact of a number of alternative striped marlin fisheries management arrangements on commercial and recreational anglers and the community as a whole including:

- a continuation of the current striped marlin fisheries management arrangements;
- a ban on striped marlin fishing off the NSW coastline;
- a ban on commercial fishing for striped marlin within 50 nautical miles of the NSW coastline; and
- a ban on commercial longline fishing within 50 nautical miles of the NSW coastline.

A key issue here is the extent to which the introduction of such restrictions would:

- reduce the numbers of NSW striped marlin caught and killed by commercial fishers. As noted above, however, a certain proportion of the commercial NSW striped marlin catch is an unavoidable by-catch of tuna fishing and will continue to be caught regardless of any changes to striped marlin fisheries management arrangements; and
- increase the numbers of NSW striped marlin captured by recreational anglers. Not all of the striped marlin released alive will be recaptured by recreational anglers fishing off the NSW coastline. Rather, some of that catch will be:
 - caught at a later date by commercial fishers operating off the NSW coastline; or
 - caught by commercial and recreational anglers in other Australian States or countries, in view of the migratory nature of striped marlin.

As discussed further in section 7, the approach adopted in this study is to estimate:

- the quantity of striped marlin that is caught and not returned alive using AFMA data on the total catch and the mortality rate of released striped marlin; and
- the extent to which the recreational striped marlin catch would have to increase in order for the net benefits derived by recreational anglers to offset the net costs incurred by commercial fishers.

2.2.2 Input – output analysis

A multi-regional input-output model was used in this study to estimate both:

- the significance of both commercial and recreational striped marlin fishing to the NSW economy and coastal economies, under current striped marlin fisheries management practices; and
- the impact that alternative striped marlin fisheries management practices, such as restrictions on commercial fishing for striped marlin, would have on the NSW economy and regional economies.

Considerable care needs to be exercised when interpreting the results of that analysis.

The results of that input-output analysis **do not** provide an indication of either:

- the net benefits that NSW and its regional coastal economies derive from commercial and recreational fishing for striped marlin off the NSW coastline; or
- the net benefits of any changes to striped marlin fisheries management arrangements.

Rather, the results of that analysis are intended to provide an indication of:

- the economic impact that commercial and striped marlin fishing has, under current striped marlin fisheries management arrangements, on output, value added, income and employment in the NSW economy and regional economies on the NSW coastline. The results of this analysis are set out in section 6.2 of the report; and
- the economic impact that changes in striped marlin fisheries management arrangements would have on output, value added, income and employment in the NSW economy and regional coastal economies. The results of that analysis are set out in section 7 of the report.

2.2.3 Data sources

As discussed in more detail throughout the report, the data used in this report came from a number of sources:

- commercial striped marlin fishing data were obtained from:
 - the Australian Fisheries Management Authority (AFMA), which provided logbook catch data for the ET&BF fishery as well as data on the number and regional location of licensed operators; and
 - the Australian Bureau of Resource Economics' (ABARE) Australian Fisheries Surveys Report 2002, which provides data on the revenues and costs of longline operations in the ET&BF fishery;
- data on exports of striped marlin from NSW were obtained from the Australian Quarantine and Inspection Service (AQIS); and
- recreational striped marlin fishing data were obtained from:
 - the *National Recreational and Indigenous Fishing Survey*, which provided information on the number of trips made off the NSW coastline by recreational anglers;
 - NSW Fisheries data obtained from its *Gamefish Tournament Monitoring Program*, catch data supplied by charter boat operators, and data on the number of licensed recreational anglers;
 - Ernst & Young's *NSW Striped Marlin Recreational Fishing Survey* which obtained catch and expenditure data from recreational anglers who went fishing for striped marlin off the NSW coastline over the survey period (1 May 2002 to 30 April 2003); and
 - Ernst & Young's *NSW Striped Marlin Charter Boat Fishing Survey* which obtained revenue and cost data from charter boat operators who took anglers fishing for striped marlin off the NSW coastline over the survey period (1 May 2002 to 30 April 2003).

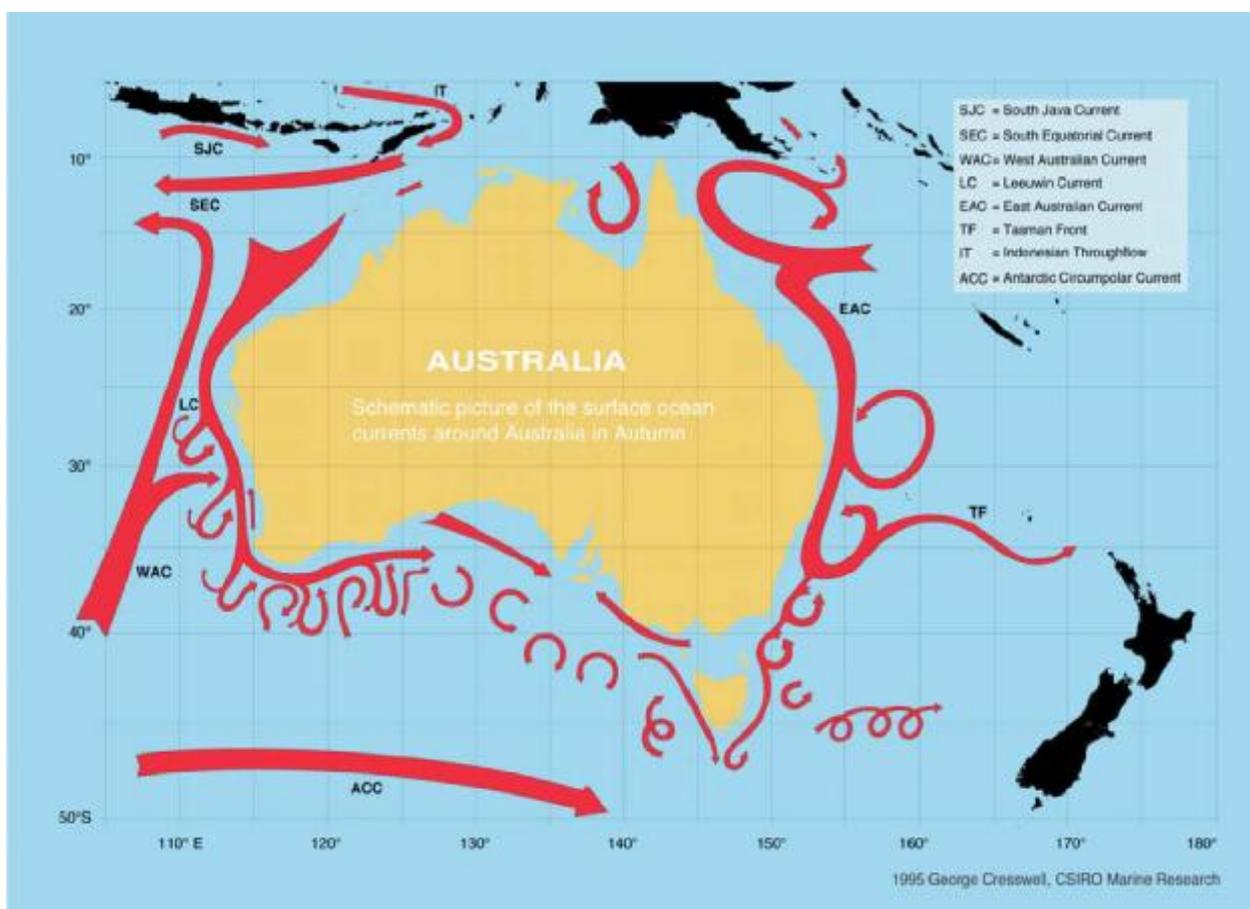
3. Supply of Striped Marlin off the NSW Coast

3.1 Striped marlin – a migratory species

Striped marlin, *Tetraoturus audax*, is a migratory species of billfish found throughout the Pacific and Indian oceans between about 45° N and 45° S.

The migratory patterns of striped marlin vary significantly both from year to year, and throughout the year, and appear to be influenced by oceanographic factors such as El Nino that affect water temperature and the currents off the Australian coastline, which are illustrated in Figure 3. As discussed further in section 4.5, this is confirmed by commercial striped marlin catch data, which is subject to significant seasonal variations.

Figure 3: Surface ocean currents off the Australian coastline



Source: AFMA

Research suggests that striped marlin tend to prefer:

- water with temperatures between 25° and 27°C and are not found in water with temperatures of less than 18°C; and
- depths of around 50 to 140 metres.

3.2 Uncertainty surrounding striped marlin stocks

In view of the migratory nature of striped marlin, considerable uncertainty surrounds the stock of striped marlin that can be found off the NSW coastline at any point in time.

As noted by Hinton and Bayliff (2002), the assessment of the stock structure of striped marlin in the Pacific ‘... has not been well determined, with essentially no further examination of hypotheses since Shomura (1980) stated:

The stock structure of the Pacific striped marlin is not clear. While many hypotheses may be advanced, considering the distributional patterns and other biological data, the two most likely hypotheses were:

1. *A single-unit stock in the Pacific*

The single unit stock hypothesis is supported by the continuous distribution of striped marlin in a horseshoe-pattern.

2. *A two-stock structure, where the stocks are separated roughly at the Equator into North Pacific and South Pacific stocks with some intermixing in the eastern Pacific.*

The two-stock hypothesis is supported by morphometric differences between adults from the north and south regions of the western Pacific (Kamimura and Honma 1958) and perhaps also in the eastern Pacific (Howard and Ueyanagi 1965). Honma and Kamimura (1958) noted that there is a zone of low longline catch rates along the Equator which suggests a separation of north and south stock at the Equator. Larval distribution suggests two centers of spawning, one in the north and one in the south, although gonad index data (Kume and Joseph 1969a) suggest that spawning occurs through the eastern tropical Pacific, the supposed region of stock mixing’.

AFMA’s *Draft Assessment Report – Eastern Tuna and Billfish Fishery* report, which was released in September 2003, notes that genetics studies and the distribution of longline catches suggest that striped marlin form several, semi-independent stocks in the Pacific, and that the striped marlin caught off eastern Australia probably form part of a wider south-western Pacific stock.

The Bureau of Rural Sciences has assessed striped marlin stocks in the ET&BF fishery and the wider Pacific Ocean as ‘uncertain’ in its Fishery Status Reports of 2000-2001 and 2001-02.

The BRS also commissioned a review of striped marlin biology and fisheries relevant to Australia. The objective of that study was to assess the interaction between the recreational and commercial sectors of the fishery and to:

- summarise available information on striped marlin biology;
- describe commercial and recreational fisheries catching striped marlin in the AFZ;
- briefly examine other fisheries for striped marlin and related species, reviewing any research, assessment or management approaches that are relevant to Australia’s fisheries;
- identify factors that influence catch rates of striped marlin in Australia’s commercial and recreational fisheries;
- compile catch and effort data that may be useful to analyses of commercial-recreational interaction for striped marlin; and
- analyse evidence of commercial-recreational interaction, if data permit.

The results of that review were published in Bromhead (2004) *Striped marlin: biology and fisheries*. Chapter 4 of that report provided a detailed review of the results of research into striped marlin fish stocks and confirmed the uncertainty currently surrounding the ‘stock’ of striped marlin in the southwest Pacific:

The collection of data pertaining to striped marlin, and the undertaking of stock assessments and catch rate standardisations have not received the attention attributed to the tuna species caught in the same longline fisheries. This is due to the fact that striped marlin are generally not regarded as a target species (although there is little doubt that the species is deliberately targeted by some fleets in some time areas strata). The assessments described in this chapter represent the sum total of assessment work that has been applied to striped marlin stocks. It is evident from these that there is still too high a level of uncertainty surrounding much of this research, due to lack of data or knowledge pertaining to key biological parameters of age and growth, fecundity, mortality, stock recruitment relationships and other factors (Uozumi, 2003). Furthermore, while models can be tuned with abundance indices derived from catch and effort data, factors such as expanding fishing area, gear types, technological advances and size regulations may confound the interpretation of fishing effort, catch rates and size composition. The recent stock assessments of striped marlin in the EPO by Hinton and Bayliff (2002) and Hinton and Maunder (2003) represent the most comprehensive assessments to date for this species, yet they only deal with the eastern Pacific ‘stock’. This study indicated that the striped marlin ‘stock’ in the Eastern Pacific may have increased in biomass in recent years. Given the uncertainty over stock structure, it is difficult to know what relevance these findings have to the southwest Pacific.

Chapter 8 of that report also presented the preliminary results of the analysis of longline catch data rates using a generalised additive model to assess trends in striped marlin availability or abundance off the east coast of Australia. As noted in the conclusion to the report, the results of that preliminary analysis suggests that there may have been either:

- an increase in the abundance of striped marlin off the east coast of Australia in the second half of the 1990s; or
- an increase in the catchability (possibly due to targeting or increasing catching efficiency) of striped marlin off the east coast of Australia in the second half of the 1990s.

It is important to note, however, that the report advises caution when interpreting these preliminary results as implying that there has been an increase in abundance of striped marlin:

Increasing abundance is supported somewhat by the analyses of charter boat catch and effort data. It can occur as a result of good recruitments or shifts in abundance and distribution within the southwest Pacific due to environmental and oceanographic factors not accounted for within the model. However, this conclusion should be treated with some caution, given that these trends appear to be driven by increasing likelihood of catching marlin in the face of decreasing catch rates in those sets that do not catch marlin (at least for coastal areas). In particular, in coastal regions A and B however, catch rates for operations taking at least one marlin appear to have declined since the early or mid 1990s. Increasing catch likelihood could occur as a result of a shift in the fishing distribution to areas more frequented by marlin, or other changes relating to increased targeting or fishing efficiency. These declines in southwest coastal waters over the past decade warrant closer monitoring and analyses.

4. Commercial Demand for Striped Marlin

4.1 Striped marlin – a by-catch of the tuna fishery

Striped marlin are a significant by-catch of Eastern Tuna and Billfish (ET&BF) fishery, which extends the entire length of the east coast of Australia out to the 200 mile limit of the Australian Fishing Zone (see Figure 4).

As outlined in Table 1, the ET&BF fishery is one of Australia's most important commercial fisheries with a gross value of production in 2002-03 of \$67.9 million.

Table 1: Eastern Tuna and Billfish Fishery Production and Value

YEAR	EASTERN TUNA AND BILLFISH FISHERY SECTOR				TOTAL	
	Long & minor line sectors		Pole & purse seine sectors		ET&BF FISHERY	
	Total production (tonnes)	Value (\$'000)	Total production (tonnes)	Value (\$'000)	Total production (tonnes)	Value (\$'000)
1994-95	1,709	11,950	1,436	1,616	3,145	13,566
1995-96	2,452	17,294	2,905	3,608	5,357	20,902
1996-97	3,892	27,944	4,889	8,508	8,781	36,452
1997-98	4,954	35,788	837	1,231	5,791	37,019
1998-99	6,339	49,932	4,592	5,283	10,931	55,215
1999-00	5,536	57,570	4,493	6,964	10,029	64,534
2000-01	6,638	62,696	1,549	2,821	8,187	65,517
2001-02	8,349	78,943	207	347	8,556	79,290
2002-03	8,523	67,913	0	0	8,523	67,913

Source: AFMA (2003), Table 2, page 31 updated using ABARE (2004) data, Table 13, p 29. Note that the 2001-02 data are preliminary and the 2002-03 data are ABARE estimates.

The ET&BF fishery is a multi-species fishery accessed by commercial fishers who catch:

- tuna (yellowfin, bluefin, striped, bigeye, albacore);
- billfish (blue marlin, black marlin, striped marlin, sailfish, spearfish and broad billed swordfish); and
- sharks (e.g. whaler, tiger, mako, hammerhead, thresher, blue).

The main commercial target species are yellowfin tuna, bigeye tuna, broadbill swordfish and albacore tuna. However, striped marlin, dolphin fish and oil fish are becoming more important.

Table 2: Eastern Tuna and Billfish Fishery Production and Value by Species

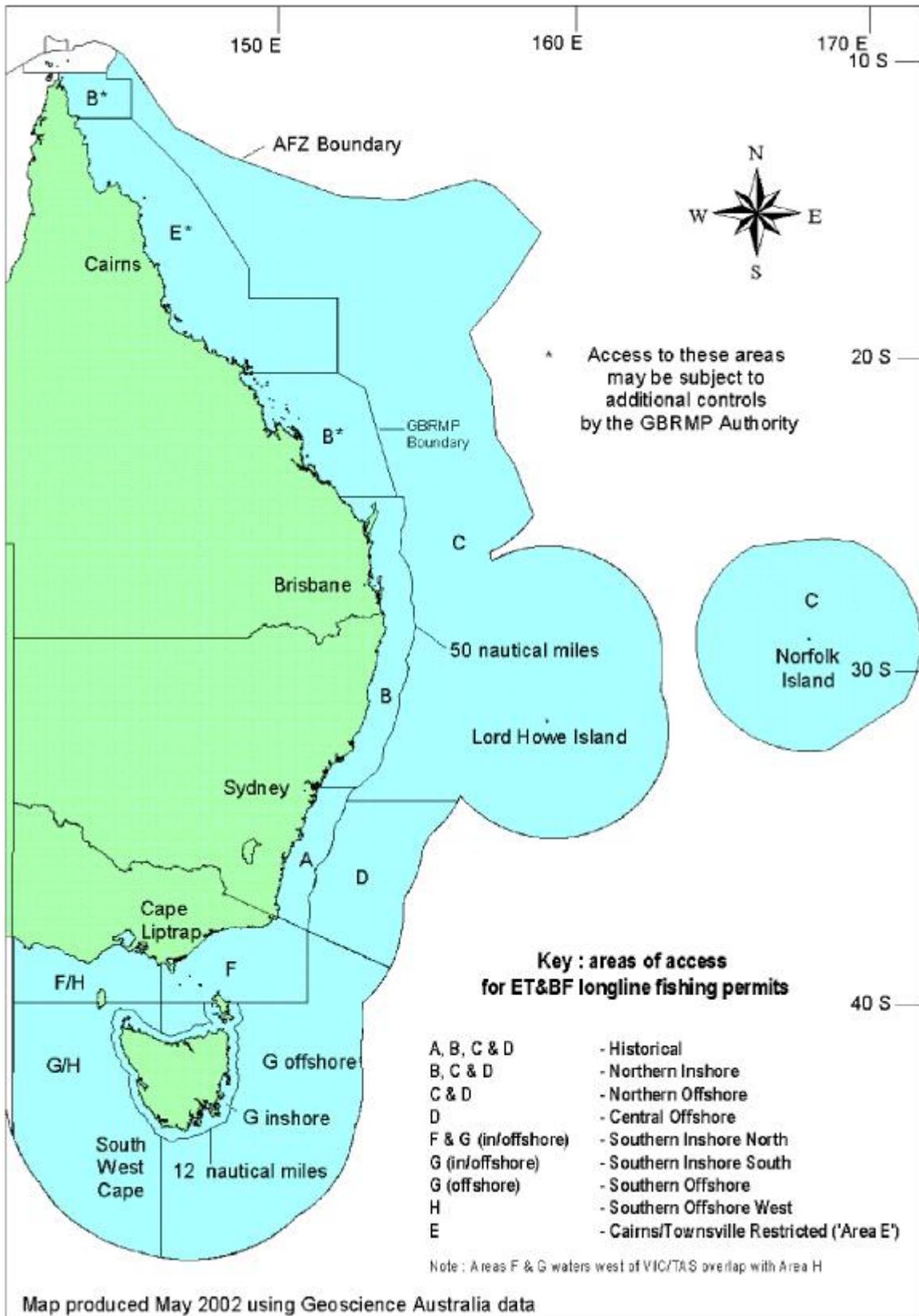
YEAR	EASTERN TUNA AND BILLFISH FISHERY SECTOR				TOTAL	
	Long & minor line sectors		Pole & purse seine sectors		ET&BF FISHERY	
	Total production (tonnes)	Value (\$'000)	Total production (tonnes)	Value (\$'000)	Total production (tonnes)	Value (\$'000)
2000-01						
Yellowfin	1,922	25,254	5	71	1,927	25,325
Billfish	2,573	18,304			2,573	18,304
Bigeye	998	16,169			998	16,169
Albacore	398	787			398	787
Skipjack	3	5	1,544	2,749	1,547	2,754
Other	745	2,176	0	0	745	2,176
TOTAL	6,638	62,696	1,549	2,821	8,187	65,516
2001-02						
Yellowfin	2,463	29,309	1	7	2,464	29,316
Billfish	3,129	27,907			3,129	27,907
Bigeye	1,019	16,747			1,019	16,747
Albacore	666	1,439			666	1,439
Skipjack	8	13	194	313	202	326
Other	1,064	3,529	12	28	1,076	3,557
TOTAL	8,349	78,943	207	347	8,556	79,290
2002-03						
Yellowfin	3,394	29,661	0	0	3,394	29,661
Billfish	2,837	23,746			2,837	23,746
Bigeye	936	11,397			936	11,397
Albacore	494	989			494	989
Skipjack	18	47	0	0	18	47
Other	844	2,074	0	0	844	2,074
TOTAL	8,523	67,913	0	0	8,523	67,913

Source: ABARE (2004), Table 13, p 29. Note that the 2001-02 data are preliminary and the 2002-03 data are ABARE estimates.

Legally, commercial catches of blue, black and striped marlin off the NSW coastline are classified as a by-catch of the ET&BF fishery since:

- Commonwealth legislation bans commercial fishing for blue and black marlin in the entire Australian Fishing Zone (AFZ). In order to avoid prosecution, commercial operators are required to return any blue or black marlin by-catch to the water immediately, dead or alive (see section 4.2.1); and
- NSW legislation classifies all marlin as a protected species. As a result, no marlin can be retained by commercial fishers operating within 3 nautical miles of the NSW coastline. However, Commonwealth licensed commercial fishers are allowed to retain and sell any striped marlin they catch in waters under Commonwealth jurisdiction beyond 3 miles (see section 4.2.2).

Figure 4: The Eastern Tuna and Billfish Fishery



Source: Perdrau & Lynch (2003), Figure 2, page 8

4.2 Regulations governing commercial fishing for striped marlin

4.2.1 Commonwealth legislation and regulations

Offshore Constitutional Settlement arrangement

Responsibility for the management of commercial fishing within the ET&BF fishery located off the NSW coastline is shared by the Commonwealth Government and the NSW Government:

- the Commonwealth Government is responsible for the management of the commercial fishery for tuna and billfish from 3 nautical miles off the NSW coastline to the 200 mile limit of the Australian Fishing Zone under an Offshore Constitutional Settlement (OCS); and
- the NSW Government is responsible for the management of commercial catches of tuna and billfish within 3 nautical miles of its coastline.

Under an OCS, responsibility for the management of a fishery between the low water mark and the edge of the Australian Fishing Zone can be allocated to:

- the Commonwealth Government;
- the State/Territory Government; or
- a fisheries Joint Authority comprising the Commonwealth Minister responsible for fisheries and one of more State/Territory Ministerial counterparts.

The OCS negotiated between the Commonwealth Government and Queensland, Victoria and Tasmania allocates responsibility for the management of the ET&BF fishery to the Commonwealth Government.

By contrast, under the OCS negotiated between the Commonwealth Government and the NSW Government, the NSW Government has retained responsibility for the management of the commercial fishery for tuna and billfish within 3 nautical miles of the coast. As a result, commercial fishers operating within 3 nautical miles of the NSW coastline are required to comply with NSW fisheries legislation and regulations, which are discussed further in section 4.2.2.

The NSW Government is also responsible for the management of the recreational striped marlin fishery from the coastline to the 200 nautical mile limit in the absence of any over-riding Commonwealth legislation.

Management of the fishery

Primary responsibility for the management of a limited number of Australia's fisheries that overlap State borders, including the ET&BF fishery, rests with the Australian Fisheries Management Authority (AFMA), which was established in 1992.

AFMA receives advice from the Eastern Tuna Management Advisory Committee (Eastern Tuna MAC), which meets around three times a year and comprises:

- an independent chair,
- an executive officer;

- an AFMA member
- a scientific member;
- a conservation member;
- a recreational/charter fisheries member;
- four industry members; and
- three permanent observers (a recreational/charter fishing observer, a State Government observer and a Great Barrier Reef Marine Park Authority observer).

In addition, there are several other Commonwealth Government agencies that play an important role in the management of Australia's fisheries, including:

- the Department of Agriculture, Fisheries and Forestry (AFFA), which provides advice to the Minister on industry development and related matters through the fisheries branch, the Australian Bureau of Agricultural and Resource Economics (ABARE), the Bureau of Rural Sciences (BRS) and the National Office of Food Safety (NOFS);
- Environment Australia (EA), which also has a direct role in the management of Commonwealth fisheries and state and territory fisheries that involve exports, through the Environment Protection and Biodiversity Conservation Act 1999;
- the National Oceans Office (NOO), which is responsible for the development of regional marine plans based on a framework for integrated and ecosystem-based planning practices; and
- the Fisheries Research and Development Corporation (FRDC), which is the key research body.

Current management arrangements for commercial fishing

The current arrangements governing commercial fishing within the ET&BF fishery are set out in the *Fisheries Management Act 1991* and its associated regulations.

In brief, the ET&BF fishery is currently managed through the issue of permits that govern both:

- fishing methods; and
- access to specific areas within the ET&BF fishery.

Revised management arrangements for the ET&BF fishery were released in the draft *Eastern Tuna and Billfish Fishery Management Plan 2003*, which has been developed under the *Fisheries Management Act 1991* in consultation with key stakeholders.

Ban on commercial fishing for blue and black marlin

Since 28 July 1998, commercial fishers operating in the Australian Fishing Zone have been prohibited from catching blue and black marlin by section 15A of the *Fisheries Management Act 1991*. Any blue or black marlin caught by commercial fishers must be returned to the water immediately, either dead or alive.

15A Prohibition against taking marlin

(1) A person must not, in the AFZ, take blue marlin (*Makaira mazara*) or black marlin (*Makaira indica*) unless the person:

(a) is the holder of a scientific permit that authorises the taking of the fish; or

(b) takes the fish in the course of:

(i) recreational fishing; or

(ii) using a charter boat for fishing.

(2) It is a defence to a prosecution for an offence against this section if the person charged satisfies the court that, upon becoming aware of the taking of the fish, he or she took steps immediately to return the fish to its natural environment.

Quality control

Seafood exports are subject to regulation under the *Export Control Act 1982* and its associated Export Controlled (Processed Food) Orders in order to ensure those exports comply with food safety and trade descriptions.

In addition, fish processing establishments must be registered by the Australian Quarantine and Inspection Service (AQIS) in accordance with the provisions of the Prescribed Goods (General) Orders, and have a quality assurance system in place, in accordance with the Export Control (Processed Food) Orders.

International agreements

Australia is a signatory to the:

- *United Nations Fish Stocks Agreement*, which was signed on 4 December 1995, ratified on 23 December 1999, and came into effect on 11 December 2001 (UNFSA). This agreement is also known as the *United Nations Agreement on Straddling and Highly Migratory Fish Stocks*. The objective of this agreement is to ensure the long-term conservation and sustainable use of straddling and highly migratory fish stocks through effective implementation of the relevant provisions of the *United Nations Convention on the Law of the Sea*. Article 6 of the UNFSA requires a precautionary approach to the conservation, management, and exploitation of those fish stocks in order to protect the living marine resources and preserve the marine environment; and
- *Convention for the Conservation and Management of Highly Migratory Fish Stocks in the Western Pacific and Central Pacific Ocean*, which was signed in September 2000 and ratified in September 2003. The Convention provides for the establishment of a Regional Fisheries Management Organisation, which is expected to be set up by the end of 2004.

Australia is also a member of the Forum Fisheries Agency (FFA), which was established under the South Pacific Forum Fisheries Agency Convention and now includes 16 members of the South Pacific Forum. The FFA does not have any regulatory functions. Rather its main objectives are:

- conservation and optimum utilisation of the species covered by the Convention, which include highly migratory fish species such as striped marlin;
- promotion of regional co-operation and co-ordination of fisheries policies;
- securing maximum benefits from the living resources of the region for their peoples and for the region as a whole (particularly developing countries);
- facilitating the collection, analysis, evaluation and dissemination of relevant statistical, scientific and economic information about the resources covered by the Convention.

4.2.2 NSW legislation and regulations

Commercial fishing for striped marlin within 3 nautical miles of the NSW coastline is subject to the provisions of the *Fisheries Management Act 1994 No.38* and the associated regulations outlined in the *Fisheries Management (General) Regulation 2002*. The scope of that Act is defined in section 7 as follows:

7 Waters to which Act applies

(1) *This Act applies:*

- (a) *in relation to all waters that are within the limits of the State, and*
- (b) *except for purposes relating to a fishery that is to be managed in accordance with the law of the Commonwealth pursuant to an arrangement under Division 3 of Part 5 and except for purposes prescribed by paragraph (d)—in relation to any waters of the sea not within the limits of the State that are on the landward side of waters adjacent to the State that are within the Australian fishing zone, and*
- (c) *for purposes relating to a fishery that is managed in accordance with the law of the State pursuant to an arrangement under Division 3 of Part 5—in relation to any waters to which the legislative powers of the State extend with respect to that fishery, whether pursuant to section 5 of the Coastal Waters (State Powers) Act 1980 of the Commonwealth or otherwise, and*
- (d) *for purposes relating to recreational fishing activities engaged in otherwise than by use of a foreign boat (other than recreational activities prohibited or regulated under a plan of management determined under section 17 of the Commonwealth Act)—in relation to any waters to which the legislative powers of the State extend with respect to such activities.*

Note. *In many cases the legislative powers of the State will extend beyond three nautical miles, particularly in relation to recreational fishing.*

Commercial fishing license requirements

Both commercial fishers and their boats are required to be licensed under Part 4, Divisions 1 and 2, sections 102 and 107 of the *Fisheries Management Act 1994 No.38*:

102 Commercial fishers required to be licensed

- (1) *A person must not take fish for sale from waters to which this Act applies unless the person is authorised to do so by a commercial fishing licence.*

107 Commercial fishing boat to be licensed

- (1) *The master of a boat must not use the boat for any of the following purposes unless the boat is licensed under this Division:*
- (a) *to take fish for sale from waters to which this Act applies,*
- (b) *to land fish in New South Wales that were taken from other waters (after the boat departed from a port in New South Wales).*

Striped marlin is protected from commercial fishing

Striped marlin, as well as blue and black marlin, are protected from commercial fishing by the *Fisheries Management Act 1994 No 38*.

Section 20 of Part 2, Division 2, of the Act enables certain species of fish to be declared as protected from commercial fishing:

20 Fish and waters protected from commercial fishing

- (1) *The regulations may declare that fish of a specified species are protected from commercial fishing.*
- (2) *The regulations may declare specified waters to be waters in which all or a class of commercial fishing is prohibited absolutely or conditionally.*
- (3) *A person who:*
- (a) *takes fish of a species declared under subsection (1), or*
- (b) *sells fish of a species declared under subsection (1), or*
- (c) *takes fish from waters declared under subsection (2) in breach of a declaration,*
- is guilty of an offence.*

Section 7 of Part 2, Division 1 of the Act then specifies a range of fish species specified as being protected from commercial fishing, which includes striped, blue and black marlin:

7 Fish protected from commercial fishing

For the purposes of section 20 (1) of the Act, the species of fish listed in the Table to this clause are protected from commercial fishing.

Table *Fish protected from commercial fishing*
Part 1 *Marine or estuarine species*

<i>Common name</i>	<i>Species</i>
<i>Groper, blue, brown or red</i>	<i>Achoerodus viridis</i>
<i>Marlin, black</i>	<i>Makaira indica</i>
<i>Marlin, blue</i>	<i>Makaira mazara</i>
<i>Marlin, striped</i>	<i>Tetrapturus audax</i>

As a result, in the absence of any other provisions, it would be illegal for commercial fishers to take striped, blue or black marlin in waters under NSW jurisdiction.

However, section 8, Part 2, Division 1 of the Fisheries Management (General) Regulation 2002 in effect enables certain commercial fishers to take striped marlin while attempting to take tuna for sale:

8 Defence—striped marlin

For the purposes of section 21 (1) (d) of the Act, it is a defence to a prosecution for an offence under section 20 (3) (b) of the Act (relating to sale of fish protected from commercial fishing) if:

- (a) the fish is striped marlin, and*
- (b) the striped marlin was taken by a person while lawfully taking or attempting to take tuna for sale, by the method of long line (pelagic), minor line or pole fishing, under the authority of a permit issued under a law of the Commonwealth.*

That is, commercial fishers are not legally able to target striped marlin. However, they are able to retain striped marlin that are taken as a by-catch when fishing for tuna. Attempting to sell striped marlin taken other than as prescribed above would be an offence under NSW legislation.

By contrast, the only defence commercial fishers have from prosecution for taking blue or black marlin while fishing for tuna is to return those species of marlin to the sea immediately, which is provided by section 36, Part 2, Division 5 of the *Fisheries Management Act 1994*:

36 Defence for accidental etc taking of fish

- (1) It is a defence to a prosecution for an offence against this Act or the regulations relating to the taking of fish if the person charged satisfies the court that, on becoming aware of the taking of the fish, the person took immediate steps to return the fish to its natural environment with the least possible injury.*
- (2) The defence provided under subsection (1) extends to fish taken and immediately released in the course of a sport fishing activity (being an activity conducted in accordance with any requirements of the regulations).*

Exemption of commercial fishers from recreational bag limits

Commercial fishers are exempted from the bag limits that apply to recreational anglers by Part 2, Division 3, section 15 of the *Fisheries Management (General) Regulation 2002*:

15 Possession limits do not apply to persons in possession of fish for sale

A possession limit specified in this Division does not apply in respect of fish which is in the possession of a person for sale or which has previously been sold.

Registration of fish receivers

Any person who receives fish, including striped marlin, for resale or other commercial use is also required to be registered under section 117, Part 4, Division 4 of the *Fisheries Management Act 1994*, subject to certain limits:

117 Fish receiver to be registered

- (1) *A person who receives fish, for resale or other commercial use, from a person whom he or she knows or reasonably suspects to be a commercial fisher (or a person acting on behalf of such a commercial fisher) is guilty of an offence unless the fish receiver is registered under this Division.*

Maximum penalty: In the case of a corporation, 500 penalty units or, in any other case, 100 penalty units or imprisonment for 3 months, or both.

- (2) *The person is not required to be registered under this Division if:*
- (a) the person holds an authority under the Fisheries Act 1935 of a class designated by the regulations under this Act, or*
 - (b) the person has received from all commercial fishers (or persons acting on their behalf) less than the minimum quantity of fish prescribed by the regulations during the period so prescribed, or*
 - (c) the fish are received in the person's capacity as an employee or agent of another fish receiver, or*
 - (d) the fish are received for the purpose only of transporting them on behalf of the owner of the fish, or*
 - (e) the regulations otherwise provide.*

4.2.3 Legislation and regulations in other jurisdictions

A number of other jurisdictions, both in Australia and overseas, have already banned commercial fishing for striped marlin including:

- **Western Australia**, which has banned commercial fishing for billfish, sailfish, spearfish and swordfish under its Fish Resources Management Act 1994 and Fish Resources Management Regulations 1995 (regulation 18);
- **New Zealand**, which has banned commercial marlin fishing. Section 25 of its *Fisheries (Commercial Fishing) Regulations 2001* requires commercial tune longline operators to tag and release all marlin caught in New Zealand fisheries waters;
- **United States**, which has banned commercial fishing for striped marlin in the Atlantic through the *Fishery Management Plan for Atlantic Tunas, Swordfish and Sharks*. In addition, the Pacific Fishery Management Council released a *Fisheries Management Plan* in October 2002, which is currently in the process of being finalised and submitted to the National Marine Fisheries Service. That management plan proposes to implement a complete ban on commercial longline fishing in the US exclusive economic zone off the west coast of the USA (California, Oregon and Washington) and will continue the current ban on the commercial harvest of striped marlin; and
- **Hawaii**, where restrictions have been placed on longline fishing in particular regions.

