The South Australian
Centre for Economic Studies

Adelaide & Flinders Universities

Value of New Zealand Recreational Fishing

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by:

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Acronyms

ABARE	Australian Bureau of Agricultural Resource Economics
AWTP	Average Willingness to Pay
BCO	Blue Cod
CRA	Crayfish
CRM	Contingent Ranking method
CV	Contingent Valuation
CVM	Contingent Valuation method
KAH	Kahawai
Kg	Kilograms
KIN	Kingfish
MWTP	Marginal Willingness to Pay
NIWA	National Institute of Water and Atmospheric Research
NZ	New Zealand
QMS	Quota Management Systems
SACES	SA Centre for Economic Studies
SNA	Snapper
TAC	Total allowable catch
TCM	Travel Cost method
TEV	Total economic value
WTP	Willingness to Pay

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In addition, Professor Jon Sutinen provided some insightful and helpful comments on the draft report. Appendix Nine includes a summary of the few comments that the Centre did not take on board, and the reasons why we did not do so.

Executive Summary

Introduction

The objectives of fisheries management are to protect the fish stock, achieve optimum utilisation of the resource and provide a distribution of the resource between various interest groups. The effective management of the fishing resource requires measures of the economic values of those resources, both in terms of the economic benefits to user groups and the associated costs of bringing the resource to these users.

In New Zealand, there is currently an acute lack of information on the relative economic values and costs of commercial and recreational fishing. Policy prescriptions involving the allocation of fisheries management between commercial and recreational sectors should consider the net benefits to the sectors involved, and accordingly this project was commissioned to estimate the value of recreational fishing to New Zealand.

The South Australian Centre for Economic Studies has expanded on the methodological foundation developed in its previous reports (i.e., SACES (1996), *The Economic Value of KGW and Snapper,* and SACES (1998) *Australian Salmon: SA Regional Economic Impact Study*) and has applied this approach to estimate the recreational economic value of five main fisheries in New Zealand: Snapper, Kingfish, Kahawai, Rock Lobster and Blue Cod. Note — the Centre has provided economic values for the fisheries from the perspective of users, it has not estimated the intrinsic value of the fisheries associated with non-users of the resource.

There is no observed market data for fish caught by recreational anglers, in essence, because the catches are not sold. To estimate the recreational value of fishing, the NZ Ministry of Fisheries commissioned the Centre to develop techniques to estimate recreational fishing value. For this study a survey technique known as Contingent Valuation was conducted to elicit an estimate of the marginal willingness of anglers to pay for catching the species. The Centre ensured that the techniques employed reflected many of the standards required by the US courts in determining environmental damages. Face-to-face surveys were conducted around New Zealand at various fishing locations from November 1998 to April 1999. All in all, over 4,000 surveys were conducted.

This report consists of 10 main sections.

Value and Policy

Section 2 of this report discusses several matters of economic principle that need to be understood to interpret economic values for the purpose of formulating fisheries management policy.

It is important to note that the Centre was not commissioned to estimate the commercial economic value of the five fisheries in question. Therefore, the Ministry of Fisheries needs to be extremely careful when they utilise the values of recreational fishing as estimated within this report. These values are *not* directly comparable to gross production commercial value — hence any policy decisions based on this would be misleading.

Fishers in the recreational sector may harvest the resource for a variety of reasons. Such reasons may include: informal food supplementation; for sport where fishers may go to elaborate means to meet the challenge; a quiet recreational pursuit; or to enjoy the outdoors. People also fish for spiritual and cultural reasons, however the purpose of this study has been to only elicit values from people fishing purely for recreational purposes.[1] The variety of reasons indicate that valuations of the resource will differ and that the evaluation is mixed with valuations of visual amenity and social experiences and with other activities such as tourism.

Just as the value of production (output) has been the most common form of misconception over the commercial economic value of fisheries, then the amount spent by recreational fishers to catch fish has also been a commonly misused concept. However, as commercial economic value of fish is not its gross production value (or the amount spent by commercial fishermen catching the fish), neither is the cost associated with fishing recreational economic value.

There are two different estimates that can be used to represent the value of recreational fishing.

(1) The value of recreational *fishing* as a whole — to work out what fishing is worth to New Zealand. This includes experience anglers who are willing to spend money trying to catch fish even though they are not successful. This estimate is the value of recreational fishing as social activity, and measures the value place on the whole day. It involves the application of average willingness to pay (AWTP) estimates.

(2) The value of recreational *fish* — estimates the actual value of the fish caught in order to compare the value of recreational fish to commercial fish. These values estimate the value of the additional fish caught, taking into consideration all other factors that influence the willingness to pay for the day's fishing trip (in other words, it strips out the influence of all other variables on willingness to pay). It involves the application of marginal willingness to pay (MWTP) estimates.

In addition to these values, there is another way of looking at the contribution of recreational fishers to the economy, namely the direct expenditure they make.

This study has estimated the value (willingness to pay) of recreational fishing; the value of recreational fish caught; and the amount of expenditure spent for all the five species in question.

The Centre's suggestion is that marginal WTP values are the best illustration of how much recreational fish are worth to New Zealand recreational fishers. These are the values that are most useful for policy purposes, i.e., cost-benefit analysis, fishery allocation, legal situations and for comparing against commercial fishing economic values.

[1] The first question asked of anglers in the survey was "Are you fishing for recreational purposes today?" If the answer was no, then the survey was concluded.

On the other hand — if the Ministry's purpose is to illustrate the general value of recreational fishing in New Zealand, than average WTP values may provide more information. Estimates of the total amount spent per year by a fisher targeting a particular species will provide a rough estimate of the amount of expenditure spent by anglers in the economy. However, it must be noted that these figures are based on recurrent expenditure only and do not take into account any capital expenditure (such as boats and rods) or multiplier effects.

In Section 3 a summary is presented of all the records collected to provide a general statistical overview.

Results

Sections 4 to 8 of this report employ complex econometric estimation procedures and contingent valuation methods to derive results. These sections are, by necessity, very technical in nature. The details of this are left to the interested reader. Section 9 provides a detailed summary of the results obtained and compares valuations between fish species.

General valuation results for the recreational value of the five fisheries are stated and interpreted below.

Empirical Results for Recreational Fishers

Table I illustrates most of the positive influences on willingness to pay for a day's fishing trip. For a detailed description of the variables used in the econometrics see Appendix 5, and Sections 4 to 8 provide additional commentary and explanation of results.

Table I
Positive Influences on Willingness to Pay for a Day's Fishing Trip

Variable	SNA	KIN	BC	KAH	RL
Income	✓	✓	✓	✓	✓
Importance of Fishing as a Recreational Activity	✓	✓	✓	✓	✓
Main Motivation to be with Family & Friends		✓	✓	✓	✓
Main Motivation to Enjoy the Outdoors	✓	✓	✓	✓	
Fisher was targeting Kingfish on the day's trip	✓	✓	✓	✓	
Particular Species of fish kept	✓		✓		
Particular Species of fish caught		✓		✓	✓
Sum of all Other Species of fish kept				✓	✓
Sum of all Other Species of fish caught	✓	✓	✓		
Member of a fishing club	✓	✓		✓	
Fishing with members apart from their household	✓			✓	✓
Increase in the average amount of time spent fishing	✓	✓		✓	
Owning a boat with an echo sounder	✓		✓		
Increase in the Enjoyment experienced on the trip	✓				✓
Targeting Blue cod on the trip	✓			✓	

Source: SACES

The main conclusions were that as income increased, so did willingness to pay (WTP) for the trip for all five fish species.[2] The more important fishing was as a recreational activity to a fisher, the more they were willing to pay for the day's fishing trip. If people were fishing mainly as a social activity rather than trying to catch fish, then this also had a positive effect on WTP. The more people caught (or kept) of the particular five fish (and a combination of all other fish caught), then the more they were willing to pay for the day's fishing trip. In addition, people who fished during the summer months had a much higher WTP than people who fished later in the year.[3]

Some variables had a statistically significant positive influence for some species of fish, but not for others, which provided some interesting comparisons between species. For example, being a member of a fishing club was not important in influencing WTP for Blue cod or Rock Lobster fishers, but it was important for Snapper, Kingfish and Kahawai fishers. Or, the WTP of Kahawai fishers was more likely to be influenced if they experienced troubles fishing on that day.

Table II
Negative Influences on Willingness to Pay for a Day's Fishing Trip

Variable	SNA	KIN	BC	KAH	RL
Fishing during the month of April	✓	✓	✓		
Fishing during the month of March		✓		✓	
Main motivation was to catch fish to eat	✓			✓	✓
Had difficulties fishing & blamed it on personal skills		✓		✓	
Fishing on the South Island			✓		
Fishing on the North Island					✓
Targeting Kahawai on the trip			✓		
Being male				✓	
Fishing on the North Island					✓
Being Polynesian				✓	
Main platform of fishing used was pots				✓	
Had difficulties fishing & blamed it on natural factors				✓	
Had difficulties fishing & blamed it on human factors				✓	

Source: SACES.

Table III illustrates the value associated with recreational fishing in New Zealand. The following discussion comments on these values. Note, the MWTP for a fish is the value associated with catching (or keeping) an additional fish on that day's fishing trip. It is derived econometrically and strips out the influence of all other variables on the WTP for that day's fishing trip. On the other hand, the AWTP of a fish is calculated by dividing the total mean willingness to pay by the total mean fish caught and kept. Hence it includes values of fishing by people who went fishing but did not catch any

[2] This is a standard economic result.

[3] This result reflects the influence of holiday fishers and the frequency with which people fish. The more a fisher goes out fishing a year, the smaller the amount they are willing to spend on each trip.

fish. This is one of the reasons why AWTP figures are usually higher than MWTP figures.[4]

Table III
Recreational Fishing Values

	Value Per Fish Kept/Caught		Value on a Weight Basis				Amount Spent ($)	
	MWTP $	AWTP $	M WTP $	AWTP $	Total MWTP Value $m	Total AWTP Value $m	Per Trip	Annual Expenditure
Snapper	5.73	30.85	5.79	31.16	15.81	85.10	35.80	417.25
Kingfish	19.76	181.10	3.26	29.83	1.24	11.40	49.68	128.08
Blue Cod	1.61	24.46	2.40	36.5	1.75	26.61	44.09	113.45
Kahawai	3.44	59.65	2.80	48.49	4.25	73.61	25.32	152.41
Rock Lobster	6.54	48.29	9.91	73.16	3.10	22.90	51.52	162.29
Total Values					**26.15**	**219.62**		**973.47**

Source: SACES.

The Value of Recreational Fishing - AWTP Values

Out of the five species the Centre studied, the fish species that is valued the highest on an AWTP basis in New Zealand recreational fishing is Kingfish, which adds $181.10 to the AWTP for a fishing trip. Kahawai is the second highest, adding $59.65, then Rock Lobster $48.29, Snapper $30.85 and Blue Cod $24.46.

On a weight AWTP (in kg) basis, the fish species that is valued the highest in New Zealand recreational fishing on a fishing trip is Rock Lobster, which adds $73.16 to the willingness to pay for a fishing trip. Kahawai is the second highest, adding $48.49, then Blue Cod $36.50, Snapper $31.16 and Kingfish $29.83.

The Centre calculated average values for the total recreational fishing estimates on a fish and per kilogram basis. The fish species that has the highest recreational fishing value is Snapper, with $85.1 million (estimated from AWTP/kg caught times recreational catch of Snapper). Kahawai is the second highest, with $73.6 million, followed by Rock Lobster $22.9 million, Blue Cod $26.6 million and Kingfish $11.4 million.

The total value of *fishing* recreationally in New Zealand was estimated to be $219.6 million.

The Value of Catching Fish - MWTP Values

Out of the five species the Centre studied, the fish species that is valued the highest in NZ recreational fishing on a fishing trip is Kingfish, which adds $19.76 to the marginal

[4] Further discussion is provided in the Snapper chapter in Section 4 on the difference between MWTP and AWTP.

WTP for a fishing trip (holding all other variables constant). Rock Lobster is the second highest, adding $6.54, then Snapper $5.73, Kahawai $3.44 and Blue Cod $1.61.

On a weight basis[5], the fish species that is valued the highest on a NZ fishing trip is Rock Lobster, which adds $9.91 to the WTP for a fishing trip (holding all other variables constant). Snapper is the second highest, adding $5.79, then Kingfish $3.26, Kahawai $2.80 and Blue Cod $2.40.

The fish species that has the highest total value for catching fish is Snapper, a value of $15.8 million on a weight basis. Kahawai is the second highest, with $4.3 million, followed by Rock Lobster $3.1 million, Blue Cod $1.8 million and Kingfish $1.2 million.

The Centre calculated the total value of *catching fish* recreationally in New Zealand to be $26.2 million.[6]

The Value of the Money Spent Fishing

For the five species in question, the Centre calculated the total amount spent per year by a fisher and an estimate for the total annual recurrent expenditure for the population of fishers targeting particular species.

The species that had the highest average amount spent per trip was Rock Lobster, with $51.52. The second highest expenditure per trip was for Kingfish $49.68, then Blue Cod $44.09, Snapper $35.80 and Kahawai $25.32.

Given the estimates of the population of New Zealand fishers who fish for each species in a given year, the largest total recurrent expenditure for a fish in a given year was for Snapper fishing, with $417.3 million dollars, followed by Rock Lobster fishing $162.3 million, Kahawai $152.4 million, Kingfish $128.1 million and Blue Cod $113.5 million.

The total value of recreational fishing expenditure in New Zealand was estimated to be $973.5 million dollars.[7]

Conclusion

The divergence between values of the species is due to the type of fish it is, what it is used for, the abundance of its stock, the area where it is fished for and the equipment needed to catch it. For example, Kingfish is primarily a recreational sporting fish. It is one of the prime fish targeted by tourists. As Kingfish grow to world record sizes in New Zealand, it is one of the species most hunted for in the North Island. The scarcity of catching a Kingfish (especially a very large one) adds to its recreational value. This implies that there is no close substitute for catching a Kingfish — people are not catching it for eating motives, they are catching it for other recreational motives.

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5 Note that per kilogram estimates depend critically on the average mean estimate of a recreational catch.

6 It is also crucial to note that the Centre has in no way attempted to estimate the value of catching other fish species than the five species presented in this report.

7 Caution is urged with this figure as there may be some double-counting involved with expenditure of various fishers. The population of fishers used to calculate the values was also highly questionable. Section 9 provides additional commentary on these points.

Like Kingfish, Kahawai have a much higher value as a recreational sport fish than as a commercial or eating fish. Rock Lobster is valued more highly as commercial or eating fish, and Blue cod and Snapper seem to be valued more as a recreational eating fish. For these two species, for most fishers who catch and keep additional fish, their catch is a substitute for buying fish commercially.

All in all, the total value of recurrent fishing expenditure in New Zealand is approximately 4 times greater than the value of general recreational fishing, which in turn is approximately 8 times greater than the value of catching and keeping fish.

1. Introduction

The objectives of fisheries management are to protect the fish stock, achieve optimum utilisation of resources and provide a distribution of the resource between various interest groups. Effective management of a fishery not only requires constant monitoring of fish stocks, but also information on the fishing activity of all sectors utilising the resource, and an analytical framework to assess the impact of policy decisions on the user groups.

The allocation of a scarce resource, however, requires measures of the economic values that different user groups derive from the resource which in turn depends upon the willingness-to-pay (WTP) of these users as well as the associated costs of bringing the resource to these users. Fisheries managers need to have measures of these marginal values and costs of fish in recreational fishing to enable comparisons with commercial sector economic values.

It is within this context that the New Zealand Ministry of Fisheries is seeking to obtain a better understanding of the economic benefits of recreational fishing of five main species: Snapper, Kingfish, Blue Cod, Kahawai and Rock Lobster.

The specific terms of reference were:

- To determine the value of recreational fishing to New Zealand;
- To determine the total economic value including market and non-market values of marine recreational fishing; and
- To determine the specific contribution of recreational fishing for Snapper, Kahawai, Kingfish, Blue Cod and Rock Lobster to the economy.