4.3 The commercial fleet operating off the NSW coastline

Table 3 presents AFMA data on the number of commercial ET&BF boats operating in the following NSW coastal regions:

- Northern NSW (28°10'S to 30°19'S);
- Mid North Coast (30°19'S to 32°26'S);
- Hunter (32°26'S to 33°31'S);
- Sydney (33°31'S to 34°05'S);
- Illawarra (34°05'S to 34°50'S); and
- Southern (34°50'S to 37°30'S).

Data for the Northern and Mid Northern regions and the Hunter and Sydney regions have been aggregated together throughout this report for confidentiality reasons.

Table 3: Number of ET&BF Commercial Boats Operating off the NSW Coastline

NSW COASTAL REGIONAL AREA												TOTAL NSW		
Northern and Mid Northern			Hunter and Sydney			Illawarra			Southern					
2000-01	2001-02	2002-03	2000-01	2001-02	2002-03	2000-01	2001-02	2002-03	2000-01	2001-02	2002-03	2000-01	2001-02	2002-03
12	12	2	11	9	12	27	28	18	34	21	24	84	70	56

Source: AFMA logbook data

4.4 Fishing methods

A variety of fishing methods are used in the ET&BF fishery including:

- ‘pelagic longline’, which involves the use of a mainline, suspended above the ocean bed by floats, to which branch lines are attached, each fitted with one or more baited hooks or artificial lures;
- ‘purse seine’, which involves the use of surface net, that is pursed at the end, to surround a school of fish;
- ‘pole’, which involves the use of an artificial lure that is attached by a line to the end of a pole; and
- ‘minor line’, which involves the use of handlines, rod and reel and trolling of a single hook or one ganged hook rig.

4.5 Commercial catches of striped marlin

4.5.1 Commercial catches of striped marlin in the ET&BF fishery

As set out in Table 4, the longline sector is responsible for catching most of the striped marlin caught by commercial operators in the ET&BF fishery.

Table 4: ET&BF Fishery – Longline and Total Catch (tonnes)

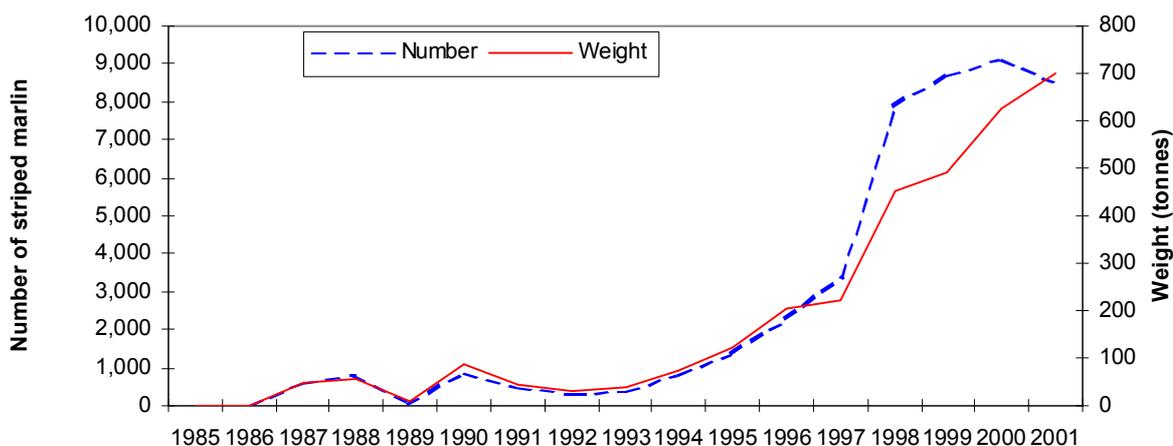
	1998-1999		1999-2000		2000-2001		2001-2002		2002-2003	
	Longline	Total	Longline	Total	Longline	Total	Longline	Total	Longline	Total
Yellowfin Tuna	2,144	2,159	1,306	1,308	1,920	1,926	2,460	2,463	3,390	3,393
Skipjack Tuna		4,669		4,497		1,556		202		18
Albacore Tuna	421	427	362	364	396	398	663	678	493	494
Bigeye Tuna	897	897	678	678	998	999	1,018	1,019	935	936
Broad Billed Swordfish	1,654	1,654	2,082	2,083	1,854	1,854	2,336	2,336	2,175	2,175
Striped Marlin	493	493	514	518	717	717	768	770	631	632
Sharks	258	259	309	310	307	308	336	337	176	177
Other	353	350	271	273	441	443	756	750	649	641
TOTAL	6,220	10,908	5,522	10,031	6,632	8,202	8,337	8,555	8,449	8,466

Source: Lynch (2003), Tables 2 and 5.

As indicated in Figure 5, there has been a significant and sustained increase in both the number and weight of striped marlin caught by longline fishing operations in the ET&BF fishery since 1993.

Specifically:

- the number of striped marlin caught in 2001 was more than 23 times the number caught in 1993; and
- the total weight of the striped marlin catch in 2001 was more than 18 times the weight of the catch in 1993.

Figure 5: Trends in Number and Weight of Striped Marlin Commercially Caught 1985 - 2001

Source: Campbell (2002)

It is this significant increase in both the number and weight of striped marlin caught by commercial operators that has prompted this investigation of the possible impacts of alternative striped marlin fishery management arrangements. Such a rapid increase is not consistent with catch levels that are meant to be a by-catch of tuna fishing. Rather, it is more consistent with striped marlin being increasingly targeted by commercial fishers.

As noted in the Bureau of Rural Sciences report on *Striped marlin: biology and fisheries*, there are specific instances of commercial operators targeting striped marlin when it is in abundance:

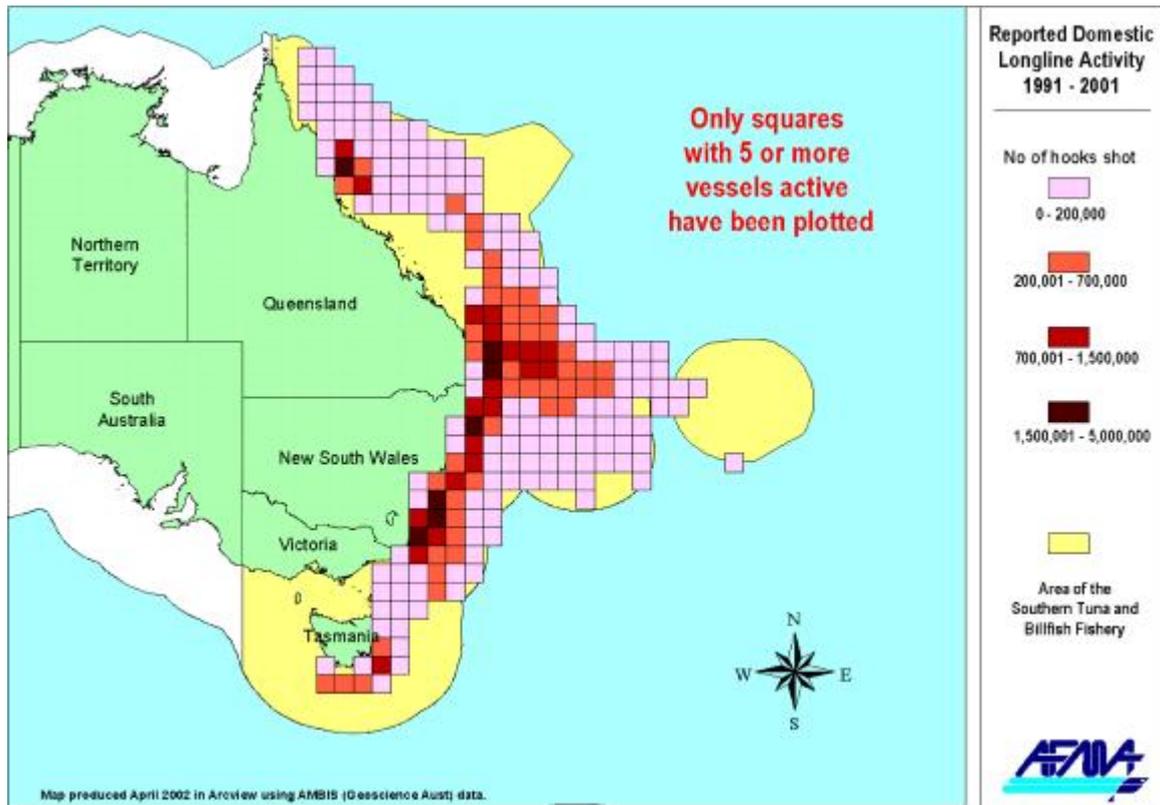
Evidence for targeting was also looked for by screening the longline data for evidence of high and sustained catches in discrete time-area strata in which very little catch is taken of species other than the one being suspected of being targeted. An example of such an occurrence for striped marlin occurred in 2002 off the south east coast. Over a 30 day period, in a small 4° square off the east coast, over 80,000 kg of striped marlin was taken by longlines. This was more than 4.5 times the total catch of other species combined (yellowfin, bigeye, albacore and swordfish), taken in the same time area strata. Such catches are strongly suggestive of targeting, which is likely to be opportunistic in nature, with fishers taking advantage of an extremely high abundance region and period for this species, in the absence of other target species being present in large numbers.

In addition, as noted in that report, the significant increase in the annual tonnage of striped marlin caught, when coupled with the high value of those fish and the low discard rates, also suggests commercial targeting of striped marlin:

In addition to evidence for specific instances of targeting, a case for striped marlin to be considered a target species could be made based on the annual tonnage caught (for example total catch weight approached that of bigeye tuna in 2000), the commercial (foreign and domestic) value of the species and minimal discarding rates (~2.6%) similar to that of other target species. Target species tend to receive the majority of management focus. It would appear that this species may warrant management and scientific attention that is closer to that afforded to current target species. This is particularly so given that far less is known about striped marlin biology and status than for other target species.

Figure 6 illustrates the distribution of longline effort off the NSW coastline over the period 1991-2001.

Figure 6: Reported Longline Activity in the ET&BF Fishery 1991-2001

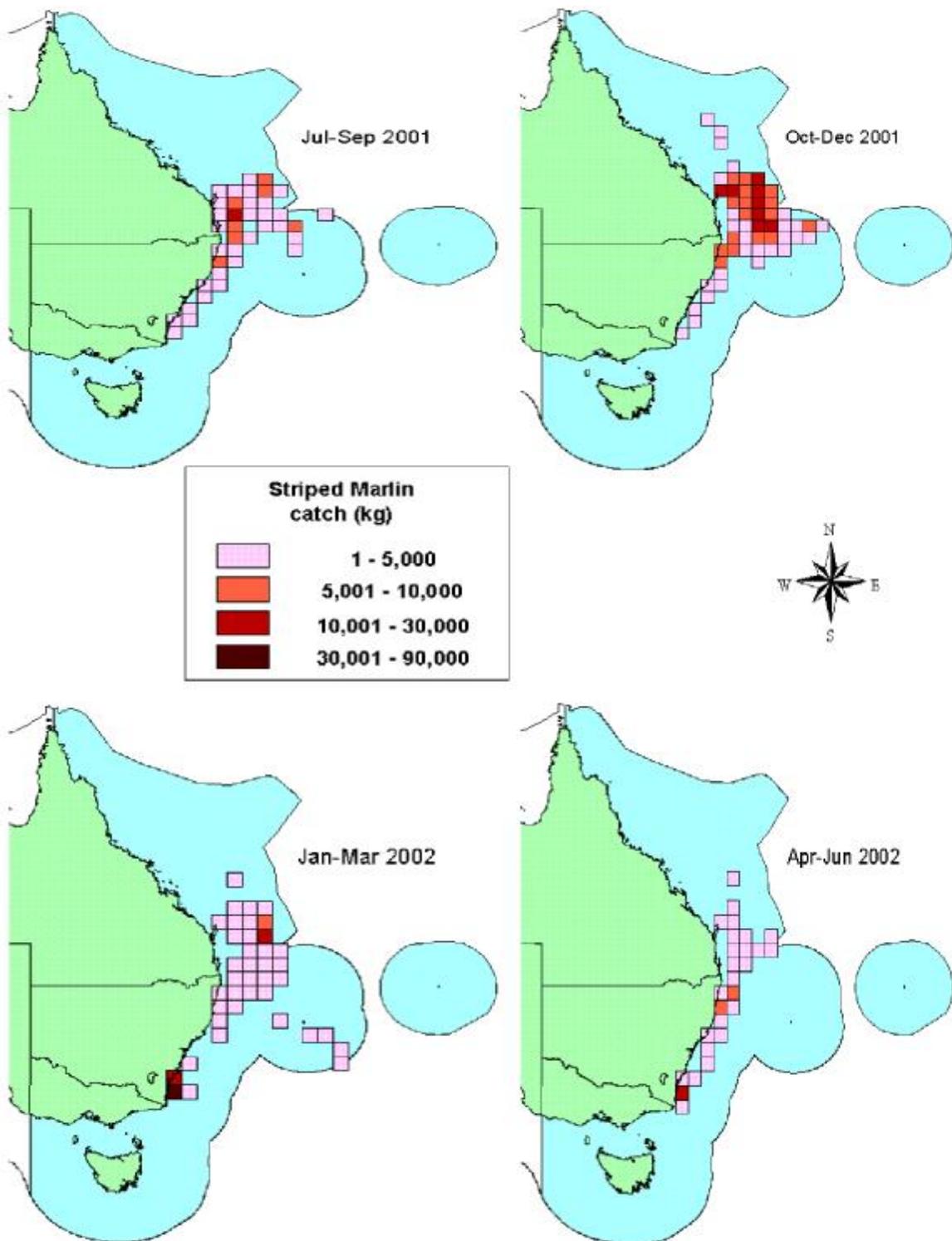


Source: AFMA

Figures 7 and 8 illustrate the significant seasonal variability of commercial striped marlin catches off the eastern coastline of Australia for the years 2001-02 and 2002-03 respectively.

In general, striped marlin catches tend to be higher off the northern coast of NSW in spring and higher off the south coast of NSW in summer as the warm water currents flow down the NSW coastline.

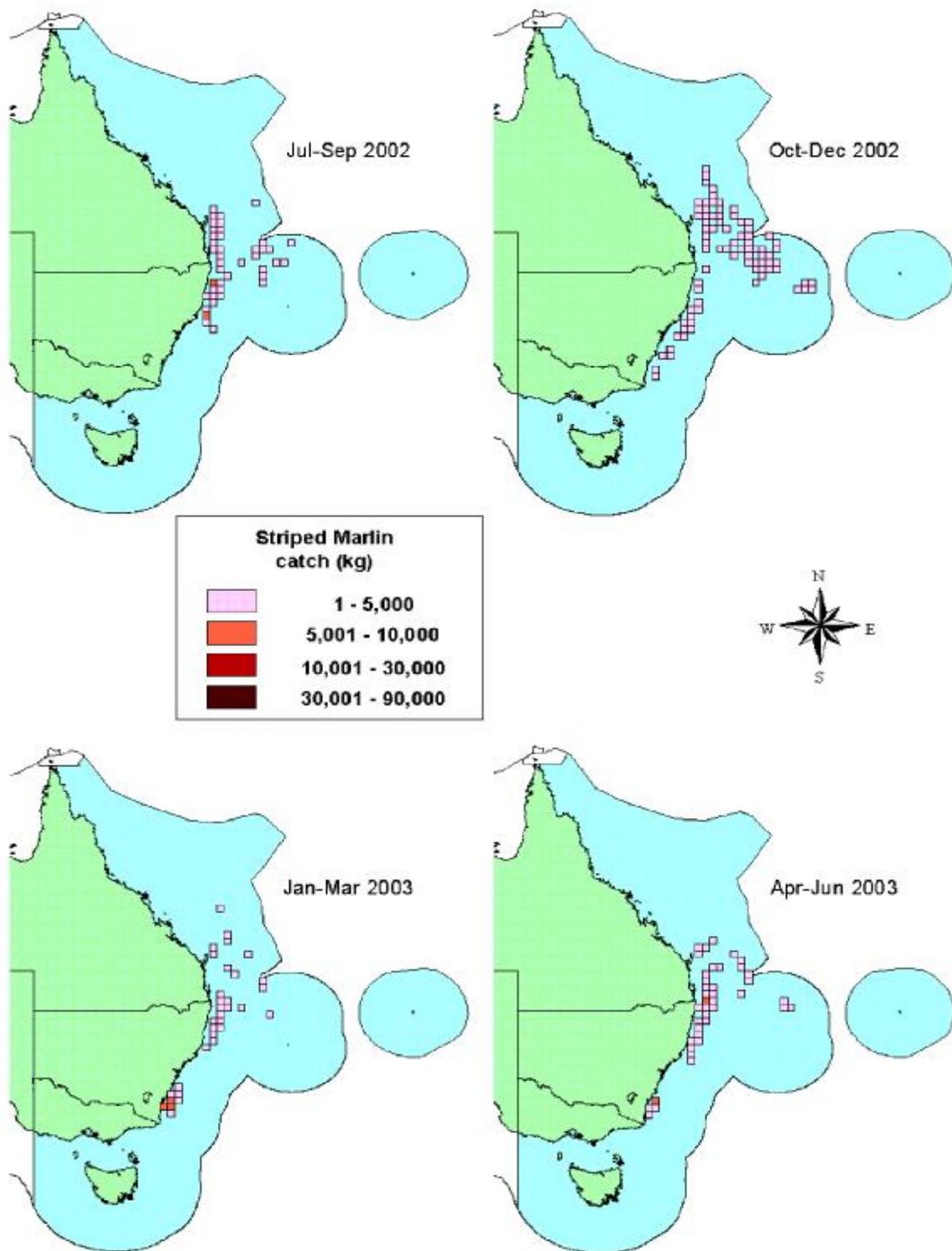
Figure 7: Location of Commercial Catches of Striped Marlin 2001-02



Map produced September 2002 using Geoscience Australia data

Source: Perdrau & Lynch (2003), Figure 15a, page 28

Figure 8: Location of Commercial Catches of Striped Marlin 2002-03



Source: Lynch (2003), Figure 15, page 30. Note that this data represents only 56.6% of the total striped marlin catch due to some data being excluded to protect individual operator confidentiality.

4.5.2 Commercial catches of striped marlin off the NSW coastline

NSW regional catches of striped marlin

Table 5 outlines AFMA logbook data on the total weight (kg) of each of the ET&BF species caught off each NSW coastal region over the period 2000-01 to 2002-03.

As indicated in that table:

- over 289 tonnes of striped marlin was caught off the NSW coastline by commercial ET&BF operators in 2001, over 283 tonnes in 2002, and over 206 tonnes in 2003. This represents approximately 40 percent of the total commercial catch of striped marlin in the ET&BF fishery in 2001, 37 percent in 2002 and 33 percent in 2003;
- over 82 percent of that striped marlin catch was caught off the coast of the Hunter, Sydney, Illawarra and Southern regions of NSW in 2001, 84 percent in 2002, and 76 percent in 2003.

Table 5: ET&BF Fishery – Catch by NSW Coastal Region (kg)

SPECIES	NSW COASTAL REGIONAL AREA												TOTAL NSW		
	Northern and Mid Northern			Hunter and Sydney			Illawarra			Southern					
	2000-01	2001-02	2002-03	2000-01	2001-02	2002-03	2000-01	2001-02	2002-03	2000-01	2001-02	2002-03	2000-01	2001-02	2002-03
Yellowfin	152,805	232,691	250,818	162,027	230,814	274,433	389,546	526,845	280,708	247,272	310,699	310,324	951,649	1,301,051	1,116,283
Skipjack	696	1,721	341	189	784	125	7,077	9,554	1,471	153,752	73,580	585,000	161,714	85,639	586,937
Southern Bluefin	1,744	812	2,360	3,482	2,695	717	21,301	9,301	8,423	11,954	13,260	8,899	38,480	26,068	20,399
Albacore	37,365	41,953	33,291	34,453	27,431	31,284	111,795	72,598	31,698	73,577	35,721	32,191	257,189	177,703	128,464
Bigeye	63,952	63,633	50,483	68,614	42,535	55,516	150,285	89,697	43,698	103,479	43,030	35,187	386,330	238,895	184,884
Swordfish	68,607	114,058	68,515	77,973	69,731	105,568	161,707	142,198	39,463	31,197	24,107	22,728	339,484	350,093	236,274
Striped Marlin	49,949	45,113	49,680	51,541	42,221	48,961	111,849	93,883	45,099	75,740	101,955	63,208	289,078	283,172	206,947

Source: AFMA logbook data

Proportion of the commercial catch caught within the 50 mile limit

As indicated in Table 6, AFMA logbook data indicates that the proportion of the NSW commercial striped marlin catch that was caught within 50 miles of the NSW coastline was:

- 71 percent in 2001;
- 61 percent in 2002; and
- 52 percent in 2003.

Table 6: ET&BF Fishery – Proportion of Catch Caught within 50nm of NSW Coastline

SPECIES	TOTAL NSW		
	2001	2002	2003
Yellow fin	78.2%	65.5%	60.3%
Skipjack	99.9%	97.4%	99.6%
Southern Bluefin	51.0%	87.7%	77.3%
Albacore	70.8%	47.4%	36.6%
Bigeye	70.6%	46.3%	39.6%
Swordfish	20.7%	11.6%	9.7%
Striped Marlin	70.7%	61.1%	52.1%

Source: AFMA logbook data

4.5.3 Exports of striped marlin from NSW

Data obtained from the Australian Quarantine and Inspection Service indicates that:

- over the period 1 July 2001 to 31 August 2002, a total of 25,263 kg of striped marlin was exported from NSW; and
- over the period 1 September 2002 to 23 September 2003, a total of 28,249 kg of striped marlin was exported from NSW.

Once these ‘trunked’ weights of exported striped marlin have been converted to equivalent ‘whole’ weights (using a conversion factor of 1.5), this suggests that approximately 13 percent of the NSW striped marlin catch was exported in 2001-02 and 20 percent in 2002-03. We note, however, that this data may overstate actual exports of striped marlin caught in NSW to the extent that it includes striped marlin that were caught in other States, but exported from NSW.

This level of exports is consistent with the data obtained from the striped marlin Size Monitoring Program (SMP). As noted by the Bureau of Rural Sciences in its report on *Striped marlin: biology and fisheries*, of the 13,454 marlin recoded by the Size Monitoring Program, 1,841, or 13.7 percent, were exported:

Many of the processors records indicate fish which have been processed for exporting (e.g. to the sashimi markets in Japan). Although the SMP coverage is just under 45% for striped marlin landed on the east coast, these records indicate when and potentially what proportion of marlin is exported rather than sold locally. Not all processors earmark export fish, so the figures here are likely to be conservative. Of the 13454 marlin recorded by the SMP, 1841 were exported (Figure 5.13). Of these, 1435 (78%) were processed in the southern region (south of Sydney) and predominantly during the months of February to May.

5. Recreational Demand for Striped Marlin

5.1 Striped marlin – a highly prized gamefish

Striped marlin are also highly prized by recreational anglers who fish off the NSW coastline for a wide range of gamefish species including:

- billfish (e.g. blue, black and striped marlin, as well as sailfish, spearfish and broad billed swordfish);
- tunas (e.g. yellowfin, bluefin, bigeye, longtail, albacore, skipjack and bonitos);
- sharks (e.g. tiger, mako, hammerhead, blue, and whaler); and
- sportfish (e.g. dolphin fish, wahoo, kingfish, cobia, Spanish mackerel, barracuda).

As discussed further in section 5.4.1, although marlin are only a by-catch of the commercial ET&BF fishery, they are the primary gamefish species targeted by recreational anglers off the NSW coastline and in recent years striped marlin are the most common species of marlin caught.

In the course of targeting marlin, however, recreational anglers can also expect to catch a certain by-catch of other gamefish species such as tunas, sharks and sportfish. Similarly, recreational anglers who target tuna, sharks and sportfish can also expect to catch the occasional striped marlin, depending on the fishing techniques employed.

5.2 Regulations governing recreational fishing for striped marlin

Recreational gamefishing comprises three main sectors:

- organised, club-based gamefishing;
- non club-based gamefishing; and
- charter boat gamefishing.

As outlined below, these three recreational gamefishing sectors are subject to a range of NSW Government legislation and regulations as well as voluntary regulations implemented by recreational gamefishing associations.

All recreational anglers who wish to go fishing for striped marlin off the NSW coastline must comply with the NSW Government legislation and regulations that are outlined in section 5.2.1.

In addition, recreational anglers who participate in organised, club-based gamefishing events usually have to comply with a number of additional voluntary regulations that are outlined in section 5.2.2.

Charter boat operators who take recreational anglers fishing for striped marlin off the NSW coastline also have to comply with the NSW Government legislation and regulations outlined in section 5.2.3.

5.2.1 Legislation and regulations governing recreational striped marlin fishing

Since the management of recreational fishing is the responsibility of State and Territory Governments, it is governed by the fisheries legislation and regulations of those states and territories.

However, the *Fisheries Management Act 1991* does provide for the Commonwealth to include recreational fishing in a management plan, although this has not been done as yet. There is an informal agreement between the States and Commonwealth that the States will continue to manage recreational fishing in the future.

Recreational fishing licences

All recreational fishers in NSW are required to pay a fee by Part 2, Division 4A, section 34C of the *NSW Fisheries Management Act 1994 No. 38* unless they are otherwise exempt:

34C Recreational fishers required to pay fishing fee

- (1) *A fishing fee is payable by all recreational fishers, unless exempted by or under this section.*
- (2) *A fisher is exempt from paying a fishing fee:*
 - (a) *if the fisher is under 18 years of age, or*
 - (b) *if the fisher is of or over 18 years of age and is only assisting a fisher under 18 years of age to take fish by means of a single rod or line, or*
 - (c) *if the fisher holds a licence, permit or other authority under this Act or the regulations and is taking fish in accordance with that licence, permit or other authority, or*
 - (d) *if the fisher is engaging in recreational fishing activities that are exempt from payment of a fishing fee by virtue of a fishing fee exemption certificate that is in force, or*
 - (e) *if the fisher is taking fish from water subject to an aquaculture permit and is taking fish to which the permit relates, or*
 - (f) *if the fisher is an Aboriginal person and:*
 - (i) *is taking fish from freshwater, or*
 - (ii) *is taking fish from other waters pursuant to a native title right or interest that is the subject of an approved determination of native title or of a claim entered on the Register of Native Title Claims (within the meaning of the *Native Title Act 1993* of the Commonwealth), or*
 - (g) *if the fisher is taking fish from an aquarium, or from a body of water of a class exempted by the regulations, or*
 - (h) *if the fisher is a fisher of a class exempted by the regulations.*

Recreational fishing license fees

The recreational angler license fees are set out in Part 2, Division 4A, section 34E of the *NSW Fisheries Management Act 1994 No. 3* but can be varied in regulation and different fees can be specified for different classes of person:

34E Amount of fishing fee

- (1) *The amount of the fishing fee is (subject to this section):*
- (a) *for a period of 3 days—\$5, or*
 - (a1) *for a period of 1 month—\$10, or*
 - (b) *for a period of 12 months—\$25, or*
 - (c) *for a period of 3 years—\$70.*
- (2) *The regulations may prescribe a different amount for any such period and may prescribe the amount for any other period for which a fishing fee may be paid.*

34F Reductions in fishing fee payable

The regulations may provide for reductions in the amount of the fishing fee otherwise payable by persons of a specified class.

Recreational fishing bag limits

Recreational anglers are restricted to daily bag limits on the number of striped marlin they are able to ‘take’ in one day by Part 2, Division 2, section 17 of the *Fisheries Management Act 1994 No. 38*:

17 Bag limits—taking of fish

- (1) *The regulations may specify the maximum quantity of fish of a specified species, or of a specified class, that a person may take on any one day (the **daily limit**).*
- (2) *A person who takes on any one day more fish than the daily limit of those fish is guilty of an offence.*

Section 18 of the Act enables limits to be set in regulations on the maximum quantity of fish that a person can have in their possession:

18 Bag limits—possession of fish

- (1) *The regulations may specify the maximum quantity of fish of a specified species, or of a specified class, that a person may have in possession in any specified circumstances (the **possession limit**).*
- (2) *A person who has in the person's possession in any such circumstances more than the possession limit of those fish is guilty of an offence. This subsection applies irrespective of the period over which the fish were taken.*

These daily and possession limits on striped marlin are set out in sections 11 and 12 (and the accompanying Table) of the *Fisheries Management (General) Regulation*:

11 Bag limits—taking of fish

- (1) *For the purposes of section 17 (1) of the Act, the daily limit of fish (of a species specified in Column 1 of Part 1 or 2 of the Table to this Division) is the quantity specified opposite that species of fish in Column 2 of Part 1 or 2 of that Table.*

12 Bag limits—possession of fish

- (1) *For the purposes of section 18 (1) of the Act, the possession limit of fish (of a species specified in Column 1 of Part 1 or 2 of the Table to this Division) is, when the person in possession of that species of fish is in or on or adjacent to any waters or is transporting or storing the fish, the quantity specified opposite that species of fish in Column 2 of Part 1 or 2 of that Table.*

Table Bag limits

Part 1 Fish—Marine or estuarine

	<i>Column 1</i>	<i>Column 2</i>
<i>Common name</i>	<i>Species</i>	<i>Daily limit and possession limit</i>
<i>Billfish (all species)</i>	<i>Species of Family Xiphiidae and Family Istiophoridae</i>	<i>2 of each species</i>

For the purposes of the *Fisheries Management Act 1994*, the term ‘take’ is defined as follows:

take fish includes:

- (a) catch or kill fish, or
- (b) gather or collect fish, or
- (c) remove fish from any rock or other matter,
or attempt to do so.

As a result, it is an offence under section 17 of the Act for a recreational angler to catch more than the daily bag limit of 2 striped marlin.

However, so long as anglers immediately return any additional fish over that bag limit to the water, they are immune from prosecution by section 36:

36 Defence for accidental etc taking of fish

- (1) *It is a defence to a prosecution for an offence against this Act or the regulations relating to the taking of fish if the person charged satisfies the court that, on becoming aware of the taking of the fish, the person took immediate steps to return the fish to its natural environment with the least possible injury.*
- (2) *The defence provided under subsection (1) extends to fish taken and immediately released in the course of a sport fishing activity (being an activity conducted in accordance with any requirements of the regulations).*

5.2.2 Voluntary regulations governing organised club-based striped marlin fishing

In addition to the legislative constraints outlined above, organised, club-based, fishing for striped marlin off the NSW coastline is also governed by a range of voluntary rules and regulations established by the Gamefishing Association of Australia (GFAA) and its state-based affiliate, the New South Wales Gamefishing Association (NSWGFA).

The voluntary rules and regulations established by the GFAA⁴ govern:

- the types of line and backing that can be used;
- the maximum length of the double and trace that can be added to the mainline to assist landing the fish;
- the minimum length of rod that can be used and the maximum size of the rod butt;

⁴ The GFAA rules and regulations can be found at http://www.gfaa.asn.au/html/7gam_01.htm.

- the prohibition of power operated, ratchet handle, and double handed reels;
- the numbers, types and distances between hooks that can be used;
- the types of fighting chairs, rod gimbals, gaffs, floats, outriggers and downriggers that can be used;
- angling practices (e.g. restrictions on the type of assistance that can be given to an angler while catching a fish); and
- fly fishing equipment and practices.

These voluntary rules and regulations are designed to:

- promote ethical and sportsman-like angling practices;
- establish uniform regulations for the compilation of Australian gamefish records; and
- provide basic angling guidelines for use in fishing tournaments.

Failure to comply with those rules regulations results in the disqualification of fish for the tournament point score and for gamefish record purposes.

Within these GFAA guidelines, the NSWGFA also imposes additional voluntary restrictions on the minimum weight for all marlin, sharks and tunas caught in competitions. For example, in order to be eligible for weigh in at a tournament, striped marlin must weigh at least:

- 60 kg if caught on 4 kg, 6 kg, 8 kg or 10 kg line class; or
- 80 kg if caught on 15 kg, 24 kg, 37 kg or 60 kg line class.

5.2.3 Legislation and regulations governing charter boat fishing for striped marlin

NSW charter boat operators are required to be licensed under section 127B of the *Fisheries Management Act 1994 No.38*:

127 B Certain charter fishing boats to be licensed

(1) *The regulations may declare that all or any specified class of charter fishing boats are required to be licensed under this Part.*

For the purposes of the Act, a ‘charter fishing boat’ is defined by section 127A of that Act as follows:

127 A Meaning of charter fishing boat

For the purposes of this Part, a boat is a charter fishing boat if:

- (a) *the boat is used for recreational fishing activities under an arrangement made with or on behalf of the persons using the boat, and*
- (b) *a payment or other consideration is required to be made or given by or on behalf of all or any of those persons for the right to fish from the boat, and*
- (c) *the boat is used for recreational fishing activities in any waters (whether or not within the limits of the State).*

5.3 The recreational fleet

Although detailed information is available on the number of licensed commercial operators in the ET&BF fishery, relatively little information is gathered on the numbers of recreational anglers who fish for striped marlin off the NSW coastline.

The total number of recreational anglers involved in fishing for striped marlin off the NSW coastline in any one year includes not only those anglers who are targeting striped marlin, but also those anglers who can reasonably expect to catch striped marlin as a by-product of their fishing activity.

As a result, for the purposes of this study, we have sought to estimate the total number of recreational anglers fishing off the NSW coastline who have a reasonable expectation of catching a striped marlin, even though that may not be targeting that species. That is, we have included those anglers who are not targeting striped marlin, but who are likely to catch striped marlin. This approach is consistent with the approach used to determine the number of commercial operators catching striped marlin off the NSW coastline (i.e. although commercial operators do not target striped marlin, they are likely to catch striped marlin when they are longline fishing for tuna).

As outlined below, our approach to estimating the total number of recreational striped marlin anglers fishing off the NSW coastline involved estimating:

- the number of recreational anglers licensed to fish in NSW, using NSW Fisheries licensing data;
- participation in offshore fishing off the NSW coastline (i.e. estimating the total number of offshore fishing trips made by recreational anglers off the NSW coastline), using data from the *National Recreational and Indigenous Fishing Survey*;
- participation in gamefishing off the NSW coastline, by estimating:
 - the number of those offshore fishing trips where there was a reasonable chance of catching a striped marlin, using NSW Fisheries' Gamefish Tournament Monitoring Program data on directed effort; and
 - the number of recreational anglers involved in gamefishing off the NSW coastline using Ernst & Young's *NSW Striped Marlin Recreational Fishing Survey* data on the average number of gamefishing trips made by each recreational angler in a year.