2. Theoretical Methodology For Economic Value

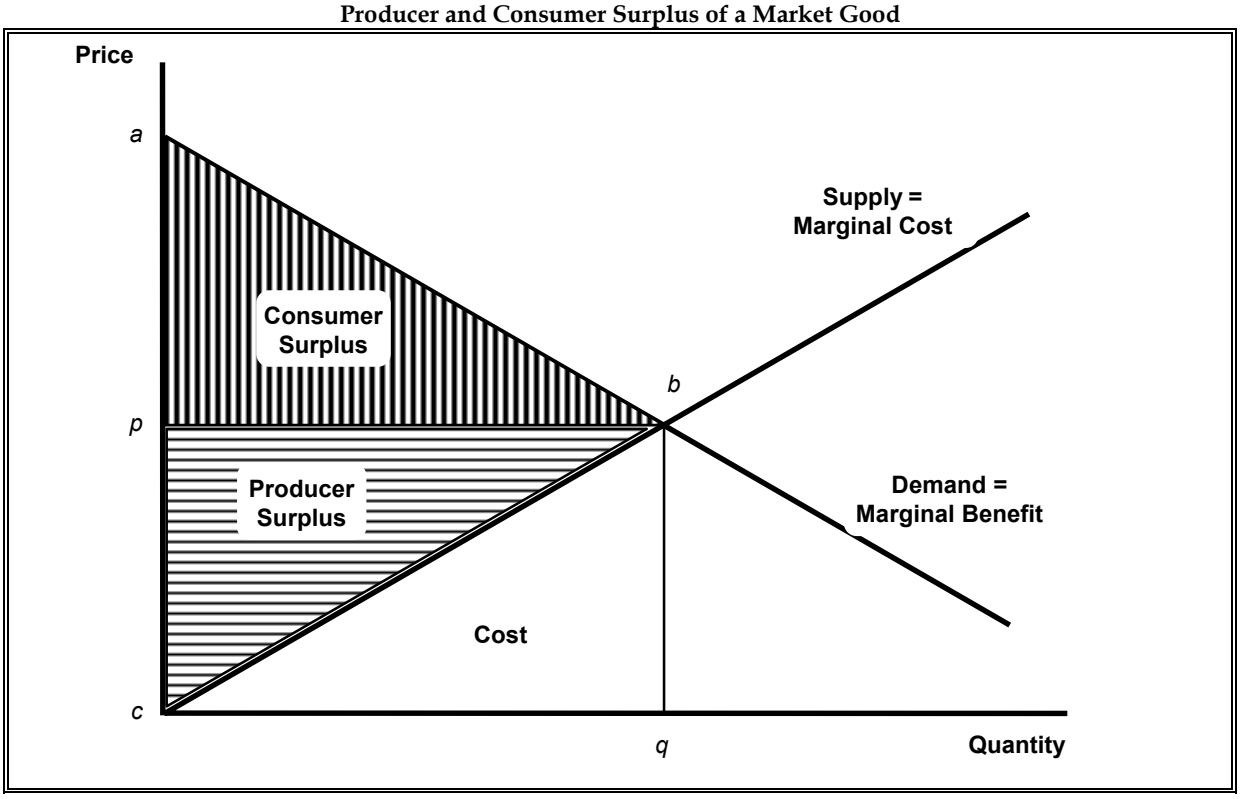
2.1 Commercial Economic Value

Although the focus of this study is specifically on recreational value of fisheries, it is important to detail exactly what commercial economic value entails. The purpose of this section is to advise caution when comparing the recreational values obtained with what is thought by many to be commercial economic value.

As economic values of fisheries resources have often not been correctly used or specified, there is a need to develop a theoretical framework to explain why certain concepts are employed for measuring economic value.

Figure 2.1 illustrates the difference between real economic value and what has popularly been considered to be economic value in fisheries, the *value of gross production* (the value of total output, i.e., the price received for the resource times the quantity produced).[8] Gross value of production is not the economic value of the resource. Economic value is the value to society of a resource. The above description of value of output does not take into account all the corresponding values to society from the consumption and production of the resource. As a simple illustration, consider Figure 2.1. The maximum price that consumers are willing to pay for each unit is indicated by the demand curve. For a given output, q, the area cqba is the total amount consumers are willing to pay. This value does not take into account the resource cost of the output. This is given by the area under the supply curve, cqb.

Figure 2.1
Producer and Consumer Surplus of a Market Good



[8] Figure 2.1 is a very simple graphical presentation of commercial value. Estimating actual commercial value would be considerably more difficult and complex than the discussion in this section.

Economic value (area abc) is the difference between the total amount consumers are willing to pay and the resource cost of the output. The economic value can be partitioned into two components: consumer surplus and producer surplus.

Consumer Surplus — takes into consideration the price paid by consumers for resource (p), as against the amount that they would have been willing to pay (indicated by the Demand curve). For some consumers, surplus funds are therefore left over after buying a good. In other words, it is the difference between the value of the product to the consumer and its price. In Figure 4.1, total consumer surplus is given by abp.

Producer Surplus — is the difference between a producer's total revenue (cpbq) and the resource cost of the output (cbq). In Figure 4.1, total producer surplus is given by cpb.

In contrast, the gross value of production, the term often confused with economic value, is cpbq (producers total revenue), an area that usually eclipses actual economic value.

The above discussion has been based on a very simplified economic model, and other economic papers that have further discussion on this issue include Burns (1973, 1977) and Willig (1976).

It is important to note that the Centre was not commissioned to estimate the commercial economic value of the five fisheries in question. Therefore, the Ministry of Fisheries needs to be extremely careful when they utilise the values of recreational fishing as estimated within this report. These values are *not* directly comparable to gross production commercial value — hence any policy decisions based on this would be misleading.

The following section extends the methodology of economic value for recreational fishers.

2.2 Recreational Economic Value

Fishers in the recreational sector may harvest the resource for a variety of reasons. Such reasons may include: informal food supplementation; for sport where fishers may go to elaborate means to meet the challenge; a quiet recreational pursuit; or to socialise and enjoy the outdoors. The variety of reasons indicate that valuations of the resource will differ and that the evaluation is mixed with valuations of visual amenity and social experience and with other activities such as tourism.

Commercial economic value relates solely to the use values of the fish, in production and consumption. Recreational economic value also relates to the use of the resource, however we no longer have available data as the fish is not traded on the marketplace (this is of course ignoring the substantial black market that exists for fish poachers). As a consequence, the recreational economic value of fish must be derived from a number of potential economic techniques.

Recreational economic value is a bundle of use, option and existence values. Use values are those derived by people who fish for the resource or go with people who fish for the resource. Option values are held by people wanting the resource to be available for

future use. Existence (intrinsic) value is the value associated with knowing a resource is there for its own sake. It is important to note that the sum of commercial and recreational economic values (primarily actual use value) are by no means total economic value of a fishery. Recreational and commercial *use* value does not take into consideration complete option or existence values.

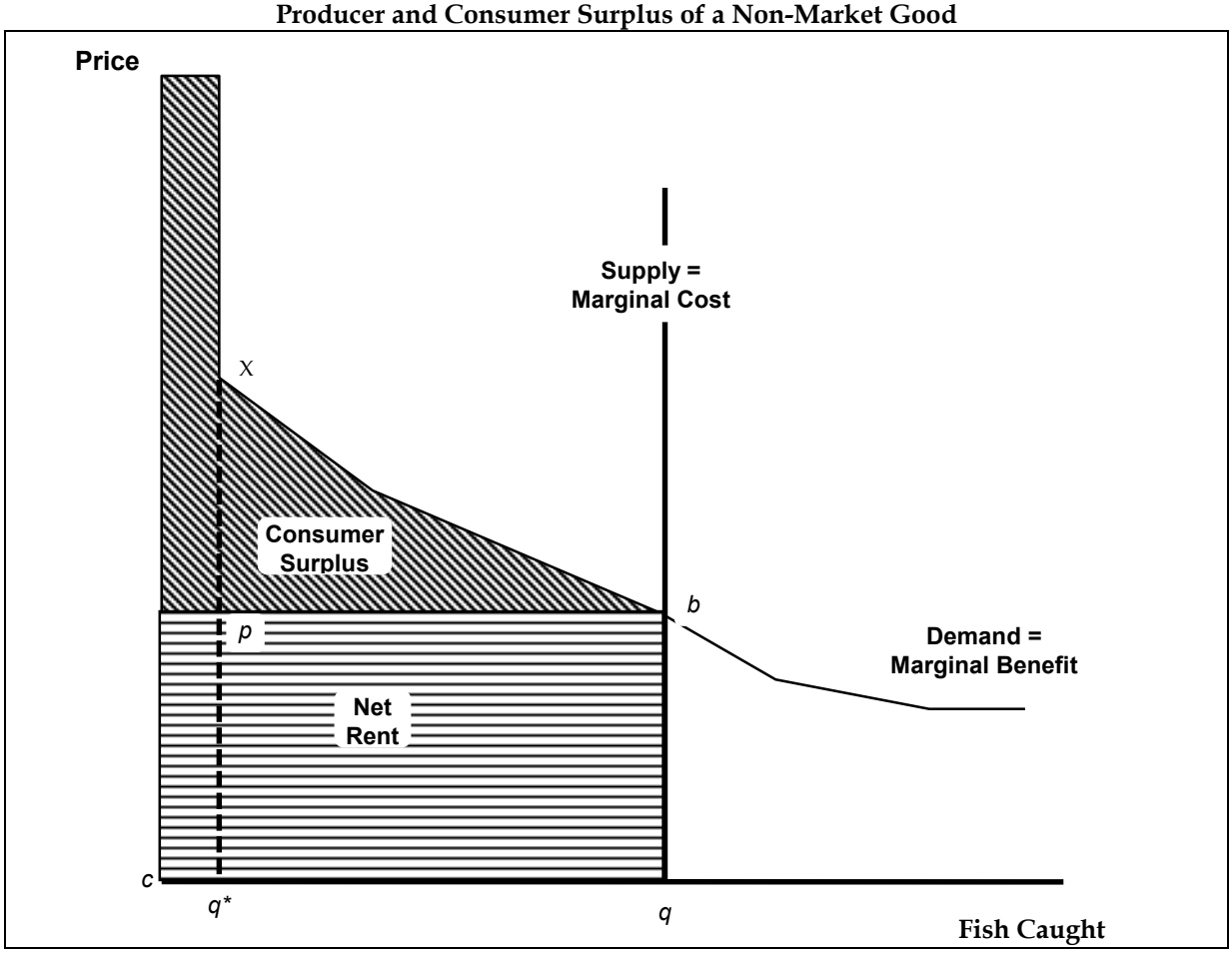
Total economic value (TEV) is classified as:

TEV = Actual Use Value + Option Value + Existence Value

Total economic value of fishing would take into account the value placed on fish by individuals who do not fish themselves, but whom value it as an activity for other people. Total economic value is described further in Appendix Two.

In the case of non market attributes such as recreational fishing, there is no readily identifiable demand curve, unlike shown in Figure 2.1. Unlike market goods which have substitutes, many ecosystem goods are only substitutable up to a certain point. Therefore, there is a certain minimum level of ecosystem services needed in order for human beings to survive. At this point (q* in Figure 2.1(b)), the demand for the resource approaches infinity. This implies that consumer surplus also approaches infinity for ecosystem services that we need for survival. However, recreational fishing does not fall into this category of essential ecosystem services (though some ardent fishers would disagree with this statement!), hence we can consider the vertical axis of the curve to begin at q*x.

Figure 2.1(b)
Producer and Consumer Surplus of a Non-Market Good



The supply of ecosystem services is presented as a vertical curve (where supply equals marginal cost), where the quantity is determined by the amount of recreational fish caught at any one point in time.

The economic value of an environmental attribute such as recreational fishing is measured by using the method of price (usually as a form of marginal or average willingness to pay per fish — which is explained later in this section) times quantity (the area q*pbq in Figure 2.1(b). This amount acts as a proxy for the value of recreational fishing.

Just as the value of production (output) has been the most common form of misconception over the commercial economic value of fisheries, then the amount spent by recreational fishers to catch fish has also been a commonly misused concept. Some recreational fishers argue that because they spend a large amount (incorporating bait, travel cost/time, tackle, petrol, boat hire etc.) for the purpose of catching a certain species, then they therefore place a higher economic value on the species and correspondingly should be allowed a greater share of the rights to harvest the resource (by distributing some of the share away from commercial quotas). However, as commercial economic value of fish is not its gross production value (or the amount spent by commercial fishermen catching the fish), neither is the cost associated with fishing the recreational economic value.

In surveys that try to find out the motivations of why anglers go fishing, catching fish is usually not the prime reason an angler goes fishing. Some of the reasons that people state as to why they go fishing include:

- to be with friends and/or family (some often answer they go fishing in order to get away from the family!);
- to relax outside;
- to see new sights; and
- to enjoy the sunshine.

To actually catch fish is important, but for most it is not the "be all and end all" of fishing. The statistics on reasons for going fishing in Sections 4 to 8 describe the motivations of recreational fishers in New Zealand for the five fisheries in question.

There are two different ways that the value of recreational fishing can be expressed.

(1) The value of recreational *fishing* as a whole — to work out what fishing is worth to New Zealand. This includes the values of anglers who are willing to spend money trying to catch fish even though they are not successful. This estimate is the value of recreational fishing as social activity, and measures the value placed on the whole day.

(2) The value of recreational *fish* — estimates the actual value of the fish caught in order to compare the value of recreational fish to commercial fish. These values estimate the value of the additional fish caught, taking into consideration all other factors that influence the willingness to pay for the day's fishing trip (in

other words, it strips out the influence of all other variables on willingness to pay).

Alternative techniques are needed to work out the value of the fishing experience and the value of the fish caught recreationally. We cannot simply apply an estimate of how much recreational anglers spend in total as a proxy for the value of the fish. This is because people may value the experience of fishing a lot higher than the amount they actually pay for it. For example, many people who are taken fishing by their friends usually do not spend much on the fishing trip. However, they would still have gone fishing if it had cost them more. These values must also be taken into consideration. The purpose of economic value estimation is to evaluate the total net benefits associated with each activity of fishing, commercial and recreational. This study attempts to do this by estimating the net benefits associated with an additional fish caught by recreational New Zealand anglers for five fisheries.

Recreational value is determined by a fishers *willingness to pay* for an extra fish, a variable that can be estimated through two primary economic methods, namely:

- a Direct Approach; and
- an Indirect Approach.

The Direct Approach attempts to elicit preferences (willingness to pay (WTP)) directly through the use of surveys or experimental techniques. Direct approaches include the contingent valuation method (CVM) and the contingent ranking method. On the other hand, the Indirect Approach seeks to elicit preferences from actual, observed market based information, where willingness to pay is revealed indirectly. An example of an indirect approach is the travel cost method (TCM). Both the CVM and the TCM are explained in greater detail in Appendix Two, and Appendix Three elaborates on the conditions required for CVMs.

For this study, it was decided that direct approach surveys (CVM) would be the best method to elicit an estimate of the marginal willingness of recreational anglers to pay for catching the species.[9] How the method was applied is elaborated on further in the next section.

2.2.1 Contingent Valuation

CVM is a survey based technique used to elicit respondents willingness to pay for an unmarketed good. Appendixes Three and Four provide greater detail on the steps undertaken to ensure the validity of the CVM and the questions asked to elicit willingness to pay. A copy of the questionnaire used for the survey can be found in Appendix One.

[9] SACES (1997) applied both methods to estimate the recreational economic value of KGW and Snapper fishing and it was found that the TCM results could not be used. This is due to the fact that most fishers travelled from Adelaide to their fishing location, hence there was no real variation in the opportunity cost of travel time that was needed to apply the TCM correctly. It was considered likely that a similar result would be obtained for the situation in New Zealand.

The Pilot Survey

The pilot study was undertaken in Auckland over the months of November and December. A total of 163 surveys were obtained. The main aims of the survey were to determine:

1. The optimum length of the questionnaire.
2. The optimum choice of questions and the need for other information.
3. Whether the questions could be easily understood by the wide cross section of New Zealand fishers with varying degrees of language fluency.
4. The range over which willingness to pay lies.
5. The need for a budget constraint reminder.

Adjustments were made accordingly.

Main Fishing Questionnaire

From 28 December 1998 to 11 April 1999, Kingett Mitchell & Associates Ltd conducted the main survey. A random sample of fishers were interviewed in areas around New Zealand that had been identified as key fishing spots for the five main fisheries in question. Excluding the results from the pilot survey, approximately 3,655 fishers were surveyed. The areas where anglers were interviewed include the following:

Table 2.1
Survey Fishing Locations

Location	City or Area	Region	Island	Mgt Area
Ataturk/Lavender Bay	Hawkes Bay	Hawkes Bay	North Island	QMA2
Chicken Island	Near Whangarei	Northland	North Island	QMA1
Dixon's Basin	Nelson	Tasman Bay	South Island	QMA7
Evans Bay	Wellington	Wellington	North Island	QMA2
Fishing Camp	Kaka Point	Southland	South Island	QMA3
Flat Point	Wairarapa Coast	Wairarapa Coast	North Island	QMA2
French Bay	Manukau Harbour	Manukau Harbour	North Island	QMA 9
Glinks Gully	Dargaville	W. C. North Island	North Island	QMA9
Greta Point	Wellington	Wellington	North Island	QMA2
Halfmoon Bay	Auckland	Hauraki Gulf	North Island	QMA1
Hen Island	Near Whangarei	Hauraki Gulf	North Island	QMA1
Island Bay	Wellington	Wellington	North Island	QMA2
Kaikoura	Kaikoura Coast	E. C. South Island	South Island	QMA3
Kaka Point	Southland	Southland	South Island	QMA3
Karitane	Otago Coast	Otago Coast	South Island	QMA3
Kawakawa Bay	Near Auckland	Hauraki Gulf	North Island	QMA1
Leigh Harbour	Near Auckland	Hauraki Gulf	North Island	QMA1
Lyall Bay	Wellington	Wellington	North Island	QMA2
Lyttleton	Christchurch	E. C. South Island	South Island	QMA3
Matapouri	Northland	Northland	North Island	QMA1
Miramar Wharf	Wellington	Wellington	North Island	QMA2
Moa Point	Wellington	Wellington	North Island	QMA2

Table 2.1 (Continued)
Survey Fishing Locations

Location	City or Area	Region	Island	Mgt Area
Moeraki	Otago Coast	Otago Coast	South Island	QMA3
Mokohinau Islands	Hauraki Gulf	Hauraki Gulf	North Island	QMA1
Ngunguru	Northland	Northland	North Island	QMA 1
Oakura Bay	Northland	Northland	North Island	QMA1
Overseas Terminal	Wellington	Wellington	North Island	QMA2
Paihia	Northland	Northland	North Island	QMA 1
Paremata	Wellington	Wellington	North Island	QMA 2
Parua Bay	Whangarei Harbour	Northland	North Island	QMA1
Picton Marina	Picton	Marlborough Sounds	South Island	QMA7
Plimmerton	Wellington	Wellington	North Island	QMA8
Puriri Bay	Whangaruru Harb.	Northland	North Island	QMA1
Raglan	Raglan Harbour	W. C. North Island	North Island	QMA9
Sandspit	Near Auckland	Hauraki Gulf	North Island	QMA1
Seatoun	Wellington	Wellington	North Island	QMA2
Seaview Marina	Wellington	Wellington	North Island	QMA2
Shag Point	Otago Coast	Otago Coast	South Island	QMA3
Snells Beach	Near Auckland	Hauraki Gulf	North Island	QMA1
Stewart Island	Stewart Island	Stewart Island	South Island	QMA5
Takapuna	Auckland	Hauraki Gulf	North Island	QMA1
Tauranga	Bay of Plenty	Bay of Plenty	North Island	QMA1
Te Kaha	Bay of Plenty	Bay of Plenty	North Island	QMA1
Te Papa (wharf)	Wellington	Wellington	North Island	QMA2
Tutukaka	Northland	Northland	North Island	QMA1
Waikawa (Marina/Ramp)	Marlborough Sounds	Marlborough Sounds	South Island	QMA7
Wairarapa Coast	Near Wellington	Wairarapa Coast	North Island	QMA2
Waitangi	Bay of Islands	Northland	North Island	QMA1
Whangarei	Whangarei Harbour	Northland	North Island	QMA1
Whitianga (Marina/Ramp)	Coromandel	Coromandel	North Island	QMA 1
Wilsher Bay	Southland	E. C. South Island	South Island	QMA3

Sources: Centre Surveys; Rick Boyd; and Todd Sylvester.

The distribution of survey effort was based on two criteria:

(1) The first was the general distribution of the fishery by quota management area for each species based on the results of the 1996 National Marine Recreational fishing survey. Survey effort was distributed geographically around the country to reflect the distribution of the fishery for each species; and

(2) The second was the results of boat-ramp sampling (for fish lengths) conducted in 1996 as part of the National Marine Recreational fishing survey. This data base provided specific information on the numbers of each species of fish landed at various sampling locations and boat-ramps around the country. Survey effort was distributed to those boat-ramps and marinas where the 1996 data indicated that those species would be likely to be landed.

It was recognised that with the resources available, it would be difficult to obtain the required numbers of surveys for some species in some areas, and for Rock lobsters and Kingfish in particular. The Rock lobster fishery is dispersed along the coast and many

divers operate from a range of locations along the coast beach rather than from recognised boat-ramps, making it more difficult to intercept returning fishers. For Kingfish, an increase in the minimum legal size meant that fewer fishers were expected to be targeting this species. In some areas where fishing effort is low overall, (e.g, West coast South Island, lower West coast North Island), it was recognised that it would not be productive to station surveyors because of the low population/incidence of recreational fishers.

Surveyors were initially stationed at three locations in Northland, three in the Hauraki Gulf, three in the Bay of Plenty, two in the Wairarapa/Wellington area, two in the Nelson area, two in the Kaikoura/Canterbury area, three in the Otago area and one in Southland. A flexible approach was adopted by some surveyors (e.g., in Northland, and Wellington) where a variety of local fishing spots were sampled depending on fishing conditions.

Intercept rates at a number of the South Island sampling locations dropped rapidly and became very low after the holiday period. Survey effort was therefore stopped at locations when the numbers of completed surveys became too low to justify continuing. In the North region, a period of prolonged easterly weather during the summer months appeared to strongly curtail the dive fishery for Rock lobsters. The easterlies also had an effect on the hook and line fisheries for Snapper, Kingfish and Kahawai and meant that intercept rates/numbers of completed surveys per interview hour were lower than expected overall. Survey effort became focussed on fewer high volume locations in order to counter this. Particular effort was also directed at trying to boost Rock lobster survey numbers but with limited success because of the dispersed nature of fishing effort along the coast and the poor weather. Hence, it was not possible to derive the optimal number of Rock Lobster surveys for the econometrics, and the Centre had to make do with the numbers available. Blue Cod was also a species with only a small amount of surveys obtained.

The general survey questionnaires provided important general fishing information for all species. These results are outlined further in Sections 3 through to 8.

2.2.2 Data Set

Approximately 3,655 surveys were conducted in total. In a number of cases respondents either refused to answer a question or provided incomplete or inconsistent answers. Where the interviewers were not confident about the accuracy of the respondent's answers these surveys were excluded from the data set. Problems typically arose with the last two questions where respondents were asked to report their occupation and to nominate a range for their gross income. Where reported incomes differed substantially from the expected income of an occupational group, the answer was deemed to be inconsistent and the questionnaire was excluded from the sample.

The results outlined in this paper are based on a final sample of approximately 3,550 fishers. The breakdown for the five main fisheries[10] was:

[10] It is important to note that these numbers were the surveys used for the econometrics analysis only. The statistics analysis in Sections 3.1, 4.2, 5.2, 6.2, 7.2 and 8.2 included only the people that were targeting a specific fishery, whereas the econometrics database included the people targeting the specific fishery and those who kept/caught (depending on the fishery involved) the fish as well.

- 2,010 for Snapper;
- 505 for Blue Cod;
- 709 for Kingfish;
- 1,181 for Kahawai; and
- 501 for Rock Lobster.

The differing number of records reflected difficulties encountered with obtaining surveys from anglers targeting particular fish.

The anglers were asked a series of questions designed to elicit the following information: (a) characteristics of recreational fishing (e.g., the importance of fishing to the fisher, times fished per year, average time spent fishing etc.); (b) characteristics of the fishing trip (e.g., duration, boat catch, fish kept, weather, sea conditions, the enjoyment of fishing that day etc.); (c) socio-economic characteristics of the fisher (e.g., income, sex, ethnic group, occupation, membership of fishing club); (d) fishing equipment used (e.g., own boat, type of echo sounder, main platform used etc.); and (e) willingness to pay (WTP) for the days fishing (e.g., based on actual amounts spent and extra bid amounts asked). Appendix One shows an example of the survey design.

Central to the study is the elicitation question which seeks to determine the respondents' WTP for the fishing trip. For this question, the initial pilot survey played a critical role in ensuring that the amounts covered the full range of values that people are willing to pay to go fishing. Having discovered the range over which the WTP lies, it was then necessary to ascertain the distribution of WTP in the sample of fishers.

Sections 4 to 9 continue the discussion on the value of New Zealand recreational fishing.

3. Recreational Fishers Characteristics and Total Recreational Catch

This section concentrates on information obtained from all the surveys completed and deemed suitable for analysis (3,540 Surveys), and is denoted as "All Fish" records. It provides an overview and statistical summary of all recreational fishers in New Zealand. It is important to keep in mind that this summary is not necessarily representative of general fishers in New Zealand, as the surveys were primarily targeted to collect records of the five fisheries in question. Nevertheless, the following summary still provides some interesting statistics.

The second half of this section summaries the latest available data for the total recreational fish catch of New Zealand.[11]

The following Sections, 4 to 8, concentrate primarily on records of the fishers who targeted the five fisheries studied: Snapper, Kingfish, Blue Cod, Kahawai and Rock Lobster.

3.1 All Fish Fishing Characteristics

3.1.1 Fishing Locations for All Surveys

Table 3.1 records the number of interviews recorded by various location classifications displaying results as percentages of the total. The interesting points to note about this table includes:

- The most common fishing locations where surveys were conducted were Raglan (12 per cent) and Tauranga (12 per cent), followed by Whitianga (9 per cent) and Takapuna (8 per cent);
- The majority of surveys for Quota Management Areas were conducted in QMA 1 (60 per cent), followed by QMA 9 (13 per cent) and QMA 7 (13 per cent);
- The majority of surveys were conducted in the North Island (82 per cent); and
- 77 per cent of interviews were conducted in metropolitan areas.

3.1.2 Characteristics of Recreational Fishing for All Fishers

Table 3.2 illustrates the enjoyment and importance of recreational fishing to all fish anglers. The interesting points to note about Table 3.2 includes:

- An average of 4 for enjoyment indicates that on average all fishers had a 'good' fishing trip; and
- Fishing is regarded as an 'important' recreational activity, with the average of 4.2.

[11] Advice was provided on these figures by E. Bradford of NIWA.

Table 3.1
Number of Interviews By Various Location Classifications: All Fish

Region	%	QMA	%	Island	%	Area	%
Dixon's Basin	1.4	1	59.8	North	81.9	Fishing location was	
Halfmoon Bay	4.4	2	8.8	South	18.1	in a metropolitan	
Island Bay	1.3	3	4.7			area	76.6
Kaikoura	2.5	4	-				
Oakura	1.6	5	0.9			Fishing location was	
Oriental Bay/Parade	2.0	6	-			in a non-	
Parua Bay	5.0	7	12.5			metropolitan area	23.4
Picton Marina/wharf	3.6	8	0.5				
Raglan	12.2	9	12.8				
Sandspit	1.6						
Seaview Marina	1.8						
Takapuna/Boat Launch	8.3						
Tauranga	12.1						
Te Kaha	7.3						
Tutukaka	3.4						
Waikawa	7.5						
Waitangi	2.7						
Whitianga	9.0						
Other*	12.1						
Total	100.0		100.0		100.0		100.0

Note: * This includes approximately 35 more locations
Source: SACES.

Table 3.2
Enjoyment and Importance of Recreational Fishing: All Fish

	Enjoyment Factor	Importance Factor
Mean Score*	4.0	4.2

Note: * Represents the averages of fishers response to the question that asked them to rank their trip in terms of 'enjoyment' and the 'importance' of fishing as a recreational activity to themselves on a scale of 1 to 5 with 1 representing 'terrible' and 'not important' while 5 represented 'excellent' and 'extremely important' respectively.
Source: SACES.

Table 3.3 illustrates the number of times all anglers fish per year, by island. The interesting points to note include:

- Most fishers went fishing between 6-15 times per year (34 per cent); and
- Fishers in the North on average went fishing more often (26 times per year) than their counterparts from the South island (18 times per year). For New Zealand as a whole, fishers ventured out roughly 25 times on average per year.

Table 3.3
Number of Fishers By Trips Per Year and Island: All Fish

Times per year	Island		Total	%
	North	South		
0-5	404	128	532	15.0
6-15	892	318	1,210	34.2
16-25	635	97	732	20.7
26-50	675	65	740	20.9
51-100	233	25	258	7.3
100+	57	5	62	1.8
NA*	3	3	6	0.2
Total	2,899	641	3,540	100.0
Average trips per year	26.2	17.7	24.7	

Note: NA indicates information not available.
Source: SACES.

Table 3.4 illustrates the motivations about why all fishers went fishing. The interesting points to note include:

- Most fishers went fishing for Sport and eating purposes (45 per cent), followed by to enjoy the outdoors (25 per cent) and to catch fish for specifically eating purposes (11 per cent).

Table 3.4
Motivation For Fishing: All Fish

	Sport Only Purposes	Eating Purposes	Sport & Eat Purposes	Enjoy Outdoors	Catch Large Fish	Family Purposes	Explore Outdoor	Custom Purposes	Other
All fish	6.2	11.3	45.1	24.7	3.0	7.6	0.5	0.1	1.5

Source: SACES.

3.1.3 Characteristics of the Fishing Trip

Table 3.5 reveals fishers fishing platform of choice and boat characteristics, some interesting observations are:

- The majority of anglers (84 per cent) fished from a boat. The high proportion of boat users is particularly due to interviewers targeting boat ramps for surveying purposes;
- Most fishers owned their own boat (66 per cent); and
- The majority of people who owned their own boat also had an echo sounder (71 per cent). The most popular type of echo sounder was one that possessed a liquid crystal display (77 per cent) while colour video echo sounders were the only other significant format utilised (20 per cent).

Table 3.5
Fishing Platform and Boating Characteristics: All Fish

Platform	%	Boat Ownership	%	Echo Sounder	%	Echo Sounder Type	%
Boat	84.2	No	34.4	No	28.8	Colour Video	20.2
Jetty	3.6	Yes	65.5	Yes	71.2	Liquid Crystal Display	76.7
Land	2.8	NA	0.1	Total	100.0	Paper Display	1.4
Diving*	7.1	Total	100.0			Other	1.8
Pots	2.3					Total	100.0
Total	100.0						

Note: * The figure for boat platform users is probably understated as a good proportion of those diving would also have utilised a boat.
Source: SACES.

Table 3.6 illustrates the number for fish caught and kept on the fishing trip. The interesting facts to arise from this table is that:

- The average catch per fisher targeting any species was 9 fish; and
- On average a fisher kept 3.5 fish.

Table 3.6
Species Targeted By Fishers and Fish Kept and Caught: All Fish

	Average Fish Caught Per Respondent For Targeted Species*	Average Fish Kept Per Respondent For Targeted Species
All species	9.2	3.5

Note: * Fish caught consisted of fish caught by all members of the party fishing, plus any fish thrown back.
Source: SACES.

Table 3.7 gives an indication of the magnitude of fishers difficulties in catching their targeted fish. The interesting fact to arise from this Table is that:

- Of the 3,518 fishers who were either targeting one of the five main fish species covered in our report or 'other' fish species, 1,253 of those fishers kept none of the fish that they targeted. This represents 35.6 per cent of fishers.

Table 3.7
Unsuccessful Fishers: All Fish

	People Who Kept Nothing	
	Number	%
All Fish Targeted	1,253	35.6

Source: SACES.

Details regarding fishers difficulties with catching their targeted fish is recorded in Table 3.8. Interesting observations include:

- There was an even split between those fishers who had no difficulties (52 per cent) and those who had difficulties (48 per cent) in catching their targeted species; and
- Natural reasons (45 per cent) was the most common reason given for why fishers had difficulties in catching their targeted fish. Human factors (31 per cent) was another importance source for difficulties followed then by Personal factors (18 per cent).

Table 3.8
Difficulties With Targeted Fish and Reasons: All Fish

Fishers Experiencing Difficulties	%	**Reason**	%
Yes had difficulties	48.3	Personal	17.5
Had no difficulties	51.6	Natural	44.8
Total	**100.0**	Human	31.3
		Other	6.4
		Total	**100.0**

Source: SACES.

Details regarding the time spent fishing on the trip and the average time spent fishing is recorded in Table 3.9. Interesting observations include:

- The average time usually spent fishing by fishers was 5.3 hours, and the average time spent fishing on the day interviewed was 4.9 hours.

Table 3.9
Average and Total Time Spent Fishing: All Fish

Fish Species	**Average Total Time Per Fisher For Trip**	**Average Time Per Fisher**
All fish	4.9	5.3

Source: SACES.

3.1.4 Socio-Economic Characteristics of All Fishers

Details regarding the expenditure[12] of people on the fishing trip is recorded in Table 3.10. Interesting observations include:

- Most fishers spent between $26-50 on their fishing trip (32 per cent), followed by those spending between $16-25 (18 per cent), $6-15 (17 per cent), $0-5 (11 per cent), and $51-75 (10 per cent); and

[12] Note, recurrent expenditure only was asked for in the surveys.

- The average amount spent by fishers per trip was $38.05 with fishers averaging almost 25 recreational fishing trips per year, which gives a total amount spent per year by an average all fish angler of $941.[13]

Table 3.10
Recreational Fishing Expenditure: All Fish

Amount Spent On Fishing Trip	%	Average Fishing Recurrent Expenditure	$
0-5	11.0	Average Amount Spent	38.05
6-15	17.2	Average Fishing Trips per year	24.72
16-25	17.7		
26-50	32.2		
51-75	10.3		
76-100	7.5		
101-150	2.9		
151+	1.1		
NA	0.1	**Total Amount Spent Per Year by an**	
Total	**100.0**	**Average All Fish Angler**	**$941**

Source: SACES.

Table 3.11 reveals certain social and economic characteristics of fishers with some interesting observations being:

- Most fishers (31 per cent) were aged between 41-50 years of age, followed by those in the 31-40 age group (29 per cent), and the age group 21-30 (15 per cent);
- The split between fishers being blue collar or white collar was even with 35 per cent of anglers classified as blue collar workers and 34.5 per cent classified as white collar. Retirees represented 12 per cent of fishers;
- Most fishers earned between $0-20,000 per year (28 per cent), followed by fishers who earned $35-50,000 per year (26 per cent), and $20-35,000 per year (21 per cent);
- Fishers are more likely employed in full time employment (70 per cent) rather than part time (or no) employment (29 per cent);
- All fishers are overwhelmingly male (88 per cent); and
- 24 per cent of fishers belonged to a fishing club.

A breakdown of fishers by recreational fishing expenditure and income group is provided in Table 3.12. Some interesting observations include:

- For fishers on incomes of between $0-20,000, the number of persons represented by this group decreases with each move to a higher expenditure group. For example, 53 per cent of fishers who spent $0-5 on their trip earned between $0-20,000 while only 7.5 per cent made up those fishers who spent over $151;

[13] This figure must be interpreted with care. It can only be thought to be a reasonable estimate if it is thought that the fishers surveyed are generally representative of NZ All fish anglers.