5.3.1 Number of recreational anglers licensed to fish in NSW

As noted in section 5.2.1, all recreational anglers who want to fish in NSW waters, including those anglers who want to fish for striped marlin off the NSW coastline, are required to pay a fee.

As a result, the total number of licensed anglers in NSW provides an indication of the maximum number of anglers who are legally entitled to go fishing for striped marlin off the NSW coastline.

NSW fishing licences are valid:

- from the date of issue or nominated commencement date; and
- for different periods of time - 3 years, 1 year, 1 month, or 3 days.

Consequently, when estimating the number of licensed anglers at any point in time, it is necessary to consider both the stock of licensed anglers who still hold a valid license purchased in a previous year, as well as the number of anglers who have purchased licences in the current year.

For example, in June 2003, the number of licensed anglers was equal to the sum of the numbers of:

- 3 year licenses sold in 2000-01, 2001-02, 2002-03 (20,394 + 19,863 + 14,518 = 55,775);
- 1 year licenses sold in 2002-03 (198,058); and
- 1 month licenses sold in June 2003 (8,204).

That is, in June 2003, there were 262,037 licensed anglers.

5.3.2 Participation in offshore fishing off the NSW coastline

Although there are around 260,000 licensed recreational anglers, obviously not all of those anglers and boats are involved in fishing for striped marlin off the NSW coastline.

Recreational anglers in NSW are able to choose from a wide range of alternative fishing locations and fish species including:

- freshwater rivers and lakes, for species such as trout, salmon, Murray cod, redfin, and European carp;
- estuarine waters, for species such as Australian bass, perch, barramundi, whiting and bream;
- coastal waters (i.e. from shoreline to 5km), for species such as whiting, flathead, bream and snapper; and
- offshore waters (i.e. more than 5km from the coastline) for gamefish species such as tuna, billfish (e.g. striped, blue and black marlin), and other sportfish (e.g. kingfish).

In addition, NSW recreational anglers also have the option of fishing in other Australian States and Territories as well as overseas.

A range of factors influence the amount of time and effort that recreational anglers decide to devote to gamefishing off the NSW coastline for striped marlin including:

- recreational angler preferences for alternative forms of fishing. Recreational anglers, like commercial fishers, have their own preferences regarding target species and tailor their fishing techniques to suit particular species; and
- the relative costs of participating in each of those different forms of fishing.

In this regard, it is important to note that gamefishing offshore is the most expensive of all forms of recreational fishing since it involves significant:

- capital costs, in the form of:
 - boats capable of carrying anglers significant distances offshore quickly and fitted out for gamefishing; and
 - specialized fishing gear, capable of handling large gamefish that make long sustained runs at high speed;
- operating costs, such as fuel, boat repairs and maintenance, experienced crew, and time.

This means that it is reasonable to expect that only a relatively small proportion of licensed anglers in NSW are actually involved in gamefishing off the NSW coastline.

Although there is little information available on the numbers of anglers that participate in fishing off the coast of NSW, the *National Recreational and Indigenous Fishing Survey* did provide data on the

total number of fishing events in NSW in 2000-01 and the proportion of that total fishing effort that involved offshore fishing as opposed to fishing in freshwater, estuarine and coastal waters.

Specifically, the survey indicated that in 2000-01, total fishing effort in NSW was 6.9 million fisher days or 7.7 million events. That fishing effort was allocated across alternative forms of recreational fishing in the following proportions:

- rivers – 14.6 percent;
- lakes and dams – 9.6 percent;
- estuarine – 47 percent;
- coastal (shoreline to 5 km offshore) – 27.5 percent; and
- offshore (more than 5 km offshore) – 1.3 percent.

That is, recreational anglers only made approximately 90,999 offshore fishing trips in 2000-01 (i.e. 1.3 percent of the 7.7 million offshore fishing events). This estimate is considered to be very conservative in view of the methodology used by the National Survey.

5.3.3 Participation in gamefishing and striped marlin fishing

Although recreational anglers made around 91,000 offshore fishing trips in 2000-01, not all of those trips will have involved fishing for billfish such as striped marlin. Rather, some of that time will have been spent chasing other gamefish species such as tuna, sharks and sportfish.

In order to determine the proportion of those trips that were spent pursuing billfish such as striped marlin, data is required on the directed effort of recreational anglers when they are fishing offshore.

The most comprehensive data available on recreational angler offshore fishing preferences is that provided by NSW Fisheries' *Gamefish Tournament Monitoring Program*, which surveys gamefish tournament effort in popular gamefish ports such as Mooloolaba and Southport in Queensland and NSW ports such as Coffs Harbour, Port Macquarie, Port Stephens, Lake Macquarie, Sydney, Wollongong, Greenwell Point, Ulladulla, Batemans Bay, Bermagui and Eden.

In particular, that survey provides time series data on the number of anglers and number of boats categorized by two main categories of directed effort:

- billfish and tuna; and
- sharks.

Table 7: Directed effort of gamefish tournaments

	1996-97		1997-98		1998-99		1999-2000	
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Billfish Fishing								
Number of angler days	4,280	83.8%	5,576	83.6%	10,673	82.3%	11,911	85.0%
Number of boat days	985	84.6%	1,194	84.6%	2,478	83.3%	2,753	85.0%
Shark Fishing								
Number of angler days	830	16.2%	1,091	16.4%	2,297	17.7%	2,107	15.0%
Number of boat days	179	15.4%	218	15.4%	497	16.7%	484	15.0%
Total								
Number of angler days	5,110	100.0%	6,667	100.0%	12,970	100.0%	14,018	100.0%
Number of boat days	1,164	100.0%	1,412	100.0%	2,975	100.0%	3,237	100.0%

As indicated in Table 7, the *Gamefish Tournament Monitoring Program* data for the years 1996 to 2000 indicate that the effort of recreational anglers offshore has been directed in the following proportions:

- 85 percent of anglers and boats have been pursuing billfish and tuna; and
- 15 percent of anglers and boats have been pursuing sharks.

This directed effort data suggests that recreational anglers undertook approximately 77,321 trips off the NSW coastline in 2000-01 to fish for billfish and tuna (i.e. 85 percent of 90,999 offshore trips).

That data has been used to estimate:

- the size of the sample of offshore fishing captured by the *NSW Striped Marlin Recreational Fishing Survey*. The 205 recreational anglers who responded to that survey accounted for 4,849 trips offshore in 2002-03, or **6.3 percent** of the estimated total number of offshore trips that involved fishing for billfish and tuna (assuming that the total number of offshore fishing trips in 2002-03 was similar to the total number in 2000-01); and
- the total number of anglers who fished for billfish/tuna off the NSW coastline. The *NSW Striped Marlin Recreational Fishing Survey* indicates that recreational anglers spend approximately 23.7 days a year fishing offshore, which suggests that there are at least **3,269 recreational anglers who fish for billfish and tuna off the NSW coastline** (77,321/23.7).

Some indication of the total number of recreational anglers engaged in fishing for billfish off the NSW coastline is also provided by:

- NSW Fisheries' *Gamefish Tournament Monitoring Program*, which indicates that the annual inter-club gamefishing tournament regularly attracts over 1,000 billfish anglers. That is, there are at the very least 1,000 anglers who engage in fishing for billfish off the NSW coastline (see Table 8); and
- NSW gamefishing and sportfishing club membership data. Although there is likely to be some overlap in this data (i.e. anglers who belong to both associations) which means that the total number of anglers who belong to these associations is less than their combined membership, it is also important to recognise that not all recreational anglers who go fishing for billfish off the NSW coastline belong to fishing associations or participate in gamefishing tournaments:
 - The NSW Game Fishing Association had a membership of:
 - 3,208 in 2000-01;
 - 3,411 in 2001-02;
 - 3,511 in 2002-03;
 - The Australian National Sportfishing association had a NSW membership of:
 - 1,919 in 2000-01;
 - 1,724 in 2001-02; and
 - 1,571 in 2002-03.

Table 8: Anglers and boats participating in Port Stephens inter-club tournament

	1996-97				1997-98				1998-99				1999-2000			
	Billfish		Sharks		Billfish		Sharks		Billfish		Sharks		Billfish		Sharks	
	Anglers	Boats	Anglers	Boats	Anglers	Boats	Anglers	Boats	Anglers	Boats	Anglers	Boats	Anglers	Boats	Anglers	Boats
Day 1	890	183	169	34	1,072	213	206	36	960	185	179	33	1,154	230	86	15
Day 2	863	183	174	32	1,002	209	193	38	972	187	160	29	994	195	185	36
Day 3 (Ladies Day)					390	67	32	5	311	55	13	3	441	66	27	5
Day 4	950	185	161	32	753	162	166	31	964	190	190	34	1,038	206	155	31
Day 5	868	184	119	22	995	209	179	34	906	180	174	32	930	190	182	35

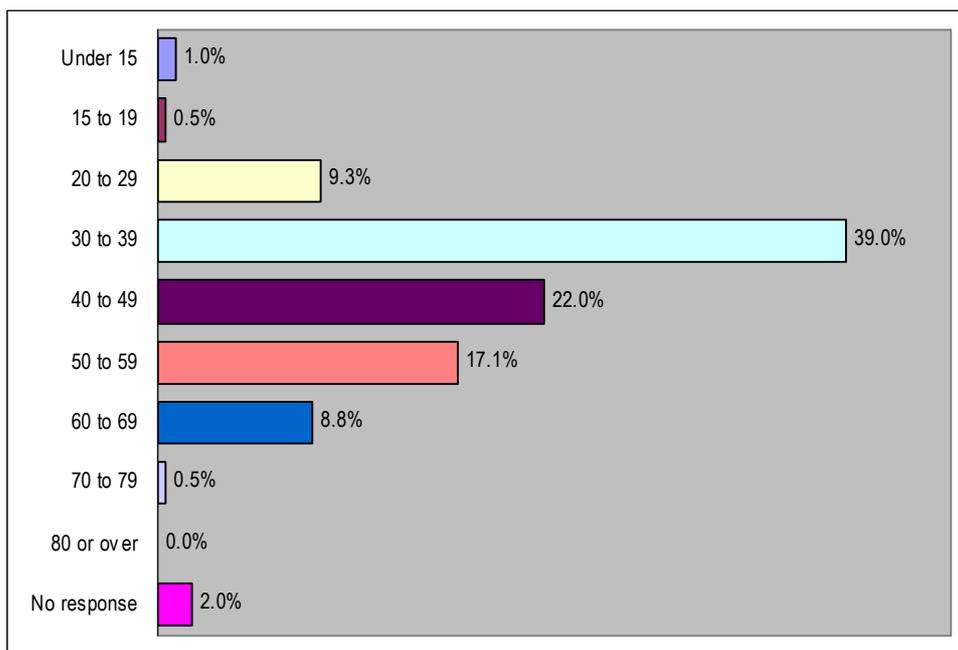
5.3.4 Angler demographics

Gender and age

Data obtained from the *NSW Striped Marlin Recreational Fishing Survey* suggests that recreational angling for striped marlin off the NSW coastline is a sport that attracts mainly men between the ages of 30 to 59.

Approximately 97 percent of the respondents to the survey were male and 3 percent were females and over 78 percent of respondents were between 30 and 59 years old.

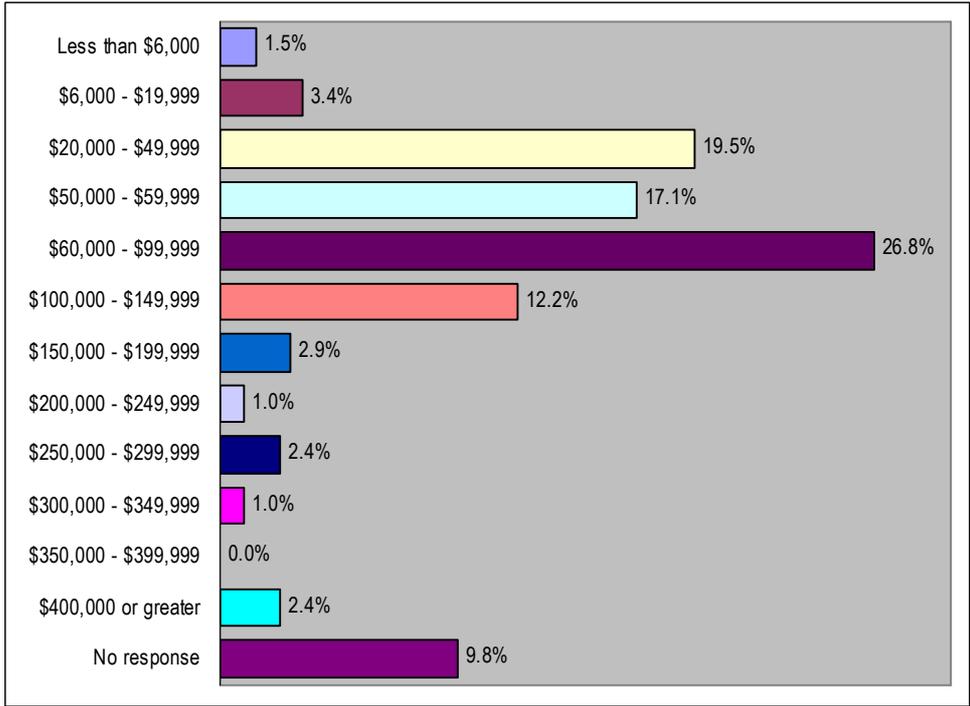
Figure 9: Age of recreational anglers surveyed



Income

Figure 10 dispels the myth that gamefishing is a pastime primarily for millionaires. Over 68 percent of respondents to the survey earned less than \$100,000 per annum and over 80 percent earned less than \$150,000 per annum.

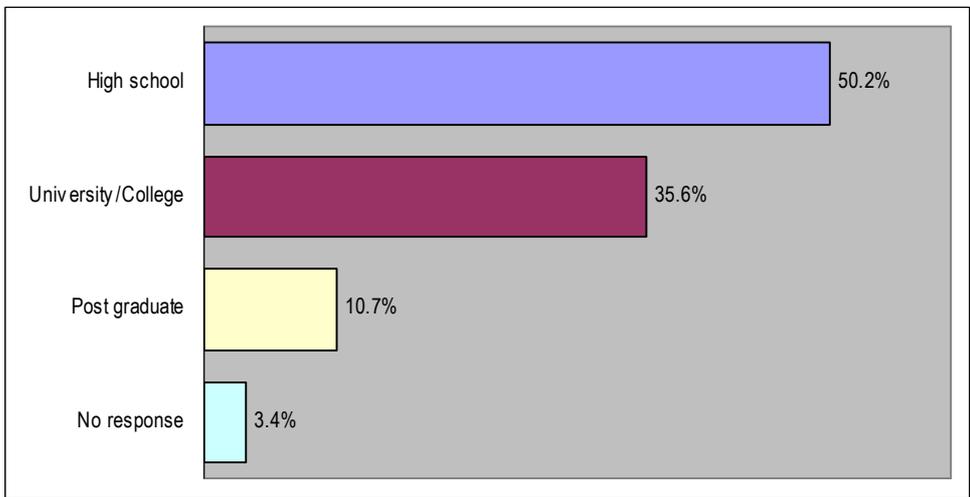
Figure 10: Gross income of recreational anglers surveyed



Education

Over 46 percent of the recreational anglers surveyed had a university degree, college diploma or post graduate education.

Figure 11: Education levels of recreational anglers surveyed



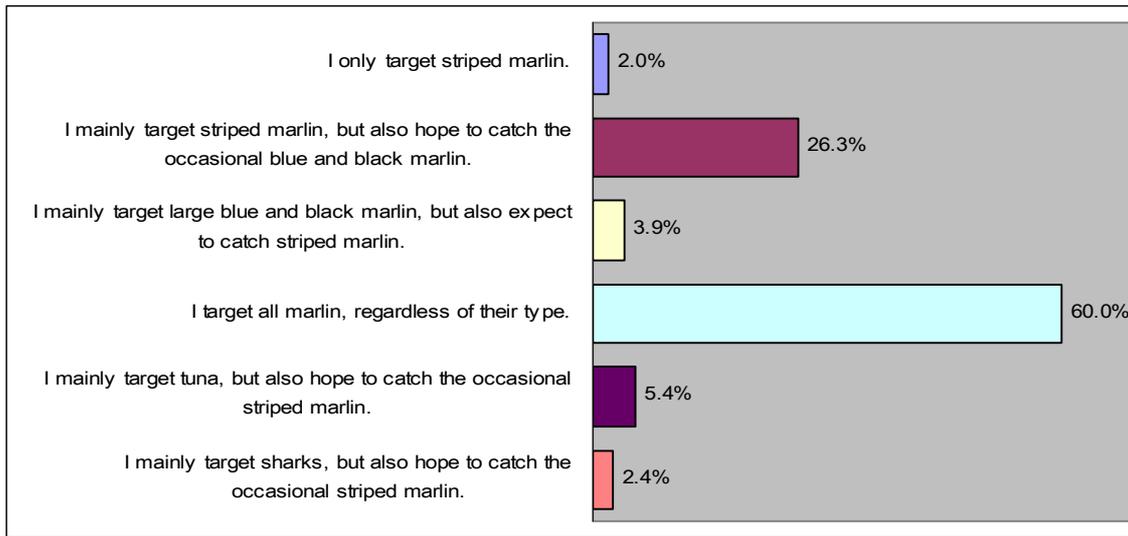
5.4 Fishing preferences and methods

5.4.1 Preferred target species - marlin

Recreational fishing survey

Data obtained from the *NSW Striped Marlin Recreational Fishing Survey* suggests that most recreational anglers fishing offshore are targeting marlin. Sharks, tuna and sportfish are more a by-catch of their marlin fishing activities. Over 92 percent of the recreational anglers surveyed indicated that they were targeting marlin, whereas only 5.4 percent of anglers surveyed indicated they primarily targeted tuna and 2.4 percent indicated they mainly targeted sharks.

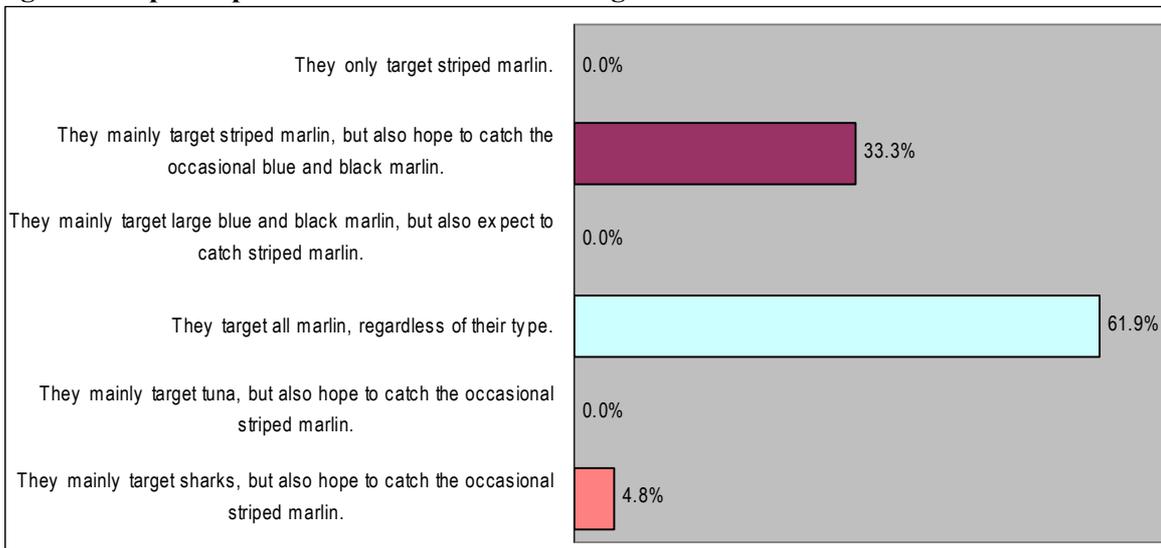
Figure 12: Species preferences of recreational anglers surveyed



Charter boat survey

A similar preference for marlin fishing was expressed by charter boat operators when they were asked in the *NSW Striped Marlin Charter Boat Fishing Survey* about the preferences of their recreational angler clients.

Figure 13: Species preferences of charter boat anglers



5.4.2 Preferred fishing locations

Recreational fishing survey

Data obtained from the *NSW Striped Marlin Recreational Fishing Survey* indicated that the 205 recreational anglers surveyed had spent a total of 4,849 days fishing for striped marlin off the NSW coastline over the survey period, and more than 50 percent of that time was spent in the Hunter and Sydney regions and over 16 percent in the Southern region (see Table 9). This is consistent with the trend for most gamefishing to be undertaken in those striped marlin fishing locations that are located the closest to major population centers.

Table 9: Number of days spent striped marlin fishing by recreational anglers surveyed

NSW COASTAL REGIONAL AREA								TOTAL NSW	
Northern and Mid Northern		Hunter and Sydney		Illawarra		Southern			
Number of days	%	Number of days	%	Number of days	%	Number of days	%	Number of days	%
468	9.7%	2,449	50.5%	788	16.3%	1,144	23.6%	4,849	100.0%

Charter boat survey

The *NSW Striped Marlin Charter Boat Fishing Survey* revealed a similar regional distribution of striped marlin fishing effort by charter boat anglers. The charter boat operators surveyed indicated they had spent 1,080 days striped marlin fishing off the NSW coastline in 2002-03 and over 60 percent of that time was spent fishing in the Hunter and Sydney regions, and over 19 percent in the Southern region (see Table 10).

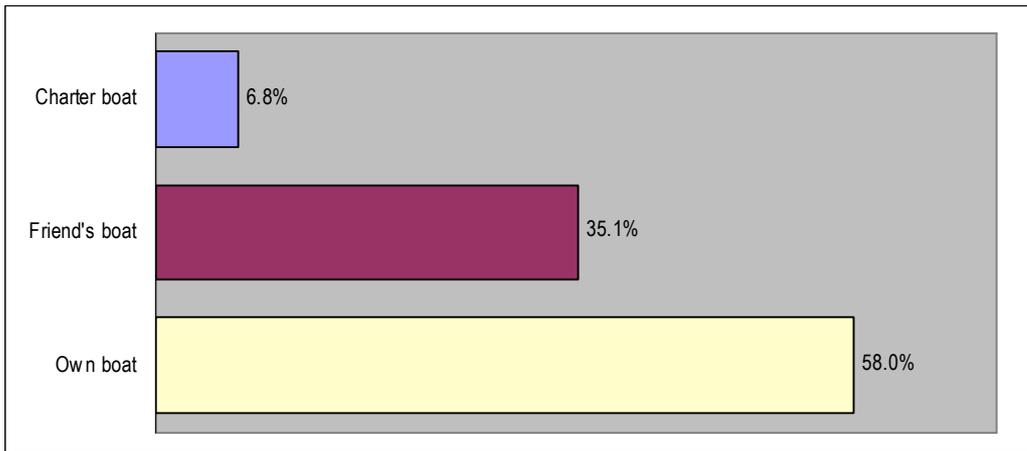
Table 10: Number of days spent striped marlin fishing by charter boat anglers

NSW COASTAL REGIONAL AREA								TOTAL NSW	
Northern and Mid Northern		Hunter and Sydney		Illawarra		Southern			
Number of days	%	Number of days	%	Number of days	%	Number of days	%	Number of days	%
144	13.3%	654	60.6%	74	6.9%	208	19.3%	1,080	100.0%

5.4.3 Boat ownership and charter boat use preferences

Data from the *NSW Striped Marlin Recreational Fishing Survey* indicates that 58 percent of the anglers surveyed mainly used their own boats to fish for striped marlin and 35 percent used their friends' boats. Only 6.8 percent of the recreational anglers surveyed normally fished for striped marlin from charter boats.

Figure 14: Ownership of boats used by recreational anglers surveyed to fish for striped marlin

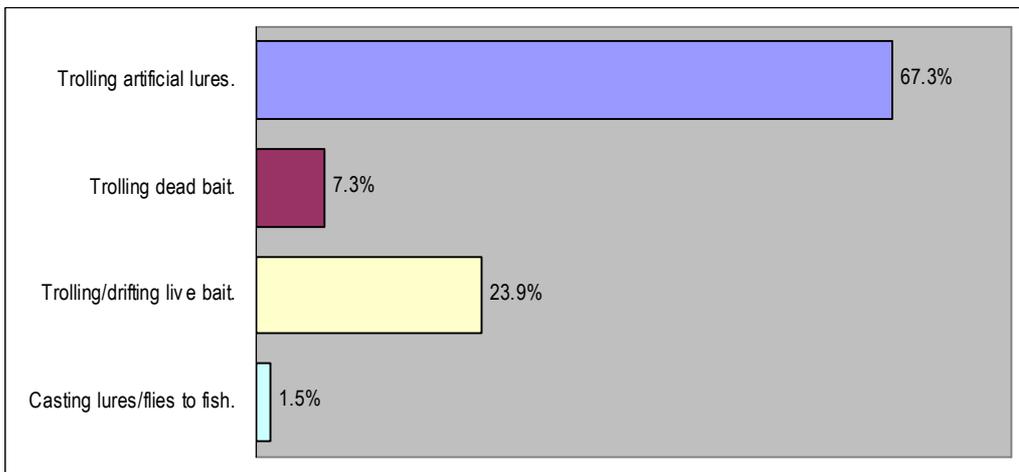


5.4.4 Preferred fishing method - trolling

As indicated in the figures below, both the *NSW Striped Marlin Recreational Fishing Survey* and the *NSW Striped Marlin Charter Boat Fishing Survey* reveal a strong preference for the use of trolled artificial lures to catch striped marlin

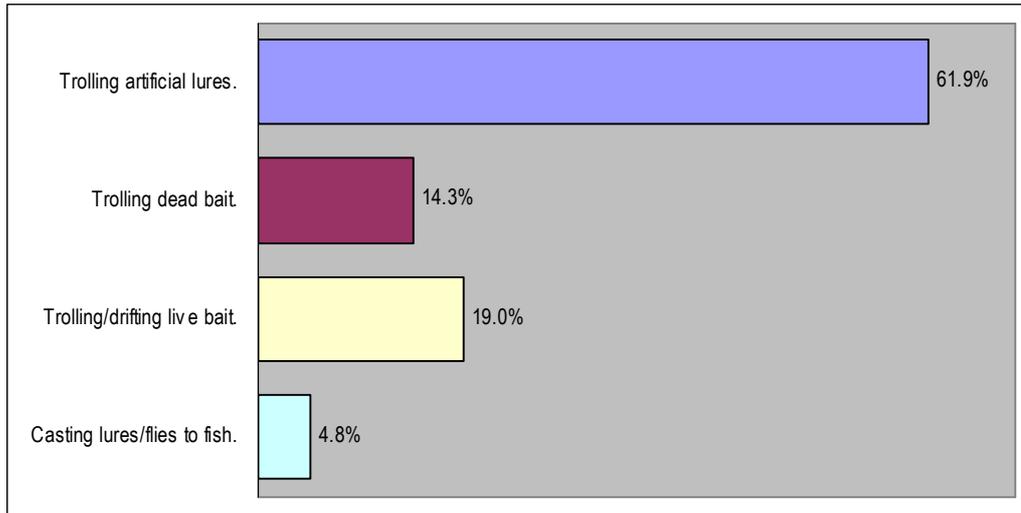
Recreational fishing survey

Figure 15: Method normally used by recreational anglers surveyed to catch striped marlin



Charter boat survey

Figure 16: Method normally used by charter boat anglers to catch striped marlin

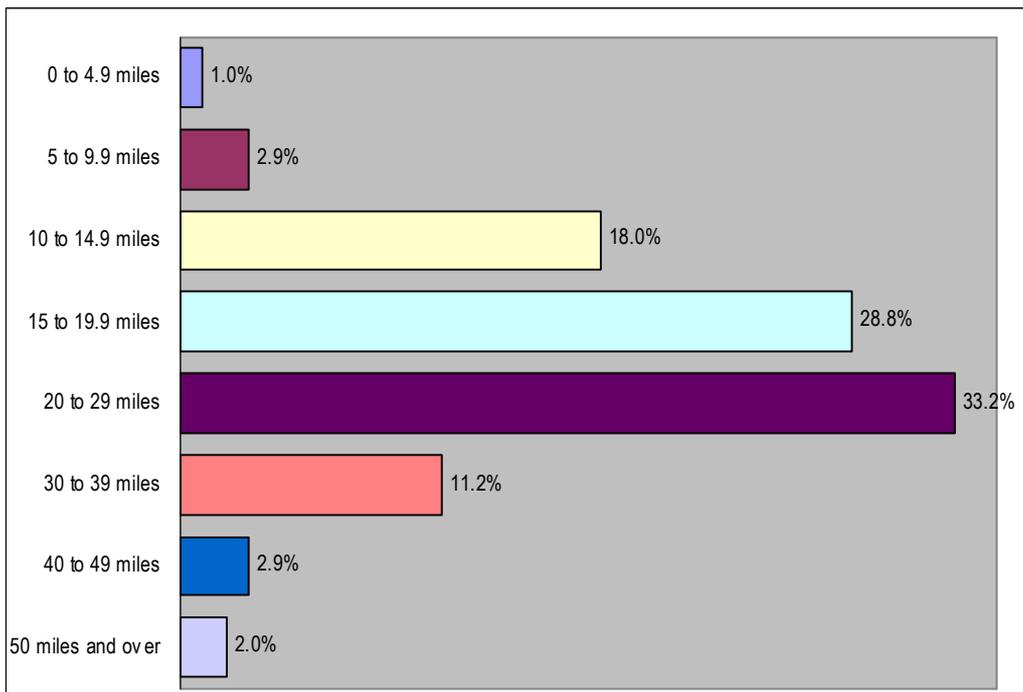


5.4.5 Distance traveled offshore

Both the *NSW Striped Marlin Recreational Fishing Survey* and the *NSW Striped Marlin Charter Boat Fishing Survey* reveal that approximately 98 percent of recreational anglers normally fish for striped marlin within 50 nautical miles of the NSW coastline.

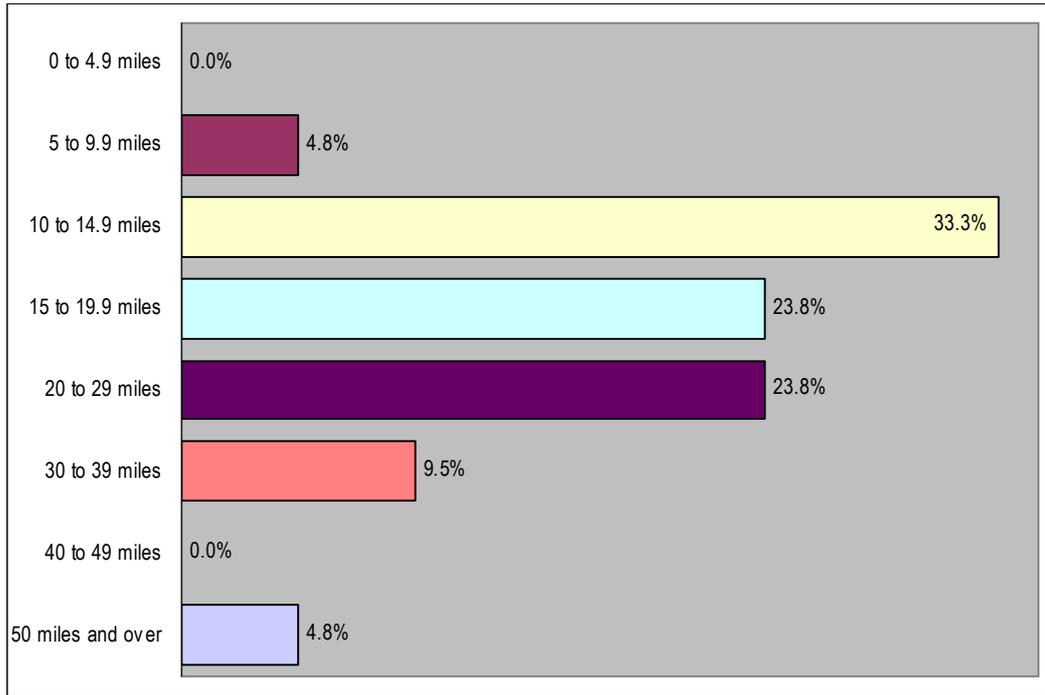
Recreational fishing survey

Figure 17: Distance normally travelled offshore by recreational anglers to fish for striped marlin



Charter boat survey

Figure 18: Distance normally travelled offshore by charter boat anglers to fish for striped marlin

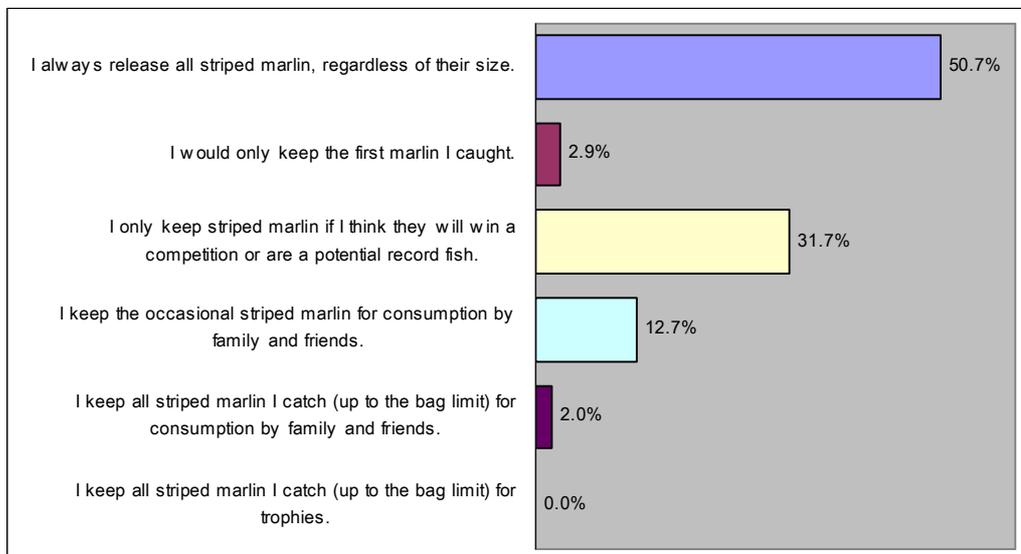


5.4.6 Strong preference for catch and release

Both the *NSW Striped Marlin Recreational Fishing Survey* and the *NSW Striped Marlin Charter Boat Fishing Survey* also reveal the strong preference of recreational anglers to release the striped marlin they catch. Of the striped marlin not released, most are kept either for competition or fishing record purposes, or consumption by family and friends.