- As expected, the proportion of fishers from the $65,000+ income group increases as fishing expenditure rises. Whereas only 5.5 per cent of fishers who spent between $0-5 dollars earned $65,000+, for fishers spending $151+, this figure rises to 30 per cent; and
- The basic trend to emerge from Table 3.12 is that as we move to a higher fishing expenditure group, a greater proportion of fishers are derived from higher income segments as would be expected.

Table 3.11
Characteristics Of Fishers: All Fish

Age	%	Employment Status	%	Income	%	FT/PT*	%	Sex	%	Club Member	%
15-20	2.6	Blue Collar	35.0	$0-20,000	28.3	FT	70.1	Female	12.3	No	74.9
21-30	14.8	White Collar	34.5	$20-35,000	20.5	PT	29.3	Male	87.7	Yes	23.5
31-40	28.9	Self-employed	5.8	$35-50,000	26.1						
41-50	30.9	Retired	12.3	$50-65,000	13.8						
51-60	12.6	Unemployed	6.9	$65,000	10.1						
61+	9.7	Student	3.1								
		Other	1.9								
			0.5								
Total	**100.0**		**100.0**		**100.0**		**100.0**		**100.0**		**100.0**

Note: Figures do not add due to NA records.
* FT and PT represent Full-time and Part-time respectively.
Source: SACES.

Table 3.12
Fishers (%) By Recreational Fishing Expenditure and Income Group: All Fish

Amount Spent ($)	$0-20k	$20-35k	$35-50k	$50-65k	$65k+	Total
0-5	52.6	18.1	17.3	6.5	5.5	100.0
6-15	43.1	16.5	21.8	9.6	8.9	100.0
16-25	26.8	22.7	29.4	11.3	9.8	100.0
26-50	24.1	23.0	28.5	14.6	9.8	100.0
51-75	16.0	24.2	28.1	21.1	10.7	100.0
76-100	11.0	18.6	31.6	24.0	14.8	100.0
101-150	10.9	14.9	29.7	22.8	21.8	100.0
151+	7.5	15.0	25.0	22.5	30.0	100.0

Source: SACES.

Table 3.13 provides information on number of fishers by island and fishing expenditure. It is interesting to note that:

- in keeping with the fact that the majority of interviews took place on the North Island, fishers overwhelmingly came from the North Island for all expenditure groups;
- the greatest prevalence of fishers from the North Island occurred in the $0-5 (90 per cent), $6-15 (89 per cent) and $16-25 (89 per cent) dollar income groups. People from the South Island made up their largest proportion of fishers in the $151+ expenditure grouping where they comprised 33 per cent of those fishers interviewed; and
- an interesting trend emerging from Table 3.13 is that the proportion of North Island fishers falls with the move to higher expenditure groups whereas the proportion of South Island fishers tended to rise although in both cases the trends were not consistent from one expenditure group to another.[14]

Table 3.13
Fishers (%) By Recreational Fishing Expenditure and Island: All Fish

Amount Spent ($)	North	South	Total
0-5	89.7	10.3	100.0
6-15	88.8	11.2	100.0
16-25	89.2	10.9	100.0
26-50	77.3	22.7	100.0
51-75	70.3	29.8	100.0
76-100	77.9	22.1	100.0
101-150	75.0	25.0	100.0
151+	67.5	32.5	100.0

Source: SACES.

3.2 Recreational Catch of New Zealand

Estimates of recreational fishing harvests for Quota Management System (QMS) and non-QMS species of fish have been derived from the 1996 national marine recreational fishing diary survey. It is unfortunate that more up-to-date figures of recreational catch were not available.

The survey was conducted jointly between the National Institute of Water and Atmospheric Research (NIWA) and John Bell & Associates on behalf of the Ministry of Fisheries. It follows previous regional surveys of the North, South and Central regions conducted at alternative times during the early 1990s.

[14] One must be careful in the interpretation of these figures as the majority of surveys were conducted in the North Island where the majority of recreational fishers are. Also, there was a greater proportion of charter fishers surveyed in the South than those surveyed in the North hence this would have tended to distort the overall figures.

Catch figures from diarists were multiplied by 'scaling factors' to derive 1996 harvest estimates for New Zealand fishers (Bradford 1998). Tonnage estimates for the various species of recreational catch were calculated by taking the harvest estimates and converting them to a weight figure by utilising mean weights (estimated from length measurements recorded from the national boat ramp survey in 1996 conducted in conjunction with the 1996 diary survey).

The following data on recreational harvests for Blue Cod, Kingfish, Snapper, Kahawai and Rock lobster are taken from Bradford (1998a) and are cross checked or supplemented by data from Annala *et al.*(1998) and Hartill *et al.* (1998). The data includes tonnage (greenweight) estimates which are given as a 'point estimate and a range calculated as one standard deviation (rounded) either side of the point estimate' (Bradford 1998a). For each species the recreational harvest is broken down by management area/fish-stock. It is important to note that these management areas differ by species and do not usually equate with Quota Management Areas. Also, a dash ('-') indicates that a reliable estimate was unable to be calculated because a lack of diarists caught that fish within the fish-stock.[15]

3.2.1 Snapper Recreational Catch

Snapper provides the largest harvest for recreational fishers in New Zealand with a total catch of 2.8 million in 1996 whereby SNA 1 accounted for the largest harvest of any recreational fish-stock with a catch of 2.4 million as shown in Table 3.14. In 1996-97, reported landings of Snapper by commercial fishers in SNA 1 was 5,049 tonnes (Annala *et al.* 1998); compared to the point estimate of 2,274 tonnes caught by recreational fishers in 1996. Thus it comes as no surprise that Snapper is probably the most important commercial and recreational fish in New Zealand with the recreational catch composing a significant proportion of the total Snapper catch in SNA 1. An unfortunate consequence of this popularity has been the heavy exploitation of the stock which especially occurred during the 1970s and early 1980s as 'all Snapper stocks were considered overfished by 1983' (MAF 1989).

Table 3.14
Recreational Harvest Estimates Of Snapper By Fishstock

Fishing Zone	No. Snapper Caught	Tonnage (t)		Mean Weight (Kg)
		Point Estimate	Range	
SNA 1	2,392,000	2,274	2165-2385	0.915
SNA 2	31,000	40	25-55	1.282
SNA 3	1,000	-	-	-
SNA 7	74,000	177	150-200	2.398
SNA 8	275,000	240	215-255	0.871
Total	2,773,000	2,731		0.990

Source: Bradford (1998).

[15] There is need for caution in using these estimates as recent research indicates that these recreational catch estimates are likely to underestimate total catch considerably (personal communication, Rick Boyd).

Table 3.15
Previous Recreational Harvest Estimates of Snapper By Fish Stock

Fishstock	Survey	No. Snapper Caught	Tonnage Range (t)
SNA 1	North	3,728,000	2,733
SNA 1	Central	71,000	52
SNA 2	Central	23,000	29
SNA 7	Central	74,000	177
SNA 8	North	284,000	187
SNA 8	Central	77,000	51
Total		4,257,000	

Note: Surveys were carried out in different years in the Ministry of Fisheries regions: North in 1993-94, Central in 1992-93, and South in 1991-92.

While recreational and commercial fishers have blamed each other for over-fishing of the natural resource, it is important to note that commercial harvests may have reached 22,000 tonnes in the mid seventies compared to the national total allowable catch of 6,893 tonnes for the 1996-97 fishing year imposed under the quota management system.

A shown in Table 3.14, recreational harvests within the other fish-stocks were paltry in respect to the catch of SNA 1. SNA 8 came closest with an estimated 240 tonnes caught by recreational fishers. Previous estimates of recreational catch of Snapper are based upon the regional surveys as summarised in Table 3.15 and show a significant decline in the catch of Snapper since the early 1990s, especially in SNA 1. While a number of factors may be responsible for this decline such as weather conditions, undoubtedly the increase in the minimum legal size from 25 to 27cm and the decrease in the daily bag limit from 20 to 9 between the national and regional surveys is partly (but not completely) responsible for the decline.

3.2.2 Kingfish Recreational Catch

Recreational catch numbers of Kingfish are based on the national and regional surveys. Kingfish recreational catch numbers are in fact small in respect to its popularity as a game-fish. From the national survey there was only one significant fish-stock (KIN 1) which contributed 64,000 Kingfish (or 382 tonnes) to the national harvest. By comparison KIN 2, KIN 3 and KIN 8 only contributed approximately 10,000 Kingfish between them.

Unfortunately the data from the regional surveys (shown in Table 3.17) cannot be directly compared since they are only provided by Quota Management Area, but they still can be used to infer general trends. Comparing the national and regional surveys does indicate that recent recreational catches for Kingfish are at least slightly lower. The recreational catch for QMA 1 which corresponds closely to KIN 1 was 87,000 based on the North survey in 1993-94 demonstrating the higher catch in previous years. At the very least both sets of surveys demonstrate that the recreational harvest of Kingfish in New Zealand is concentrated heavily off the north and north-east coast of the North Island.

Table 3.16
Recreational Harvest Estimates of Kingfish By Fishstock

Fishing Zone	No. Kingfish Caught	Tonnage (t)		Mean Weight (Kg)
		Point Estimate	Range	
KIN 1	64,000	382	350-410	*6.065*
KIN 2	5,000		-	-
KIN 3	3,000		-	-
KIN 8	2,000		-	-
Total	74,000			6.065

Source: Bradford (1998).

Table 3.17
Previous Recreational Harvest Estimates of Kingfish By Fish Stock

Quota Management Area	Survey	No. Kingfish Caught	Tonnage Range (t)
QMA 1	North	87,000	390-600
QMA 1	Central	6,000	25-45
QMA 2	North	2,000	5-15
QMA 2	Central	6,000	20-40
QMA 7	Central	2,000	5-15
QMA 8	Central	1,000	0-10
QMA 9	North	12,000	50-80

Note: Surveys were carried out in different years in the Ministry of Fisheries regions: North in 1993-94, Central in 1992-93, and South in 1991-92.

3.2.3 Blue Cod Recreational Catch

Table 3.18 displays estimates for recreational catch of Blue Cod in New Zealand, where the total catch was estimated at 1.1 million in 1996. It should be noted that according to Bradford (1998b), the 22,000 Blue Cod caught in BCO 3N may be an underestimate since 15,000 alone were counted during the boat ramp survey at Montunau ramp.

Table 3.19 lists estimates of recreational catch based on the regional surveys of the early 1990s. A comparison with the data gained from the national diary survey shows that while harvest numbers have declined in BCO 1, BCO 5, and BCO 7 during the time between the regional and national surveys, harvests have increased in BCO 2, BCO 3, and BCO 8. Overall, recreational harvests of Blue Cod seem to have remained steady throughout the 1990s from a national perspective. Finally, it should be remembered that changes in harvest numbers may be related to changes in fishing regulations (for example; the Marlborough Sounds area of BCO 7 where the minimum legal size of Blue Cod was decreased to 28 cm while the daily catch limit was reduced to 6 between surveys) (Bradford, 1998b).

Table 3.18
Recreational Harvest Estimates of Blue Cod By Fish Stock

Fishing Zone	No. Blue Cod Caught	Tonnage (t)		Mean Weight (Kg)
		Point Estimate	Range	
BCO 1	34,000	17	10-20	0.495
BCO 2	145,000	81	70-90	0.560
(BCO 3N)	22,000	15	-	0.696
(BCO 3S)	195,000	159	-	0.815
BCO 3	217,000	174	155-195	0.815
BCO 5	171,000	139	120-155	0.815
BCO 7	356,000	239	220-260	0.671
BCO 8	159,000	79	70-90	0.495
Total	1,082,000	729		0.670

Source: Bradford (1998).

Table 3.19
Previous Recreational Harvest Estimates of Blue Cod By Fish Stock

Fishing Zone	Survey	No. Blue Cod Caught	Tonnage Range (t)
BCO 1	North	33,000	15-30
BCO 1	Central	4,000	0-5
BCO 2	North	1,000	0-5
BCO 2	Central	117,000	55-85
BCO 3	South	206,000	205-285
BCO 5	North	1,000	0-5
BCO 5	South	188,000	150-230
BCO 7	North	2,000	0-5
BCO 7	Central	311,000	145-205
BCO 7	South	62,000	20-40
BCO 8	North	2,000	0-5
BCO 8	Central	124,000	50-110

Note: Surveys were carried out in different years in the Ministry of Fisheries regions: North in 1993-94, Central in 1992-93, and South in 1991-92.

3.2.4 Kahawai Recreational Catch

The National 1996 survey estimated that 1.2 million Kahawai (1,518 tonnes) had been caught by recreational fishers. A comparison of harvest rates in 1996 (Table 3.20) with those estimated from the regional surveys (Table 3.21) suggests a small decline in the harvest of Kahawai for most fish-stocks.

KAH 1 provided the largest recreational harvest of Kahawai for fishers with a catch of 666,000 in 1996 which is unremarkable given that KAH 1 contains the Bay of Plenty, probably the major source for Kahawai. The catch of Kahawai in KAH 1 also proved to be the second largest recreational catch by fish-stock in New Zealand after SNA 1 for Snapper. Although the 226,000 Kahawai caught in KAH 3 was the second largest harvest in 1996, it should be noted that this size is small relative to those catches in KAH 2 and 9 because KAH 3 takes in the Quota Management Areas of 3 through to 8, i.e., almost all waters surrounding the southern island.

Table 3.20
Recreational Harvest Estimates of Kahawai By Fish Stock

Fishing Zone	No. Kahawai Caught	Tonnage (t)		Mean Weight (Kg)
		Point Estimate	Range	
KAH 1	666,000	960	900-1020	1.441
KAH 2	142,000	217	190-240	1.525
KAH 3	226,000	137	125-145	0.605
KAH 9	199,000	204	195-225	1.022
Total	1,233,000	1,518		1.230

Source: Bradford (1998).

Table 3.21
Previous Recreational Harvest Estimates of Kahawai By Fish Stock

Fishing Zone	Survey	No. Kahawai Caught	Tonnage Range (t)
KAH 1	North	706,000	900-1000
KAH 1	Central	19,000	20-35
KAH 9	North	248,000	280-380
KAH 9	Central	6,000	-
KAH 2	Central	190,000	240-340
KAH 3	Central	182,000	85-135
KAH 3	South	41,000	65-110

Note: Surveys were carried out in different years in the Ministry of Fisheries regions: North in 1993-94, Central in 1992-93, and South in 1991-92.

3.2.5 Rock Lobster Recreational Catch

The recreational harvest in 1996 of Rock Lobster's broken down by fish-stock is shown in Table 3.22. The total estimated Rock Lobster recreational catch was 534,000 (or 313 tonnes).

Caution should be shown towards the tonnage and mean weight estimates for Rock Lobster. This is because 'male and female Rock Lobsters tend to be of different sizes and to have different tail width to weight relations' (Bradford (1998a), p. 8). Importantly

Rock Lobsters were not consistently sexed during the 1996 boat ramp survey preventing the accurate measurement of tail length by sex or by providing an indication of sex ratios for Rock Lobster. The mean weights recorded in Table 3.22 have therefore been calculated by finding the weight of Rock Lobsters assuming they were 'all female' and then 'all male' and taking the average (Bradford, 1998a).

Table 3.22
Recreational Harvest Estimates of Rock Lobster By Fish Stock

Fishing Zone	No. Rock Lobster Caught	Tonnage (t)		Mean Weight (Kg)
		Point Estimate	Range	
CRA 1	74,000	51	35-65	0.686
CRA 2	223,000	138	115-155	0.618
CRA 3	27,000	-	-	-
CRA 4	118,000	73	55-90	0.618
CRA 5	41,000	35	25-45	0.858
CRA 7	3,000	-	-	-
CRA 8	22,000	16	10-20	0.700
CRA 9	26,000	-	-	-
Total	534,000	313		0.655

Source: Bradford (1998).

Table 3.23
Previous Recreational Harvest Estimates Of Rock Lobster By Fish Stock

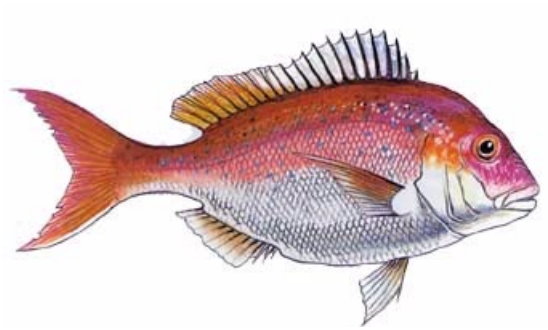
Fishstock	Survey	No. Rock Lobster Caught	Tonnage (t)
CRA 1	North	56,000	38
CRA 1	Central	1,000	-
CRA 2	North	133,000	82
CRA 2	Central	4,000	-
CRA 3	Central	8,000	-
CRA 4	Central	65,000	40
CRA 5	Central	11,000	10
CRA 5	South	65,000	40
CRA 7	South	8,000	7
CRA 8	Central	1,000	-
CRA 8	South	29,000	21
CRA 9	North	6,000	-

Note: Surveys were carried out in different years in the Ministry of Fisheries regions: North in 1993-94, Central in 1992-93, and South in 1991-92.

CRA 2 and CRA 4 were the most important fish-stocks for Rock Lobster in 1996 with increased harvests of 223,000 and 118,000 respectively.