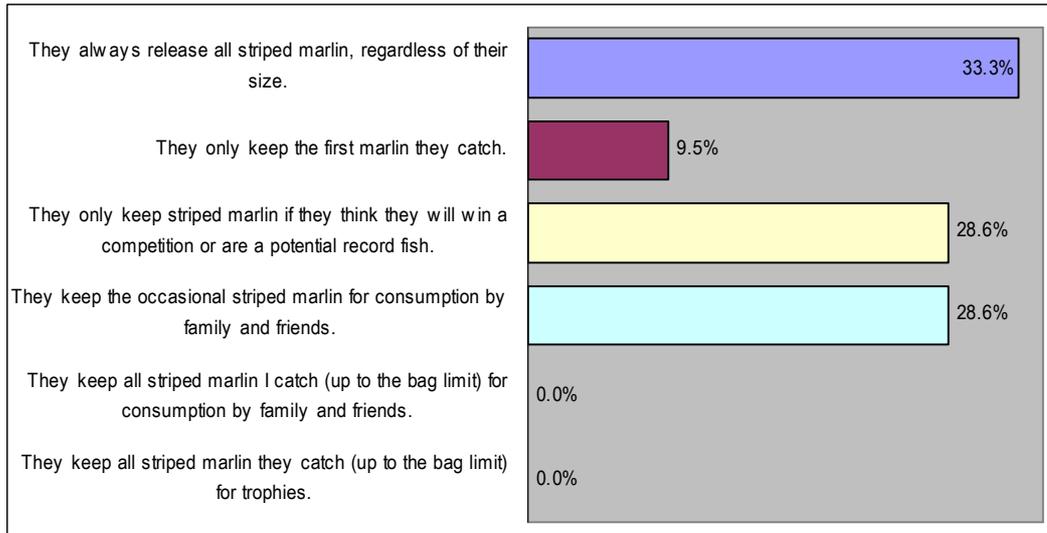
Recreational fishing survey

Figure 19: Treatment of striped marlin caught by recreational anglers



Charter boat survey

Figure 20: Treatment of striped marlin caught by charter boat anglers

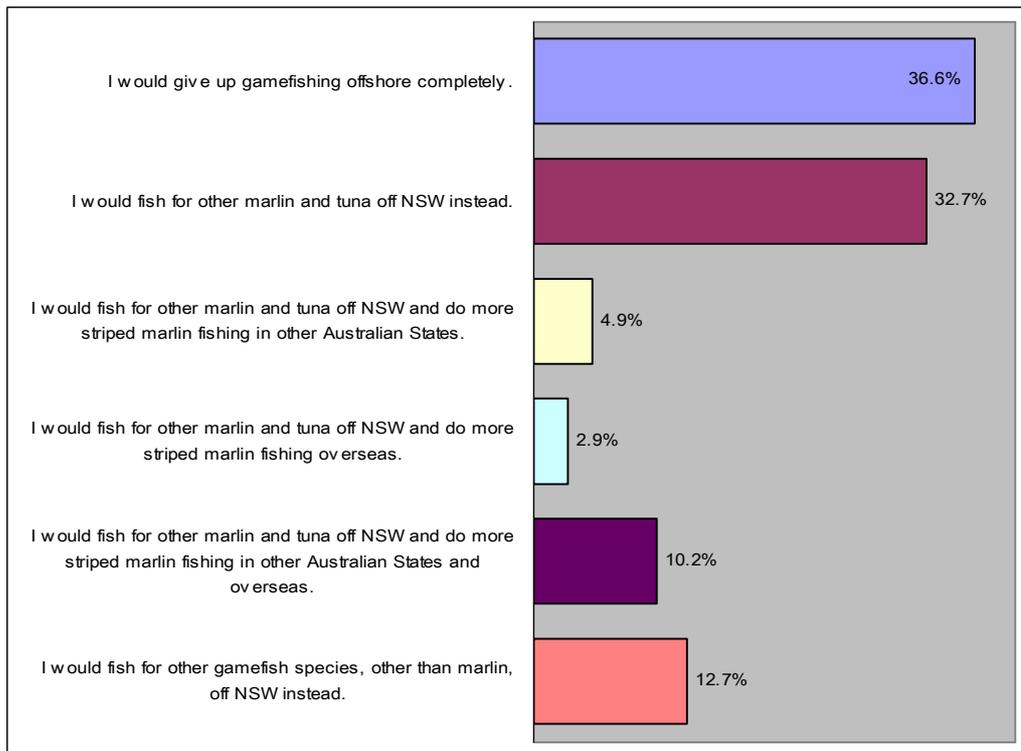


5.4.7 Response to reduction in striped marlin stocks

Recreational fishing survey

The *NSW Striped Marlin Recreational Fishing Survey* revealed that if striped marlin stocks were to fall to a level where recreational anglers were unlikely they would catch a fish, over 36 percent of those anglers surveyed indicated that they would give up gamefishing completely, whereas over 32 percent would fish for other marlin and tuna off the NSW coastline instead.

Figure 21: Response of recreational anglers to a fall in striped marlin stocks to a level where they would be unlikely to catch a fish



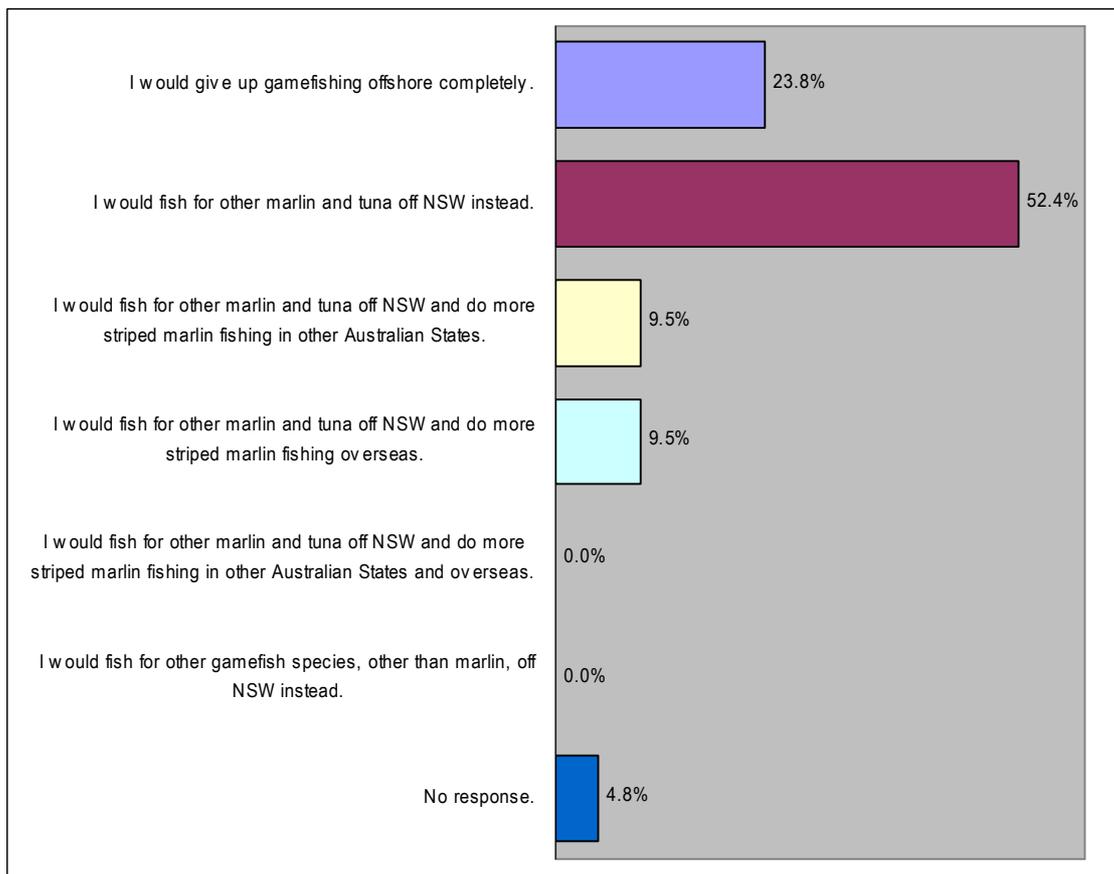
Only around 10 percent of recreational anglers indicated that they would seek to fish for striped marlin in other Australian states or overseas.

Charter boat survey

Similar results were obtained from the *NSW Striped Marlin Charter Boat Fishing Survey*.

That survey revealed that if striped marlin stocks were to fall to a level where charter boat operators were unlikely they would catch a fish, over 52 percent of those operators surveyed indicated that they would fish for other marlin and tuna off the NSW coastline instead and over 23 percent of operators indicated that they would give up their gamefishing operations completely.

Figure 22: Response of charter boat operators to a fall in striped marlin stocks to a level where they would be unlikely to catch a fish



5.5 Recreational catches of striped marlin off the NSW coastline

Unlike commercial fishers operating in the ET&BF fishery, recreational anglers operating in that fishery are not required submit records of their catches to fisheries authorities, except for charter boat operators.

Although gamefish competitions organised by clubs provide detailed catch records through the Gamefish Tournament Monitoring Program, the information currently available on both the number and weight of striped marlin caught off the NSW coastline by non-club recreational anglers is relatively poor in relation to the AFMA logbook information on commercial catches of striped marlin in the ET&BF fishery.

As outlined below, we have:

- extracted data from the *Gamefish Tournament Monitoring Program* on tournament catches of striped marlin off the NSW coastline in 1998-99 and 1999-2000 (section 5.5.1);
- outlined the latest NSW Fisheries data on striped marlin caught off the NSW coastline by charter boat operators (section 5.5.2);
- outlined the data obtained from Ernst & Young's *NSW Striped Marlin Recreational Fishing Survey* on recreational catches of striped marlin and other billfish off the NSW coastline (section 5.5.3); and
- combined NSW Fisheries' charter boat catch data with the catch data obtained from the *NSW Striped Marlin Recreational Fishing Survey* to provide an estimate of recreational angler striped marlin catches off the NSW coastline (section 5.5.4)

5.5.1 NSW Fisheries gamefish tournament catch data

The NSW Fisheries *Gamefish Tournament Monitoring Program* aims to develop a long-term series of data for the 'organised' or club-based component of the east coast gamefish fishery to assist in the better management of gamefish species. In particular, it is designed to assess trends in:

- fishing effort;
- success rates of anglers;
- spatial distribution of catches; and
- sizes of fish caught.

At the time this report was prepared, the most recent data publicly available from the *Gamefish Tournament Monitoring Program* was for 1998-99 and 1999-2000. Although more recent data has been collected by NSW Fisheries, that data was still being processed when this report was being finalised.

Table 11 presents the most recent *Gamefish Tournament Monitoring Program* data available on catches of billfish, tunas, sharks and other sportfish caught off the NSW coastline (i.e. it excludes Queensland tournament catch data).

As indicated in Table 11, striped marlin were the most common species of billfish caught at fishing tournaments held off the NSW coastline in 1998-99. By contrast, in 1999-2000, black marlin comprised the largest part of the billfish catch, primarily due to the unusually high concentrations of those fish off the NSW coastline that year. More recent data obtained from the *NSW Striped Marlin*

Recreational Fishing Survey confirm that striped marlin continue to comprise the bulk of recreational angler catches of billfish off the NSW coastline.

Table 11: Gamefish Tournament Monitoring Program catch data for NSW

	1998-99			1999-2000		
	Number of fish	Average weight (kg)	Total weight (kg)	Number of fish	Average weight (kg)	Total weight (kg)
BILLFISH						
Striped marlin	498	81	40,398	241	74	17,887
Black marlin	258	64	16,558	531	41	21,952
Blue marlin	81	121	9,782	134	125	16,692
Sailfish	7	39	274	11	32	355
Shortbill spearfish	5	20	102	3	37	110
TUNAS						
Yellowfin tuna	111	24	2,640	405	8	3,191
Albacore	1	10	10	50	8	408
Longtail tuna				2	9	18
SHARKS						
Shortfin mako shark	61	86	5,246	116	60	6,909
Tiger shark	43	181	7,762	37	189	6,980
Whaler shark	30	105	3,147	18	74	1,326
Hammerhead shark	61	60	3,652	29	63	1,835
Blue shark	6	56	333	41	59	2,438
SPORTFISH						
Dolphin fish	69	3	240	127	5	668
Wahoo	9	15	134	24	11	259
Kingfish	45	3	142	41	2	90
Barracuda				2	14	28

5.5.2 Charter boat catch data

All charter boat operators licensed to operate off the NSW coastline are required to provide NSW Fisheries with data on the number of striped they catch each year. Table 12 presents that data for the years 2000-01, 2001-02 and 2002-03.

Since no data is collected on the estimated weight of those striped marlin, it was necessary to use data obtained from the *NSW Striped Marlin Recreational Fishing Survey* on the average weight of striped marlin caught by charter boat anglers in order to obtain an estimate of the total weight of the striped marlin caught by charter operators each year.

As indicated in Table 12, charter boat operators caught:

- 870 striped marlin in 2000-01 weighing an estimated 58,769 kg; and
- 804 striped marlin in 2001-02 weighing an estimated 54,310 kg; and
- 325 striped marlin in 2002-03 weighing an estimated 21,954 kg.

Most of these marlin were caught in the Hunter, Sydney and Southern regions of NSW and over 96 percent were released.

Table 12: Striped marlin caught charter boat operators off the NSW coastline

STRIPED MARLIN	NSW COASTAL REGIONAL AREA												TOTAL NSW		
	Northern and Mid Northern			Hunter and Sydney			Illawarra			Southern					
	2001	2002	2003	2001	2002	2003	2001	2002	2003	2001	2002	2003	2001	2002	2003
Released															
Number	107	164	57	347	194	54	87	73	9	233	285	176	774	716	296
Weight (kg)	7,228	11,078	3,850	23,440	13,105	3,648	5,877	4,931	608	15,739	19,252	11,889	52,284	48,366	19,995
Kept															
Number	22	13	3	28	21	8	22	22	3	24	32	15	96	88	29
Weight (kg)	1,486	878	203	1,891	1,419	540	1,486	1,486	203	1,621	2,162	1,013	6,485	5,944	1,959
TOTAL															
Number	129	177	60	375	215	62	109	95	12	257	317	191	870	804	325
Weight (kg)	8,714	11,956	4,053	25,331	14,523	4,188	7,363	6,417	811	17,360	21,413	12,902	58,769	54,310	21,954

It is important to note that the catch data for the year 2003 is preliminary and incomplete at this stage. This explains why the reported catch is much lower than for previous years.

5.5.3 Recreational striped marlin fishing survey catch data

Table 13 sets out the data obtained from Ernst & Young’s *NSW Striped Marlin Recreational Fishing Survey* on recreational angler catches of striped marlin and other billfish off the NSW coastline over the 2002-03 survey period.

As indicated in Table 13, the results of this survey are consistent with data collected by NSW Fisheries from charter boat operators, even though most of the anglers surveyed fish from their own, or friends’ boats, rather than charter boats:

- striped marlin comprise most of the billfish catch (68% of the total billfish catch);
- most of those striped marlin are caught in the Hunter, Sydney and Southern regions of NSW; and
- over 96 percent of striped marlin caught by recreational anglers are released.

Table 13: Striped marlin caught by recreational anglers surveyed in 2002-03

	NSW COASTAL REGIONAL AREA												TOTAL NSW		
	Northern and Mid Northern			Hunter and Sydney			Illawarra			Southern					
	Striped marlin	Blue marlin	Black marlin	Striped marlin	Blue marlin	Black marlin	Striped marlin	Blue marlin	Black marlin	Striped marlin	Blue marlin	Black marlin	Striped marlin	Blue marlin	Black marlin
Released															
Number	70	16	178	562	69	127	91	7	20	252	9	17	975	101	342
Weight (kg)	3,498	1,495	5,410	35,417	6,853	8,403	4,633	936	888	16,252	1,370	1,758	59,800	10,654	16,459
Kept															
Number	3	0	1	12	7	8	14	0	6	9	4	2	38	11	17
Weight (kg)	195	0	59	759	690	531	2,662	0	634	704	674	217	4,320	1,364	1,441
TOTAL															
Number	73	16	179	574	76	135	105	7	26	261	13	19	1,013	112	359
Weight (kg)	3,693	1,495	5,469	36,176	7,542	8,934	7,295	936	1,522	16,956	2,044	1,975	64,120	12,017	17,900

5.5.4 Estimated total recreational striped marlin catch

Estimates of the total number and weight of striped marlin caught off the NSW coastline by recreational anglers were obtained using:

- NSW Fisheries data on striped marlin caught by charter boat anglers; and
- *NSW Striped Marlin Recreational Fishing Survey* data on striped marlin caught by non-charter boat anglers (i.e. those who fish from their own, or friends', boats).

Table 14 outlines that survey data.

Table 14: Total striped marlin caught by recreational anglers surveyed and charter boat operators 2002-03

	NSW COASTAL REGIONAL AREA								TOTAL NSW		
	Northern and Mid Northern		Hunter and Sydney		Illawarra		Southern		Charter	Non charter	Total
	Charter	Non charter	Charter	Non charter	Charter	Non charter	Charter	Non charter			
Released											
Number	57	66	54	530	9	89	176	190	296	875	1,171
Weight (kg)	3,850	3,538	3,648	34,637	608	4,463	11,889	12,782	19,995	55,420	75,415
Kept											
Number	3	3	8	12	3	14	15	9	29	38	67
Weight (kg)	203	195	540	759	203	2,662	1,013	704	1,959	4,320	6,279
TOTAL											
Number	60	69	62	542	12	103	191	199	325	913	1,238
Weight (kg)	4,053	3,733	4,188	35,396	811	7,125	12,902	13,486	21,954	59,740	81,694

The survey data outlined in Table 12 were then expanded out to the estimated population of charter and non-charter anglers to produce estimates of the total recreational catch of striped marlin, which are set out in Table 15.

Table 15: Estimated total catch of striped marlin off the NSW coastline 2002-03

	NSW COASTAL REGIONAL AREA								TOTAL NSW		
	Northern and Mid Northern		Hunter and Sydney		Illawarra		Southern		Charter	Non charter	Total
	Charter	Non charter	Charter	Non charter	Charter	Non charter	Charter	Non charter			
Released											
Number	528	1,049	500	8,427	83	1,415	1,630	3,021	2,741	13,913	16,653
Weight (kg)	35,654	56,254	33,778	550,728	5,630	70,962	110,090	203,234	185,152	881,178	1,066,330
Kept											
Number	28	48	74	191	28	223	139	143	269	604	873
Weight (kg)	1,877	3,101	5,004	12,068	1,877	42,326	9,383	11,194	18,140	68,688	86,828
TOTAL											
Number	556	1,097	574	8,618	111	1,638	1,769	3,164	3,010	14,517	17,526
Weight (kg)	37,531	59,355	38,782	562,796	7,506	113,288	119,473	214,427	203,292	949,866	1,153,158

As indicated in Table 15, it is estimated that the total catch of striped marlin off the NSW coastline by recreational anglers in 2002-03 was over 1,000 tonnes, which is higher than the commercial striped marlin catch for the entire ET&BF fishery (750 tonnes), although over 96 percent of the recreational striped marlin catch was released.

6. Economic Value and Significance of NSW Striped Marlin Fishing

Having outlined what is known about the supply and demand for striped marlin off the NSW coastline, we now turn our attention to estimating the:

- **economic value of striped marlin to the commercial and recreational fishing sectors of the economy.** This involves using cost-benefit analysis to estimate the economic value that commercial and recreational fishers place on the striped marlin they catch off the NSW coastline (i.e. the net benefits they derive from catching those fish), under current fisheries management practices; and
- **economic significance of striped marlin to the NSW economy and regional economies.** This involves using a multi-regional input/output model to estimate the contribution that commercial and recreational striped marlin fishing make to the NSW economy and regional economies along the NSW coastline, under current fisheries management practices.

6.1 Economic Value of Striped Marlin to the Commercial and Recreational Fishing Sectors of the Economy

6.1.1 What is the economic value of NSW striped marlin to commercial fishers?

Estimation of the gross value of striped marlin to commercial fishers

What is the gross value of striped marlin to commercial fishers?

As noted in section 2.2.1, the gross value of the commercial catch of striped marlin off the NSW coastline can be estimated by multiplying the total weight of striped marlin caught by commercial fishers off the NSW coastline by the average price that commercial fishers receive for striped marlin that is destined for sale on domestic or export markets. That prevailing domestic price of striped marlin is determined, in turn, by the prices paid to fish processors for 'trunked' striped marlin that is sold on world markets, less the costs of freight and insurance.

In practice, however, estimation of the gross value of unprocessed striped marlin to commercial fishers is complicated by:

- the lack of actual price data;
- differences in the whole and processed weights of striped marlin;
- possible quality differences between the striped marlin destined for domestic and international markets; and
- seasonal fluctuations in the supply of, and demand for, striped marlin.

These problems and their implications for our approach to estimating the gross value of striped marlin to commercial fishers are discussed further below.

- ***Lack of actual price data***

One of the main problems encountered when seeking to estimate the gross value of striped marlin caught by commercial fishers off the NSW coastline is the lack of readily available data on the actual prices they receive for that marlin.

In particular, there is little information available publicly on the prices that commercial fishers actually receive for the whole striped marlin they supply to fish processors due to the commercial sensitivity of that data. Rather, it is necessary to rely on publicly available data on the prices that fish processors receive for 'trunked' striped marlin that is sold on domestic and export markets. As discussed further below, however, those prices will tend to be higher per kilogram of striped marlin due to the weight lost in the trunking process and the value added by that trunking process.

In addition, there is only limited data publicly available on the actual prices fish processors receive for the 'trunked' NSW striped marlin on that is sold on domestic markets. Although price data is publicly available for striped marlin sold on the Sydney Fish Market, those sales only comprise a relatively small proportion of the total domestic sales of NSW striped marlin (approximately 11 percent of domestic sales in 2001-02 and 21 percent in 2002-03). There is no comprehensive data publicly available on the prices received for the remaining striped marlin that are sold on the domestic market through other channels due to the commercial sensitivity of that information. What little information there is suggests that the prices received for those striped marlin range between those prices paid on export markets for NSW striped marlin and those prices paid on the Sydney Fish Market.

Similarly, there is little data available on the prices that fish processors actually receive for 'trunked' striped marlin that are destined for export markets due to the commercial sensitivity of that data. Rather, it is necessary to rely on the prices actually paid for striped marlin in Japan, which is the main market for Australian exports of striped marlin.

- ***Differences between whole and processed fish weights***

Typically, most striped marlin are traded on domestic and international markets in a semi-processed, 'trunked' (i.e. gutted and headed), form.

As a result, in order to estimate the gross value of whole striped marlin to commercial operators using actual market price data for 'trunked' striped marlin, it is necessary to:

- convert the 'trunked' weights of striped marlin into whole weights. For the purposes of estimating the gross value of striped marlin, we have used the same conversion factor that has been used by AFMA to scale up 'trunked' striped marlin weights to whole weights. That is, we have increased 'trunked' weights by a factor of 1.5 to convert them into whole weights. This means that the gross value of a kilogram of unprocessed striped marlin is approximately 67 percent (i.e. $1/1.5$) of the gross value of a kilogram of 'trunked' striped marlin; and
- adjust the price paid for processed striped marlin so that it excludes the return that fish processors derive from 'trunking' the striped marlin. Part of the price paid for 'trunked' striped marlin on domestic and international marlin represents a return to fish processors that should be excluded from estimates of the gross value of whole striped marlin to commercial fishers. In the absence of detailed information on the value added by the 'trunking' process, however, no attempt has been made in this report to adjust the estimated gross value of striped marlin to commercial operators so that it excludes the value added by fish processors. As a result, the estimated gross value of striped marlin to commercial fishers will tend to overstate its actual gross value since it includes the value added by fish processing.

- **Possible quality differences in striped marlin traded on domestic and international markets**

In theory, if the quality of the striped marlin traded on the domestic and international markets is identical, then it is reasonable to expect that the price of striped marlin on the domestic market in Australia will be equal to the price of striped marlin on export markets, expressed in Australian dollars, less the costs of freight and insurance. This is because fish processors will not be prepared to sell striped marlin on the domestic market unless they receive a price that is at least as high as what they could get if they were to sell that fish on export markets, less the costs associated with exporting those fish. Similarly, fish retailers will not be prepared to pay prices for processed striped marlin that are higher than the landed price of imported striped marlin.

In practice, however, it is possible that the quality of NSW striped marlin sold on export markets may be consistently higher than the quality traded on domestic markets due to the practice of fish processors only selecting the highest grade fish for export.

Indeed, the Bureau of Rural Sciences report on *Striped Marlin: Biology and Fisheries* suggests that seasonal variations in the quality of striped marlin due to spawning may explain observed seasonal fluctuations in the level of exports of striped marlin:

... if SMP data are indicative of overall trends in proportions of marlin exported, it would appear that most of the marlin (70-90%) brought to southern processors during these months are subsequently exported. The percentage reported as being exported during other months, for example in the 3rd and fourth quarters when total catches (and processing numbers) are much higher and occur predominantly in the northern region, is much lower (<30%). It is likely that the variation in proportion of marlin exported will be linked to the flesh quality of the fish, which varies seasonally depending on whether they are feeding (good quality flesh, particularly in larger individuals) or post spawning (poor quality flesh).

- **Seasonal fluctuations in supply and demand**

Estimation of the gross value of the striped marlin caught off the NSW coastline by commercial operators is also complicated by the significant seasonal fluctuations and differences in the prices paid for that striped marlin on domestic and export markets.

Although some of those seasonal fluctuations and differences in price may be due to seasonal fluctuations and differences in quality, a more likely explanation is **seasonal fluctuations in the supply and demand** for NSW striped marlin. As noted in section 4.5.1, the supply of striped marlin caught off the east coast of Australia is not constant over time. Rather, it is subject to significant seasonal variations. In particular:

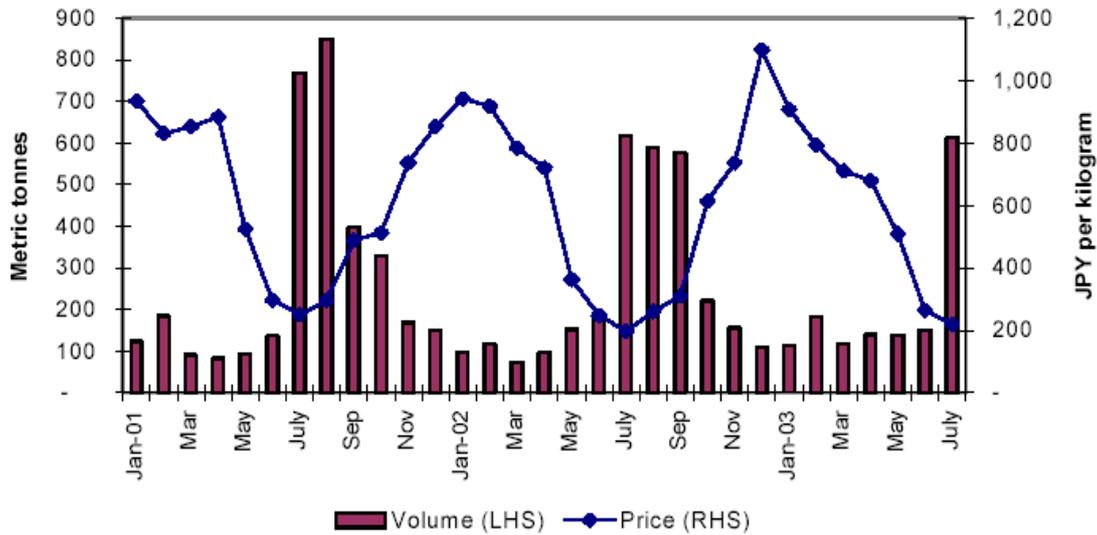
- commercial catches of striped marlin off the Queensland coastline tend to be concentrated in the period July to December; and
- commercial catches of striped marlin off the NSW coastline tend to be concentrated in the period January to June.

Similarly, there are also significant fluctuations in both export and domestic demand for Australian striped marlin. As illustrated in Figure 23, the prices paid for striped marlin in Japan, which is the major export market for Australian striped marlin, are not constant over time. Rather, there are significant seasonal fluctuations in those prices due to seasonal fluctuations in both the demand for striped marlin and the quantity of striped marlin available from fish processors located in both the

northern and southern hemispheres. The average fresh striped marlin prices at selected Japanese ports⁵ over the period January 2001 to July 2003 tend to follow an annual cycle where:

- the highest prices are paid in December/January (over 1,000 Japanese yen per kg, or around A\$14 per kg given exchange rates prevailing at that time), when the quantity of striped marlin entering Japan is at its lowest; and
- the lowest prices are paid in July (around 200 Japanese yen, or A\$3 per kg given exchange rates prevailing at that time), when the quantity of striped marlin entering Japan reaches its peak.

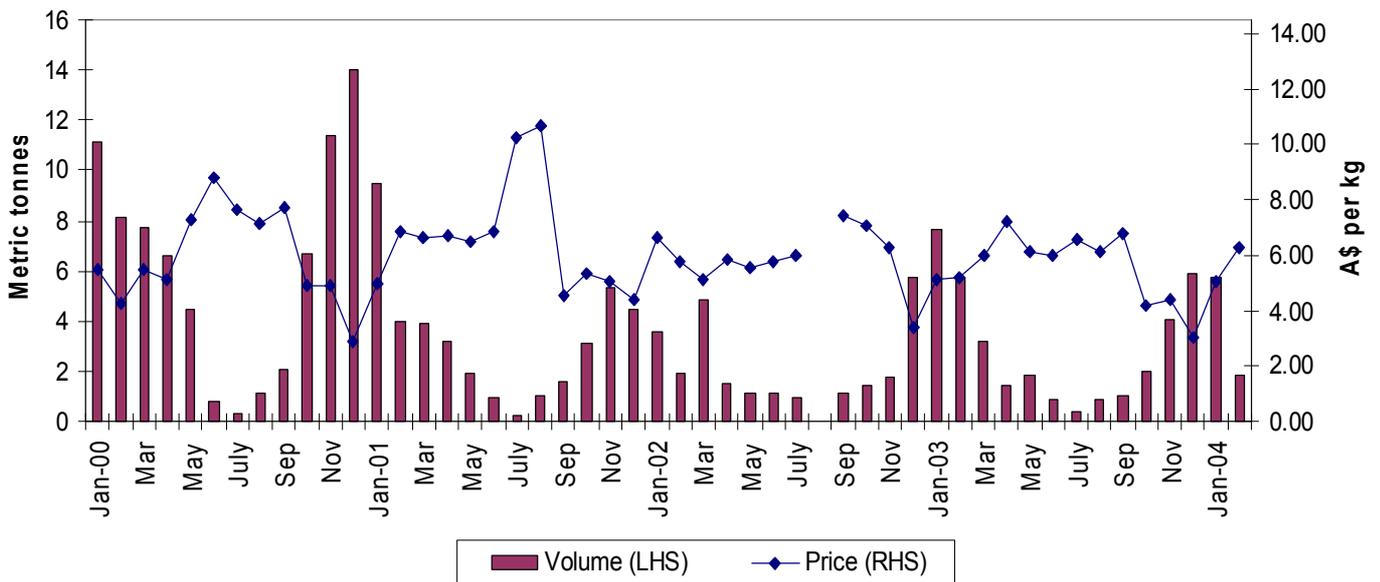
Figure 23: Volumes and prices of striped marlin landed at major Japanese ports



Source: Forum Fisheries Agency (2003)

As indicated in Figure 24, there are also significant seasonal fluctuations in the prices paid for striped marlin on the Sydney fish market.

Figure 24: Volumes and prices of striped marlin traded on the Sydney Fish Market



⁵ The sample covered 49 ports for 2002 and 52 ports for 2003.

These significant seasonal fluctuations and differences in the prices paid from striped marlin on domestic and export markets explain, to some extent, the pattern of Australian exports of striped marlin.

Exports of striped marlin caught off the Queensland coastline tend to increase over the period from June to December due to:

- increases in supply of striped marlin caught off the Queensland coastline;
- increases in the prices paid in Japan for striped marlin (i.e. increasing export demand); and
- decreases in the prices paid for striped marlin on the domestic Australian market.

By contrast, exports of striped marlin caught off the NSW coastline tend to increase over the period from January to May due to:

- increases in the supply of striped marlin caught off the NSW coastline; and
- the significantly higher, albeit decreasing, prices paid for striped marlin on the Japanese market in relation to the prices paid on the domestic Australian market.

- ***Approach used to estimate the gross value of NSW striped marlin to commercial fishers***

As noted by the Bureau of Rural Science in its report on *Striped marlin: biology and fisheries*, when estimating the gross value of striped marlin caught by commercial operators, it is important to take into account the prices they receive in Australia (i.e. the ‘beach price’) for striped marlin that are destined to be sold on both domestic and export markets. This is the approach used by ABARE to estimate that the **gross value of production (GVP) of striped marlin in the ET&BF fishery** was approximately **\$7.9m in 2001/02**:

It is important that economic estimates of striped marlin value to the fishery take into account its export value in addition to value in the local market. The Australian Bureau of Agricultural and Resource Economics (ABARE) compiles GVP estimates for species caught in the tuna and billfish fisheries. GVP estimates calculated for striped marlin attempt to take into account the value (beach price to the fishermen) of both domestic market and export bound striped marlin catches. In the 2001/2 financial year, ABARE estimated a GVP for striped marlin in the eastern tuna and billfish fishery of \$7.9 million.

The simplest approach to estimating the gross value of the striped marlin caught by commercial fishers off the NSW coastline would be to:

- use ABARE’s estimate of the gross value of production of striped marlin in the ET&BF fishery to determine the average price received by a commercial fisher for a kilogram of striped marlin. Given that the total catch of striped marlin in the ET&BF fishery was 770 tonnes (whole weight) and ABARE’s estimate of the gross value of that catch was \$7.9 to commercial fishers, this suggests that commercial fishers operating in the ET&BF fishery received an average price of \$10.26 per kilogram of whole striped marlin; and
- value the quantity of striped marlin caught by commercial fishers off the NSW coastline using that average striped marlin price.

The main problem with this approach, however, is that it assumes that commercial fishers operating off the NSW coastline are receiving the same average price for their striped marlin as the average commercial fisher operating in the ET&BF fishery.

As outlined below, however, available price data suggest that this is unlikely to be the case. Rather, it suggests that the average price that commercial fishers received for the striped marlin they caught off the NSW coastline is likely to be less than \$10.26 per kilogram of whole striped marlin.

For example, in 2001-02 approximately:

- 13 percent of striped marlin caught off the NSW coastline is exported and sold at prices of around \$12 per kilogram of ‘trunked’ striped marlin, which is equivalent to a price of \$8 per kilogram of whole striped marlin;
- 9 percent of the striped marlin caught off the NSW coastline were sold on the Sydney Fish Market in 2001-02 for an average price of around \$5.82 per kilogram of ‘trunked’ striped marlin, which is equivalent to a price of \$3.88 per kilogram of whole striped marlin; and
- the remaining 78 percent of the striped marlin caught off the NSW coastline were sold on the domestic market at prices ranging between the average price paid on export markets for NSW striped marlin and the average price paid on the Sydney Fish Market.

In order to sell the entire NSW striped marlin catch for a weighted average price of \$10.26 per kilogram in 2001-02, however, commercial operators would have had to sell the remaining 78 percent of the total NSW striped marlin on the domestic market for an average price of \$11.40 per kilogram of whole striped marlin, or \$17.10 per kilogram of ‘trunked’ striped marlin, which is unrealistic since it exceeds the highest prices paid for striped marlin on the Japanese market at that time.

Although fish processors may receive a higher average price for the striped marlin they sell through channels other than the Sydney Fish Market, it is unrealistic to expect that average price to be higher than the average price paid for NSW striped marlin that are exported. Rather, it is more realistic to assume that those striped marlin would trade at an average price somewhere between the average price paid for that striped marlin on export markets and the average price paid on the Sydney Fish Market.

As a result, in this report the gross value of striped marlin caught by commercial fishers off the NSW coastline has been estimated using a weighted average of the prices paid for NSW striped marlin on domestic and export markets. That is, the gross value of striped marlin to commercial fishers has been estimated by:

- valuing the proportion of the total volume of striped marlin caught off the NSW coastline that is sold on the domestic Australian market using:
 - the average price paid for striped marlin on the Sydney Fish Market to value the proportion of the total striped marlin catch sold at those prices (i.e. around \$6 per kg of ‘trunked’ striped marlin); and
 - a mid-point of the average price paid on export markets for NSW striped marlin (i.e. \$12 per kg of ‘trunked’ striped marlin) and the average price paid on the Sydney Fish Market for NSW striped marlin (i.e. around \$6 per kg of ‘trunked’ striped marlin) to value the remaining striped marlin sold on the domestic market. That is, those striped marlin sold on the domestic market through channels other than the Sydney Fish Market have been valued at \$9 per kilogram of ‘trunked’ striped marlin; and
- valuing the proportion of the total volume of striped marlin caught off the NSW coastline that is sold on export market at the average export price received for striped marlin sold on the Japanese market over the period January to May (around \$12 or 800 Japanese yen per kilogram of ‘trunked’ striped marlin, or \$8 per kilogram of whole striped marlin).

In effect, this approach involves valuing the total NSW striped marlin catch each year using the following estimated weighted average prices:

- \$8.81 per kilogram of ‘trunked’ striped marlin, or \$5.87 per kilogram of whole striped marlin in 2000-01;
- \$9.11 per kg of ‘trunked’ striped marlin, or \$6.07 per kilogram of whole striped marlin in 2001-02; and
- \$8.99 per kilogram of ‘trunked’ striped marlin, or \$6 per kilogram of whole striped marlin, in 2002-03.

Gross value of striped marlin to commercial fishers

Table 16 presents estimates of the gross value of the commercial longline catch of striped marlin off the NSW coastline using the approach outlined above. This suggests that the **gross value of the commercial catch of striped marlin caught off the NSW coastline to commercial operators** was approximately:

- **\$1.70 million in 2000-01**, or \$5.87 per kg of whole striped marlin;
- **\$1.72 million in 2001-02**, or \$6.07 per kg of whole striped marlin; and
- **\$1.24 m in 2002-03**, or \$6.00 per kg or whole striped marlin.

Table 16: Estimated gross value of striped marlin caught by commercial fishers 2000 to 2002

	2000-2001			2001-2002			2002-2003		
	Weight (kg)	Price/kg	Value	Weight (kg)	Price/kg	Value	Weight (kg)	Price/kg	Value
Striped Marlin	289,078	\$5.87	\$1,697,856	283,172	\$6.07	\$1,720,130	206,947	\$6.00	\$1,240,717

Net value of striped marlin catch to commercial fishers

What is the net value of the striped marlin caught by commercial fishers?

The net value of the entire commercial catch off the NSW coastline to commercial fishers will be much less than its gross value in view of the significant costs associated with catching those fish.

As noted in section 2.2.1, the net value that commercial fishers place on the striped marlin they catch off the NSW coastline is equal to the difference between the marginal revenue obtained for each striped marlin caught (i.e. the prevailing market price of striped marlin) and the marginal cost of catching that striped marlin (i.e. the net value of the commercial catch is equal to the area between the demand curve for striped marlin and the supply curve).

In the absence of empirical estimates of the elasticity of the price elasticity of the demand and supply curves for commercially caught striped marlin, however, it is necessary to use average revenue and cost data as a proxy for the marginal revenue and costs of catching striped marlin. In so doing, however, it is important to note that the use of average cost data will tend to overestimate marginal costs to the extent that there are significant economies of scale (i.e. significant fixed costs) in striped marlin fishing.

The most comprehensive and recent data on the average revenue and costs incurred by commercial operators in the ET&BF fishery was released in May 2003 by the Australian Bureau of Agriculture and Resource Economics (ABARE) in its *Australian Fisheries Surveys Report 2002*.

The ARARE survey covers vessels that held a Commonwealth longline or minor line tuna permit for the fishery and that caught more than one tonne of tuna in 2000-01. It sampled:

- 20 out of the 143 vessels that were eligible for the survey in 1999-2000; and
- 32 out of the 132 vessels that were eligible for the survey in 2000-01

Table 17 presents the key results of that survey for 1999-2000 and 2000-01, which is the most recent year for which data is available. It indicates the major measures of financial performance for an average longline boat operating in the ET&BF fishery.

It is important to note that the average revenue and cost per boat data set out in Table 17 includes the revenue and costs of catching not only striped marlin, but also the other species caught by a boat operating in the ET&BF fishery (e.g. tuna and broadbill swordfish).

As a result, in order to determine the average revenue and costs associated with catching striped marlin, it is necessary to apportion this average revenue and cost data between the striped marlin catch and the remainder of the catch.

When apportioning revenues and costs between striped marlin and the rest of the catch, it is important to bear in mind that there are significant differences in the sizes, weights, and values of the catch. For example, in 2000-01 (the latest year for which detailed cost data is available), the striped marlin catch of an average boat operating off the NSW coastline comprised approximately:

- 3.75% of the total number of fish caught;
- 11.9% of the total weight of fish caught; and
- 3.5% of the total value of fish caught.

This highlights the importance of selecting the most appropriate set of weights to apportion the revenues and costs incurred by the average boat. Use of an inappropriate method of apportionment can result in a significant over or under-estimation of the net value of striped marlin to commercial operators.

As indicated in Table 17, the **gross revenue** that an average commercial longline boat derived from catching **tuna and billfish** was **\$563,990 in 2000-2001**.

In order to determine the proportion of that gross revenue that was attributable to catches of striped marlin, we have estimated the average weight of striped marlin caught by each boat operating off the NSW coastline (289,078 kg of whole striped marlin divided by 84 boats, which is approximately 3,441 kg of whole striped marlin) and multiplied that average striped marlin catch per boat by the estimated weighted average price of striped marlin of \$5.87 per kilogram of whole marlin. As indicated in Table 18, this yields an average boat income of \$20,213 per annum from sales of striped marlin.

Table 17: ABARE estimates of average commercial longline boat revenue and costs

	1999-2000		2000-2001	
	Average per boat	Standard error	Average per boat	Standard error
RECEIPTS				
Tuna and billfish receipts	\$433,880	12	\$563,990	8
Other fishing receipts	\$24,760	41	\$46,970	27
Non-fishing receipts	\$15,540	18	\$32,320	16
Total cash receipts	\$474,190	12	\$643,280	8
COSTS				
Administration	\$12,990	13	\$12,430	8
Bait	\$26,750	28	\$28,850	16
Crew costs	\$167,290	12	\$220,890	7
Fuel	\$44,220	14	\$76,070	11
Ice	\$2,420	47	\$3,150	31
Insurance	\$17,560	10	\$21,960	8
Interest paid	\$21,340	29	\$36,840	16
Leasing	\$8,300	45	\$20,080	35
License fees and levies	\$14,590	11	\$13,750	11
Repairs and maintenance	\$75,930	15	\$90,040	12
Other costs	\$31,930	20	\$53,630	14
Total cash costs	\$423,300	11	\$577,700	7
BOAT CASH INCOME	\$50,890	33	\$65,580	35
less depreciation	\$38,880	21	\$47,990	12
BOAT BUSINESS PROFIT	\$12,020	143	\$17,590	128
plus interest, leasing and rent	\$30,040	24	\$57,060	16
Profit at full equity	\$42,050	35	\$74,650	33
CAPITAL				
- excluding quota and licenses	\$578,240	20	\$790,690	12
- including quota and licenses	na		\$1,292,510	8
Rate of return to boat capital	7%	38	9.4%	32
Rate of return to full equity	na		5.8%	32

Source: Galeano, Gooday, and Levantis (2003), ABARE.

The approach used to apportion costs between striped marlin and the rest of the ET&BF catch is as follows:

- the costs of administration, insurance, interest, and leasing incurred by the average boat operating in the ET&BF fishery have been apportioned between striped marlin and the rest of the catch on a value basis (i.e. the proportion of the total value of the catch that striped marlin comprise). That is, each of these costs has been multiplied by that proportion to determine the cost attributable to striped marlin fishing. This overcomes the problems potentially created by the significant

differences in the sizes, weights and values of the fish caught by commercial operators in the ET&BF fishery;

- fuel costs have been apportioned on a value basis as well. We note, however, that it could be argued that fuel costs should be apportioned on a weight basis (i.e. the proportion of the total weight of the catch made up by striped marlin), since fuel costs on the return journey to port are more dependent on the total weight of the fish carried and fish weight provides a more accurate measure of the volume those fish occupy in the hold than either fish numbers (which don't account for the significant differences in fish sizes) or fish value per kilogram (which does not accurately reflect their respective weights or their use of storage capacity). However, apportionment of fuel costs on a weight basis results in fuel costs comprising more than 40 percent of the total cash costs of catching striped marlin, which was considered to be too high. As a result, it was decided to be conservative and to apportion fuel costs on a value basis instead so as not to underestimate the net value of striped marlin to commercial anglers;
- labour costs have been apportioned on a weight basis in order to reflect the greater amount of time associated with handling striped marlin, which are much larger on average than the other species caught by the ET&BF fleet and can cause injury to crew if not handled carefully;
- bait costs have been apportioned on a per fish basis (i.e. the proportion of the total number of fish made up by striped marlin); and
- ice costs have been apportioned on a weight basis. The amount of ice carried on a trip is fixed and has been proportioned between the tuna and striped marlin catches on a weight basis.

Table 18 sets out the results of this process of allocating revenue and costs between the striped marlin operations of an average longline boat and its other operations (i.e. tuna, broad billed swordfish, etc).

Table 18 indicates that the average commercial boat owner and crew operating off the NSW coastline in 2000-2001 derived:

- a **profit** on its striped marlin operations of **\$5,708** if we allocate a proportion of all costs to striped marlin fishing. Under these assumptions, the net value of the commercial catch of striped marlin caught off the NSW coastline to commercial operators is approximately **\$479,487**; or
- a **profit** on its striped marlin operations of **\$16,093** if we only allocate a proportion of operating costs (bait, fuel and ice) to striped marlin fishing. Under these assumptions, the net value of the commercial catch of striped marlin caught off the NSW coastline in 2000-2001 was approximately **\$1.35 million**.

Table 18: Average longline boat revenue and costs from striped marlin and other operations

	Striped marlin operations		Other operations		TOTAL
	All costs apportioned	Only operating costs apportioned	All costs apportioned	Only operating costs apportioned	
RECEIPTS					
Striped marlin receipts	\$20,213	\$20,213			\$20,213
Tuna and other billfish receipts			\$543,777	\$543,777	\$543,777
Other fishing receipts			\$46,970	\$46,970	\$46,970
Non-fishing receipts			\$32,320	\$32,320	\$32,320
Total cash receipts	\$20,213	\$20,213	\$623,067	\$623,067	\$643,280
COSTS					
Administration	\$435		\$11,995		\$12,430
Bait	\$1,082	\$1,082	\$27,768	\$27,768	\$28,850
Fuel	\$2,662	\$2,662	\$73,408	\$73,408	\$76,070
Ice	\$375	\$375	\$2,775	\$2,775	\$3,150
Insurance	\$769		\$21,191		\$21,960
Interest paid	\$1,289		\$35,551		\$36,840
Leasing	\$703		\$19,377		\$20,080
License fees and levies	\$481		\$13,269		\$13,750
Repairs and maintenance	\$3,151		\$86,889		\$90,040
Other costs	\$1,877		\$51,753		\$53,630
Total cash costs	\$12,825	\$4,119	\$564,875	\$573,581	\$577,700
BOAT CASH INCOME	\$7,388	\$16,093	\$58,192	\$49,487	\$65,580
less depreciation	\$1,680		\$46,310		\$47,990
BOAT BUSINESS PROFIT	\$5,708	\$16,093	\$11,882	\$49,487	\$17,590

In order to facilitate a comparison of the relative net values of striped marlin to commercial fishers, recreational anglers, and charter boat operators, we have also estimated the net benefit that commercial operators derive from striped marlin when labour, finance and insurance costs are excluded (i.e. before those costs are deducted). This approach avoids the problems associated with estimating the imputed labour costs of recreational skippers and charter boat operators as well as the financial and insurance costs incurred by recreational anglers who use their own boats to go striped marlin fishing and who choose to use different forms of finance and to accept different levels of risk.

As indicated in Table 19, when labour, finance and insurance costs are excluded, the net benefit of the striped marlin caught by an average commercial longline boat is:

- **\$8,469** if we allocate a proportion of all costs (excluding labour, financing, and insurance costs) to striped marlin fishing. Under these assumptions, the net value of the commercial catch of striped marlin caught off the NSW coastline to commercial operators was approximately **\$711,394**; or
- **\$16,093** if we only allocate a proportion of operating costs (bait, fuel and ice) to striped marlin fishing. Under these assumptions, the net value of the commercial catch of striped marlin caught off the NSW coastline in 2000-2001 was approximately **\$1.35 million**.

Table 19: Net benefits derived by an average longline boat's striped marlin operations and other operations (before labour, finance and insurance costs)

	Striped marlin operations		Other operations		TOTAL
	All costs apportioned	Only operating costs apportioned	All costs apportioned	Only operating costs apportioned	
RECEIPTS					
Striped marlin receipts	\$20,213	\$20,213			\$20,213
Tuna and other billfish receipts			\$543,777	\$543,777	\$543,777
Other fishing receipts			\$46,970	\$46,970	\$46,970
Non-fishing receipts			\$32,320	\$32,320	\$32,320
Total cash receipts	\$20,213	\$20,213	\$623,067	\$623,067	\$643,280
COSTS					
Administration	\$435		\$11,995		\$12,430
Bait and ice	\$1,457	\$1,457	\$30,543	\$30,543	\$32,000
Fuel	\$2,662	\$2,662	\$73,408	\$73,408	\$76,070
License fees and levies	\$481		\$13,269		\$13,750
Repairs and maintenance	\$3,151		\$86,889		\$90,040
Other costs	\$1,877		\$51,753		\$53,630
Total costs (excluding labour, finance and insurance costs)	\$10,064	\$4,119	\$267,856	\$103,951	\$277,920
NET BENEFIT (before depreciation, labour, finance and insurance costs)	\$10,149	\$16,093	\$355,211	\$519,117	\$365,360
less depreciation	\$1,680	\$0	\$46,310	\$0	\$47,990
NET BENEFIT (after depreciation, but before labour, finance and insurance costs)	\$8,469	\$16,093	\$308,901	\$519,117	\$317,370

Net value of striped marlin catch to commercial fishers

Since no detailed revenue and cost data is available for 2001-02 and 2002-03, it was assumed for the purposes of this report that commercial operators continue to make the same profit per boat on their striped marlin operations in 2001-02 and 2002-03 as they did in 2000-01.

Under this assumption, the net value of the commercial striped marlin catch to commercial operators is estimated to range between:

- \$0.71 million and \$1.35 million in 2000-01;
- \$0.70 million and \$1.32 million in 2001-02; and
- \$0.51 million and \$0.97 million in 2002-03.

Net value of a kilogram of striped marlin to commercial fishers

What is the net value of an additional kilogram of striped marlin to commercial fishers?

As discussed in section 2.2.1, the net value of an additional kilogram of striped marlin to commercial fishers is equal to:

- the additional revenue obtained from the sale of a kilogram of striped marlin; less

- the marginal cost associated with catching that additional kilogram of striped marlin.

This can be estimated by dividing the estimated net value of striped marlin caught by commercial operators off the NSW coastline by the total weight of the NSW commercial striped marlin catch, expressed in kilograms.

Using the estimated net value set out in Table 19, the estimated net value of an additional kilogram of striped marlin to NSW commercial operators in 2000-01 is:

- **\$2.46** if we allocate a proportion of all costs (excluding labour, financing, and insurance costs) to striped marlin fishing; or
- **\$4.68** if we only allocate a proportion of operating costs (bait, fuel and ice) to striped marlin fishing.

6.1.2 What is the economic value of NSW striped marlin to recreational anglers?

Approach to estimating the gross value of striped marlin to recreational anglers

What is the gross value of striped marlin to recreational anglers?

As discussed in section 2.2.1, the gross value of the quantity of striped marlin that recreational anglers catch off the NSW coastline is equal to the amount they were willing to pay to catch that quantity of striped marlin, which comprises the sum of:

- the amount they actually paid to catch those striped marlin (i.e. the cost of catching those striped marlin); and
- the additional amount they would have been prepared to pay to catch that quantity of striped marlin (i.e. the difference between the total amount they were willing to pay and the amount they actually paid, which is referred to as 'consumer surplus').

This means that it is possible to obtain a conservative estimate of the gross value of striped marlin to recreational anglers by estimating the total amount they actually paid to catch those striped marlin. That estimate is conservative in the sense that it excludes any additional consumer surplus the recreational angler derives from catching that quantity of striped marlin (i.e. the difference between what they were willing to pay to catch that quantity of striped marlin and what they actually paid).

In order to estimate the total gross value of striped marlin to recreational anglers, it is necessary then to add an estimate of the additional amount that they would have been willing to pay for those striped marlin (i.e. an estimate of the additional consumer surplus that recreational anglers derive from catching those striped marlin).

As noted in section 5, recreational anglers have a choice between a number of alternative ways of going fishing for striped marlin. They can:

- charter a boat and crew to take them striped marlin fishing and supply any necessary gear they don't have;
- share the use of a friend's boat and gear. This is a cost effective solution for less experienced anglers who do not have sufficient skill to locate and catch striped marlin, or sufficient resources to purchase a suitable boat and fishing gear; or
- use their own boat and fishing gear. Although this involves greater up front costs, it provides the angler with much greater flexibility in terms of when and where they can fish.

Consequently, in order to estimate the gross value of the NSW recreational catch of striped marlin to recreational anglers, we have estimated the expenditure incurred by recreational anglers who use:

- charter boats to fish for striped marlin; and
- their own boat, or a friend's boat, to fish for striped marlin.

Then we have added to this total expenditure an estimate of the additional amount that recreational anglers would have been prepared to pay to catch those striped marlin (i.e. an estimate of the 'consumer surplus') in order to determine the gross value of those striped marlin to recreational anglers.

Expenditure by recreational anglers who use charter boats

A conservative estimate of the gross value of that striped marlin catch to those recreational anglers can be obtained by estimating what it cost them to catch those fish.

When recreational anglers go charter boat fishing for striped marlin, they incur a wide range of costs including:

- onshore costs such as:
 - the costs of traveling to and from the port of departure, which includes transportation costs as well as the opportunity cost of that travel time to recreational anglers;
 - accommodation costs incurred by those recreational anglers who do not live near that location and have to use onshore accommodation in order to spend more than one day fishing for striped marlin. This includes the cost of rental accommodation as well as the imputed rental value of any accommodation for those anglers who either stay in their own holiday homes or stay with friends;
- offshore costs, such as:
 - the cost of chartering the boat and its crew;
 - the market value of any striped marlin released. Although recreational anglers are not allowed to sell their striped marlin catch, the striped marlin they catch and release do have a value in the market place. This suggests that recreational anglers must derive a benefit from releasing striped marlin that is at least as high as the prevailing market price of that striped marlin;
 - the opportunity cost of the time spent by the recreational angler on board the charter boat searching for, catching, and releasing striped marlin. When recreational anglers take time off work to go striped marlin fishing, the opportunity cost of their time is equal to the income they forgo (i.e. their wage rate). However, when recreational anglers confine their striped marlin fishing to weekends, public holidays and paid recreation leave, the opportunity cost of their fishing time is equal to the value of the other alternative recreational activities they have to forgo. This is much more difficult to estimate since it depends on the values recreational anglers place on those alternative recreational activities.

When estimating those onshore and offshore costs, it is important to include only those costs that had to be incurred by recreational anglers in order to go charter boat fishing for striped marlin off the NSW coastline. Any additional costs not directly related to striped marlin fishing should be excluded.

Although recreational anglers may go charter boat fishing with the objective of targeting striped marlin, in practice such charter trips also result in a 'by-catch' of other billfish (e.g. blue and black marlin) and gamefish (e.g. tuna, sharks, and sportfish such as kingfish).

As a result, when estimating the costs that charter boat anglers actually incur catching striped marlin, we have apportioned the travel, accommodation costs and the opportunity cost of time spent gamefishing between:

- **fishing for billfish as opposed to other gamefish** using NSW Fisheries *Gamefish Tournament Monitoring Program* data on catch composition between billfish and all other gamefish (i.e. tuna, sharks and sportfish) for recreational anglers targeting billfish and tuna off the NSW coastline. As outlined previously, billfish comprised approximately **85 percent** of the total catch; and
- **fishing for striped marlin as opposed to other billfish** using *NSW Striped Marlin Recreational Fishing Survey* data on the proportion of the billfish catch that comprises striped marlin. As outlined previously, striped marlin comprised approximately **68 percent** of the total billfish catch of recreational anglers surveyed.

Overall, this means that only **58 percent** (i.e. 85% x 68%) of the travel and accommodation costs reported by charter boat anglers, and the opportunity cost of time spent gamefishing, have been apportioned to striped marlin fishing and used to estimate the gross value of striped marlin to recreational anglers who use charter boats to go fishing for striped marlin.

A similar approach was used to estimate the proportion of charter boat hire costs actually incurred catching striped marlin. As outlined further below, this estimate was obtained by apportioning the gross revenue earned by charter boat operators between:

- **billfish and all other charter boat activities** using data obtained from the *NSW Striped Marlin Charter Boat Fishing Survey* on the proportion of time that charter boats spent taking recreational anglers fishing for billfish as opposed to other charter activities (e.g. other fishing activities, diving, whale watching etc). On average, the charter boats surveyed spent around **50 percent** of their time billfishing; and
- **striped marlin and other billfish fishing** using *NSW Striped Marlin Recreational Fishing Survey* data on the proportion of the billfish catch that comprises striped marlin. As outlined previously, striped marlin comprised approximately **68 percent** of the total billfish catch of recreational anglers surveyed.

Overall, this means that only around **34 percent** of charter boat hire costs have been included when estimating the gross value of striped marlin to recreational anglers who chartered boats to go fishing for striped marlin.

The data sources and approaches used to estimate the onshore and offshore costs incurred by recreational anglers who chartered boats to go fishing for striped marlin are as follows:

- **travel costs** have been estimated using data provided by charter boat anglers to the *NSW Striped Marlin Recreational Fishing Survey*. Only those costs associated with traveling to and from the region in which the port of departure is located have been included and those costs have then been apportioned between striped marlin and other offshore fishing activities in the manner outlined above. Other costs associated with traveling around within that particular regional area have been excluded. This produced an estimated travel cost of \$10,213 for the recreational anglers surveyed, who comprise approximately 6.3 percent of the estimated number of recreational anglers participating in gamefishing off the NSW coastline. This suggests that the total travel costs incurred by all recreational anglers who went charter boat fishing for striped marlin fishing is approximately **\$162,391**. This is likely to underestimate total travel costs incurred by recreational anglers since recreational anglers who use their own cars have only reported fuel costs and have not included other vehicle running costs (e.g. the costs of vehicle depreciation, tyre wear, insurance, registration etc). In addition, the reported travel costs also do not include the opportunity cost of time spent traveling;

- **accommodation costs** have been estimated using data provided by charter boat anglers to the *NSW Striped Marlin Recreational Fishing Survey*. It was assumed that all reported accommodation costs had to be incurred in order to go fishing for billfish and the proportion of those costs actually incurred catching striped marlin was estimated in the manner outlined above. This produced an estimated accommodation cost of \$13,340 for the recreational anglers surveyed, who comprise 6.3 percent of the estimated number of recreational anglers participating in gamefishing off the NSW coastline. This suggests that the total accommodation costs incurred by all recreational anglers who went striped marlin fishing is approximately **\$212,110**. Although it is possible that reported accommodation costs could include some additional costs that were not directly related to offshore fishing, data supplied by recreational anglers on the number of nights they stayed in a particular region, and the number of days they spent fishing offshore for billfish, suggests this is unlikely to be the case. Rather, it is more likely that reported accommodation costs underestimate the actual accommodation costs incurred by recreational anglers since those reported costs exclude the imputed rental costs incurred by those anglers who either stayed in their own holiday houses, or stayed with family or friends;
- **charter boat hire costs** have been estimated using data provided by charter boat operators to the *NSW Striped Marlin Charter Boat Fishing Survey* on the gross revenue they derived from their charter boat operations off the NSW coastline. The proportion of that revenue attributable to striped marlin fishing operations was then estimated in the manner outlined above. It was estimated that the 24 boats surveyed had earned \$452,110 of gross revenue from striped marlin fishing. The average charter boat was estimated to have earned approximately \$18,838 from striped marlin fishing and \$30,858 from other activities over the 2001-2002 financial year. Since there were 250 boats licensed to take recreational anglers offshore fishing, this suggests that total recreational angler expenditure on the hire of charter boats for striped marlin fishing was approximately **\$4.2 million**;
- **the market value of striped marlin released** by charter boat anglers was estimated using NSW Fisheries data on the total number of striped marlin released by charter boat operators. As indicated in Table 13, in 2002-03 a total of 296 striped marlin weighing an estimated 19,995 kg were released by charter boat operators. This suggests that the market value of striped marlin released by charter boat anglers was **\$119,969** assuming a weighted average market price of \$6.00 per kg of whole striped marlin in 2002-03; and
- **the opportunity cost of time** spent by recreational anglers charter boat fishing was estimated using data provided by charter boat operators to the *NSW Striped Marlin Charter Boat Fishing Survey*. That survey indicated recreational anglers had spent 3,291 days fishing for striped marlin from the charter boats surveyed. It was assumed that the opportunity cost of a day spent gamefishing was equal to 10 percent of the estimated average daily wage rate of \$237, which was obtained from the *NSW Striped Marlin Recreational Fishing Survey*. The proportion of that cost attributable to striped marlin fishing operations was then estimated in the manner outlined above. Under these assumptions, the estimated the opportunity cost of the time spent charter boat fishing was \$45,082 for those recreational anglers who had chartered the boats surveyed. Since the charter boats surveyed only represent approximately 11 percent of 250 charter boats licensed to go gamefishing off the NSW coastline, this suggests that the opportunity cost of the time recreational anglers spend charter boat fishing for striped marlin is approximately **\$417,460**. This rough estimate serves to illustrate the significant amount of time that recreational anglers invest in striped marlin fishing. In view of the considerable uncertainty surrounding the opportunity cost of recreational anglers' time, however, we have adopted a different approach when estimating the net value of striped marlin to recreational anglers. This involves excluding the opportunity cost of time from our calculations and estimating instead the net benefits of striped marlin exclusive of those imputed labour costs.

As outlined in Table 20, the estimated total costs incurred by recreational anglers who hired charter boats to go fishing for striped marlin off the NSW coastline was estimated to be approximately \$5 million over the 2002-03 survey period. That is, the gross value (excluding consumer surplus) of striped marlin caught by recreational anglers who used charter boats to fish for those marlin was at least **\$5.1 million** in 2002-03.

Table 20: Estimated gross value of striped marlin to recreational anglers in 2002-03 (excluding consumer surplus)

	Charter boat striped marlin anglers		Non-charter boat striped marlin anglers		TOTAL			
	Survey	Total	Survey	Total	Survey	\$/kg caught	Total	\$/kg caught
ONSHORE COSTS								
Travel	\$10,213	\$162,391	\$267,331	\$4,250,569	\$277,545	\$3.40	\$4,412,959	\$3.83
Accommodation	\$13,340	\$212,110	\$112,658	\$1,791,262	\$125,998	\$1.54	\$2,003,372	\$1.74
OFFSHORE COSTS								
Charter boat hire	\$452,110	\$4,186,539			\$452,110	\$5.53	\$4,186,539	\$3.63
Boat costs			\$1,187,569	\$18,882,355	\$1,187,569	\$14.54	\$18,882,355	\$16.37
Fishing gear costs			\$245,620	\$3,905,353	\$245,620	\$3.01	\$3,905,353	\$3.39
Market value of striped marlin released	\$119,969	\$119,969	\$332,520	\$5,287,068	\$452,489	\$5.54	\$5,407,037	\$4.69
Opportunity cost of fishing time	\$45,082	\$417,460	\$60,072	\$955,145	\$105,154	\$1.29	\$1,372,605	\$1.19
TOTAL COSTS	\$640,714	\$5,098,469	\$2,205,771	\$35,071,751	\$2,846,485	\$34.84	\$40,170,220	\$34.83

Expenditure by recreational anglers who use their own boats or friends' boats

In addition to estimating the gross value of the striped marlin caught by charter boat anglers, it is also necessary to estimate the gross value of striped marlin caught by those recreational anglers who either used their own boats, or shared the use of friends' boats to go striped marlin fishing.

Once again, it is possible to obtain a conservative estimate of the gross value of that catch to those recreational anglers by estimating what it actually cost them to catch those marlin.

Recreational anglers who use their own boats and fishing gear when they go striped marlin fishing, or share their friends equipment, face many of the same costs faced by recreational anglers who use charter boats. Those common costs include onshore travel and accommodation costs, as well as offshore costs such as the market value of striped marlin released and the opportunity cost of time spent marlin fishing.

The main difference is that charter boat anglers pay a fee that covers the use of the boat and its fishing gear, whereas non-charter boat anglers incur the costs of supplying their own boats and fishing gear, or share friends' boats and fishing gear. Those costs include:

- boat related costs such as the cost of fuel, boat mooring and storage, boat repairs and maintenance, and depreciation;
- fishing gear related costs, such as the depreciation of rods, reels, lures, line and the cost of consumables such as terminal tackle; and
- contributions to friends to cover part of the costs of sharing their boats and fishing gear.

Not all of the onshore and offshore costs incurred by non-charter boat anglers, however, will be attributable to catching striped marlin. Rather, some of those costs will be associated with other activities.

For example, some of the costs associated with owning and operating a boat will be attributable to activities other than fishing offshore for gamefish. As a result, we have apportioned those boat related costs between offshore gamefishing and other activities using data provided by boat owners to the *NSW Striped Marlin Recreational Fishing Survey* on the proportion of time their boat was used for offshore gamefishing.

Similarly, some of the travel, accommodation, boating and fishing gear costs associated with going gamefishing will be attributable to catching gamefish other than striped marlin (e.g. other billfish, tuna, sharks, and sportfish). As a result, we have apportioned those costs between:

- **fishing for billfish as opposed to other gamefish** using NSW Fisheries *Gamefish Tournament Monitoring Program* data on catch composition between billfish and all other gamefish. As noted above, billfish comprised approximately **85 percent** of the total catch; and
- **fishing for striped marlin as opposed to other billfish** using *NSW Striped Marlin Recreational Fishing Survey* data on the proportion of the billfish catch that comprises striped marlin. As noted above, striped marlin comprised approximately **68 percent** of the total billfish catch of recreational anglers surveyed.

Overall, this means that only **58 percent** of travel, accommodation, boating and fishing gear related costs reported by non-charter boat anglers have been apportioned to striped marlin fishing and used to estimate the gross value of striped marlin to those anglers.

The data sources and approaches used to estimate the onshore and offshore costs incurred by recreational anglers who chartered boats to go fishing for striped marlin are as follows:

- **travel and accommodation costs** have been estimated using data provided to the *NSW Striped Marlin Recreational Fishing Survey* in the same manner used to estimate the costs incurred by charter boat anglers. This produced an estimated travel costs of \$267,331 and accommodation costs of \$112,658 for the recreational anglers surveyed, who comprise 6.3 percent of the estimated number of recreational anglers participating in gamefishing off the NSW coastline. This suggests that the non-charter boat anglers incurred:
 - **travel costs** of approximately **\$4.3 million**; and
 - **accommodation costs** of approximately **\$1.8 million**;
- **boat related costs** have been estimated using data provided to the *NSW Striped Marlin Charter Boat Fishing Survey* by boat owners on the cost of fuel, mooring and storage, repairs and maintenance, and contributions to friends for the cost of sharing the use of their boats. Boat license costs have also been included as well as boat depreciation, which was calculated at a straight line rate of 7.5 percent of the original boat cost. The proportion of these boat related costs attributable to catching striped marlin as opposed to other gamefish was then estimated in the manner outlined above. It was estimated that the boat owners surveyed had incurred boat related costs of approximately \$1,187,569. This suggests that non-charter boat anglers incurred boat related costs of approximately **\$18.9 million**;
- **fishing gear related costs** have been estimated using data provided to the *NSW Striped Marlin Recreational Fishing Survey* by non-charter boat anglers. Depreciation of rods, reels, lures, gaffs, harnesses and special clothing has been calculated at a straight line rate of 15 percent. Line costs have been spread over two years. The proportion of these costs attributable to catching striped marlin as opposed to other gamefish was then estimated in the manner outlined above. It was estimated that the non-charter boat anglers surveyed had incurred expenditure of \$245,620 on fishing gear in order to catch striped marlin. This suggests that total expenditure by non-charter boat anglers was approximately **\$3.9 million**;

- **the market value of striped marlin released** by non-charter boat anglers was estimated using data provided to the *NSW Striped Marlin Fishing Survey*. As indicated in Table 14, in 2002-03 the non-charter anglers surveyed released 875 striped marlin that weighed 55,420 kg. At a weighted average market price of \$6.00 per kilogram of whole striped marlin, the estimated value of striped marlin released by charter boat anglers in 2002-03 was \$332,520. Since the recreational anglers surveyed represent 6.3 percent of the estimated total number of recreational anglers who go fishing for marlin offshore, it is estimated that the market value of the striped marlin released by all non-charter recreational anglers is approximately **\$5.29 million**; and
- **the opportunity cost of time** spent by non-charter boat anglers was estimated using data provided to the *NSW Striped Marlin Recreational Fishing Survey*. That survey indicated recreational anglers had spent 4,211 days fishing for striped marlin from their own boats or friends, boats. It was assumed that the opportunity cost of a day spent striped marlin fishing to these recreational anglers is equal to 10 percent of their average daily gross income of \$251. The proportion of that cost attributable to striped marlin fishing operations was then estimated in the manner outlined above. Under these assumptions, the estimated the opportunity cost of the time spent striped marlin fishing was \$60,072 for those recreational anglers surveyed. Since those anglers represent approximately 6.3 percent of the estimated anglers who go gamefishing off the NSW coastline, this suggests that the opportunity cost of the time recreational anglers spend charter boat fishing for striped marlin is approximately **\$955,145**.

As outlined in Table 20, the estimated total costs incurred by recreational anglers who used their own boat, or a friend's boat, to go fishing for striped marlin off the NSW coastline was at approximately \$35.1 million over the survey period. That is, the gross value (excluding consumer surplus) of striped marlin caught by recreational anglers who used charter boats to fish for those marlin was at least **\$35.1 million**.