The regional surveys (Table 3.23) show an interesting discrepancy where the catch in CRA 4 was almost half that of CRA 4 in 1996. After heavy fishing by commercial fishers in the decades before the 1990s, the fishery was thought to be in a precarious position and was placed under the Quota Management System in 1990. Total Allowable Commercial Catch was 2,745 tonnes in 1992, compared to an estimated recreational catch of between 200-300 tonnes, which coupled with poachers estimated to be stealing approximately 800 tonnes per year, meant continued pressure on the Rock Lobster biomass (NZ Ministry of Fisheries).

4. Snapper



4.1 Biological Information

Snapper (*Chrysophrys auratus*) is easily New Zealand's most important recreational and commercial fish, as well as being a fish of large cultural importance to Maori in northern New Zealand. A sea bream, Snapper commonly resides in shallow waters (20-50 metres) but are found down to depths of 200m (Ministry of Fisheries Fact sheet). Geographically they are abundant in the warm shallow coastal waters of the North Island and the northern part of the South Island.

4.2 Characteristics of Recreational Snapper Fishers

4.2.1 Fishing Locations

Table 4.1 records the number of interviews (expressed as percentages) for Snapper anglers by alternative location classifications. From those interviewed we find that:

- Most surveys were conducted in Whitianga (15 per cent) and Raglan (15 per cent), followed by Takapuna (14 per cent) and Tauranga (approximately 14 per cent);
- 78 per cent of interviews were conducted in Quota Management Area 1 while 16 per cent were in QMA 9;
- Reflecting the fact that QMA 1 and 9 are both located in the North Island, 98 per cent of surveys took place in the North Island; and
- Metropolitan areas (90 per cent) greatly outweighed non-metropolitan areas (10 per cent) in terms of the number of interviews conducted.

Table 4.1
Number Of Interviews By Various Location Classifications: Snapper

Region	%	QMA	%	Island	%	Area	%
Halfmoon Bay	3.7	1	77.9	North	97.5	Fishing location was	
Parua Bay	10.1	2	3.5	South	2.5	in a metropolitan	
Raglan	14.9	3	0.1			area	90.4
Takapuna/Boat	14.3	4					
Launch		5	0.0			Fishing location was	
Tauranga	13.6	6				in a non-	
Te Kaha	4.7	7	2.4			metropolitan area	9.6
Tutukaka	4.9	8	0.3				
Waitangi	4.7	9	15.8				
Whitianga	15.3						
Other	13.9						
Total	100.0		100.0		100.0		100.0

Note: * Other includes another 41 locations.
Source: SACES.

4.2.2 Characteristics of Recreational Fishing

Indicators of Snapper anglers enjoyment and importance of recreational fishing are provided in Table 4.2:

- Snapper anglers on average regarded their trip as a 'good' experience given an mean score of 4.1; and
- An average of 4.3 for the importance factor implies that Snapper anglers generally regard fishing as an 'important' recreational activity.

Table 4.2
Enjoyment and Importance Of Recreational Fishing: Snapper

	Enjoyment Factor	Importance Factor
Mean Score	4.1	4.3

Source: SACES.

Snapper anglers by the number of trips they undertake per year is illustrated in Table 4.3. Important points to observe include:

- Most Snapper fishers ventured out between 6-15 times per year (32 per cent) followed by fishers undertaking 26-50 and 16-25 trips per year (24 per cent of surveys each); and
- Snapper anglers averaged 26 fishing trips per year.

Table 4.3
Number of Fishers by Trips Per Year and Island: Snapper

Times Per year	Total	%
0-5	173	10.9
6-15	507	32.0
16-25	382	24.1
26-50	387	24.4
51-100	114	7.2
101+	21	1.3
Total	1,585	100.0
Average trips per year	25.9	

Source: SACES.

Table 4.4 illustrates the motivations why Snapper fishers go fishing. Some interesting characteristics include:

- 'Sporting and eating' purposes (54 per cent) was regarded by the majority of Snapper fishers as the primary reason for undertaking their recreational activity, whereas only 7 per cent favoured 'eating' purposes and 5 per cent favoured 'sporting' purposes individually; and
- The other major motivation for fishing was to 'enjoy the outdoors' (25 per cent).

Table 4.4
Motivation For Fishing: Snapper (%)

	Sport Only Purposes	Eating Purposes	Sport & Eat Purposes	Enjoy Outdoors	Catch Large Fish	Family Purposes	Explore Outdoor	Custom Purposes	Other
% indicating reason	5.1	6.8	53.9	25.4	3.2	4.5	0.1	0	1.1

Source: SACES

4.2.3 Characteristics of the Fishing Trip

Data regarding Snapper fishers platform of choice for fishing and boating characteristics is illustrated in Table 4.5. Interesting points to note include:

- 92 per cent of Snapper fishers interviewed were fishing from a boat;
- Of those anglers fishing from a boat, 73 per cent replied that they owned their own boat;
- Echo sounders prove to be popular with 76 per cent of fishers who own a boat confirming that they have an echo sounder; and
- Echo sounders fitted with a Liquid Crystal Display were the most common form (81 per cent) with the only other significant model being those with Colour Video (16 per cent) display.

Table 4.5
Fishing Platform and Boating Characteristics: Snapper

Platform	%	Boat Ownership	%	Echo Sounder	%	Echo Sounder Type	%
Boat	92.2	No	27.3	No	23.9	Colour Video	15.9
Jetty	1.2	Yes	72.6	Yes	76.1	Liquid Crystal Display	81.1
Land	2.9	NA	0.1	Total	100.0	Paper Display	1.5
Diving	1.5	Total	100.0			Other	1.6
Pots	2.2					Total	100.0
Total	100.0						

Source: SACES.

Table 4.6 provides information relating to the average number of fish caught and kept by species for Snapper fishers. Interesting points to observe include:

- Snapper anglers on average caught just over 10 Snapper per fisher and kept approximately 3 on average;
- Caught and kept averages for other species of fish were quite low in comparison to average Snapper caught and kept. Of the 4 other main species studied, Kahawai was the most common caught by Snapper anglers with 1 caught and 0.5 kept on average; and
- For all species of fish, Snapper anglers on average caught 15 fish and kept 5.

Table 4.6
Fish Kept and Caught: Snapper

	Average Fish Caught Per Respondent for Targeted Species*	Average Fish Kept Per Respondent for Targeted Species
Blue Cod	0.2	0.1
Kingfish	0.3	0.1
Snapper	10.4	3.1
Rock lobster	0.4	0.2
Kahawai	1.1	0.5
Other	2.7	1.0
Total	15.1	5.0

Note: * Fish caught consist of all fish caught by the party with whom the person was fishing with, and includes fish thrown back and given away.
Source: SACES.

Unsuccessful Snapper fishers, defined as those who kept no Snapper, are recorded in Table 4.7. We find that:

- Of the 1,585 fishers targeting Snapper, 452 or 28.5 per cent kept no Snapper.

Table 4.7
Unsuccessful Fishers: Snapper

Targeted Fish	People Who Kept Nothing	
	Number	%
Snapper	452	28.5

Source: SACES.

More detailed data which summarises Snapper fishers difficulty in catching their targeted species is illustrated in Table 4.8. Responses to the survey indicate the following:

- A little under half of those interviewed (46 per cent) reported that they experienced difficulties in catching Snapper; and
- Snapper anglers believed that natural factors (44 per cent) were the primary reasons for their difficulties experienced while human factors (31 per cent) was also a significant factor according to anglers interviewed.

Table 4.8
Difficulties With Targeted Fish and Reasons: Snapper

Fishers Experiencing Difficulties	(%)	Reason	%
Yes had Difficulties	46.4	Personal	18.8
Had No Difficulties	53.6	Natural	44.4
Total	0.0	Human	30.5
	100.0	Other	6.3
		Total	**100.0**

Source: SACES.

Table 4.9 lists two measures of time spent fishing by Snapper anglers with the results of the survey indicating:

- The average time spent fishing on the day of the interview for Snapper anglers was 5.1 hours; and
- The average time Snapper fishers usually spend fishing was 5.4 hours per fisher.

Table 4.9
Average and Total Time Spent Fishing: Snapper

Fish Species	Average Total Time Per Fisher for Trip	Average Time Per Fisher
Snapper	5.1	5.4

Source: SACES.

4.2.4 Socio-Economic Characteristics Of Snapper Anglers

A breakdown of Snapper anglers by expenditure on fishing trip is depicted in Table 4.10 and it should be noted that:

- Most Snapper fishers (32 per cent) spent between $26-50 on their fishing trip while a further 21 per cent spent between $16-25, followed by the $6-15 (17.5 per cent) and $51-75 (11 per cent) brackets; and
- The total amount spent per year by an average Snapper angler was $927. This follows from the fact that the average amount spent per Snapper angler was $35.8 and that they went fishing almost 26 trips per year.

Table 4.10
Recreational Fishing Expenditure: Snapper

Amount Spent On Fishing Trip	%	Average Fishing Recurrent Expenditure	
0-5	9.4	Average Amount Spent	35.8
6-15	17.5	Average Fishing Trips per year	25.9
16-25	21.0		
26-50	31.8		
51-75	11.0		
76-100	6.8		
101-150	2.1		
151+	0.4		
Total	**100.0**	**Total Amount Spent Per Year by an Average Snapper Angler**	**$927**

Source: SACES.

Personal characteristics regarding Snapper fishers such as the nature of their employment was asked in the survey conducted. Table 4.11 summarises this information and provides the following findings:

- Most fishers were aged between 31-40 (30 per cent) and 41-50 (30 per cent) years of age, followed by the 51-60 age group (14 per cent);
- Slightly more fishers could be classified as working in white collar employment (36 per cent) than in blue collar employment (35 per cent). Retirees represented 13 per cent of Snapper anglers;
- Most Snapper anglers earn $35-50,000 (29 per cent), followed by fishers in the $0-20,000 bracket (24 per cent), $20-35,000 (18 per cent), $50-65,00 (15 per cent) and $65,000+ (13 per cent) divisions;
- The majority of Snapper anglers had full time employment (74 per cent);
- 90 per cent of Snapper fishers surveyed were male; and
- Just over a quarter of fishers who were targeting Snapper (27 per cent) were members of a fishing club.

Table 4.11
Socio-Economic Characteristics of Fishers: Snapper

Age	%	Employment	%	Income ($)	%	FT/PT*	%	Sex	%	Club	%
15-20	1.9	Blue Collar	34.9	0-20,000	24.4	FT	73.8	Female	9.9	No	72.2
21-30	12.8	White Collar	36.4	20-35,000	18.2	PT	25.9	Male	90.0	Yes	26.8
31-40	30.3	Self-employed	5.9	35-50,000	28.6						
41-50	30.4	Retired	13.4	50-65,000	15.3						
51-60	14.0	Unemployed	5.4	65,000+	12.5						
61+	10.2	Student	1.8								
		Other	2.0								
		NA	0.3								
Total	100.0		100.0		100.0		100.0		100.0		100.0

Note: * FT and PT represent Full-time and Part-time respectively.
Source: SACES.

Logic would suggest that fishers with lower incomes would spend less per trip than fishers on higher incomes. Table 4.12 attempts to identify such patterns by showing fishers by their income group and amount spent per trip. For Snapper fishers we discover the following:

- Snapper fishers in the lowest income division ($0-20,000) increasingly form a greater proportion of fishers as one moves towards lower expenditure brackets. For example, Snapper fishers earning between $0-20,000 a year form the greatest proportion of fishers in the lowest expenditure bracket (44 per cent) while their lowest contribution comes in the highest expenditure bracket ($151+) where they are not even represented;
- Snapper fishers earning $65,000 or more (i.e., the highest income division) exhibited higher participation rates in higher expenditure groups. These fishers formed only 9 per cent of fishers spending between $0-5 per trip but comprised a quarter of all fishers spending between $100-150 per trip. Thus the trend identified is that Snapper fishers on wages of $65,000+ increasingly make up a larger percentage of fishers the higher the expenditure group except for the

$151+ division where they represent a reduced 17 per cent of fishers in that expenditure bracket in comparison to the previous bracket; and

- The lowest representation for any group was for fishers earning $0-20,000 and spending $151+ (0 per cent) while the greatest share of any income group was for those fishers earning $50-65,000 who constituted exactly half of fishers spending $151+ on their fishing trip.

Table 4.12
Fishers (%) By Recreational Fishing Expenditure and Income Group: Snapper

Amount Spent $	$0-20,000	$20-35,000	$35-50,000	$50-65,000	$65,000+	Total
0-5	44.3	22.1	18.1	6.7	8.7	100.0
6-15	36.2	15.2	27.5	10.5	10.5	100.0
16-25	26.0	22.3	29.4	10.1	12.2	100.0
26-50	19.0	18.6	31.9	17.6	13.0	100.0
51-75	14.5	16.9	29.7	25.6	13.4	100.0
76-100	12.3	13.2	32.1	24.5	17.9	100.0
100-150	9.4	12.5	25.0	28.1	25.0	100.0
151+	0.0	16.7	16.7	50.0	16.7	100.0

Source: SACES.

4.3 Snapper Recreational Economic Value Results

Based on the motivations of Snapper fishers, the database utilised consisted of the people who indicated they were targeting Snapper, and the people who indicated they kept Snapper.[16]

All the information collected in the survey was initially included in a general regression model to determine the WTP for Snapper in New Zealand. The coefficients and standard errors reported in Table 4.1 are calculated from a Probit regression using the well known method of Cameron and James (1986). The coefficients (summarised in column 3 of the table) provide a measure of the contribution of each variable to WTP, holding all other variables at given levels.

The variables listed in Table 4.13 were arrived at through sequential statistical tests in which statistically insignificant variables were omitted. This procedure of "testing down", which was pioneered by Hendry (1980), is widely employed in econometric research. There were a considerable amount of variables that were considered in the initial regression. As some of the initial regression results provide interesting information, they have been commented upon in Appendix Seven.

However, for the purposes of estimating a marginal willingness to pay (MWTP) per fish, the table below presents the variables that are the most significant in influencing WTP for a given Snapper fishing trip. Descriptions of variables are given in Appendix Five. Another model is also presented in Appendix Six, which illustrates two different values for Snapper. However, for policy purposes Table 4.13 is the most preferred model.

16 Based on previous work done by the Centre, when it came to choosing databases there were two choices of databases for each fishery. These choices were:

1. the records of fishers who were targeting a particular fish plus those who kept that fish from their trip; and
2. the records of fishers who were targeting a particular fish plus those who caught the fish on their trip.

The Centre used the following rule of thumb — if the fishery in question was primarily fished for eating reasons, the kept database was used. If people had a wide range of motivations when it came to fishing for a particular fish (mainly sporting reasons but also other recreational motives) then the caught database was used. The reason for this difference is that fishers can derive value from different fishing trips targeting different fish. The Centre did a variety of tests on types of databases and compared the fit of each regression from various databases and concluded that the rule of thumb applied provided the best results.

For example, fishing for Kingfish is considered to be primarily a sport, and if anyone catches a Kingfish on the trip it considerably adds to the enjoyment of the day — hence increasing willingness to pay for the fishing trip (even if that individual did not catch a Kingfish for him/herself). In this case it is extremely important to include the records and values of the people who indicated that there was Kingfish caught on their fishing trip.

Table 4.13
The Preferred Model For Snapper

Variable		Coefficient	Asymptotic t-Statistic
Kept Snapper	b2	5.73	3.044*
Catch other than Snapper	b3	1.09	1.299****
Date April	b4	-40.91	1.889***
Member of a Club	b5	68.98	4.103*
Owning their own boat with an echo sounder	b6	28.53	2.313**
Enjoyment	b7	13.14	1.864***
Fishing-time	b8	8.42	2.482*
Fishing with people other than household	b9	43.96	3.299*
Average time usually spent fishing	b10	6.28	1.701***
Importance	b11	21.53	2.467*
Log Income	b12	89.46	4.057*
Working Full-time	b13	54.35	2.695*
Motivation Enjoy	b14	34.59	2.385*
Motivation Eat	b15	-48.58	-2.141**
Year Times	b16	-0.42	-1.679***
Targeting Kingfish	b17	38.39	2.400*
Targeting Blue Cod	b18	127.48	3.282*
Targeting Rock Lobster	b19	-133.42	-3.331*

Notes: * T-statistic significant at 99 per cent level.
** T-statistic significant at 97.5 per cent level.
*** T-statistic significant at 95 per cent level.
**** T-statistic significant at 90 per cent level.
Log-likelihood Ratio Statistic: 394.4.[17]
Source: SACES.

Consider the first explanatory variable, which is the MWTP of a Snapper kept. This is defined as the number of Snapper from the catch which the respondent keeps (takes home).[18] The coefficient of 5.73 indicates that an additional Snapper adds $5.73 to the

[17] This test implies that we can reject the null hypothesis that the independent variables have no effect on our dependent variable (if they said yes or no to the WTP amount).