Total expenditure on striped marlin by recreational anglers

As indicated in Table 20, the total **gross value (excluding consumer surplus) of striped marlin caught by recreational anglers off the NSW coastline is estimated conservatively to be over \$40 million in 2002-03, or \$34.83 per kilogram of whole striped marlin**, which is significantly higher than the gross value of striped marlin to commercial operators which was estimated to be \$1.24 million in 2002-03, or \$6 per kilogram of whole striped marlin.

Indeed, even the gross value of the striped marlin caught by those recreational anglers that were surveyed in 2002-03 (\$2.85 million or \$34.84 per kg) was more than twice the gross value of the entire NSW commercial striped marlin catch in that year.

Additional consumer surplus derived by recreational striped marlin anglers

As discussed in section 2.2.1, in order to estimate the gross value of striped marlin to recreational anglers it is necessary to estimate not only what recreational anglers actually spend to go striped marlin fishing, but also the additional amount they would have been prepared to pay to go striped marlin fishing. That is, it is necessary to add to the conservative estimates of the gross value of striped marlin that are set out in Table 20 an estimate of the value of the consumer surplus derived by recreational striped marlin anglers (i.e. the difference between what they were willing to pay to go striped marlin fishing and what they actually paid).

This requires information on how the quantity of striped marlin demanded by recreational anglers varies in response to changes in the amount that has to be paid to go striped marlin fishing (i.e. recreational angler demand for striped marlin and its sensitivity to changes in the cost of going striped marlin fishing).

In order to estimate recreational demand for striped marlin, we:

- surveyed recreational striped marlin anglers to obtain information on the number of trips they made to each regional NSW coastal fishing area and the costs they incurred to travel to, stay in, and go fishing in each of those areas; and
- sought to use a 'travel cost method' (TCM) in order to construct a demand function for recreational striped marlin fishing.

Although the TCM is often used to estimate the demand for recreational fishing at particular locations, two main problems were encountered when seeking to use this method to estimate recreational angler demand for striped marlin fishing off the NSW coastline:

- most of the recreational striped marlin anglers surveyed live in their own homes in close proximity to the ports from which they depart in order to go striped marlin fishing. As a result, their total expenditure on travel and accommodation to their port of embarkation only comprised a relatively small proportion of the total costs of going striped marlin fishing and did not vary significantly with the number of striped marlin fishing trips; and
- those recreational anglers surveyed who did travel significant distances in order to fish for striped marlin were not constrained to one location. Rather, they had a choice between numerous locations along the entire length of the NSW coastline and the quality of the fishing at those locations can vary considerably over time. Although it is possible, in theory, to apply the TCM to multiple destination problems such as this, the approach is more complex and requires a reasonably large number of responses from individuals who fish for striped marlin in several coastal regions.

For these reasons, it was concluded that there was insufficient data from anglers who travelled significant distances to go striped marlin fishing off the NSW coastline to enable the TCM to produce a sufficiently reliable estimate of the demand for recreational striped marlin off the NSW coastline.

As a result, for the purposes of this report a less informationally demanding approach was used which involved assuming that:

- the quantity of striped marlin demanded by recreational anglers is a linear function of the price that recreational anglers have to pay to go striped marlin fishing (i.e. it is assumed that the recreational angler demand 'curve' for striped marlin is a straight line); and
- recreational angler demand for striped marlin is neither price elastic or inelastic (i.e. a 'unitary' income-compensated arc elasticity of demand was assumed).

Under these assumptions, it was estimated that **the value of consumer surplus** derived by recreational anglers in 2002-03 was approximately **\$13.4 million**.

This estimate is considered to be conservative since available evidence suggests that the price elasticity of demand for striped marlin fishing is relatively inelastic since recreational anglers and charter boat operators do not consider other gamefish species to be close substitutes in consumption for striped marlin. As noted previously, over 36 percent of recreational anglers and 23 percent of charter boat operators indicated that they would give up offshore gamefishing completely if it was unlikely that they would catch a striped marlin. As a result, it is likely that the net value of striped marlin to recreational anglers is much higher.

In order to obtain a more accurate estimate of the value of striped marlin to recreational anglers in the future, it is recommended that NSW Fisheries should:

- **require recreational anglers to indicate on their fishing license application forms whether or not they intend fishing for striped marlin.** This would provide NSW Fisheries with a much more accurate indication of the numbers, and geographic distribution, of those recreational anglers who are currently participating in striped marlin fishing, than can be obtained from the data provided by the recreational anglers and charter boat operators who responded to the surveys conducted during this project; and
- **conduct a random survey of those recreational anglers who have indicated an intention to go striped marlin fishing to determine their price elasticity of demand for striped marlin fishing.** At the moment, it is difficult to use random statistical sampling techniques to survey recreational striped marlin anglers since those anglers comprise a relatively small proportion of the total number of recreational anglers and their identities are unknown. As a result, it would be necessary to survey a very large proportion of licensed recreational anglers in order to obtain sufficiently large number of responses from recreational striped marlin anglers. Once the identities of licensed recreational striped marlin anglers are known, however, much more accurate, random, statistical sampling techniques could be used. In particular, consideration should be given to conducting a random sample of recreational striped marlin anglers to determine their willingness to pay to catch striped marlin.

A number of alternative methods could be used to estimate that willingness to pay including:

- market based methods, where the demand for striped marlin fishing is estimated from actual market data on how the demand for striped marlin fishing responds to changes in price (e.g. using time series data obtained from charter boat operators);
- revealed preference methods, such as the TCM, as well as:
 - the random utility method (RUM), which like the TCM, which would use trip data and travel costs to estimate the demand for recreational striped marlin. Unlike the TCM, however, the RUM is capable of taking into account the fact that recreational anglers have a choice between alternative locations when they go striped marlin fishing and the chances of their catching striped marlin at those locations can differ significantly. The main problem with the RUM method, however, is that it does not explain the reason for the number of trips that are made to each location by recreational anglers. As a result, even though the probability of catching a striped marlin at a particular location might change, the number of trips made to that location is assumed to remain constant;
 - hedonic pricing method (HCM), which would estimate the demand for striped marlin fishing using data on the behavior of recreational striped marlin anglers in related markets (e.g. demand for goods and services that are complements in consumption with striped marlin fishing, such as demand for striped marlin fishing gear); or
- stated preference methods, such as the contingent valuation method (CVM), which would involve asking recreational striped marlin anglers how much they would be willing to pay for a particular increase in the quantity of striped marlin they catch, or the quality of their striped marlin fishing experience. One of the main problems with this widely used technique is that it can result in significant 'hypothetical market' bias. That is, data obtained from such surveys can be biased by the fact that respondents are not being presented with actual market choices. While recreational anglers may say they are prepared to pay large amounts of money to increase the quantity of striped marlin they catch, they may not be prepared to pay that much in practice.

Estimated gross value of NSW striped marlin to recreational anglers

The **gross value of NSW striped marlin to recreational anglers in 2002-03** (including consumer surplus) was estimated to be **\$53.6 million, or \$46.45 per kg** of the estimated striped marlin caught by recreational anglers.

This estimate was obtained by summing:

- the conservative estimate of the gross value of striped marlin set out in Table 20, which is equal to what recreational anglers paid to go striped marlin fishing, which was \$40.2 million; and
- the estimate of the additional consumer surplus derived by recreational anglers, which was \$13.4 million.

Net value of striped marlin to recreational fishing sector of the economy

What is the net value of striped marlin to recreational striped marlin fishing sector of the economy?

As discussed in section 2.2.1, the net value of NSW striped marlin to recreational anglers and charter boat operators has been estimated by estimating both the:

- the consumer surplus derived by recreational anglers from striped marlin fishing, which was estimated in the manner outlined above; and
- the producer surplus derived by:
 - charter boat operators who take recreational anglers striped marlin fishing off the NSW coastline; and
 - recreational anglers who either use their own boats, or friends boats, to go fishing for striped marlin off the NSW coastline.

The approach used to estimate the producer surplus derived by charter boat operators and recreational anglers is outlined below.

Producer surplus derived by charter boat operators

The net value of striped marlin caught by charter operators off the NSW coastline was estimated using data obtained from the *NSW Striped Marlin Charter Boat Fishing Survey* which surveyed the gross revenue and costs incurred by 27 charter boats, which represent 10.6 percent of the 250 charter boats licensed to take recreational angler gamefishing off the NSW coastline in 2002-03.

The gross revenue and costs reported by these charter operators was apportioned between:

- **billfish and all other charter boat activities** using data obtained from the survey on the proportion of time that charter boats spent taking recreational anglers fishing for billfish as opposed to other charter activities (e.g. other fishing activities, diving, whale watching etc). On average, the charter boats surveyed spent around **50 percent** of their time billfish fishing; and
- **striped marlin and other billfish fishing** using *NSW Striped Marlin Recreational Fishing Survey* data on the proportion of the billfish catch that comprises striped marlin, which indicates that striped marlin comprised approximately **68 percent** of the total billfish catch of recreational anglers surveyed.

Overall, this means that only around **34 percent** of charter boat gross revenues and expenses have been allocated to the striped marlin operations of charter boats. The remaining revenues and expenses have been allocated to the 'other operations' of those charter boats.

The estimated net value of the striped marlin operations of the NSW charter boat operators surveyed are set out in Table 21.

Table 21 indicates that in 2002-2003, the NSW charter boats surveyed derived:

- a **profit** on their striped marlin operations of **\$3,926** if we allocate a proportion of all costs (excluding labour, financing, and insurance costs) to striped marlin fishing. Under these assumptions, the net value of striped marlin caught by charter boats off the NSW coastline in 2002-03 was approximately **\$981,572**; or
- a **profit** on their striped marlin operations of **\$14,519** if we only allocate a proportion of operating costs (bait, fuel and ice) to striped marlin fishing. Under these assumptions, the net value of striped marlin caught by charter boats off the NSW coastline in 2002-2003 was approximately **\$3.6 million**.

Table 21: Net value of striped marlin to charter boat operators surveyed

	Striped marlin operations		Other operations		TOTAL
	All costs apportioned	Only operating costs apportioned	All costs apportioned	Only operating costs apportioned	
RECEIPTS					
Striped marlin receipts	18,838	18,838			18,838
Other fishing receipts			30,858	30,858	30,858
Total cash receipts	18,838	18,838	30,858	30,858	49,696
COSTS					
Administration	209		766		975
Bait and ice	280	280	775	775	1,056
Lures	147	147	244	244	392
Fuel	3,602	3,602	4,901	4,901	8,503
License fees and levies	366		740		1,107
Repairs and maintenance	4,099		4,604		8,702
Boat mooring and storage	2,012		1,446		3,459
Other costs (line, terminal tackle, etc)	289	289	350	350	639
Total costs (excluding labour, finance and insurance costs)	11,004	4,318	13,828	6,271	24,832
NET BENEFIT (before depreciation, labour, finance and insurance costs)	7,834	14,519	17,030	24,587	24,864
less depreciation	3,907		4,001		7,908
NET BENEFIT (after depreciation, but before labour, finance and insurance costs)	3,926	14,519	13,029	24,587	16,955

Producer surplus derived by recreational anglers who use their own, or friends', boats

The producer surplus derived by recreational anglers who fish from either their own, or friends', boats was estimated using data obtained from the *NSW Striped Marlin Recreational Fishing Survey*.

As set out in Table 22, the gross benefits that these recreational anglers derive from their activities include:

- the **market value of the striped marlin fishing trips** that these recreational anglers supply to:
 - themselves (2,843 boat days which are valued at an average price of \$600 per boat per day, which is obtained from the NSW Striped Marlin Charter Boat Fishing Survey); and
 - their friends (1,390 angler trips valued at \$150 per angler, which was obtained from the *NSW Striped Marlin Charter Boat Fishing Survey*, assuming an average of 4 anglers per boat);
- the **market value of the striped marlin they catch**, regardless of whether they release or keep those marlin (59,740 kg valued at \$6.00 per kg); and
- the **market value of other fish caught**, which was not valued.

As indicated in Table 22, in order to produce those gross benefits, these recreational anglers also incur the following costs:

- fuel;
- licence fees and levies (e.g. boat driver's licence and NSW fishing licence);
- boat repairs and maintenance;
- boat mooring and storage costs;
- contributions to friends for the use of their boat and fishing gear;
- other costs (e.g. sea sick pills, sunscreen); and
- depreciation of capital equipment including the boat, boat trailer and fishing equipment (i.e. the proportion of the value of that capital equipment consumed each year). The assumed economic rates of depreciation are as follows:
 - boat (7.5 percent straight line per annum);
 - boat trailer (20 percent) ;
 - boat electronic equipment (15 percent);
 - fishing gear, except line (15 percent);
 - line (50 percent – that is, it is assumed that it is replaced on average once every 2 years); and
 - special equipment, such as wet weather gear etc (15 percent).

These gross benefits and costs have been apportioned between:

- **fishing for billfish as opposed to other gamefish** using NSW Fisheries *Gamefish Tournament Monitoring Program* data on catch composition between billfish and all other gamefish. As noted above, billfish comprised approximately **85 percent** of the total catch; and
- **fishing for striped marlin as opposed to other billfish** using *NSW Striped Marlin Recreational Fishing Survey* data on the proportion of the billfish catch that comprises striped marlin. As noted

above, striped marlin comprised approximately **68 percent** of the total billfish catch of recreational anglers surveyed.

Overall, this means that only **58 percent** of the gross benefits and costs arising from these activities of these recreational anglers have been attributed to their striped marlin fishing operations and used to estimate the net value of striped marlin to those anglers.

The estimated net value of the striped marlin operations of the NSW recreational anglers who used their own, or friends, boats are set out in Table 22.

Table 22 indicates that in 2002-2003, the recreational anglers surveyed who either used their own boats to go striped marlin fishing off the NSW coastline in 2002-2003, or shared the use of friends' boat, derived:

- a **profit** on their striped marlin operations of **\$31,716**, if a proportion of all costs (excluding labour, financing, and insurance costs) is allocated to striped marlin fishing. Under these assumptions, the net value of the striped marlin caught by these recreational anglers was approximately **\$504,288**; or
- a **profit** on their striped marlin operations of **\$969,680** if only a proportion of operating costs (bait, fuel and ice) is allocated to striped marlin fishing. Under these assumptions, the net value of the striped marlin caught by these recreational anglers was approximately **\$15.42 million**.

In view of the difficulties associated with determining the composition and value of recreational angler's non-striped marlin catch, no value for that catch has been included in Table 22. As a result, Table 22 indicates that recreational anglers are making a loss on their non-striped marlin fishing activities.

Table 22: Net value of striped marlin caught by recreational anglers surveyed who use their own, or friends', boats (producer surplus only)

	Striped marlin operations		Other operations		TOTAL
	All costs apportioned	Only operating costs apportioned	All costs apportioned	Only operating costs apportioned	
BENEFITS					
Market value of striped marlin trips	1,106,465	1,106,465	807,835	807,835	1,914,300
Market value of striped marlin caught	358,440	358,440			358,440
Market value of other fish caught			Not valued	Not valued	Not valued
Total benefits	1,464,905	1,464,905	807,835	807,835	2,272,740
COSTS					
Fuel	369,273	369,273	269,608	269,608	638,881
License fees and levies	4,546		3,319		7,865
Repairs and maintenance	255,189		186,315		441,504
Boat mooring and storage	49,818		36,372		86,191
Contributions to friends	125,952	125,952	91,958	91,958	217,910
Other costs	12,659		9,242		21,901
Total costs (excluding labour, finance and insurance costs)	817,437	495,225	596,814	361,566	1,414,251
NET BENEFIT (before depreciation, labour, finance and insurance costs)	647,468	969,680	211,021	446,269	858,489
less depreciation (boat, fishing gear, lures)	615,752		449,563		1,065,315
NET BENEFIT (after depreciation, but before labour, finance and insurance costs)	31,716	969,680	-238,542	446,269	-206,826

Net value of striped marlin to the recreational fishing sector of the economy

It is estimated that the **total net value of the striped marlin caught by recreational anglers** off the NSW coastline ranges between:

- **\$14.9 million** (if a proportion of all costs is allocated to striped marlin fishing, excluding labour, finance, and insurance costs); and
- **\$32.4 million** (if only a proportion of operating costs is allocated to striped marlin fishing).

This estimate was obtained by summing the:

- consumer surplus derived by recreational striped marlin anglers, which was estimated to be \$13.4 million; and
- producer surplus derived by charter boat operators and recreational anglers, which was estimated to range between:
 - \$1.49 million (if a proportion of all costs is allocated to striped marlin fishing, excluding labour, finance, and insurance costs); and
 - \$19 million (if only a proportion of operating costs is allocated to striped marlin fishing).

Net value of a kilogram of striped marlin catch to recreational anglers

The **net value of an additional kilogram of striped marlin to the recreational fishing sector in 2002-03** was estimated to be between:

- **\$12.90 per kg** (if a proportion of all costs is allocated to striped marlin fishing, excluding labour, finance, and insurance costs); and
- **\$28.13 per kg** (if only a proportion of operating costs is allocated to striped marlin fishing).

This is significantly greater than the estimated net value of an additional kilogram of striped marlin to NSW commercial operators in 2000-01, which is \$2.46 per kg (if a proportion of all costs is allocated to striped marlin fishing, excluding labour, finance, and insurance costs), or \$4.68 (if only a proportion of operating costs is allocated to striped marlin fishing).

6.2 Economic Significance of Striped Marlin to the NSW Economy and Regional Coastal Economies

The economic significance of commercial and recreational striped marlin fishing at a NSW State and NSW coastal regional level was estimated in terms of its impact on:

- output;
- value added;
- employment; and
- household income.

The NSW coastal regions examined included the:

- Northern and Mid Northern regions;
- Sydney and Hunter regions;

- Illawarra region; and
- Southern region.

The Northern and Mid Northern, and Sydney and Hunter regions, were combined due to the confidential nature of some data.

The economic impact 'input-output' modeling was undertaken by the Centre for Agricultural and Regional Economics (CARE), a private organisation which provides consultancy and research services in the area of regional, resource and business economics.

The total economic impact of marlin fishing on the NSW economy is outlined in Table 23 for both commercial and recreational fishing in terms of output, value added, household income and employment.

Table 23: Summary of total economic impact of striped marlin fishing on the NSW economy

Striped marlin fishing sector	Output	Value Added	Wages	Employment
Commercial	\$4,627,409	\$1,914,024	\$1,308,539	34
Recreational	\$112,442,374	\$44,392,254	\$26,203,502	907
TOTAL	\$117,069,783	\$46,306,277	\$27,512,041	941

As indicated in Table 23, the total economic impact of striped marlin fishing on the NSW economy is to:

- generate \$117 million in output;
- contribute \$46.3 million to value added (Gross State Product);
- provide \$27.5 million in household income; and
- create 941 jobs in the NSW economy.

The impact of recreational striped marlin fishing far outweighs that of commercial striped marlin fishing, given the number of people involved in recreational fishing in NSW, their associated spending and the type of equipment involved in recreational marlin fishing (e.g. boats and fishing gear).

Commercial striped marlin fishing is only a small part of the overall ET&BF industry. As a result, it only contributes a relatively small component to the economic activity of commercial fishing vessels in terms estimated sales and costs incurred by commercial fishing operators.

6.2.1 Economic impact on NSW

The economic impact of striped marlin fishing on the NSW economy was calculated using four key economic impact indicators – output (sales), value added (Gross State Product), household income (wages and salaries) and employment (full and part time jobs).

Outlined below is a break down of each of the economic impact calculations for each of the indicators by direct impact, flow-on impact and total impact. The tables below emphasise the point that the recreational fishing sector is significantly larger than the commercial sector. In all four economic impact indicators, recreational fishing is estimated to generate the majority of economic activity. Based on the information outlined below the recreational striped marlin fishing sector currently creates

around 96 percent of all output, value added, household income and employment for the entire striped marlin fishing industry.

Output

Striped marlin fishing contributes \$117.0 million to the output of the NSW economy:

- \$4.6 million of output from the commercial fishing sector; and
- \$112.4 million of output from recreational fishing.

Table 24: Impact of striped marlin fishing on output

Striped marlin fishing sector	Direct	Flow-on	Total
Commercial	\$1,697,892	\$2,929,517	\$4,627,409
Recreational	\$54,472,554	\$57,969,820	\$112,442,374
TOTAL	\$56,170,446	\$60,899,337	\$117,069,783

Value added

Striped marlin fishing contributes \$46.3 million to the value added by the NSW economy, comprising:

- \$1.9 million of value added by the commercial fishing sector; and
- \$44.4 million of value added by the recreational fishing sector.

Table 25: Impact of striped marlin fishing on value added

Striped marlin fishing sector	Direct	Flow-on	Total
Commercial	\$728,925	\$1,205,728	\$1,914,024
Recreational	\$17,785,961	\$26,606,293	\$44,392,254
TOTAL	\$18,514,886	\$27,812,021	\$46,306,277

Household income

Striped marlin fishing contributes \$27.5 million to household income:

- \$1.3 million from the commercial fishing sector; and
- \$26.2 million from recreational fishing.

Table 26: Impact of striped marlin fishing on household income

Striped marlin fishing sector	Direct	Flow-on	Total
Commercial	\$649,417	\$670,051	\$1,308,539
Recreational	\$11,783,823	\$14,419,679	\$26,203,502
TOTAL	\$12,433,240	\$15,089,729	\$27,512,041

Employment

Striped marlin fishing creates a total of 941 jobs:

- 34 generated by the commercial fishing sector; and
- 907 by recreational fishing.

Table 27: Impact of striped marlin fishing on employment

Striped marlin fishing sector	Direct	Flow-on	Total
Commercial	17	17	34
Recreational	476	431	907
TOTAL	492	448	941

6.2.2 NSW regional impact

Economic impact modelling of the striped marlin fishing industry was also undertaken for the NSW coastal regions, the results of which are summarised in Table 28.

Table 28: Impact of striped marlin fishing on NSW regional economies

Region	Output	Value Added	Household income	Employment
Northern and Mid Northern	\$8,909,603	\$3,166,584	\$2,110,881	96
Hunter and Sydney	\$61,885,021	\$23,708,820	\$14,378,942	388
Illawarra	\$10,575,116	\$3,601,963	\$2,451,402	97
Southern	\$20,820,005	\$7,695,002	\$5,372,858	213
Other regions	\$14,880,037	\$8,133,909	\$3,197,958	145
TOTAL NSW	\$117,069,783	\$46,306,277	\$27,512,041	941

The Sydney and Hunter regions were estimated to gain most of the economic activity for all economic impact indicators followed by the Southern region, Illawarra and the Northern and Mid Northern regions. For all indicators its share of economic activity accounted for just over 50 percent with the exception of employment, where it was around 41 percent of total employment.

In Table 29, the economic impact is broken down by coastal region, economic indicator, as well as by the contribution of commercial fishing and recreational fishing.

Table 29: Contribution of striped marlin fishing to output, value added, household income and employment in NSW coastal regional economies

Region	Commercial	Recreational	Total
Northern and Mid Northern			
Output	\$583,909	\$8,325,694	\$8,909,603
Value added	\$250,878	\$2,915,706	\$3,166,584
Household income	\$182,263	\$1,928,618	\$2,110,881
Employment	5	91	96
Hunter and Sydney			
Output	\$548,353	\$61,336,668	\$61,885,021
Value added	\$225,133	\$23,483,687	\$23,708,820
Household income	\$154,680	\$14,224,262	\$14,378,942
Employment	3	386	388
Illawarra			
Output	\$1,313,321	\$9,261,796	\$10,575,116
Value added	\$550,752	\$3,051,211	\$3,601,963
Household income	\$393,452	\$2,057,950	\$2,451,402
Employment	9	89	97
Southern			
Output	\$947,511	\$19,872,495	\$20,820,005
Value added	\$407,619	\$7,287,383	\$7,695,002
Household income	\$304,177	\$5,068,681	\$5,372,858
Employment	7	207	213

In all of the NSW coastal regions outlined in the table above, recreational striped marlin fishing generates the majority of economic activity.

The majority of commercial striped marlin fishing activity occurs in the Illawarra region (\$1.3 million output, \$0.55 million value added, \$0.4 million household income and 9 jobs) followed by Southern, Mid North and Northern and Sydney and the Hunter.

By contrast, the majority of recreational striped marlin fishing activity occurs in the Sydney and Hunter region (\$61.3 million output, \$23.5 million value added, \$14.2 million household income and 386 jobs) followed by Southern, with Mid North and Northern and Illawarra having around the equivalent economic impact.

7. Economic Impact of Alternative Striped Marlin Management Arrangements

The results of the analysis in section 6.1 indicate that recreational anglers place a much higher net value on an additional striped marlin than commercial fishers.

This suggests there are potential net benefits to the community from introducing alternative striped marlin fisheries management arrangements that seek to reallocate some of the striped marlin catch from commercial to recreational uses.

This section examines the potential economic impact of four alternative striped marlin fisheries management arrangements:

- a continuation of the current striped marlin management arrangements (section 7.1). This approach provides the 'base case' against which each of the other alternative striped marlin fisheries management arrangements is assessed;
- a ban on striped marlin fishing off the NSW coastline (section 7.2);
- a ban on commercial fishing for striped marlin within 50 nautical miles of the NSW coastline (section 7.3); and
- a ban on commercial longline fishing within 50 nautical miles of the NSW coastline (section 7.4).

In particular, it examines the potential economic impact that those alternative management arrangements would have on:

- commercial and recreational anglers and the community as a whole; and
- the NSW economy and regional economies.

7.1 Economic impact of continuing current striped marlin management arrangements

Consider first the implications of continuing the current striped marlin management arrangements.

At first sight, such an approach appears attractive in view of the considerable uncertainty currently surrounding the total supply of striped marlin off the NSW coastline.

On closer inspection, however, it is apparent that such an approach would potentially:

- impose an annual net cost on the community as a whole;
- reduce the sustainability of the fishery in the medium to long term for both commercial and recreational anglers; and
- adversely affect the coastal regional economies of NSW that rely on striped marlin fishing as an importance source of income.

7.1.1 Impact on commercial and recreational anglers and the community as a whole

When evaluating each of the alternative striped marlin fisheries management arrangements, we have assessed their economic impact relative to what would have happened had the current striped marlin fisheries management arrangements been continued. That is, the continuation of current striped marlin fisheries management practices is the 'base case' against which each of the alternative arrangements is assessed.

As a result, by definition, a continuation of the current striped marlin fisheries management arrangements in the short term will not change the net benefits that commercial fishers, recreational anglers and the community as a whole, derive from striped marlin fishing in NSW.

It is important to note, however, that this does not mean that continuing the current striped marlin fisheries management arrangements would guarantee that commercial fishers and recreational anglers would continue to derive the net benefits they currently derive from striped marlin fishing.

On the contrary, if the commercial striped marlin catch continues to increase at its current rate, there is a risk that it could undermine the sustainability of the NSW striped marlin fishery in the medium to longer term, thereby reducing:

- the present value of the fishery to commercial fishers by reducing the economic life of the fishery;
- the probability of catching a striped marlin off the NSW coastline and thereby deter recreational fishing for striped marlin.

Nor does this mean that it is in the community's best interests to continue the current striped marlin management arrangements. Although a continuation of the current striped marlin fisheries management arrangements would mean that both commercial and recreational anglers would continue to derive a net benefit from striped marlin fishing, this does not mean that it is not possible for the community to derive greater net benefits from alternative striped marlin management arrangements.

On the contrary, it is important to note that the current striped marlin management arrangements are imposing a net cost on the community each year. That annual net cost to the community arises because the current striped marlin management arrangements perpetuate an inefficient allocation of the total striped marlin catch between commercial and recreational anglers.

As indicated in section 6.1, the net value of striped marlin to recreational anglers is significantly higher (\$12.90 to \$28.13 per kg) than it is to commercial fishers (\$2.46 to \$4.68 per kg). As a result, the community is not deriving as great a net benefit from the current striped marlin catch as it would if a greater proportion of the catch was allocated to recreational anglers.

This means that every kilogram of striped marlin caught by commercial anglers generates a net loss to the community equal to the additional net benefit that would have been generated had that striped marlin been caught by a recreational angler (i.e. \$10.44 to \$23.45 per kg). As a result, the continuation of current striped marlin management arrangements imposes an opportunity cost on the community of approximately \$2.2 million to \$4.9 million per annum based on 2002-03 commercial striped marlin catch data.

In addition, in the medium to long term, there is a risk that the increasing commercial catch of striped marlin could deplete the stocks of striped marlin off the NSW coastline, thereby threatening the sustainability of both the commercial and recreational striped marlin fishery.

As indicated in section 5.4.7, over 36 percent of recreational striped marlin anglers and 23 percent of charter boat operators surveyed indicated that they would give up gamefishing completely if the level of stocks of striped marlin off the NSW coastline fell to such a level that they were unlikely to catch a

striped marlin. This would impose a net cost on the community of approximately \$5.2 to \$11.2 million per annum.

7.1.2 Impact on the NSW economy and regional economies

A continuation of the current striped marlin fisheries management arrangements would not change the impact that commercial and striped marlin fishing is currently having on the NSW economy and regional economies. In the short term, commercial and striped marlin fishing would continue to have the same impact on the NSW economy and regional economies as set out in section 6.2 of this report.

Once again, however, it is important to note that this does not mean that commercial and recreational striped marlin fishing will continue to make a significant contribution to the NSW economy and regional coastal economies.

As noted above, in the medium to longer term there is a risk that reductions in the sustainability of the striped marlin fishery will reduce the level of both commercial and recreational angling in NSW coastal economies, which would have the most adverse effects on those coastal regions of NSW that currently derive the most benefits from commercial and recreational fishing for striped marlin (Hunter and Sydney, Illawarra and Southern).

7.2 Economic impact of a ban on commercial striped marlin fishing off the NSW coast

Now consider the implications of imposing a ban on commercial fishing for striped marlin off the NSW coastline in relation to what would happen if we were to continue the current striped marlin fisheries management arrangements.

As noted in section 4.2.3, such a ban already exists in Western Australia for all marlin, and off the NSW coastline for blue and black marlin. In addition, New Zealand and the US also ban commercial fishing for marlin off their coastlines.

7.2.1 Impact on commercial and recreational anglers and the community as a whole

Impact on commercial operators

Commercial fishers operating in the Australian Fishing Zone are already prohibited from catching blue and black marlin by section 15A of the *Fisheries Management Act 1991*. As a result, it would be possible to impose a ban commercial fishing for striped marlin off the NSW coastline by extending the scope of section 15A of the Act to include striped marlin.

Under such a ban, commercial fishers would be required to treat striped marlin in the same manner as they have to treat blue and black marlin. That is, in order to avoid prosecution under the Act, any striped marlin caught by commercial operators would have to be returned to the water immediately, either dead or alive.

Following the introduction of such a ban on commercial fishing, commercial operators would not be able to sell their striped marlin catch since they would be prohibited from landing NSW striped marlin. As a result, they would experience a loss in gross revenue each year equal to the value of their striped marlin catch. That is, they would experience an economic loss equal to the expected net present value of the gross income they would otherwise have expected to derive from their future catches of striped marlin.

In addition to reducing the gross revenue of commercial operators, a ban on striped marlin fishing would also provide an incentive for commercial operators to alter their fishing techniques in order to reduce their by-catch of striped marlin. This has the potential to reduce the total costs currently incurred by commercial operators and offset the revenue lost from not being able to sell their striped marlin.

As a result, the magnitude of the net loss that commercial operators would incur as a result of the introduction of a ban on commercial fishing for striped marlin off the NSW coastline would depend on the extent to which the current catch of striped marlin exceeds the minimum avoidable level of striped marlin by-catch that could be expected while fishing for tuna and broad billed swordfish.

If the current commercial striped marlin catch is equal to the unavoidable level of striped marlin by-catch, commercial operators would experience an annual net loss equal in value to the market value of their expected striped marlin catch.

By contrast, if the current commercial striped marlin catch exceeds the unavoidable level of striped marlin by-catch, commercial operators will experience an annual decrease in net revenue less than the gross market value of the striped marlin catch.

This means that the **maximum potential annual loss** that commercial operators could expect to incur as a result of the introduction of a ban on commercial fishing for striped marlin off the NSW coastline is equal to the gross value of the commercial catch, which was estimated to be:

- \$1.70 million in 2000-01, or \$5.87 per kg of whole striped marlin;
- \$1.72 million in 2001-02, or \$6.07 per kg of whole striped marlin; and
- \$1.24 m in 2002-03, or \$6.00 per kg or whole striped marlin.

Impact on recreational anglers

Now consider the economic impact that such a ban on commercial striped marlin fishing is likely to have on recreational anglers.

The immediate impact of such a ban would be to increase the quantity of striped marlin off the NSW coastline that is available for recreational anglers to catch. AFMA ET&BF fishery data on mortality rates for blue and black marlin suggest that around 29 percent of the commercial striped marlin catch would die before it is released. Since the total commercial catch of striped marlin off the NSW coastline was 289,078 kg in 2000-01, 283,172 kg in 2001-02, and 206,947 in 2002-03, this suggests that a ban on commercial fishing for striped marlin would have potentially increased the annual supply of striped marlin off the NSW coastline by:

- 205,534 kg in 2000-01;
- 201,335 kg in 2001-02; and
- 147,139 kg in 2002-03.

The net value of that increase in the supply of striped marlin to recreational anglers will depend on:

- the quantity of those additional striped marlin that recreational anglers can realistically expect to catch in that year; and
- the net value that recreational anglers derive from catching those additional striped marlin.

In theory, a ban on commercial fishing for striped marlin off the NSW coastline has the potential to increase the annual recreational striped marlin catch by at least the quantity of striped marlin released

alive by commercial anglers each year. Indeed, the potential increase in the annual recreational catch could exceed that figure since a high proportion of the striped marlin caught by recreational anglers is released alive and are available to be caught again within the same year.

For example, if recreational anglers caught all of the striped marlin released by commercial anglers, recreational anglers would derive a net benefit from the ban of:

- \$3.73 million to \$8.13 million in 2000-01;
- \$3.65 million to \$7.97 million in 2001-02; and
- \$2.67 million to \$5.82 million in 2002-03.

In practice, however, it is unlikely that recreational anglers will catch all of the striped marlin released each year by commercial operators. Rather, some of those marlin will die from the trauma of capture, be caught and killed by commercial operators fishing off the Queensland coastline, may be caught in subsequent years by NSW recreational anglers, or may escape capture completely.

As a result, the net benefit that recreational anglers would derive from the imposition of a ban on commercial fishing for striped marlin off the NSW coastline is likely to be lower than those potential net economic benefits.

Impact on the community as a whole

In theory, if all of the striped marlin caught and released alive by commercial operators off the NSW coastline were caught in the same year by recreational anglers, the potential net benefit of such a ban to the community would have been:

- \$2.03 million to \$6.43 million in 2000-01;
- \$1.93 million to \$6.25 million in 2001-02; and
- \$1.43 million to \$4.58 million in 2002-03.

In practice, however, the actual magnitude of the net benefit (or net cost) to the community arising from the imposition of a ban on commercial striped marlin fishing off the NSW coastline will depend on the extent to which that ban increases the number of striped marlin actually caught by recreational anglers for a given effort and increases the number of recreational anglers fishing for striped marlin.