[18] Once again, a choice has to be made about what is the correct variable to use — the number of fish kept or the total amount of fish caught on the boat from the trip. The Centre used the same rule of thumb — if the fishery in question was primarily fished for eating reasons, the kept variable was used. If people had a wide range of motivations when it came to fishing for a particular fish (mainly sporting reasons but also other recreational motives) then the caught variable was used. Econometrics was conducted on all possible combinations for each fishery, and it was found that the above approach did provide the best fitting and significant regressions.
Another finding by the Centre was that if motivations of the fishers were not taken into consideration in the final choice of which variable to use — the end result for the value of a fish may be significantly underestimated.
It is important to note that there are a number of differing influences on the Catch Snapper variable. People may be watching other people catch the fish on the boat (and this could imply a positive influence or negative influence if it means further frustration for the individual involved), or throwing back under-size fish (which is probably a negative influence on WTP for a fishing trip) or catching and releasing fish for other reasons (which is probably a positive influence on WTP). Therefore - it is hard to decide if the positive

WTP for a fishing trip. That is, the marginal value of a Snapper, excluding the impact of all other variables in the model, is $5.73.[19]

The second term is the number of other fish that was caught on the day's fishing trip by the party. The marginal value of other fish is 1.09.[20]

Table 4.13 indicates that the following variables have a significant, positive effect on WTP for a Snapper fishing trip: being a member of a fishing club; working full-time; owning a boat and it has an echo sounder; an increase in the enjoyment associated with the fishing trip that day; an increase in the amount of time spent fishing that day[21]; an increase in the average amount of time usually spent on fishing trips; fishing with people apart from members of the household[22]; an increase in the importance of fishing as a recreational activity; an increase in a fisher's income; targeting either Kingfish or Blue Cod on the fishing trip that day; and if the main motivation for fishing was indicated to be to enjoy the outdoors then this also had a positive effect on WTP for a Snapper fishing trip.

Table 4.3 indicates that the following variables have a significant, negative effect on WTP for a Snapper fishing trip: an increase in the amount of times spent fishing in a year[23]; fishing during the month of April[24]; targeting Rock Lobster on that trip that day; and if the main motivation for fishing was indicated to be to catch fish for eating purposes then this also had a negative effect on WTP for a Snapper fishing trip.[25]

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or negative influences on WTP of the Catch Snapper variable are positive or negative overall. The Centre consequently studied each fishery and chose the regression that had the highest marginal WTP figure for the catch and kept fisheries variables.

For example, in the Snapper regression above, if the variable Catch Snapper was used instead of Kept Snapper, the marginal value of a Snapper was $2.54, significantly lower than our estimate of $5.73. This result illustrates that NZ fishers gain more value from taking Snapper home (to eat or give away) than they do from simply catching it alone. Overall — it can be assumed that the negative influences on catching Snapper other than those kept (namely under-size fish) dominated the positive aspects of catching Snapper that was not kept.

19 Based on a 95 per cent confidence interval, we can be sure that our mean marginal WTP per Snapper lies between $5.66 and $5.80.

20 It is hard to conclude much about the value of all other species caught on the fishing trip simply because the surveys were conducted in a large number of places. Hence, people were fishing for a wide range of other fish along with Snapper, and the sum of all other species and their effect on willingness to pay can be counteractive. However, it is possible to conclude that within our Snapper database, on the whole catching Snapper was valued considerably higher than catching other species.

21 Note, the longer the time spent fishing on a trip the more likely it is that the fisher spent more on their trip, as well as having a greater WTP for the fishing trip.

22 This variable indicates that the more a fishing trip is a social occasion (whether it be on charter boats or with friends and family) the higher the WTP is for the fishing trip. Similarly, when the main motivation is to enjoy the outdoors this suggests fishing was more of a social occasion, and also increases WTP for the trip.

23 This suggests that the more people fish in a year, the lower their WTP for a fishing trip is. It also shows that people who only go fishing on holidays (a large proportion of the surveys were conducted during the summer holiday period) are much more likely to have a higher WTP for the fishing trip.

24 As compared to surveys conducted in December, January and February, fishers who were fishing in the months of April and March had a lesser WTP. These results indicate that WTP for a Snapper trip is higher in summer months.

25 This result indicates that, of the people who indicated that their main motivation for fishing for Snapper was to catch them for eating purposes, fishing for Snapper is a substitute for buying Snapper. As the cost associated with fishing increases, then the willingness to pay for a fishing trip falls and people would be more likely to go buy fish from a shop. The value of the fish to people whose main motivation was to catch fish to eat is lower because there is the alternative of purchasing the same fish, or a close substitute, in the market at a modest price.

The signs and sizes of these coefficients all appear to be reasonable. Table 4.14 describes the prediction success of the Probit model prior to the implementation of the Cameron-James procedure. To interpret this Table note that a 0 response indicates that a fisher is not willing to pay the offer amount (what they spent plus an additional bid amount), and a 1 indicates that they are willing to pay the offer amount. The Table summarises the number of "yes" and "no" responses that have been predicted by the model. Clearly, the greater the number of correct predictions, the better the model. The figures suggest that this model correctly predicted 555 out of 967 (57 per cent) "no" responses and 633 out of 1044 (61 per cent) "yes" responses correctly.

Table 4.14
Prediction Success Of The Snapper Model

		Actual	
		0	**1**
Predicted	**0**	555	411
	1	412	633
	Total	967	1,044

Source: SACES.

For policy purpose the average values of these variables in the Snapper database used may well be of some interest and these are presented in Table 4.15.

Table 4.15 indicates that average WTP for a fishing trip is \$101.80 and that each fisher kept on average 3.3 Snapper.[26] This suggests that the average value of Snapper is: (101.80/3.3) = \$30.85.[27] If we assume that the average weight of a Snapper is 0.99 Kg[28]; this implies an average WTP of 30.85/0.99 = \$31.16 per Kg of fish caught. From Table 4.13 we know that the marginal WTP for Snapper is \$5.73. Thus, the marginal WTP in terms of weight is given by: 5.73/0.99 = \$5.79 per Kg.

Table 4.15
Average Values of Some Key Variables

Variable	**Mean**	**Dispersion**
Number of Snapper caught	10.3	min = 0, max = 110, sd = 10.5, skew = 2.1
Number of Snapper kept	3.3	min = 0, max = 25, sd = 3.3, skew = 1.6
Number of other fish caught	5.2	min = 0, max = 120, sd = 7.2, skew = 4.3
Number of other fish kept	2.4	min = 0, max = 50, sd = 4.2, skew = 3.7
Willingness to pay	101.8	min = 20, max = 830, sd = 52.6, skew = 3.0

Where: min = minimum; max = maximum; sd = standard deviation; skew = skewness.

[26] It is important to note that mean WTP and mean fish were calculated as averages from the Snapper database used. Mean WTP estimates do not represent amounts people indicated they were willing to pay per fish caught or kept.

[27] That is WTP /(number of Snapper kept) = (101.80/3.3) = \$30.85.

[28] As estimated from Bradford (1998).

A large difference between the average and the marginal WTP has also been reported in other studies of the recreational value of other species of fish (such as King George Whiting, Australian Salmon and Snapper) in South Australia.[29]

The WTP for Snapper may be viewed as an indicator of the utility or satisfaction that recreational fishers obtain from catching and keeping Snapper. Thus, the high average WTP for Snapper suggests that on average fishers obtain substantially greater utility from fishing than they do from simply purchasing Snapper from a shop. Similarly, diminishing marginal utility implies that as the number of fish caught increases, the satisfaction obtained from catching each additional fish declines.

A low marginal value for Snapper may well arise from "strategic bias". Stated simply this implies that respondents consistently provide misleading answers. In the present context respondents may have an incentive to register "protest votes" if they believe that this study is a precursor to a tax, license fee or charge on fishing. A significant number of respondents did in fact forcefully express such a view, and on some occasions declined to be interviewed.[30]

However, strategic bias does not explain why the average WTP is found to be consistently and significantly higher than the marginal WTP in all recreational fishing studies undertaken thus far in Australia (and New Zealand). Strategic bias merely implies that both the average and the marginal WTP will be higher (or lower) than the true WTP. The reason for the difference between the marginal and average WTP appears to lie in a fundamental and widely encountered phenomenon in economics termed the "principle of diminishing marginal utility". This principle asserts that as more of a good is consumed the satisfaction (utility) obtained from consumption of each additional unit of the good declines.

A significant number of fishers in the Snapper database (i.e., approximately 22 per cent) caught no Snapper. Twelve per cent of Snapper fishers kept over 38 per cent of the total Snapper catch. Overall, the distribution of catch is skewed somewhat.

Since a small number of fishers catch a large number of fish, the principle of diminishing marginal utility suggests that the value which they place on the last fish caught is considerably lower than the value that would be placed if the same fish were caught by another fisher with a **lower** overall catch.

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29 See SACES (1997) and (1998), Collins (1991), and Staniford and Siggins (1992).

30 The Centre attempted to analyse whether this was the case by including in some surveys a question as to whether the respondent thought a fishing tax was going to be implemented by the government in the next year or so. Although a large number of surveys had the additional question attached to it, one of the main problems was that a number of surveyors did not ask the additional question. Hence, the resulting records were not good enough to perform separate econometrics upon, although they do provide some interesting additional information. Other feedback from the surveyors indicated that some anglers were quite hostile when asked the question because they felt they had been misguided when answering the WTP question, and in reality it was a government tax question. Accordingly, they refused to answer the question.

Approximately 260 people were recorded as having answered the extra question, and of these 80 per cent said that they didn't think the government was going to implement a tax. However, this in no way implies that there was no strategic behaviour by the respondents. Further analysis would be needed before any conclusions can be drawn.

Furthermore in Appendix Eight a formal argument is provided which demonstrates with greater accuracy the conditions under which a more equally distributed catch narrows the gap between the average and the marginal WTP. This therefore suggests that the unequal distribution of the Snapper catch is potentially responsible for the large discrepancy between the average and marginal WTP. This argument is also applicable to the Kingfish, Blue Cod, Kahawai and Rock Lobster catch.

4.4 Total Recreational Value of Snapper in New Zealand

To estimate the total recreational value of Snapper fishing in New Zealand, calculations of the marginal value of a Snapper are applied to estimates of the total Snapper catch in the region. For explanation of this theory — see Section 2.2.

Hence, the recreational value of Snapper in New Zealand is calculated in the following ways:

Marginal WTP per kg of Snapper x Catch of Snapper = Recreational Value of NZ Snapper
$5.79 per kg x 2,731,000 kg (see Section 3.2.1) = $15,806,697

Average WTP per kg of Snapper x Catch of Snapper = Recreational Value of NZ Snapper
$31.16 per kg x 2,731,000 kg = $85,098,194

Hence, the total recreational value of Snapper fishing in New Zealand using a marginal WTP is estimated to be $15.8m[31], and $85.1m using an average WTP.

4.5 Conclusion

This section has outlined the Centre's analysis on Snapper recreational fishing in New Zealand. The main points can be summarised as follows:

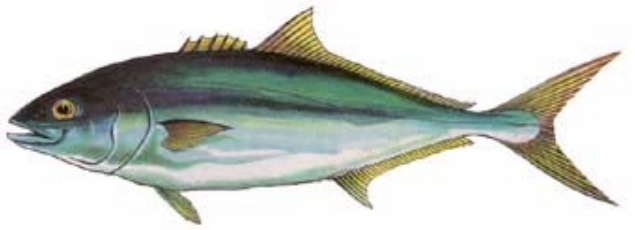
- As compared to "All fishers" — Snapper anglers go fishing marginally more times per year; are more likely to fish for Sport and Eating purposes; fish from a boat platform more often; are more likely to own their own boat; are more likely to catch and keep additional fish; spend a longer time fishing; have a lower average fishing trip expenditure; have a higher income; and are more likely to work in white collar employment.
- For the current situation of Snapper fishing in 1999, the marginal WTP for an additional Snapper, excluding the impact of all other variables, was $5.73. This was lower than the average WTP for a Snapper at $30.85. The marginal WTP for a Snapper implies that catching and keeping an additional Snapper adds $5.73 to the WTP for a given fishing trip (*ceteris parabis*);
- Variables such as being a member of a fishing club; working full-time; owning a boat (and it having an echo sounder); an increase in the enjoyment associated with the fishing trip that day; an increase in the amount of time spent fishing that day; an increase in the average amount of time usually spent on fishing

[31] Based on the 95 per cent confidence interval for the marginal WTP estimate (with a lower and upper limits of 5.90 and 6.04 per Snapper respectively) the recreational value of NZ Snapper per kg ranges from a lower limit of $15,616,046 to an upper limit of $15,997,348.

trips; fishing with people apart from members of the household; an increase in the importance of fishing as a recreational activity; an increase in a fisher's income; targeting either Kingfish or Blue Cod on the fishing trip that day; and if the main motivation for fishing was indicated to be to enjoy the outdoors, all have a positive effect on WTP;

- The correct form of Snapper to use is the amount of Snapper kept, not the amount of Snapper caught, however if future data collections allow, there should be two values used: that of Snapper kept and that of Snapper Given Away (see Appendix Six for discussion); and
- The total recreational value that the New Zealand recreational value for Snapper was estimated to be $15.8 (using a MWTP value) and $85.1 million (using a AWTP value) dollars.

5. Kingfish



5.1 Biological Information

Belonging to the *Carangidae* family of fish, the Kingfish (*Seriola lalandi lalandi*) is a much sought-after sporting fish which is found among the temperate coastal waters or certain countries of the Pacific rim. According to McGregor (1995), the species and related species can be found in Australia, India, South Africa, Japan and off the west coast of America. It is in New Zealand however where Kingfish are often found at their largest (New Zealand anglers have claimed many world records for Kingfish catches). Within the confines of New Zealand, Kingfish prefer the Northern waters of the North Island and northern part of the South Island.

5.2 Characteristics of Recreational Kingfish Fishers

5.2.1 Fishing Locations for Kingfish Surveys

The number of interviews (expressed as percentages) recorded for respondents who targeted Kingfish by various location classifications is displayed in Table 5.1. Interesting points to follow from this table include:

- Most of the surveys were conducted at Whitianga (35 per cent), followed by Tauranga (8 per cent), Tutukaka (8 per cent) and Parua Bay (7 per cent);
- An overwhelming proportion of surveys for Quota Management Areas were conducted in QMA 1 (87 per cent) with only QMA 2 (12 per cent) proving to be any other significant source;
- Surveys were conducted almost exclusively in the North Island (99.8 per cent); and
- Metropolitan areas were significantly favoured in interviews of Kingfish fishers — contributing almost 94 per cent of those surveyed.

Table 5.1
Number Of Interviews By Various Location Classifications: Kingfish

Region	%	QMA	%	Island	%	Area	%
Parua Bay	7.3	1	86.9	North	99.8	Fishing location was	
Sandspit	5.3	2	11.8	South	0.2	in a metropolitan	
Takapuna/Boat	6.2	3	0.2			area	93.6
Launch		4					
Tauranga	8.4	5	0.0			Fishing location was	
Tutukaka	7.8	6				in a non-	
Whitianga	35.1	7	0.0			metropolitan area	6.4
Other*	29.8	8	0.2				
		9	0.9				
Total	**100.0**		**100.0**		**100.0**		**100.0**

Note: * Other includes approximately 44 locations.
Source: SACES.

5.2.2 Characteristics of Recreational Fishing

Table 5.2 illustrates the enjoyment and importance of recreational fishing to Kingfish anglers. The results imply the following:

- given an average enjoyment factor of 4.1, Kingfish anglers on average regarded their trip as a 'good' experience; and
- fishing is certainly regarded as an 'important' recreational activity with an average of 4.4 for all Kingfish anglers.

Table 5.2
Enjoyment and Importance Of Recreational Fishing: Kingfish

	Enjoyment Factor	Importance Factor
Mean Score	4.1	4.4

Source: SACES.

The number of Kingfish anglers recorded by trips per year, is illustrated in Table 5.3. Important observations include:

- Most Kingfish anglers undertook between 6-15 fishing trips year (32 per cent) followed by 26-50 (24 per cent) and 16-25 (23 per cent) times per year; and
- Kingfish anglers went fishing almost 26 fishing trips per year.

Table 5.3
Number Of Fishers By Trips Per Year and Island: Kingfish

Times Per Year	Total	%
0-5	62	13.8
6-15	145	32.2
16-25	102	22.7
26-50	107	23.8
51-100	26	5.8
100+	8	1.8
Total	450	100.0
Average trips per year	25.8	

Source: SACES.

Motivations regarding why Kingfish anglers go fishing are detailed in Table 5.4. The results suggest the following:

- Kingfish anglers main motivation for fishing was for 'sporting and eating' purposes (66 per cent). Fishing due to 'enjoyment of the outdoors' was the second main motivation for going fishing (15 per cent) and was followed by 'sporting' purposes solely (10 per cent).

Table 5.4
Motivations for Fishing: Kingfish (%)

	Sport	Eat	Sport & Eat	Enjoy Outdoors	Large Fish	Family	Explore Outdoors	Custom Reasons	Other
% indicating reason	10	3.5	65.9	15	0.7	2.4	0.2	0	2.2

Source: SACES.

5.2.3 Characteristics of the Fishing Trip

Table 5.5 illustrates the fishing platform and boating characteristics of Kingfish anglers. The interesting points to note include:

- A boat was by far the most common fishing platform of choice for fishers targeting Kingfish (82 per cent);
- Almost two-thirds of anglers owned their own boat (64 per cent); and
- Of those who replied that they owned a boat, 87 per cent reported that their boat was fitted with an echo sounder. Liquid Crystal Display echo sounders were used most prevalently (80.5 per cent), followed by Colour Video (18 per cent).

Table 5.5
Fishing Platform and Boating Characteristics: Kingfish

Platform	%	Boat Ownership	%	Echo Sounder	%	Echo Sounder Type	%
Boat	82.2	No	35.8	No	13.1	Colour Video	17.9
Jetty	4.0	Yes	64.2	Yes	86.9	Liquid Crystal Display	80.5
Land	4.5	NA	0.0	Total	100.0	Paper Display	1.2
Diving	4.5	Total	100.0			Other	0.4
Pots	4.9					Total	100.0
Total	100.0						

Source: SACES.