Each kilogram of striped marlin released by commercial operators would cost them a maximum of \$6 based on the weighted average price received by commercial operators for a kilogram of striped marlin in 2002-03, whereas each additional kilogram of striped marlin caught by recreational anglers would produce a net benefit of:

- \$12.90 if all of the costs they incur have to increase in order to catch those marlin (i.e. when recreational anglers have no excess capacity to catch additional striped marlin); or
- \$28.13 per kilogram if they only have to increase operating costs in order to catch those additional striped marlin (i.e. when recreational anglers have excess capacity to catch additional striped marlin).

That is, each kilogram of striped marlin reallocated to recreational anglers would generate a net benefit to the community of \$6.90 to \$22.13.

This means that the imposition of a ban on commercial fishing for striped marlin off the NSW coastline would have to increase the recreational catch of striped marlin by around 4.9 percent to 15.6 percent in order to recover the net cost incurred by commercial striped marlin fishers.

The magnitude of the actual net benefit will depend on the extent to which recreational catches of striped marlin increase exceeds that ‘break even’ level. The higher the resulting growth in striped marlin captured by recreational anglers, the higher the net benefit to the community.

7.2.2 Impact on the NSW economy and regional economies

Impact of a reduction in the commercial striped marlin catch

Implementation of a ban on commercial fishing for striped marlin off the NSW coastline would:

- reduce the revenue that commercial operators currently derive from their sales of striped marlin to zero, since they would have to release all striped marlin; and
- leave the costs incurred by commercial operators largely unaffected if it is assumed that the current level commercial striped marlin catch does not exceed the minimal by-catch level (i.e. to the extent that it is an unavoidable by-catch of tuna fishing).

Since operating costs would remain relatively constant, there would be little immediate impact on household income or wages, as crew costs would remain unchanged and therefore the number of jobs in the short term would be expected to be constant. However, in the longer term commercial operators may attempt to cut costs via labour reductions. Alternatively, commercial operators may seek to catch other types of fish or increase the volume of catch of other fish species but this is difficult to judge without industry specific data on the expectations of commercial fishing operators.

As a result, output is impacted (only slightly) along with value added as a result of commercial operators experiencing lower returns without the sales contribution of striped marlin. The implications of this scenario on output and value added are outlined in Tables 30 and 31.

Table 30: Impact on output of a ban on commercial striped marlin fishing

Region	Direct	Flow-on	Total impact	Current impact	Change
Northern and Mid Northern	\$277,437	\$279,129	\$556,566	\$583,909	-\$27,343
Hunter and Sydney	\$208,078	\$314,597	\$522,675	\$548,353	-\$25,678
Illawarra	\$647,354	\$604,467	\$1,251,821	\$1,313,321	-\$61,500
Southern	\$485,515	\$417,626	\$903,141	\$947,511	-\$44,370
Total coastal regions	\$1,618,384	\$1,615,819	\$3,234,203	\$3,393,093	-\$158,890
TOTAL NSW	\$1,618,384	\$2,792,335	\$4,410,719	\$4,627,409	-\$216,690

A ban on commercial striped marlin is expected to reduce the value of output only marginally, by \$216,690 for the NSW economy as a whole.

In terms of NSW regions, Illawarra would experience the largest fall in output of \$61,500, followed by the Southern (\$44,370), Northern and Mid Northern (\$27,343) and Sydney and Hunter regions (\$25,678). This appears to be consistent with current estimated impact of commercial fishing whereby the Illawarra has the largest component of the NSW marlin fishing industry followed by Southern, Northern and Mid Northern, and Sydney and the Hunter regions.

The key reason why there would only be a marginal impact on output is that it is expected that commercial operators would continue to operate in a similar fashion since revenue from striped marlin only represents a relatively small proportion of a typical commercial operator’s revenue. However, in

the event that this revenue was no longer available it would reduce the return to commercial fishing operators and impact upon value added or contribution to Gross State Product.

Value added, or contribution to Gross State Product, is a better measure of the value of an industry sector to the economy as total sales or output “double counts” the value of production.

The impact of a ban on commercial striped marlin fishing on value added is significantly larger than its impact on output since it takes into account the lost revenue from commercial marlin fishing. As result, the total impact is a fall in value added of \$4.5 million on the NSW economy as outlined in Table 31.

Table 31: Impact on value added of a ban on commercial striped marlin fishing

Region	Direct	Flow-on	Total impact	Current impact	Change
Northern and Mid Northern	-\$166,109	-\$167,386	-\$333,495	\$250,878	-\$584,373
Hunter and Sydney	-\$124,582	-\$174,690	-\$299,272	\$225,133	-\$524,405
Illawarra	-\$387,587	-\$344,533	-\$732,120	\$550,752	-\$1,282,871
Southern	-\$290,690	-\$251,162	-\$541,852	\$407,619	-\$949,471
Total coastal regions	-\$968,967	-\$937,771	-\$1,906,738	\$1,434,381	-\$3,341,120
TOTAL NSW	-\$968,967	-\$1,575,364	-\$2,544,332	\$1,914,024	-\$4,458,355

In terms of the impact that such a ban would have on regional coastal economies, the Illawarra region would experience the largest fall in value added of \$1.3 million, followed by Southern region (\$0.9 million), Northern and Mid Northern regions (\$0.6 million) and the Sydney and Hunter region (\$0.5 million). Once again, this appears to be consistent with current estimated impact of commercial fishing whereby the Illawarra has the largest component of the NSW marlin fishing industry followed by Southern, Mid North and Northern and Sydney and the Hunter.

Impact of a potential increase in the recreational striped marlin catch

While the imposition of a ban on commercial fishing for striped marlin would cause the commercial fishing sector of the NSW economy and regional coastal economies to contract to some extent, this would be offset by the expansionary effect of an increase in recreational striped marlin fishing activity.

In theory, implementation of a ban on commercial fishing for striped marlin off the NSW coastline has the potential to:

- increase the probability of recreational anglers catching a striped marlin to some extent (i.e. increase the strike rate);
- reduce the costs of catching striped marlin; and
- expand recreational demand for striped marlin, as well as regional expenditure on striped marlin fishing trips, boats, fishing gear, travel and accommodation.

That is, it has the potential to expand economic activity in the recreational fishing sector of the economy. However, it is difficult to determine the nature and extent of that expansion, since it depends on the magnitude of the reduction in costs of catching striped marlin and the magnitude of the resultant expansion in recreational fishing activity and regional expenditure.

This makes it difficult to assess the net impact that banning commercial fishing for striped marlin will have on both the overall level of economic activity in the NSW economy and coastal regional

economies without making certain assumptions regarding the extent to which such a ban will increase the level of recreational fishing and expenditure.

In the absence of detailed information on the manner in which recreational anglers would respond to an increase in the probability of catching striped marlin, it is useful to determine the extent to which the value added by the recreational striped marlin fishing sector would have to expand in order to offset the loss in value added arising from placing a ban on commercial fishing for striped marlin off the NSW coastline.

As noted in section 6.2, the value added by recreational striped marlin fishing is estimated to be around \$46.3 million per annum. As a result, a 9.5 percent expansion in the value added by the recreational striped marlin fishing sector would be required in order to offset the loss in value added arising from banning commercial striped marlin fishing off the NSW coastline.

It is important to note, however, that the decision as to whether or not to implement such a ban should not be made on the basis of whether such a ban would produce an overall increase in the level of economic activity in the NSW economy or regional coastal economies.

Rather, such a decision should be based on an assessment of the extent to which such a ban could be expected to produce an overall net benefit for the community as a whole. As discussed in section 7.1.1, this involves an evaluation of the extent to which the reduction in the producer surplus of commercial operators is expected to be more than offset by an increase in the consumer and producer surplus of recreational anglers.

7.3 Economic impact of a ban on commercial striped marlin fishing within 50 nautical miles of the NSW coast

An alternative to banning commercial fishing off the NSW coastline would be to ban commercial fishing for striped marlin within a particular distance off the NSW coastline in order to reduce direct competition between commercial and recreational anglers.

As indicated in section 5 of this report, the results of the *NSW Striped Marlin Recreational Fishing Survey* suggest that most recreational anglers fish for striped marlin within 50 nautical miles of the NSW coastline (98 percent of recreational anglers with their own boats and more than 95 percent of charter boat anglers). As a result, virtually all of the striped marlin caught by recreational anglers off the NSW coastline are caught within the commercial longline fishing permit zones A and B, which extend out 50 nautical miles from the NSW coastline.

Similarly, as outlined in Table 6, AFMA catch data suggests that approximately 71 percent of the commercial catch of striped marlin was caught inside that 50 mile limit (i.e. inside longline fishing permit zones A and B) in 2000-01, 61 percent in 2001-02, and 52 percent in 2002-03.

This suggests there is significant scope to reduce direct competition between the commercial and recreational striped marlin anglers by banning commercial fishing for striped marlin within 50 nautical miles of the NSW coastline.

The use of a 50 nautical mile limit would reduce the extent to which such a ban would impose additional compliance costs on commercial operators and administrative costs on AFMA. Such a 50 nautical mile limit is already used to define how far the commercial longline fishing permit zones A and B extend off the NSW coastline.

7.3.1 Impact on commercial and recreational anglers and the community as a whole

Impact on commercial operators

Such a ban could be implemented in much the same manner as a ban on all commercial fishing for striped marlin off the NSW coastline. That is, the scope of section 15A of the *Fisheries Management Act 1991* could be extended to include striped marlin caught by commercial operators within 50 nautical miles of the NSW coastline.

Under such a ban, commercial fishers would be required to treat striped marlin caught within the 50 nautical mile limit in the same manner as they have to treat blue and black marlin. That is, in order to avoid prosecution under the Act, any striped marlin caught by commercial operators within the 50 nautical mile limit would have to be returned to the water immediately, either dead or alive.

The economic impact that such a ban would have on commercial operators can be estimated in much the same manner as a ban on all commercial fishing for striped marlin off the NSW coastline.

The immediate impact of such a ban would be to prevent commercial operators from selling the striped marlin they catch within 50 miles of the NSW coastline.

For example, such a ban would have reduced the commercial catches of striped marlin by:

- 204,498 kg in 2000-01 (i.e. approximately 70.7 percent of 289,078 kg);
- 173,027 kg in 2001-02 (i.e. approximately 61.1 percent of 283,172 kg);
- 107,848 kg in 2002-03 (i.e. approximately 52.1 percent of 206,947).

However, commercial operators would still incur the costs of having to catch and release striped marlin within the 50 nautical mile limit, assuming those costs are not avoidable.

As a result, if the current commercial striped marlin catch within the 50 nautical mile limit is equal to the unavoidable level of striped marlin by-catch, commercial operators would experience an annual net loss equal in value to the market value of their expected striped marlin catch.

By contrast, if the current commercial striped marlin catch within the 50 nautical mile limit exceeds the unavoidable level of striped marlin by-catch, commercial operators will experience an annual decrease in net revenue less than the gross market value of the striped marlin catch.

This means that the **maximum potential annual loss** that commercial operators could expect to incur as a result of the introduction of a ban on commercial fishing for striped marlin within 50 nautical miles of the NSW coastline is equal to the gross value of the commercial catch of striped marlin caught within that limit, which is estimated to be:

- \$1.2 million in 2000-01, or \$5.87 per kg of whole striped marlin;
- \$1.1 million in 2001-02, or \$6.07 per kg of whole striped marlin; and
- \$0.6 million in 2002-03, or \$6.00 per kg of whole striped marlin.

Impact on recreational anglers

A ban on commercial fishing for striped marlin within 50 nautical miles of the NSW coastline also has the potential to increase the annual recreational striped marlin catch by at least the quantity of striped marlin that would be released alive by commercial anglers each year within that 50 mile limit (i.e. 71

percent of the catch), which would have been:

- 145,392 kg in 2000-01;
- 123,022 kg in 2001-02; and
- 76,680 kg in 2002-03.

The net benefit that recreational anglers would derive from such increases in the supply of striped marlin will depend on the proportion of these released striped marlin that are recaptured by recreational anglers.

For example, if recreational anglers caught all of the striped marlin released by commercial anglers, recreational anglers would derive a net benefit from the ban of:

- \$1.88 million to \$4.1 million in 2000-01;
- \$1.59 million to \$3.5 million in 2001-02; and
- \$0.99 million to \$2.2 million in 2002-03.

Once again, however, it is unlikely that recreational anglers will catch all of the striped marlin released each year by commercial operators within the 50 nautical mile limit. Rather, some of those marlin will be caught and killed by commercial operators fishing outside the 50 mile limit, as well as commercial fishers operating off the NSW coastline, or may be caught in subsequent years by NSW recreational anglers.

As a result, the net benefit that recreational anglers derive from the imposition of a ban on commercial fishing for striped marlin within 50 nautical miles of the NSW coastline is likely to be lower than those potential economic benefits.

Impact on the community as a whole

In theory, if all of the striped marlin caught and released alive by commercial operators within the 50 nautical mile limit were caught in the same year by recreational anglers, the potential net benefit to the community would have been:

- \$0.68 million to \$2.89 million in 2000-01;
- \$0.54 million to \$2.41 million in 2001-02; and
- \$0.34 million to \$1.51 million in 2002-03.

In practice, however, the actual magnitude of the net benefit (or net cost) to the community arising from the imposition of a ban on commercial striped marlin fishing within the 50 mile limit will depend on the extent to which that ban increases the number of striped marlin actually caught by recreational anglers for a given effort.

Each kilogram of striped marlin released by commercial operators would cost them a maximum of \$6 based on the weighted average price received by commercial operators for a kilogram of striped marlin in 2002-03, whereas each additional kilogram of striped marlin caught by recreational anglers would produce a net benefit of:

- \$12.90 if all of the costs they incur have to increase in order to catch those marlin (i.e. when recreational anglers have no excess capacity to catch additional striped marlin); or

- \$28.13 per kilogram if they only have to increase operating costs in order to catch those additional striped marlin (i.e. when recreational anglers have excess capacity to catch additional striped marlin).

That is, each kilogram of striped marlin reallocated to recreational anglers would generate a net benefit to the community of \$6.90 to \$22.13.

This means that the imposition of a ban on commercial fishing for striped marlin within 50 miles of the NSW coastline would have to increase the recreational catch of striped marlin by around 2.5 percent to 8.1 percent in order to recover the costs incurred by commercial operators each year. Once again, the magnitude of the actual net benefit will depend on the extent to which recreational catches of striped marlin increase exceeds that 'break even' level.

7.3.2 Impact on the NSW economy and regional economies

Impact of a reduction in the commercial striped marlin catch

AFMA catch data suggests that around 71 percent of the commercial striped marlin fishing catch in 2000-01 was caught within 50 nautical miles from the NSW coast.

As a result, the implementation of a ban on commercial striped marlin fishing within 50 nautical miles of the NSW coastline could be expected to reduce the amount of revenue from commercial sales of striped marlin by around 71 percent.

Table 32: Impact on output of a ban on commercial striped marlin fishing with 50 miles of the NSW coastline

Region	Direct	Flow-on	Total impact	Current impact	Change
Northern and Mid Northern	\$272,588	\$274,250	\$546,839	\$574,386	-\$27,547
Hunter and Sydney	\$204,441	\$309,099	\$513,540	\$539,410	-\$25,870
Illawarra	\$636,040	\$593,903	\$1,229,943	\$1,291,901	-\$61,958
Southern	\$477,030	\$410,327	\$887,357	\$932,057	-\$44,701
Total coastal regions	\$1,590,099	\$1,587,579	\$3,177,678	\$3,337,754	-\$160,076
TOTAL NSW	\$1,590,099	\$2,743,533	\$4,333,632	\$4,551,939	-\$218,307

As indicated in Table 32, the impact of banning commercial fishing for striped marlin within 50 nautical miles of the NSW coastline is similar to that of implementing a ban on commercial fishing for striped marlin. Although commercial fishing operators would receive some revenue from their sales of striped marlin caught outside the 50 nautical mile limit, it still results in a fall in returns to operators with operating costs remaining constant.

However, the impact on value added is different since the expected losses from striped marlin fishing are lessened by the income of some sales of striped marlin as outlined in the Table 33.

Table 33: Impact on value added of a ban on commercial striped marlin fishing within 50 miles of the NSW coastline

Region	Direct	Flow-on	Total impact	Current impact	Change
Northern and Mid Northern	-\$106,178	-\$106,994	-\$213,172	\$250,878	-\$464,050
Hunter and Sydney	-\$79,633	-\$111,664	-\$191,297	\$225,133	-\$416,430
Illawarra	-\$247,749	-\$220,228	-\$467,977	\$550,752	-\$1,018,728
Southern	-\$185,811	-\$160,545	-\$346,356	\$407,619	-\$753,975
Total coastal regions	-\$619,371	-\$599,430	-\$1,218,802	\$1,434,381	-\$2,653,183
TOTAL NSW	-\$619,371	-\$1,006,985	-\$1,626,356	\$1,914,024	-\$3,540,380

The total impact is a fall in value added of \$3.5 million, around \$1 million lower than the \$4.4 million loss of value added that would occur if a ban was imposed on commercial fishing for striped marlin off the NSW coastline.

In terms of the regional impact of such a ban, the Illawarra region would experience the largest fall in value added of \$1.0 million, followed by Southern (\$0.75 million), Northern and Mid North (\$0.5 million) and Sydney and Hunter (\$0.4 million). Once again, this appears to be consistent with current estimated impact of commercial fishing whereby the Illawarra has the largest component of the NSW marlin fishing industry followed by Southern, Mid North and Northern and Sydney and the Hunter.

Impact of a potential increase in the recreational striped marlin catch

Although the imposition of a ban on commercial fishing for striped marlin within 50 mile of the NSW coastline would cause the commercial fishing sector of the NSW economy and regional coastal economies to contract to some extent, this would be offset by the expansionary effect of an increase in recreational striped marlin fishing activity.

As is the case with the implementation of a ban on commercial striped marlin fishing off the NSW coastline, in theory the implementation of a ban on commercial fishing for striped marlin within 50 nautical miles of the NSW coastline also has the potential to:

- increase the probability of recreational anglers catching a striped marlin to some extent:
- reduce the costs of catching striped marlin; and
- expand recreational demand for striped marlin, as well as regional expenditure on striped marlin fishing trips, boats, fishing gear, travel and accommodation.

That is, it has the potential to expand economic activity in the recreational fishing sector of the economy. However, once again it is difficult to determine the nature and extent of that expansion, since it depends on the magnitude of the reduction in costs of catching striped marlin and the magnitude of the resultant expansion in recreational fishing activity and regional expenditure.

Overall, a 7.7 percent expansion in the value added by the recreational striped marlin fishing sector would be required in order to offset the loss in value added arising from banning commercial striped marlin fishing within 50 nautical miles of the NSW coastline.

Once again, however, it is important to note that the decision as to whether or not to implement such a ban should not be made on the basis of whether such a ban would produce an overall increase in the level of economic activity in the NSW economy or regional coastal economies. Rather, such a

decision should be based on an assessment of the extent to which such a ban could be expected to produce an overall net benefit for the community as a whole.

7.4 Economic impact of a ban on commercial longline fishing within 50 nautical miles of the NSW coast

One of the main problems with banning commercial fishing for striped marlin within 50 nautical miles of the NSW coastline is that it would be difficult to enforce in practice. In order to enforce such a ban, it would be necessary to detect and prove instances where striped marlin have been captured within the 50 nautical mile limit and have not been returned immediately to the water. This would be difficult to achieve in practice and would reduce the effectiveness of the ban and the net benefits the community would derive from such a ban. That is, although banning striped marlin fishing within 50 nautical miles of the NSW coastline has the potential, in theory, to generate net benefits for the community, in practice those net benefits may not be realised due to the problems associated with enforcing such a ban.

An alternative approach that would be easier to enforce would be to ban commercial longline fishing for all species within the 50 nautical mile limit. In order to enforce such a ban, it would only be necessary to detect and prove instances of commercial longline fishing within the 50 nautical mile limit, which would be relatively easy to achieve through aerial photography.

7.4.1 Impact on commercial and recreational anglers and the community as a whole

Impact on commercial operators

The economic impact that such a ban would have on commercial longline operators can be estimated in a similar manner to a ban on striped marlin fishing within 50 nautical miles of the NSW coastline.

The immediate impact of such a ban would be to reduce the commercial catch of striped marlin by the quantity of striped marlin they would otherwise have caught within 50 miles of the NSW coastline. For example, such a ban would have reduced the commercial catches of striped marlin by:

- 204,498 kg in 2000-01 (i.e. approximately 70.7 percent of 289,078 kg);
- 173,027 kg in 2001-02 (i.e. approximately 61.1 percent of 283,172 kg);
- 107,848 kg in 2002-03 (i.e. approximately 52.1 percent of 206,947).

This would reduce gross revenue of commercial longline operators by:

- \$1.2 million in 2000-01, or \$5.87 per kg of whole striped marlin;
- \$1.1 million in 2001-02, or \$6.07 per kg of whole striped marlin; and
- \$0.6 million in 2002-03, or \$6.00 per kg of whole striped marlin

In addition, banning commercial longline fishing within 50 nautical miles of the NSW coastline would also reduce their total catch of other ET&BF species by the proportion of the catch that is caught within the 50 nautical mile limit, which is set out in Table 6. For example, if such a ban had been implemented in 2000-01, it would have reduced the NSW:

- yellowfin tuna catch by 744,295 kg (i.e. by approximately 78 percent);
- bigeye tuna catch by 272,904 kg (i.e. by approximately 71 percent);

- albacore catch by 182,151 kg (i.e. by approximately 71 percent);
- broadbilled swordfish catch by 70,291 kg (i.e. by approximately 21 percent); and
- southern bluefin tuna catch by 19,624 kg (i.e. by approximately 51 percent).

As a result, banning commercial longline fishing within 50 nautical miles of the NSW coastline would tend to reduce the gross revenue commercial longline operators derive each year by the market value of the other ET&BF species they would otherwise have caught within that limit. In particular, it is estimated that such a ban would reduce the gross revenue derived from the sale of other ET&BF species by:

- \$34.2 million in 2000-01;
- \$29.4 million in 2001-02; and
- \$22.1 million in 2002-03.

However, it is important to note that banning commercial longline fishing within 50 nautical miles of the NSW coastline would also reduce the costs that those commercial longline operators incur to catch those species within the 50 nautical mile limit. In particular, it is estimated that such a ban would have:

- reduced the costs of catching striped marlin by:
 - \$0.6 million in 2000-01;
 - \$0.4 million in 2001-02; and
 - \$0.3 million in 2002-03;
- reduced the costs of catching other ET&BF species by:
 - \$19.3 million in 2000-01;
 - \$16.6 million in 2001-02; and
 - \$12.4 million in 2002-03;

As a result, the net cost to commercial longline operators of implementing such a ban is equal to the net value of the fish they otherwise would have caught within the 50 nautical mile limit, which is significantly less than the gross value of those fish.

That is, the net cost to commercial longline operators of banning commercial longline fishing within 50 nautical miles of the NSW coastline would have been \$15.8 million in 2000-01.

If we assume that the net benefit derived by commercial longline operators from each kilogram of other species is constant over time at \$14.96, it is possible to obtain a rough estimate of the potential net cost of such a ban to commercial longline operators in later years.

Using this approach, it is estimated that the net cost to commercial longline operators of a ban on longline fishing within 50 nautical miles of the NSW coastline would be:

- \$13 million in 2001-02; and
- \$6.9 million in 2002-03.

Impact on recreational anglers

A ban on commercial longline fishing within 50 nautical miles of the NSW coastline potentially has much the same effect on recreational anglers as a ban on commercial striped marlin fishing within the 50 nautical mile limit.

That is, it has the potential to increase the annual recreational striped marlin catch by at least the quantity of striped marlin that would otherwise have been caught by commercial anglers each year within that 50 mile limit. Indeed, in relation to a ban on commercial striped marlin fishing within 50 nautical miles of the NSW coastline, a ban on commercial longline fishing within the 50 nautical mile limit would produce an even greater potential increase in the supply of striped marlin to recreational anglers since it would not result in the death of striped marlin following their capture and release by commercial operators within the 50 nautical mile limit. That is, in theory, a ban on commercial longline fishing within 50 nautical miles of the NSW coastline has the potential to increase the annual recreational striped marlin catch by:

- 204,498 kg in 2000-01 (rather than 145,392 kg);
- 173,027 kg in 2001-02 (rather 123,022 kg); and
- 107,848 kg in 2002-03 (rather than 76,680 kg).

The net benefit that recreational anglers would derive from such increases in the supply of striped marlin will depend on the proportion of these released striped marlin that are recaptured by recreational anglers.

For example, if recreational anglers caught all of the striped marlin that would otherwise have been caught by commercial longline operators within 50 nautical miles of the NSW coastline, recreational anglers would derive a net benefit from catching those striped marlin of:

- \$1.88 million to \$4.09 million in 2000-01;
- \$1.59 million to \$3.46 million in 2001-02; and
- \$0.99 million to \$2.16 million in 2002-03.

Unlike a ban on commercial fishing for striped marlin within 50 nautical miles of the NSW coastline, however, the imposition of a ban on commercial longline fishing within that limit also has the potential to increase the annual recreational catch of tuna and swordfish. For example, had such a ban been implemented in 2000-01, it would increased the potential recreational catch of:

- yellowfin tuna by 744,295 kg;
- bigeye tuna by 272,904 kg;
- albacore by 182,151 kg;
- broadbilled swordfish by 70,291 kg; and
- southern bluefin tuna by 19,624 kg.

This means that, in order to estimate the net benefit the community would derive from such a ban, it is necessary to have information not only on the net benefit recreational anglers would derive from catching additional striped marlin, but also the net benefit they would derive from catching additional tuna and swordfish.

In the absence of detailed information on the net value that recreational anglers place on yellowfin tuna, bigeye tuna, albacore, broadbill swordfish, and southern bluefin tuna, we have assumed for the purposes of evaluating this option that recreational anglers would derive at least the same net benefit

from catching tuna and swordfish as commercial fishers. That is, if all of the tuna and swordfish that would otherwise have been caught by commercial longline operators within 50 nautical miles of the NSW coastline were caught in the same year by recreational anglers, the net benefit to recreational anglers would be:

- \$15.79 million in 2000-01;
- \$13.05 million in 2001-02; and
- \$6.9 million in 2002-03.

That is, it is assumed that there is no net gain or loss to the community associated with reallocating a proportion of the commercial longline tuna and swordfish catch to recreational anglers. The net loss that commercial longline operators incur as a result of not being able to fish within 50 nautical miles of the NSW coastline is offset by the net gain that recreational anglers would derive if they caught all of those fish in the same year.

Under this assumption, it is estimated that if all of the striped marlin, tuna and swordfish that would otherwise have been caught by commercial longline operators within 50 nautical miles of the NSW coastline were caught in the same year by recreational anglers, recreational anglers would derive a net benefit of:

- \$17.78 million to \$20.9 million in 2000-01;
- \$14.66 million to \$17.3 million in 2001-02; and
- \$7.99 million to \$9.63 million in 2002-03.

Once again, however, it is unlikely that recreational anglers will catch all of the striped marlin, tuna and swordfish released each year by commercial operators within the 50 nautical mile limit. Rather, some of those fish will be caught and killed by commercial operators fishing outside the 50 mile limit, as well as commercial fishers operating off the NSW coastline, or may be caught in subsequent years by NSW recreational anglers.

As a result, the net benefit that recreational anglers derive from the imposition of a ban on commercial longline fishing within 50 nautical miles of the NSW coastline is likely to be lower than that potential economic net benefit to the extent that recreational anglers only catch a proportion of the striped marlin, tuna and swordfish that would otherwise have been caught by commercial longline operators.

In addition, the net benefit that recreational anglers derive from the imposition of such a ban might be higher or lower than these estimated potential benefits if the net benefits recreational anglers derive from catching tuna and swordfish are higher or lower than those derived by commercial longline operators.

Impact on the community as a whole

In theory, if all of the striped marlin, tuna and swordfish that would otherwise have been caught by commercial longline operators within the 50 nautical mile limit were caught in the same year by recreational anglers, the imposition of a ban on commercial longline fishing within 50 nautical miles of the NSW coastline would result in a net benefit to the community of:

- \$1.99 million to \$5.1 million in 2000-01;
- \$1.62 million to \$4.25 million in 2001-02; and
- \$1.09 million to \$2.73 million in 2002-03.

In practice, however, the actual magnitude of that net benefit (or net cost) to the community arising from the imposition of such a ban will depend on the extent to which:

- the ban increases the number of striped marlin, tuna and swordfish actually caught by recreational anglers for a given effort and increases the number of recreational anglers fishing for those species. For example, since each kilogram of striped marlin reallocated to recreational anglers would generate a net benefit to the community of \$6.90 to \$22.13, the recreational striped marlin catch would have to increase by around 2.5 percent to 8.1 percent in order to offset the net benefits that commercial longline operators would otherwise have derived from catching striped marlin within 50 nautical miles of the NSW coastline. If the ban produced an even greater increase in the recreational catch of striped marlin, the increased net benefits to recreational anglers would help offset the net benefits commercial longline operators would forgo as a result of not being able to fish for tuna and swordfish within 50 nautical miles of the NSW coastline; and
- the net benefits recreational anglers derive from catching tuna and swordfish are greater than or less than the net benefits that commercial longline operators derive from catching those fish. It is estimated that commercial longline operators derive an average net benefit of around \$14.96 per kilogram of tuna and swordfish. This means that if recreational anglers derived a net benefit of say \$20 per kg from catching tuna and swordfish, in 2002-03 they would have had to catch at least 39 per cent of the tuna and swordfish that would otherwise have been caught by commercial longline operators in order to offset the net benefits that those commercial longline operators would otherwise have derived from catching tuna and swordfish within 50 nautical miles of the NSW coastline. By contrast, if the net benefit recreational anglers derive from catching tuna and swordfish is less than that derived by commercial longline operators, they would have to catch a much higher proportion of the tuna and swordfish that would otherwise have been caught by commercial longline operators in order to offset the net benefit commercial longline operators would have derived from that catch. For example, if the net benefit recreational anglers derive from catching tuna and swordfish is say \$10 per kilogram on average, then in 2002-03 recreational anglers would have had to catch around 79 per cent of the tuna and swordfish that would otherwise have been caught by commercial longline operators

7.4.2 Impact on the NSW economy and regional economies

Impact of a reduction in the commercial longline catch

Implementation of a ban on commercial longline fishing within 50 nautical miles of the NSW coastline would have similar effects, in some respects, to the implementation of a ban on commercial fishing for striped marlin within 50 nautical miles of the NSW coastline. That is, it would tend to reduce the amount of revenue from commercial sales of striped marlin by approximately 71 percent if it was implemented in 2000-01.

However, as noted above, unlike the previous option, it would also:

- reduce the costs commercial operators incur in order to catch striped marlin and other ET&BF longline species within the 50 nautical mile limit by approximately 65 percent; and
- reduce the gross revenue that commercial operators derive from the sale of other ET&BF species caught within the 50 nautical mile limit by approximately 65 percent.

As indicated in Table 34, the impact of banning commercial longline fishing within 50 nautical miles of the NSW coastline is similar to that of implementing a ban on commercial fishing for striped marlin within 50 nautical miles, only much greater. Such a ban would reduce the gross output of the NSW economy by around \$68.6 million, which is much greater than the fall in gross output associated with either banning commercial striped marlin fishing off the NSW coastline (\$0.2 million), or banning commercial striped marlin fishing within 50 nautical miles of the NSW coastline (\$0.2 million).

Table 34: Impact on output of a ban on commercial longline fishing with 50 miles of the NSW coastline

Region	Direct	Flow-on	Total impact	Current impact	Change
Northern and Mid Northern	\$3,806,262	\$3,829,467	\$7,635,730	\$16,292,424	-\$8,656,695
Hunter and Sydney	\$2,854,697	\$4,316,070	\$7,170,767	\$15,300,328	-\$8,129,562
Illawarra	\$8,881,279	\$8,292,909	\$17,174,188	\$36,644,719	-\$19,470,530
Southern	\$6,660,959	\$5,729,561	\$12,390,520	\$26,437,762	-\$14,047,242
Total coastal regions	\$22,203,198	\$22,168,007	\$44,371,204	\$94,675,233	-\$50,304,029
TOTAL NSW	\$22,203,198	\$38,309,058	\$60,512,255	\$129,115,537	-\$68,603,282

Banning commercial longline fishing within 50 nautical miles of the NSW coastline would also have a much greater negative impact on the value added by the commercial fishing sector in NSW. As indicated in Table 35, such a ban would reduce that value added by approximately \$69.8 million, which is significantly greater than the reduction in value added arising from banning commercial striped marlin fishing off the NSW coastline (\$4.5 million) or banning commercial striped marlin fishing within 50 nautical miles of the NSW coastline (\$3.5 million).

Table 35: Impact on value added of a ban on commercial longline fishing within 50 miles of the NSW coastline

Region	Direct	Flow-on	Total impact	Current impact	Change
Northern and Mid Northern	\$98,961	\$99,722	\$198,682	\$9,347,127	-\$9,148,444
Hunter and Sydney	\$74,221	\$104,073	\$178,294	\$8,387,942	-\$8,209,648
Illawarra	\$230,908	\$205,259	\$436,167	\$20,519,721	-\$20,083,554
Southern	\$173,181	\$149,632	\$322,813	\$15,186,929	-\$14,864,116
Total coastal regions	\$577,271	\$558,685	\$1,135,956	\$53,441,719	-\$52,305,762
TOTAL NSW	\$577,271	\$938,537	\$1,515,808	\$71,312,070	-\$69,796,262

In terms of the regional impact of such a ban, the Illawarra region would experience the largest fall in value added of \$20 million, followed by Southern (\$14.9 million), Northern and Mid Northern (\$9.1 million) and Sydney and Hunter (\$8.2 million). Once again, this appears to be consistent with current estimated impact of commercial fishing whereby the Illawarra has the largest component of the NSW marlin fishing industry followed by Southern, Mid Northern and Northern and Sydney and the Hunter.

Impact of a potential increase in the recreational striped marlin catch

Although the imposition of a ban on commercial longline fishing within 50 mile of the NSW coastline would cause the commercial fishing sector of the NSW economy and regional coastal economies to contract to some extent, this would be offset by the expansionary effect of an increase in recreational striped marlin fishing activity.

As is the case with the implementation of a ban on commercial striped marlin fishing off the NSW coastline, or within 50 nautical miles of the NSW coastline, banning commercial longline fishing within 50 nautical miles of the NSW coastline has the potential to:

- increase the probability of recreational anglers catching a striped marlin to some extent;
- reduce the costs of catching striped marlin; and
- expand recreational demand for striped marlin, as well as regional expenditure on striped marlin fishing trips, boats, fishing gear, travel and accommodation.

In addition, banning commercial longline fishing within 50 nautical miles of the NSW coastline also has the potential to

- increase the probability of recreational anglers catching tuna and other ET&BF species;
- reduce the costs of catching those other ET&BF species; and
- expand recreational demand for gamefishing in general, as well as regional expenditure on striped gamefishing trips, boats, fishing gear, travel and accommodation.

That is, banning commercial longline fishing within 50 nautical miles of the NSW coastline has greater potential to stimulate an increase in gamefishing activity off the NSW coastline than would the imposition of a ban on striped marlin fishing within 50 nautical miles.