Average fish caught and kept by fishers targeting Kingfish is recorded in Table 5.6. Some of the interesting results include:

- Kingfish fishers caught an average of almost 1 Kingfish per fisher and kept an average of 0.4 Kingfish;
- Fishers targeting Kingfish were much more successful at catching Snapper (8.5 Snapper per fisher) and keeping Snapper (2.7 per fisher) than their primary targeted fish; and
- Kingfish fishers on average caught 14.9 fish and kept approximately 5.6.

Table 5.6
Fish Kept and Caught: Kingfish

	Average Fish Caught Per Respondent for Targeted Species	Average Fish Kept Per Respondent for Targeted Species
Kingfish	0.9	0.4
Blue Cod	0.3	0.1
Snapper	8.5	2.7
Rock Lobster	0.7	0.3
Kahawai	1.5	0.9
Other	2.9	1.2
Total	14.9	5.6

Source: SACES.

Table 5.7 reveals to a degree the difficulty Kingfish anglers had in catching Kingfish by reporting the number who kept none. One significant point to observe from Table 5.7 is that:

- While 450 anglers had targeted Kingfish, a majority went home with no Kingfish. This high proportion (72 per cent) of anglers keeping nothing demonstrates that Kingfish was a difficult fish to catch, or at least at a size legal to take home.

Table 5.7
Unsuccessful Fishers: Kingfish

Fish Species	People Who Kept Nothing	
	Number	%
Kingfish	322	71.6

Source: SACES.

Results regarding anglers difficulties and the nature of these difficulties in catching Kingfish is presented in Table 5.8. Interesting observations follow:

- Two thirds of respondents (67 per cent) had difficulties in catching Kingfish. This is not surprising given 72 per cent of Kingfish anglers kept no Kingfish, one could argue that a greater proportion of fishers should have had difficulties in catching Kingfish if this was the case. However, some fishers may have caught Kingfish but thrown back all their catch and thus believed to have no difficulties in catching Kingfish; and
- Natural reasons (42 per cent) accounted for the greater share of fishers difficulties in catching Kingfish. This was followed by Human (27 per cent) and Personal (23 per cent) factors.

Table 5.8
Difficulties With Targeted Fish and Reasons: Kingfish

Fishers Experiencing Difficulties	%	Reason	%
Yes had difficulties	66.7	Personal	23.3
Had no difficulties	33.3	Natural	42.0
Total	100.0	Human	27.0
		Other	7.7
		Total	100.0

Source: SACES.

Table 5.9 lists details regarding average time spent on the fishing trip per fisher on the day interviewed and average time normally spent fishing per fisher. Responses from Kingfish anglers indicate that:

- The average time usually spent fishing by fishers on the day interviewed was 5.4 hours, and the average time normally spent fishing by Kingfish anglers was 6 hours.

Table 5.9
Average and Total Time Spent Fishing: Kingfish

Fish Species	Average Total Time Per Fisher for Trip	Average Time Per Fisher
Kingfish	5.4	6.0

Source: SACES.

5.2.4 Socio-Economic Characteristics of Kingfish Fishers

Characteristics regarding Kingfish Anglers expenditure patterns is illustrated in Table 5.10 with inspection showing:

- Most Kingfish anglers spent between $26-50 on their fishing trip (30 per cent), followed by the $51-75 (17 per cent) and $16-25 (17 per cent); and
- $49.68 was the average amount spent per trip by those fishers targeting Kingfish. With these fishers averaging almost 26 trips per year, this implies a total amount spent per year by an average Kingfish angler of $1,281.

Table 5.10
Recreational Fishing Expenditure: Kingfish

Amount Spent on Fishing Trip	%	Average Fishing Recurrent Expenditure	
0-5	6.9	Average Amount Spent	49.7
6-15	11.3	Average Fishing Trips per year	25.8
16-25	16.7		
26-50	30.4		
51-75	17.3		
76-100	11.3		
101-150	4.7		
151+	1.3		
Total	**100.0**	**Total Amount Spent Per Year by an Average Kingfish Angler**	**$1,281**

Source: SACES.

Table 5.11 provides detailed indicators of Kingfish anglers more personal traits such as employment. Important characteristics revealed include:

- Almost two-thirds of Kingfish anglers interviewed were between the ages of 31 and 50 years of age with 33 per cent falling in the 41-50 age group and 31 per cent being aged between 31-40 years of age;
- The split between Kingfish anglers in either blue or white collar employment was very similar (approximately 35 per cent each). Retirees represented 11 per cent of Kingfish anglers;
- The income group with the greatest number of fishers was the $35-50,000 (29 per cent), followed by the $0-20,000 income group (23 per cent) and fishers in the $20-35,000 bracket (19 per cent);
- Three quarters of anglers possessed full time employment (75 per cent);
- Ninety per cent of fishers interviewed were male; and
- 41 per cent of fishers targeting Kingfish were a member of a club.

Proportions of fishers by recreational fishing expenditure and income group is illustrated in Table 5.12. Interesting aspects include:

- The highest concentration of fishers from a single income group in an expenditure division was for fishers on $50-65,000 a year who comprised exactly half of fishers spending $151 or more on their fishing trip. This was closely followed by fishers earning $0-20,000 in the lowest expenditure division (0 to $5) (48 per cent);
- The lowest concentrations occurred for the lowest earners in the highest expenditure groupings where no Kingfish fishers from the $0-20,000 and $20-35,000 group spent more than $151; and

- The expectation that lower income groups spend more heavily in the lower expenditure divisions and that the higher income fishers are more concentrated in higher expenditure divisions is very much evident from Table 5.12. For instance, the largest representations for the $50-65,000 and $65,000+ income brackets occur in the highest expenditure division of $151+ representing 50 per cent and 33 per cent of those fishers in that income group respectively. Also, the highest proportions for the lowest income groups of $0-20,000 (48 per cent) and $20-35,000 (26 per cent), occur in the lowest expenditure group of $0-5.

Table 5.11
Socio-Economic Characteristics of Fishers: Kingfish

Age	%	Employment Status	%	Income	%	FT/PT*	%	Sex	%	Club Member	%
15-20	3.3	Blue Collar	35.3	$0-$20k	23.1	FT	74.9	Female	10.0	No	55.3
21-30	13.3	White Collar	34.9	$20-$35k	18.7	PT	24.9	Male	90.0	Yes	41.3
31-40	30.7	Self-employed	6.9	$35-$50k	28.9						
41-50	33.1	Retired	10.9	$50-$65k	16.0						
51-60	12.9	Unemployed	6.0	$65k+	12.0						
61+	6.7	Student	3.8								
		Other	2.0								
Total	**100.0**		**100.0**		**100.0**		**100.0**		**100.0**		**100.0**

Note: * FT and PT represent Full-time and Part-time respectively.
Source: SACES.

Table 5.12
Fishers (%) by Recreational Fishing Expenditure and Income Group: Kingfish

Amount Spent	$0-20k	$20-35k	$35-50k	$50-65k	$65+	Total
0-5	48.4	25.8	16.1	3.2	6.5	100.0
6-15	37.3	19.6	15.7	9.8	17.6	100.0
16-25	30.7	22.7	25.3	13.3	8.0	100.0
26-50	17.6	19.1	33.1	17.6	12.5	100.0
51-75	20.8	14.3	36.4	19.5	9.1	100.0
76-100	10.2	18.4	38.8	20.4	12.2	100.0
100-150	10.5	15.8	26.3	21.1	26.3	100.0
151+	0.0	0.0	16.7	50.0	33.3	100.0
Total	**23.4**	**18.9**	**29.3**	**16.2**	**12.2**	**100.0**

Source: SACES.

5.3 Kingfish Recreational Economic Value Results

Based on the motivations of Kingfish fishers, the database utilised consisted on the people who indicated they were targeting Kingfish, and the people who indicated they caught Kingfish.[32]

Table 5.13 below presents the variables that are the most significant in influencing WTP for a given Kingfish fishing trip. Descriptions of variables are given in Appendix Five.

Table 5.13
Preferred Model for Kingfish

Variable		Coefficient	Asymptotic t-statistic
Catch of Kingfish	b2	19.76	**2.010****
Fish Caught Other than Kingfish	b3	1.41	**1.389*****
Competition	b4	164.42	**1.975****
Motivation Enjoy	b5	67.79	**1.794*****
Targeting Kingfish	b6	62.04	**1.944*****
Club	b7	53.93	**1.686*****
Date March	b8	-54.78	**-1.566*****
Date April	b9	-108.69	**-2.415***
Average time	b10	15.51	**2.181****
Importance	b11	75.32	**2.931***
Log Income	b12	207.83	**4.253***
Motivation Family	b13	129.02	**1.859*****
Reasons for difficulties were personal	b14	-72.47	**-1.652*****

Notes: * T-statistic significant at 99 per cent level.
** T-statistic significant at 97.5 per cent level.
*** T-statistic significant at 95 per cent level.
**** T-statistic significant at 90 per cent level.
Log-likelihood Ratio Statistic: 124.0
Source: SACES.

Consider the first explanatory variable, "Catch of Kingfish". This is defined as the catch of Kingfish from the fishing trip. The coefficient of 19.76 indicates that an additional Kingfish caught adds $19.76 to the WTP for a fishing trip. That is, the marginal value of a Kingfish, excluding the impact of all other variables in the model, is $19.76.[33] The second term is the number of other fish that was caught on the day's fishing trip by the party. The marginal value of other fish is 1.41.

Table 5.13 indicates that the following variables have a significant, positive effect on WTP for a Kingfish fishing trip: being a member of a fishing club; specifically targeting Kingfish; fishing during a competition; an increase in the average amount of time

[32] As fishing for Kingfish was generally undertaken for sport motives, the caught database (and the caught Kingfish variable) was used.

[33] Based on a 95 per cent confidence interval, we can be sure that our mean marginal WTP per Kingfish caught lies between $19.15 and $20.37.

usually spent fishing; an increase in the importance of fishing as a recreational activity; an increase in a fisher's income; and if the main motivations for fishing was indicated to be either to enjoy the outdoors, or to fish with family and friends' then this also had a positive effect on WTP for a Kingfish fishing trip.

Table 5.13 indicates that the following variables have a significant, negative effect on WTP for a Kingfish fishing trip: fishing during the months of March and April; and if the fisher indicated that they experienced difficulties in trying to catch Kingfish, and blamed those difficulties on their own personal skills, then this had a negative effect on WTP for a Kingfish fishing trip.

The signs and sizes of these coefficients all appear to be reasonable. Table 5.14 describes the prediction success of the Probit model. The figures suggest that this model correctly predicted 153 out of 297 (52 per cent) "no" responses and 267 out of 412 (65 per cent) "yes" responses correctly.

Table 5.14
Prediction Success of the Kingfish Model

		Actual	
		0	**1**
Predicted	**0**	153	145
	1	144	267
	Total	**297**	**412**

Source: SACES.

For policy purpose the average values of these variables in the Kingfish database used may well be of some interest and these are presented in Table 5.15 below.

Table 5.15
Average Values of Some Key Variables

Variable	**Mean**	**Dispersion**
Number of Kingfish caught	1.33	min = 0, max = 10, sd = 1.6, skew = 1.8
Number of Kingfish kept	0.65	min = 0, max = 9, sd = 1.03, skew = 3.0
Number of other fish caught	14.9	min = 0, max = 125, sd = 13.5, skew = 2.3
Number of other fish kept	5.8	min = 0, max = 42, sd = 5.4, skew = 1.7
Willingness to pay	117.7	min = 25, max = 855, sd = 65.7, skew = 3.7

Where: min = minimum; max = maximum; sd = standard deviation; skew = skewness.

Table 5.15 indicates that average WTP for a fishing trip is $117.70 and that each fisher kept on average 0.65 Kingfish. This suggests that the average value of Kingfish is: (117.70/0.65) = $181.10.[34] If we assume that the average weight of a Kingfish is = 6.07 Kg[35]; this implies an average WTP of 181.10/6.07 = $29.83 per Kg of fish caught. From Table 5.15 we know that the marginal WTP for Kingfish is $19.76. Thus, the marginal WTP in terms of weight is: 19.76/6.07 = $3.26 per Kg.

Once again, there is a large difference between average and marginal WTP for a Kingfish. Within the Kingfish database, 57 per cent of fishers kept no Kingfish[36]. Of the Kingfish kept, 14 per cent of fishers kept over 55 per cent of the total Kingfish catch kept. This indicates that the distribution of Kingfish kept is highly skewed, and a more even distribution would reflect a higher marginal WTP.

5.4 Total Recreational Value of Kingfish in New Zealand

To estimate the total recreational value of Kingfish fishing in New Zealand, calculations of the marginal value of a Kingfish are applied to estimates of the total Kingfish catch in the region. For explanation of this theory — see Section 2.2.

Hence, the recreational value of Kingfish in New Zealand is calculated in the following ways:

Marginal WTP per kg of Kingfish x Catch of Kingfish = Recreational Value of NZ Kingfish
$3.26 per kg x 382,000 kg (see Section 3.2.2) = $1,243,545

Average WTP per kg of Kingfish x Catch of Kingfish = Recreational Value of NZ Kingfish
$29.83 per kg x 382,000 kg = $11,395,615

Hence, the total recreational value of Kingfish fishing in New Zealand using a marginal WTP per kg is estimated to be $1.2 million[37], and $11.4 million using an average WTP per kg.

5.5 Conclusion

This section has outlined the Centre's analysis on Kingfish recreational fishing in New Zealand. The main points can be summarised as follows:

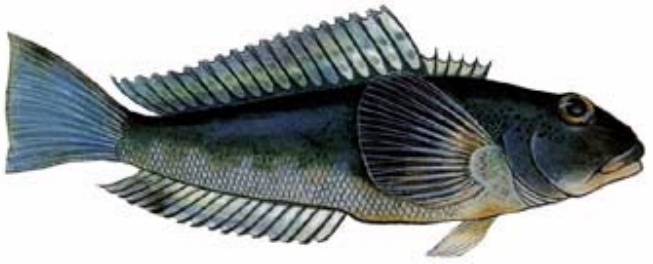
- as compared to "All fishers" — Kingfish anglers regard fishing as a more important recreational activity; they go fishing marginally more times per year; they are more likely to fish for Sport and Eating purposes; are more likely to catch and keep additional fish; they are more likely to have difficulties in trying to catch their targeted fish; they spend a longer time fishing; they have a higher

[34] That is WTP /(number of Kingfish kept) = (117.70/0.65) = $181.10.
[35] As estimated from Bradford (1998).
[36] 36 per cent caught no Kingfish on their boat trip either.
[37] Based on the 95 per cent confidence interval for the marginal WTP estimate (with a lower and upper limits of 19.15 and 20.37 per Kingfish respectively) the recreational value of NZ Kingfish per kg ranges from a lower limit of $1,205,327 to an upper limit of $1,281,764.

average fishing trip expenditure; they have higher incomes; and they are more likely to be a member of a fishing club;

- for the current situation of Kingfish fishing, the marginal WTP for an additional Kingfish, excluding the impact of all other variables, was $19.76. This was lower than the average WTP for a Kingfish at $181.10. The marginal WTP for a Kingfish implies that catching and keeping an additional Kingfish adds $19.76 to the WTP for a given fishing trip (*ceteris parabis*);
- variables such being a member of a fishing club; specifically targeting Kingfish; fishing during a competition; an increase in the average amount of time usually spent fishing; an increase in the importance of fishing as a recreational activity; an increase in a fisher's income; and if the main motivations for fishing was indicated to either be to enjoy the outdoors or to fish with family and friends, then these all have a positive effect on WTP;
- the correct form of Kingfish to use is the amount of Kingfish caught, not the amount of Kingfish kept; and
- the New Zealand recreational value for Kingfish was estimated to be $1.2 (using a MWTP value) and $11.4 (using a AWTP value) million dollars.

6. Blue Cod



6.1 Biological Information

Blue Cod (*Parapercis*) belong to the weaver family (*Pinguipedidae*) of fish and are endemic to New Zealand. Predominantly a southern species, they are most abundant around Southland and the Chatham Islands but do appear as far north as North Cape in reasonable numbers. Minimum legal length of 33 cm is usually reached at an age of 5-6 years for Southland blue Cod, 6-8 years for those located in the Marlborough Sounds and 8 years in the Northland.

6.2 Characteristics of Recreational Blue Cod Fishers

6.2.1 Survey Locations for Blue Cod Fishers

Table 6.1 records the number of interviews recorded by various location classifications displaying results as percentages of the total. The interesting points to note about this table includes:

- The most common location for Blue Cod surveys was Waikawa (19 per cent), followed by Kaikoura (10 per cent) Moeraki (9 per cent) and Picton and Seaview Marinas (7 per cent);
- Most of the surveys for Quota Management Areas were conducted in QMA 7 (31 per cent), followed by QMA 3 (31 per cent) and QMA 2 (14 per cent);
- The majority of surveys were conducted in the South Island (70 per cent); and
- 53 per cent of interviews were conducted in non-metropolitan areas.