Once again, however, it is difficult to determine the nature and extent of that expansion, since it depends on the magnitude of the reduction in costs of catching striped marlin and other ET&BF species and the magnitude of the resultant expansion in recreational fishing activity and regional expenditure.

Overall, it is estimated that the value added by the recreational striped marlin fishing sector would have to increase by over 154 percent in order to offset the loss in value added arising from banning commercial longline fishing within 50 nautical miles of the NSW coastline.

As mentioned previously, however, it is important to note that the decision as to whether or not to implement such a ban should not be made on the basis of whether such a ban would produce an overall increase in the level of economic activity in the NSW economy or regional coastal economies. Rather, such a decision should be based on an assessment of the extent to which such a ban could be expected to produce an overall net benefit for the community as a whole.

Annex 1: Terms of Reference

Title

An assessment of the comparative economic and social benefits of the use of the striped marlin resource by commercial and recreational fishers.

Background

Striped marlin *Tetrapturus audax* is a popular commercial and recreational species widely distributed in tropical, subtropical and temperate waters of the Indian and Pacific Oceans. Striped marlin commonly occur in oceanic waters but sufficient numbers are found adjacent to the continental slope to support commercial and recreational fisheries. The number of fishers and the size of the catch of striped marlin off the East Coast of Australia have risen over the past decade which in turn has led to concerns about the long term viability of the resource.

Objectives

The study will:

- Detail the management and jurisdictional arrangements for striped marlin fishers in Australia and overseas (where relevant).
- Describe and analyse the striped marlin fisheries of NSW and estimate the economic value of the catch to each sector under current management arrangements.
- Describe and analyse the social benefits from the striped marlin fisheries of NSW under current management arrangements.
- Assess the potential economic and social impacts of alternative management arrangements for the striped marlin fishery in NSW, including banning or modifying the commercial fishery for this species, with particular regard to regional communities and recreational fishing. Primary and secondary costs and benefits will be appraised.

Deliverables

On completion of the survey and analysis of data collected, the consultants will submit a written report to NSW Fisheries detailing the findings of the survey. The consultants will also provide a verbal presentation of the findings and progress reports during the survey.

Timetable

The consultant will be expected to complete the survey within 4 months of the granting of the contract. It is expected that key personnel will be available throughout the survey period to discuss issues with NSW Fisheries.

Additional requirements

The study will:

- Consider relevant previous studies in Australia and overseas.
- Survey the Charter Boat Fishery, sport fishers and game fishers to identify the benefits to each sector.
- Identify employment opportunities particularly with respect to regional NSW.
- Consider regional tourism opportunities.
- Consider interstate boat movements and fishing interactions.
- Consider flow of benefits to interested parties including those of fishing tackle merchants and manufacturers.
- Consider the capital value of assets in each sector.
- Examine tournament records and participation rates in tournaments in general as related to the scarcity of fish.

The preferred applicant will:

- Demonstrate experience in the survey and evaluation of economic and social benefits.
- Have knowledge of the commercial and recreational tuna and marlin fisheries of NSW and Eastern Australia.
- Propose methods for the execution and delivery of the objectives of the project.
- Be capable of addressing the terms of reference and reporting within 4 months of being notified of selection.
- Be selected by a Departmental Committee according to the relative merits of the application and the applicant's knowledge, experience and capability outlined above.

Annex 2: The Input-Output Model

Ernst & Young (EY) used an economic input output model of the NSW economy to assess the impact of commercial and recreational striped marlin fishing on the NSW economy and its regions.

The model consists of thirteen regional input-output models and an aggregated table for NSW.

The State and regional economic data is based on the Australian Bureau of Statistics NSW statistical areas. The software that runs the input output models allows for the manipulation of the input output tables enabling the calculation of economic impacts.

The modelling was undertaken by the Centre for Agricultural and Regional Economics (CARE), a private organisation that provides consultancy and research services in the area of regional, resource and business economics.

IO Tables

Input-output tables are matrices of data that disaggregate the inputs used, and the outputs produced, by the various activities that comprise an economy. Input-output tables outline the structure of an economy and were developed so that the transactions between industries could be analysed. In addition to transactions where industries sell their goods and services to final users (eg consumers, government and capital formation), these tables can answer questions of the type – What will be the effect on all industries of the sale of products and services to final users?

The core component of the input-output method is the transactions table. This is a matrix where there is a row and column for each defined sector. The rows of the input-output table indicate how the turnover of each industry is sold to other industries or to final users (consumers, government and capital formation). The columns of the table indicate how the turnover value is allocated to purchases from other industries (intermediate inputs), payments for labour, imports, indirect taxes and business profit.

Input-output tables can be used to estimate these flow-on impacts as a result of economic change or the flow-on impacts of existing industries. The main types of economic changes include new projects/industries or loss of industries or operations, new infrastructure developments, changes in Government policy (eg tax levels) and changes in production, prices or natural occurrences (eg economic impact of droughts).

The flow-on effects are generated through industry expenditure on locally provided intermediate inputs and labour. The use of imported supplies and the funds paid as indirect taxes, capital returns and profits can generate flow-on effects but they are not included in the estimated flow-on effects in the input output model. Thus, the composition of the inputs used and the capacity of the defined economy to supply those inputs determine the size and industry composition of the flow-on effects.

There are a number of important simplifying assumptions underlying the construction of input-output tables, their use and the results input-output analysis and modelling generate. Those simplifying assumptions mean that input-output modelling has a number of important limitations that should be considered when undertaking economic impact assessments as well as analysing the results generated. The assumptions and limitations that tend to be highlighted in the input-output analysis literature include the homogenous nature of input output methods; the linearity of input output methods; and the lack of resource constraints contained with input-output models.

Modelling Approach

The task of estimating the economic impact of striped marlin fishing has to be conceptualised in a way that is compatible with the use of input-output methods. These methods were developed so that the transactions among industries could be studied, referred to as inter-industry transactions. In addition to the transactions where industries sell their goods and services to final users (e.g. consumers, exports, government and capital formation). The model can answer questions of the type,

“What will be the effect on all industries of the sale of products and services to final users?”

This involves working ‘backwards’ from that sale to final users to examine the various contributions to the creation of that final product. This works through the supply (or value) chain for that product or service and identifies all of the trades that take place between contributing businesses.

In this study, the approach begins with the identification of the sales to final users. In general, that is sales of fishing equipment and fishing trip goods and services for recreational fishing and the sale of goods and services involved in commercial fishing. The value of these goods and services is estimated and is referred to as gross output or turnover.

For recreational anglers, these purchases include items such as food and beverages, accommodation any fishing gear purchased during their trip and for commercial fishing operations, these items include the typical operating expenditure of commercial boats, such as crew costs, fuel, bait, repairs and insurance.

For each of these activities, the next part of the work involves describing and measuring the flow-on effects that they generate through production-induced and consumption-induced linkages. Input-output methods were developed for this purpose.

The flow-on effects are generated through expenditure on locally provided intermediate inputs and labour. The use of imported supplies and the funds paid as indirect taxes, capital returns and profits can generate flow-on effects but they are not included in the estimated flow-on effects in the input output model. Thus, the composition of the inputs used and the capacity of the defined economy to supply those inputs determine the size and industry composition of the flow-on effects.

Economic impacts can be measured using a range of variables. The usual measures are:

- **Gross output or turnover** – this is a guide to business operation impacts to which business operators can readily relate. However, it involves double counting of intermediate inputs at each stage of the supply chain and so is not the preferred economic measure.
- **Value added** – this is a measure that nets out the use of intermediate inputs in the supply chain and approximates the measurement of gross national product (GNP) used by the ABS to measure the value of output.
- **Employment** – this is a socio-economic measure used as an indicator of performance. Employment may be measured in terms of the number of jobs or in terms of jobs adjusted to full-time equivalents. Both measures are used in this analysis.
- **Household income** – this is a measure of the contribution that these activities make to the income (before tax) of households.

Each of the above measures are reported in the results of this report. It should be noted that the results for employment need to be interpreted carefully. Of all the measures, the employment outcomes are increasingly complicated by the growing flexibility in employment arrangements.

Results

The estimated economic impacts of commercial and recreational striped marlin fishing are set out in the two tables below.

COMMERCIAL STRIPED MARLIN FISHING IMPACTS

IMPACTS	Flow-on Effects				TOTAL IMPACT
	Direct Effect	Production Induced	Consumption Induced	Total Flow-on	
GROSS OUTPUT (\$)					
Northern and Mid Northern	\$291,067	\$138,181	\$154,661	\$292,842	\$583,909
Hunter and Sydney	\$218,300	\$184,104	\$145,949	\$330,052	\$548,353
Illawarra	\$679,157	\$351,061	\$283,103	\$634,164	\$1,313,321
Southern	\$509,368	\$210,358	\$227,785	\$438,143	\$947,511
<i>Total coastal</i>	<i>\$1,697,892</i>	<i>\$883,704</i>	<i>\$811,496</i>	<i>\$1,695,201</i>	<i>\$3,393,093</i>
NSW	\$1,697,892	\$1,474,942	\$1,454,575	\$2,929,517	\$4,627,409
VALUE-ADDED (\$)					
Northern and Mid Northern	\$124,959	\$52,155	\$75,956	\$128,111	\$250,878
Hunter and Sydney	\$93,719	\$64,255	\$69,447	\$133,702	\$225,133
Illawarra	\$291,570	\$123,625	\$140,068	\$263,693	\$550,752
Southern	\$218,677	\$79,595	\$112,636	\$192,230	\$407,619
<i>Total coastal</i>	<i>\$728,925</i>	<i>\$319,629</i>	<i>\$398,107</i>	<i>\$717,737</i>	<i>\$1,434,381</i>
NSW	\$728,925	\$518,615	\$687,113	\$1,205,728	\$1,914,024
HOUSEHOLD INCOME (\$)					
Northern and Mid Northern	\$111,329	\$30,370	\$41,740	\$72,111	\$182,263
Hunter and Sydney	\$83,496	\$36,948	\$35,416	\$72,363	\$154,680
Illawarra	\$259,767	\$62,125	\$73,777	\$135,902	\$393,452
Southern	\$194,825	\$47,514	\$63,651	\$111,165	\$304,177
<i>Total coastal</i>	<i>\$649,417</i>	<i>\$176,957</i>	<i>\$214,585</i>	<i>\$391,542</i>	<i>\$1,034,572</i>
NSW	\$649,417	\$309,482	\$360,569	\$670,051	\$1,308,539
EMPLOYMENT (no.)					
Northern and Mid Northern	3.8	0.6	0.9	1.5	5.3
Hunter and Sydney	1.3	0.7	0.7	1.4	2.7
Illawarra	6.7	1.0	1.2	2.3	8.9
Southern	4.7	0.7	1.1	1.8	6.5
<i>Total</i>	<i>16.7</i>	<i>3.0</i>	<i>3.9</i>	<i>6.9</i>	<i>23.6</i>
NSW	16.7	7.1	9.8	16.9	33.6

RECREATIONAL STRIPED MARLIN FISHING IMPACTS

IMPACTS	Flow-on Effects				TOTAL IMPACT
	Direct Effect	Production Induced	Consumption Induced	Total Flow-on	
GROSS OUTPUT (\$)					
Northern and Mid Northern	\$5,023,471	\$1,529,671	\$1,772,552	\$3,302,224	\$8,325,694
Hunter and Sydney	\$31,575,534	\$13,531,397	\$16,229,737	\$29,761,135	\$61,336,668
Illawarra	\$5,936,166	\$1,553,301	\$1,772,329	\$3,325,630	\$9,261,796
Southern	\$11,937,383	\$3,444,505	\$4,490,606	\$7,935,111	\$19,872,495
<i>Total coastal</i>	<i>\$54,472,554</i>	<i>\$20,058,874</i>	<i>\$24,265,225</i>	<i>\$44,324,099</i>	<i>\$98,796,653</i>
NSW	\$54,472,554	\$25,556,531	\$32,413,289	\$57,969,820	\$112,442,374
VALUE-ADDED (\$)					
Northern and Mid Northern	\$1,372,176	\$671,064	\$872,466	\$1,543,530	\$2,915,706
Hunter and Sydney	\$9,928,908	\$5,834,540	\$7,720,239	\$13,554,779	\$23,483,687
Illawarra	\$1,483,530	\$690,802	\$876,879	\$1,567,681	\$3,051,211
Southern	\$3,560,228	\$1,506,622	\$2,220,533	\$3,727,155	\$7,287,383
<i>Total coastal</i>	<i>\$16,344,842</i>	<i>\$8,703,028</i>	<i>\$11,690,117</i>	<i>\$20,393,146</i>	<i>\$36,737,987</i>
NSW	\$17,785,961	\$11,294,873	\$15,311,420	\$26,606,293	\$44,392,254
HOUSEHOLD INCOME (\$)					
Northern and Mid Northern	\$1,091,730	\$358,520	\$478,367	\$836,887	\$1,928,618
Hunter and Sydney	\$7,191,003	\$3,095,272	\$3,937,988	\$7,033,259	\$14,224,262
Illawarra	\$1,234,033	\$362,042	\$461,875	\$823,917	\$2,057,950
Southern	\$2,960,664	\$853,175	\$1,254,841	\$2,108,016	\$5,068,681
<i>Total coastal</i>	<i>\$12,477,431</i>	<i>\$4,669,009</i>	<i>\$6,133,071</i>	<i>\$10,802,080</i>	<i>\$23,279,510</i>
NSW	\$11,783,823	\$6,384,872	\$8,034,807	\$14,419,679	\$26,203,502
EMPLOYMENT (no.)					
Northern and Mid Northern	56	14	21	35	91
Hunter and Sydney	213	67	105	173	386
Illawarra	58	12	19	31	89
Southern	129	29	49	78	207
<i>Total coastal</i>	<i>456</i>	<i>123</i>	<i>194</i>	<i>316</i>	<i>772</i>
NSW	476	172	260	431	907

Annex 3: NSW Striped Marlin Recreational Fishing Survey



NSW STRIPED MARLIN RECREATIONAL FISHING SURVEY

WHO SHOULD COMPLETE THIS SURVEY?

Any recreational angler who has been fishing for **STRIPED MARLIN** off the **NSW COAST** over the survey period **1 MAY 2002 to 30 APRIL 2003**.

WHY IS THIS SURVEY BEING CONDUCTED?

NSW Fisheries has commissioned Ernst & Young to undertake a detailed study of the economic impact that both recreational and commercial striped marlin fishing are having on the NSW economy.

This survey of recreational striped marlin fishing is an important part of that study. In particular, it will help NSW Fisheries develop a much more detailed understanding of the nature and extent of recreational striped marlin fishing off the NSW coast and the impact that activity has on regional economies.

We urge you to participate in this important survey. The information you provide will help us to achieve a better balance of the competing demands recreational and commercial fishers are placing on this valuable fishery.

WHEN DO I NEED TO RETURN THE SURVEY FORM?

The survey needs to be completed and returned **by 30 April 2003**.

WHERE SHOULD I SEND THE COMPLETED SURVEY FORM?

Completed survey forms should be sent to either of the following addresses:

Striped Marlin Recreational Fishing Survey	Striped Marlin Recreational Fishing Survey
NSW Fisheries	GFAA Research & Development Foundation
PO Box 21	8/765 Princess Highway
Cronulla, NSW	Blakehurst, NSW
2230	2221

CAN I COMPLETE THE SURVEY ON THE INTERNET?

Yes. An online version of the survey form will also be available for those who have Internet access.

A link to that site will be available on the NSW Fisheries website: <http://www.fisheries.nsw.gov.au/>



DEMOGRAPHIC INFORMATION

Q1. Name and Address:

First name: Surname:

Street: Suburb:

State: Postcode: Country:

Q2. Gender: Male FemaleQ3. Age: Under 15 15 to 19 20 to 29 30 to 39 40 to 49 50 to 59 60 to 69 70 to 79 80 or overQ4. Highest education level achieved: High school University/College Post graduate

Q5. Annual gross income (before tax):

Less than \$6,000 \$6,000 - \$19,999 \$20,000 - \$49,999 \$50,000 - \$59,999 \$60,000 - \$99,999 \$100,000 - \$149,999

\$150,000 - \$199,999 \$200,000 - \$249,999 \$250,000 - \$299,999 \$300,000 - \$349,999 \$350,000 - \$399,999 \$400,000 or greater

ANGLER PREFERENCES AND ATTITUDES

Q6. Which one of the following statements best describes your striped marlin fishing preferences?

- I only target striped marlin.
- I mainly target striped marlin, but also hope to catch the occasional blue and black marlin.
- I mainly target large blue and black marlin, but also expect to catch striped marlin.
- I target all marlin, regardless of their type.
- I mainly target tuna, but also hope to catch the occasional striped marlin.
- I mainly target sharks, but also hope to catch the occasional striped marlin.

Q7. How far offshore do you normally travel to fish for striped marlin?

- 0 to 4.9 miles 5 to 9.9 miles 10 to 14.9 miles 15 to 19.9 miles
- 20 to 29 miles 30 to 39 miles 40 to 49 miles 50 miles and over

Q8. What method do you normally use to catch striped marlin?

- Trolling artificial lures. Trolling dead bait. Trolling/drifting live bait. Casting lures/flyes to fish.

Q9. What do you do with the striped marlin you catch?

- I always release all striped marlin, regardless of their size.
- I would only keep the first marlin I caught.
- I only keep striped marlin if I think they will win a competition or are a potential record fish.
- I keep the occasional striped marlin for consumption by family and friends.
- I keep all striped marlin I catch (up to the bag limit) for consumption by family and friends.
- I keep all striped marlin I catch (up to the bag limit) for trophies.

Q10. What would you do if the stock of striped marlin off the NSW coast fell to such a low level that you were most unlikely to catch a fish?

- I would give up gamefishing offshore completely.
- I would fish for other marlin and tuna off NSW instead.
- I would fish for other marlin and tuna off NSW and do more striped marlin fishing in other Australian States.
- I would fish for other marlin and tuna off NSW and do more striped marlin fishing overseas.
- I would fish for other marlin and tuna off NSW and do more striped marlin fishing in other Australian States and overseas.
- I would fish for other gamefish species, other than marlin, off NSW instead.

TRAVEL AND ACCOMMODATION INFORMATION

Question	Regional Area Where You Stay When You Go Fishing for Striped Marlin					
	Northern NSW Tweed Heads Byron Bay Ballina Yamba	Mid North Coast Coffs Harbour Port Macquarie Forster South West Rocks	Hunter Port Stephens Newcastle Lake Macquarie	Sydney Terrigal Gosford Sydney Botany Bay Broken Bay Port Hacking	Illawarra Wollongong Shellharbour Kiama Shoalhaven Jervis Bay Ulladulla	Southern NSW Batemans Bay Narooma Bermagui Merimbula Eden
Q11. How many trips did you make to each region to fish for striped marlin between 1 May 2002 and 30 April 2003?	<input type="text"/> trips					
Q12. How did you get there? (Tick only one in each area)	<input type="checkbox"/> Own car <input type="checkbox"/> Friend's car <input type="checkbox"/> Hire car <input type="checkbox"/> Train/bus <input type="checkbox"/> Fly <input type="checkbox"/> Boat	<input type="checkbox"/> Own car <input type="checkbox"/> Friend's car <input type="checkbox"/> Hire car <input type="checkbox"/> Train/bus <input type="checkbox"/> Fly <input type="checkbox"/> Boat	<input type="checkbox"/> Own car <input type="checkbox"/> Friend's car <input type="checkbox"/> Hire car <input type="checkbox"/> Train/bus <input type="checkbox"/> Fly <input type="checkbox"/> Boat	<input type="checkbox"/> Own car <input type="checkbox"/> Friend's car <input type="checkbox"/> Hire car <input type="checkbox"/> Train/bus <input type="checkbox"/> Fly <input type="checkbox"/> Boat	<input type="checkbox"/> Own car <input type="checkbox"/> Friend's car <input type="checkbox"/> Hire car <input type="checkbox"/> Train/bus <input type="checkbox"/> Fly <input type="checkbox"/> Boat	<input type="checkbox"/> Own car <input type="checkbox"/> Friend's car <input type="checkbox"/> Hire car <input type="checkbox"/> Train/bus <input type="checkbox"/> Fly <input type="checkbox"/> Boat
Q13. How much did it cost you in total to travel to and from each area to fish from striped marlin over the survey period (1 May 2002 to 30 April 2003)? (Include total travel costs for all trips made to each area)	<input type="text"/>					
Q14. If you normally travel to each area in your own car/boat: How many kms is it from your home to that area? What is the engine capacity of your car/boat?	<input type="text"/> km <input type="text"/> litres					
Q15. How many nights did you stay in each area over the survey period (1 May 2002 to 30 April 2003)?	<input type="text"/> nights					
Q16. Where do you usually stay in each region where you go striped marlin fishing? (Tick only one in each area)	<input type="checkbox"/> Own home <input type="checkbox"/> Own holiday house <input type="checkbox"/> Rented house <input type="checkbox"/> Flat/unit <input type="checkbox"/> Motel/hotel <input type="checkbox"/> B&Breakfast <input type="checkbox"/> Boat <input type="checkbox"/> Own caravan <input type="checkbox"/> Onsite van/cabin <input type="checkbox"/> Tent <input type="checkbox"/> Friend/relative	<input type="checkbox"/> Own home <input type="checkbox"/> Own holiday house <input type="checkbox"/> Rented house <input type="checkbox"/> Flat/unit <input type="checkbox"/> Motel/hotel <input type="checkbox"/> B&Breakfast <input type="checkbox"/> Boat <input type="checkbox"/> Own caravan <input type="checkbox"/> Onsite van/cabin <input type="checkbox"/> Tent <input type="checkbox"/> Friend/relative	<input type="checkbox"/> Own home <input type="checkbox"/> Own holiday house <input type="checkbox"/> Rented house <input type="checkbox"/> Flat/unit <input type="checkbox"/> Motel/hotel <input type="checkbox"/> B&Breakfast <input type="checkbox"/> Boat <input type="checkbox"/> Own caravan <input type="checkbox"/> Onsite van/cabin <input type="checkbox"/> Tent <input type="checkbox"/> Friend/relative	<input type="checkbox"/> Own home <input type="checkbox"/> Own holiday house <input type="checkbox"/> Rented house <input type="checkbox"/> Flat/unit <input type="checkbox"/> Motel/hotel <input type="checkbox"/> B&Breakfast <input type="checkbox"/> Boat <input type="checkbox"/> Own caravan <input type="checkbox"/> Onsite van/cabin <input type="checkbox"/> Tent <input type="checkbox"/> Friend/relative	<input type="checkbox"/> Own home <input type="checkbox"/> Own holiday house <input type="checkbox"/> Rented house <input type="checkbox"/> Flat/unit <input type="checkbox"/> Motel/hotel <input type="checkbox"/> B&Breakfast <input type="checkbox"/> Boat <input type="checkbox"/> Own caravan <input type="checkbox"/> Onsite van/cabin <input type="checkbox"/> Tent <input type="checkbox"/> Friend/relative	<input type="checkbox"/> Own home <input type="checkbox"/> Own holiday house <input type="checkbox"/> Rented house <input type="checkbox"/> Flat/unit <input type="checkbox"/> Motel/hotel <input type="checkbox"/> B&Breakfast <input type="checkbox"/> Boat <input type="checkbox"/> Own caravan <input type="checkbox"/> Onsite van/cabin <input type="checkbox"/> Tent <input type="checkbox"/> Friend/relative

EXPENDITURE WITHIN NSW COASTAL REGIONS

Question	Regional Area Where You Stay When You Go Fishing for Striped Marlin					
	Northern NSW	Mid North Coast	Hunter	Sydney	Illawarra	Southern NSW
Q17. How much did you (and any non-striped marlin fishing family members who accompanied you) spend WITHIN each area over the survey period (1 May 2002 to 30 April 2003) on:						
accommodation	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
restaurants, clubs, cafes	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
food and soft drink	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
alcohol	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
entertainment	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
any fishing gear, bait, berley, ice	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
other retail shopping	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
tournament entry costs	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
vehicle fuel	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
boat fuel	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
boat charter	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
boat mooring/storage	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
boat repairs/maintenance	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

STRIPED MARLIN CATCH AND RELEASE INFORMATION

Question	Regional Area Where You Fish for Striped Marlin					
	Northern NSW	Mid North Coast	Hunter	Sydney	Illawarra	Southern NSW
Q18. How many days did you spend fishing for striped marlin in each area over the survey period (1 May 2002 to 30 April 2003)?	<input type="text"/> days					
Q19. How many billfish did you CATCH in each area over the survey period (1 May 2002 to 1 April 2003) and what was their estimated total weight (by type of marlin)?	Striped marlin No. <input type="text"/>					
	Kg. <input type="text"/>					
	Blue marlin No. <input type="text"/>					
	Kg. <input type="text"/>					
	Black Marlin No. <input type="text"/>					
	Kg. <input type="text"/>					
Q20. How many of the billfish you caught in each area did you KEEP and what was their total weight (by type of marlin)? Leave blank if you released all of the marlin you caught	Striped marlin No. <input type="text"/>					
	Kg. <input type="text"/>					
	Blue marlin No. <input type="text"/>					
	Kg. <input type="text"/>					
	Black Marlin No. <input type="text"/>					
	Kg. <input type="text"/>					

BOAT OWNERSHIP AND USE INFORMATION

Q21. Do you normally fish for striped marlin from:

- a charter boat (make sure you have answered Q17. on your expenditure on charter boats).
- a friend's boat (make sure you answer Q22. below).
- your own boat (make sure you answer Q23. below).

Q22. If you normally fish for striped marlin from a friend's boat, how much do you normally contribute towards the cost of taking that boat on a typical trip?

Q23. If you normally fish for striped marlin from your own boat:

What is the length of your boat? metres

How old is your boat? years

How many years have you owned your boat? years

How much did you pay for it?

If you bought your boat trailer separately:

How old is the trailer? years

How much did it cost?

If you have purchased additional electronic equipment for the boat:

Roughly how old is that equipment? years

How much did it cost?

Over the survey period (1 May 2002 to 30 April 2003):

How much did you spend on boat fuel? Include amounts spent

How much did you spend on boat repairs and maintenance? in regional coastal areas (Q17.)

How many days did you use your boat during the survey period? days

How many days did you use your boat to fish for striped marlin off the NSW coast over the survey period? days

STRIPED MARLIN FISHING GEAR OWNERSHIP AND EXPENDITURE INFORMATION

Q24. If you have purchased your own striped marlin fishing gear:

Where do you normally purchase most of your striped marlin fishing equipment?:

- direct from retailers near where I live
- direct from retailers in the regions where I go fishing for striped marlin
- via mail/internet order from retailers in NSW
- via mail/internet order from retailers in other States
- via mail/internet order from retailers in other countries

How much did your fishing equipment cost you and roughly how old is it?

	Cost	Years old
Rods suitable for striped marlin fishing	<input type="text"/>	<input type="text"/>
Reels suitable for striped marlin fishing	<input type="text"/>	<input type="text"/>
Harnesses and gaffs suitable for striped marlin fishing	<input type="text"/>	<input type="text"/>
Lures suitable for striped marlin fishing	<input type="text"/>	<input type="text"/>
Special clothing (eg wet weather gear, sunglasses, boat shoes)	<input type="text"/>	<input type="text"/>

Over the survey period (1 May 2002 to 30 April 2003), how much did you spend on:

	Cost	
Rods suitable for striped marlin fishing	<input type="text"/>	Include any expenditure in regional coastal areas on striped marlin fishing gear (Q17).
Reels suitable for striped marlin fishing	<input type="text"/>	
Harnesses and gaffs suitable for striped marlin fishing	<input type="text"/>	
Lures suitable for striped marlin fishing	<input type="text"/>	
Line and terminal tackle for striped marlin fishing (traces, hooks, etc)	<input type="text"/>	
Special clothing (eg wet weather gear, sunglasses, boat shoes)	<input type="text"/>	
Chemist supplies (eg sunscreen, seasick pills, film)	<input type="text"/>	

Annex 4: NSW Striped Marlin Charter Boat Fishing Survey



NSW STRIPED MARLIN CHARTER BOAT FISHING SURVEY

WHO SHOULD COMPLETE THIS SURVEY?

Any charter boat operator who has been fishing for **STRIPED MARLIN** off the **NSW COAST** over the survey period **1 MAY 2002 to 30 APRIL 2003**.

WHY IS THIS SURVEY BEING CONDUCTED?

NSW Fisheries has commissioned Ernst & Young to undertake a detailed study of the economic impact that both recreational and commercial striped marlin fishing are having on the NSW economy.

This survey of NSW charter boat operators is an important part of that study and is intended to complement the data obtained from the NSW Striped Marlin Recreational Fishing Survey. In particular, it will help NSW Fisheries develop a much more detailed understanding of the nature and extent of recreational striped marlin fishing off the NSW coast and the impact that activity has on regional economies.

We urge you to participate in this important survey. The information you provide will help us to achieve a better balance of the competing demands recreational and commercial fishers are placing on this valuable fishery.

CONFIDENTIALITY

The information you supply will be **STRICTLY CONFIDENTIAL**. It will be used only for the purposes of this project and will only be made public in aggregate form. It will not be disclosed to other parties.

WHEN DO I NEED TO RETURN THE SURVEY FORM?

The survey needs to be completed and returned **by 31 May 2003**.

WHERE SHOULD I SEND THE COMPLETED SURVEY FORM?

Completed survey forms should be sent to the following address:

Striped Marlin Charter Boat Fishing Survey

NSW Fisheries

PO Box 21

Cronulla, NSW

2230



BUSINESS NAME AND ADDRESS

Q1. Business name and address

Business name:

Street:

Suburb:

State:

Postcode:

ANGLER PREFERENCES AND ATTITUDES

Q2. Which one of the following statements best describes your client's striped marlin fishing preferences?

- They only target striped marlin.
- They mainly target striped marlin, but also hope to catch the occasional blue and black
- They mainly target large blue and black marlin, but also expect to catch striped marlin.
- They target all marlin, regardless of their type.
- They mainly target tuna, but also hope to catch the occasional striped marlin.
- They mainly target sharks, but also hope to catch the occasional striped marlin.

Q3. How far offshore do you normally travel to fish for striped marlin?

- 0 to 4.9 miles 5 to 9.9 miles 10 to 14.9 miles 15 to 19.9 miles
- 20 to 29 miles 30 to 39 miles 40 to 49 miles 50 miles and over

Q4. What method do your clients normally use to catch striped marlin?

- Trolling artificial lures. Trolling dead bait. Trolling/drifted live bait. Casting lures/flyes to fish.

Q5. What happens to the striped marlin your clients catch?

- They always release all striped marlin, regardless of their size.
- They only keep the first marlin they catch.
- They only keep striped marlin if they think they will win a competition or are a potential record fish.
- They keep the occasional striped marlin for consumption by family and friends.
- They keep all striped marlin they catch (up to the bag limit) for consumption by family and friends.
- They keep all striped marlin they catch (up to the bag limit) for trophies.

Q6. What would you do if the stock of striped marlin off the NSW coast fell to such a low level that your clients were most unlikely to catch a fish?

- I would cease taking clients gamefishing offshore.
- I would take clients fishing for other marlin and tuna off NSW instead.
- I would take clients fishing for other gamefish species, other than marlin, off NSW instead.
- I would take clients fishing for other marlin and tuna off NSW and shift striped marlin fishing activities to other States.

CHARTER BOAT OPERATIONS

Question	Regional Area of Operation					
	Northern NSW Tweed Heads Byron Bay Ballina Yamba	Mid North Coast Coffs Harbour Port Macquarie Forster South West Rocks	Hunter Port Stephens Newcastle Lake Macquarie	Sydney Terrigal Gosford Sydney Botany Bay Broken Bay Port Hacking	Illawarra Wollongong Shellharbour Kiama Shoalhaven Jervis Bay Ulladulla	Southern NSW Batemans Bay Narooma Bermagui Merimbula Eden
Q7. How many charter boats did you operate in each area over the survey period (1 May 2002 to 30 April 2003)?	<input type="text"/> boats	<input type="text"/> boats	<input type="text"/> boats	<input type="text"/> boats	<input type="text"/> boats	<input type="text"/> boats
Q8. How many days were you chartered to operate in each area over the survey period (1 May 2002 and 30 April 2003)? (regardless of whether the clients went fishing, diving, whale watching or just sight seeing).	<input type="text"/> days	<input type="text"/> days	<input type="text"/> days	<input type="text"/> days	<input type="text"/> days	<input type="text"/> days
Q9. How many days were you chartered to take anglers STRIPED MARLIN FISHING in each area over the survey period (1 May 2002 to 30 April 2003)? (Include all days when there was a chance of catching striped marlin)	<input type="text"/> days	<input type="text"/> days	<input type="text"/> days	<input type="text"/> days	<input type="text"/> days	<input type="text"/> days
Q10. How many anglers did you take fishing for STRIPED MARLIN in each area over the survey period (1 May 2002 to 30 April 2003)?	<input type="text"/> anglers	<input type="text"/> anglers	<input type="text"/> anglers	<input type="text"/> anglers	<input type="text"/> anglers	<input type="text"/> anglers

CHARTER BOAT REVENUE AND EXPENDITURE

Question	Regional Area of Operation					
	Northern NSW	Mid North Coast	Hunter	Sydney	Illawarra	Southern NSW
Q11. How much gross revenue did you earn from your operations in each area over the last financial year (1 July 2002 to 30 June 2003)?	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Q12. How much did you spend WITHIN each area in which you operated over the last financial year on:						
new/second hand boats	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
electronic equipment	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
any fishing gear	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
boat fuel	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
boat mooring/storage	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
boat repairs/maintenance	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
bait/ice	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
administration	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
insurance	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
interest expense	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
license fees and levies	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

DEPRECIATION OF CAPITAL EQUIPMENT

Q13. Over the last financial year (1 July 2001 to 30 June 2002), how much depreciation did you claim in relation to your:

Boats (including any boating equipment)	<input type="text"/>
Fishing equipment	<input type="text"/>
Any other capital equipment	<input type="text"/>

PURCHASES OF EQUIPMENT USED FOR STRIPED MARLIN FISHING

Q14. Where do you normally purchase your boats and boating equipment?:

- from suppliers in the regions where we operate
- from suppliers in other areas of NSW
- from suppliers in other States
- from suppliers in other countries (ie you import them)

Q15. Where do you normally purchase most of your striped marlin fishing equipment?:

- direct from suppliers in the regions where we operate
- via mail/internet order from suppliers in other areas of NSW
- via mail/internet order from suppliers in other States
- via mail/internet order from suppliers in other countries

Q16. Over the last financial year (1 July 2001 to 30 June 2002), how much did you spend in total on:

The purchase of new/used boats	<input type="text"/>	
Electronic equipment	<input type="text"/>	
Rods and reels suitable for striped marlin fishing	<input type="text"/>	Include any expenditure in regional coastal areas on striped marlin fishing gear (Q12).
Harnesses and gaffs suitable for striped marlin fishing	<input type="text"/>	
Lures suitable for striped marlin fishing	<input type="text"/>	
Line and terminal tackle for striped marlin fishing (traces, hooks, etc)	<input type="text"/>	
Special clothing (eg wet weather gear, sunglasses, boat shoes)	<input type="text"/>	
Chemist supplies (eg sunscreen, seasick pills, film)	<input type="text"/>	

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