Table 6.1
Number of Interviews by Various Location Classifications: Blue Cod

Region	%	QMA	%	Island	%	Area	%
Kaikoura	9.6	1	14.1	North	30.4	Fishing location was	
Karitane	5.8	2	14.4	South	69.6	in a metropolitan area	47.1
Moeraki	9.3	3	30.8				
Seaview Marina	7.1	4				Fishing location was	
Stewart Island	6.7	5	7.1			in a non-metropolitan	
Picton Marina	7.1	6				area	52.6
Waikawa	18.9	7	31.4				
		8	1.3			NA	0.3
		9	0.6				
Other*	35.6	NA	0.3				
Total	100.0		100.0		100.0		100.0

Note: * This includes approximately 45 more locations.
Source: SACES.

6.2.2 Characteristics of Blue Cod Recreational Fishing

Table 6.2 illustrates the enjoyment and importance of recreational fishing to all fish anglers. The interesting points to note about Table 6.2 includes:

- An average of 4 for enjoyment indicates that on average Blue Cod fishers had a 'good' fishing trip; and
- Fishing is regarded as an 'important' recreational activity, with the average of 4.1.

Table 6.2
Enjoyment and Importance Of Recreational Fishing: Blue Cod

	Enjoyment Factor	Importance Factor
Mean Score	4.0	4.1

Source: SACES.

Table 6.3 illustrates the number of times all anglers fish per year, by island. The interesting points to note include:

- The most common trip frequency for Blue Cod fishers was 6-15 trips per year (44 per cent), followed by those fishing 16 to 25 times per year (20 per cent); and
- Fishers in the North on average went fishing more often (24 trips per year) than their counterparts from the South island (16 trips per year). For New Zealand as a whole, Blue Cod fishers ventured out roughly 18 times on average per year.

Table 6.3
Number of Fishers by Trips Per Year and Island: Blue Cod

Times per year	Island		Total	%
	North	South		
0-5	4	48	52	16.7
6-15	35	103	138	44.2
16-25	26	36	62	19.9
26-50	23	22	45	14.4
51-100	7	8	15	4.8
100+	0	0	0	0.0
NA	0	0	0	0.0
Total	95	217	312	100.0
Average trips per year	24.0	15.9	18.4	

Note: NA indicates information not available.
Source: SACES.

Table 6.4 reveals Blue Cod fishers motivations for going fishing. Interesting points to note include:

- The majority of Blue Cod anglers (53 per cent) cite fishing for sport and eating purposes as their main motivation for fishing, followed by to enjoy the outdoors (18 per cent) and to catch fish for primarily eating purposes (14 per cent).

Table 6.4
Motivation for Fishing: Blue Cod

	Sport Only Purposes	Eating Purposes	Sport & Eat Purposes	Enjoy Outdoors	Catch Large Fish	Family Purposes	Explore Outdoor	Custom Purposes	Other
% indicating reason	5.4	13.5	53.2	18.3	0.0	8.3	1.0	0.0	0.3

Source: SACES.

6.2.3 Characteristics of the Fishing Trip for Blue Cod Fishers

Table 6.5 reveals fishers fishing platform of choice and boat characteristics, some interesting observations are:

- The majority of Blue Cod anglers (94 per cent) fished from a boat. The high proportion of boat users is particularly due to interviewers targeting boat ramps for surveying purposes;
- Most fishers owned their own boat (65 per cent); and
- The majority of people who owned their own boat also had an echo sounder (72 per cent). The most popular type of echo sounder was one that possessed a liquid crystal display (69 per cent) while colour video echo sounders were the only other significant format utilised (25 per cent).

Table 6.5
Fishing Platform and Boating Characteristics: Blue Cod

Platform	%	Boat Ownership	%	Echo Sounder	%	Echo Sounder Type	%
Boat	94.3	No	34.9	No	27.6	Colour Video	25.0
Jetty	0.6	Yes	65.1	Yes	72.4	Liquid Crystal Display	69.1
Land	0.6	NA	0.0			Paper Display	0.7
Diving	2.2					Other	5.3
Pots	2.2						
Total	**100.0**		**100.0**		**100.0**		**100.0**

Note: The figure for boat platform users is probably understated as a good proportion of those diving would also have utilised a boat.

Source: SACES.

Table 6.6 illustrates the number for fish caught and kept on the fishing trip. The interesting fact to arise from this Table is that:

- Blue Cod anglers on average indicated a boat catch of almost 14 Blue Cod, and kept just over 6 of them;
- No other fish was caught in significant quantities. The total fish caught was almost 18 fish, and almost 8 of these were kept.

Table 6.6
Species Caught and Fish Kept by Blue Cod

	Average Fish Caught* Per Respondent	Average Fish Kept Per Respondent
Blue Cod	13.7	6.8
Snapper	1.0	0.5
Kingfish	0.3	0.1
Kahawai	1.0	0.4
Rock Lobster	0.2	0.2
Other species	1.3	0.4
Total	**17.5**	**7.8**

Note: * Fish caught consisted of fish caught by all members of the party fishing, plus any fish thrown back.
Source: SACES.

Table 6.7 gives an indication of the magnitude of fishers difficulties in catching their targeted fish. The interesting fact to arise from this Table is that:

- 26 per cent of Blue Cod fishers kept no Blue Cod.

Table 6.7
Unsuccessful Fishers: Blue Cod

	People Who Kept Nothing	
	Number	%
Blue Cod Targeted	81	26.0

Source: SACES.

Details regarding fishers difficulties with catching their targeted fish is recorded in Table 6.8. Interesting observations include:

- There was an even split between Blue Cod fishers who had difficulties (50 per cent) and those who had no difficulties (50 per cent) in catching Blue Cod; and
- Natural reasons (63 per cent) was the most common reason given for why fishers had difficulties in catching their targeted fish. Human factors (26 per cent) was another importance source for difficulties followed then by Personal factors (7 per cent).

Table 6.8
Difficulties With Targeted Fish and Reasons: Blue Cod

Fishers Experiencing Difficulties	%	Reason	%
Yes had difficulties	50.0	Personal	6.8
Had no difficulties	49.7	Natural	62.7
Total	**100.0**	Human	25.5
		Other	5.0
		Total	**100.0**

Source: SACES.

Details regarding the time spent fishing on the trip and the average time spent fishing is recorded in Table 6.9. Interesting observations include:

- The average time usually spent fishing by fishers was 4.2 hours, and the average time spent fishing on that day was 3.7 hours.

Table 6.9
Average and Total Time Spent Fishing: Blue Cod

Fish Species	Average Total Time Per Fisher For Surveyed Trip	Average Time Usually spent Fishing Per Fisher
Blue Cod	3.7	4.2

Source: SACES.

6.2.4 Socio-Economic Characteristics of Blue Cod Fishers

Details regarding the expenditure[38] of people on the fishing trip is recorded in Table 6.10. Interesting observations include:

- Most fishers spent between $26-50 on their fishing trip (40 per cent), followed by those spending between $51-75 (19 per cent) and $16-25 (16 per cent); and
- The average amount spent by fishers per trip was $44.09 with fishers averaging 18 recreational fishing trips per year, which gives a total amount spent per year by an average all fish angler of $810[39].

[38] Note, recurrent expenditure only was asked for in the surveys.

[39] This figure must be interpreted with care. It can only be thought to be a reasonable estimate if it is thought that the fishers surveyed are generally representative of NZ Blue Cod anglers.

Table 6.10
Recreational Fishing Expenditure: Blue Cod

Amount Spent on Fishing Trip	%	Average Fishing Recurrent Expenditure	
0-5	6.4	Average Amount Spent	44.09
6-15	9.9	Average Fishing Trips per year	18.38
16-25	16.0		
26-50	39.7		
51-75	18.6		
76-100	5.4		
101-150	1.6		
151+	2.2		
Total	**100.0**	**Total Amt Spent Per Year by a Blue Cod Fisher**	**$810**

Source: SACES.

Table 6.11 reveals certain social and economic characteristics of fishers with some interesting observations being:

- The most common age for fishers was 41-50 (36 per cent), followed by those in the 31-40 age group (25 per cent), and the age group 51-60 (16 per cent);
- Blue collar employment was more common for Blue Cod fishers (41 per cent), than white collar employment (27 per cent). Retirees represented 14 per cent of fishers;
- The most common annual income category for Blue Cod fishers was $0-20,000 (28 per cent), followed by $20-35,000 and $35-50,000 (both 25 per cent);
- Blue Cod fishers are more likely employed in full time employment (68 per cent) rather than part time (or no) employment (30 per cent);
- Blue Cod fishers are overwhelmingly male (84 per cent); and
- 26 per cent of Blue Cod fishers belonged to a fishing club.

Table 6.11
Characteristics Of Fishers: Blue Cod

Age	%	Employment Status	%	Annual Income $	%	FT/PT*	%	Sex	%	Club Member	%
15-20	0.3	Blue Collar	41.3	0-20,000	28.2	FT	67.9	Female	16.0	No	70.8
21-30	12.8	White Collar	27.2	20-35,000	25.3	PT	29.5	Male	84.0	Yes	26.0
31-40	25.3	Self-employed	5.1	35-50,000	25.3						
41-50	36.2	Retired	13.5	50-65,000	13.5						
51-60	16.0	Unemployed	6.1	65,000+	4.8						
61+	8.7	Student	2.2								
		Other	2.6								
Total	**100.0**		**100.0**		**100.0**		**100.0**		**100.0**		**100.0**

Note: Figures do not add due to NA records.
* FT and PT represent Full-time and Part-time respectively.
Source: SACES.

A breakdown of fishers by recreational fishing expenditure and income group is provided in Table 6.12. Some interesting observations include:

- The expected trend that the proportion of fishers in the $0-20,000 income range decreases as amount spent on fishing trip increases is certainly observed. Their highest contributions came in the lowest expenditure categories where they made up nearly 39 per cent of people spending between $0-5 and a similar proportion of the $6-15 recreational expenditure division; and
- The highest representation for any income group came in the $151+ expenditure category where the $20-35,000 and $50-65,000 income groups each represented 43 per cent of those surveyed for that expenditure group.

Table 6.12
Fishers (%) By Recreational Fishing Expenditure and Income Group: Blue Cod

Amount Spent ($)	$0-20k	$20-35k	$35-50k	$50-65k	$65k+	Total
0-5	38.9	16.7	22.2	16.7	5.6	100.0
6-15	38.7	32.3	12.9	12.9	3.2	100.0
16-25	20.8	22.9	37.5	12.5	6.3	100.0
26-50	33.9	22.3	30.6	6.6	6.6	100.0
51-75	25.0	32.1	17.9	23.2	1.8	100.0
76-100	17.6	41.2	17.6	23.5	0.0	100.0
101-150	20.0	0.0	60.0	20.0	0.0	100.0
151+	0.0	42.9	0.0	42.9	14.3	100.0

Source: SACES.

6.3 Blue Cod Recreational Economic Value Results

Based on the motivations of Blue Cod fishers, the database utilised consisted on the people who indicated they were targeting Blue Cod, and the people who indicated they kept Blue Cod.[40]

Table 6.13 presents the variables that were statistically significant in influencing WTP for a given Blue Cod fishing trip. Descriptions of variables are given in Appendix Five.

[40] As fishing for Blue Cod was generally undertaken for eating motives, the kept database (and the kept Blue Cod variable) was used.

Table 6.13
The Preferred Model for Blue Cod

Variable		Coefficient	Asymptotic t-statistic
Kept Blue Cod	b2	1.61	1.030
Fish Catch other than Blue Cod	b3	4.04	2.259**
Metropolitan Area	b4	87.51	2.487*
Date April	b5	- 94.28	- 1.854***
Club	b6	104.19	2.425*
Echo Sounder with Colour Video	b7	146.26	2.706*
Log Income	b8	80.72	2.268**
Island	b9	65.96	1.697***
Importance of Fishing	b10	44.18	2.239**
Motivation of Enjoy	b11	61.99	1.683***
Motivation of Family & Friends	b12	95.03	2.009**
Targeting Kingfish	b13	191.01	2.634*
Targeting Kahawai	b14	- 103.17	- 1.799***

Notes: * T-statistic significant at 99 per cent level.
** T-statistic significant at 97.5 per cent level.
*** T-statistic significant at 95 per cent level.
**** T-statistic significant at 90 per cent level.
Log-likelihood Ratio Statistic: 124.3
Source: SACES.

The Blue Cod kept variable adds $1.61 to the WTP for a fishing trip. That is, the marginal value of a Blue Cod, excluding the impact of all other variables in the model, is $1.61.[41] The small value (and lack of significance) of the kept Blue Cod variable is illustrative of the fact that where Blue Cod is present, fishers can go out and easily catch a large number. This result does make economic sense, as the more easy (and plentiful) a fish is to catch, then the lower the value is associated with it. The second term is the number of other fish that was caught on the day's fishing trip by the party. The marginal value of other fish is 4.04.

Table 6.13 indicates that the following variables have a significant, positive effect on WTP for a Blue Cod fishing trip: being a member of a fishing club; fishing in a metropolitan area; specifically targeting Kingfish on that trip; owning your own boat with an echo sounder that has a colour video; an increase in the importance of fishing as a recreational activity; an increase in a fisher's income; fishing on the North Island (as compared to the South Island) for Blue Cod; and if the main motivations for fishing was indicated to be either to enjoy the outdoors or to fish with family and friends' then these also had a positive effect on WTP for a Blue Cod fishing trip.

[41] The *t* statistic for the kept Blue Cod variable is only just significant at an approximately 85 per cent level. The lack of confidence (and the small coefficient) in the Blue Cod variable illustrates that catching an additional Blue Cod only marginally increases WTP for a fishing trip.

However, for the above model, based on a 95 per cent confidence interval, the mean marginal WTP per Blue Cod caught lies between $1.50 and $1.72.

Table 6.13 indicates that the following variables have a significant, negative effect on WTP for a Blue Cod fishing trip: fishing during the month of April; and if the fisher indicated that they were targeting Kahawai.

The signs and sizes of these coefficients all appear to be reasonable. Table 6.14 describes the prediction success of the Probit model. The figures suggest that this model correctly predicted 144 out of 242 (59 per cent) "no" responses and 164 out of 263 (62 per cent) "yes" responses correctly.

Table 6.14
Prediction Success of the Blue Cod Model

		Actual	
		0	**1**
Predicted	**0**	144	99
	1	98	164
	Total	242	263

Source: SACES.

For policy purpose the average values of these variables in the Blue Cod database used may well be of some interest and these are presented in Table 6.15 below.

Table 6.15
Average Values of Some Key Variables

Variable	Mean	Dispersion
Number of Blue Cod caught	10.6	min = 0, max = 500, sd = 26, skew = 13.5
Number of Blue Cod kept	4.6	min = 0, max = 204, sd = 9.9, skew = 10.5
Number of other fish caught	9.6	min = 0, max = 220, sd = 12.8, skew = 9.1
Number of other fish kept	3.4	min = 0, max = 204, sd = 9.9, skew = 15.7
Willingness to pay	112.5	min = 0, max = 830, sd = 72.8, skew = 5.1

Where: min = minimum; max = maximum; sd = standard deviation; skew = skewness.
Source**:** SACES

Table 6.15 indicates that average WTP for a fishing trip is $112.50 and that each fisher kept on average 4.6 Blue Cod. This suggests that the average value of Blue Cod is: (112.50/4.6) = $24.46.[42] If we assume that the average weight of a Blue Cod is 0.67 Kg[43]; this implies an average WTP of 24.46/0.67 = $36.50 per Kg of fish caught. From Table 6.13 we know that the marginal WTP for Blue Cod is $1.61. Thus, the marginal WTP in terms of weight is given by: 1.61/0.67 = $2.40 per Kg.

Once again, there is a large difference between average and marginal WTP for a Blue Cod. Although a lot more fishers caught and kept Blue Cod (85 per cent of Blue Cod fishers kept at least one Blue Cod), the distribution of fish kept was still skewed. Of the

[42] That is WTP /(number of Blue Cod kept) = (112.50/4.6) = $24.46
[43] As estimated from Bradford (1998).

Blue Cod kept, 11 per cent of fishers kept over 60 per cent of the total Blue Cod. This indicates that the distribution of Blue Cod kept is highly skewed, and a more even distribution would result in a higher marginal WTP.

6.4 Total Recreational Value of Blue Cod in New Zealand

To estimate the total recreational value of Blue Cod fishing in New Zealand, calculations of the marginal value of a Blue Cod are applied to estimates of the total Kingfish catch in the region. For explanation of this theory — see Section 2.2.

Hence, the recreational value of Blue Cod in New Zealand is calculated in the following ways:

Marginal WTP per kg of Blue Cod x Catch of Blue Cod = Recreational Value of NZ Blue Cod
$2.40 per kg x 729,000 kg (see Section 3.2.3) = $1,751,776
Average WTP per kg of Blue Cod x Catch of Blue Cod = Recreational Value of NZ Blue Cod
$36.50 per kg x 729,000 kg = $26,610,156

Hence, the total recreational value of Blue Cod fishing in New Zealand using a marginal WTP per kg is estimated to be $1.8 million[44], and $26.6 million using an average WTP.

6.5 Conclusion

This section has outlined the Centre's analysis on Blue Cod recreational fishing in New Zealand. The main points can be summarised as follows:

- as compared to "All fishers" — Blue Cod anglers go fishing significantly less times per year; they are more likely to fish for Eating purposes; they are more likely to fish from a boat platform; are more likely to catch and keep additional fish; they are less likely to blame their difficulties in trying to catch fish on natural or human factors; they spend significantly less time fishing and go fishing less times per year; they have a lower average fishing trip expenditure; they are more likely to be employed in Blue collar employment; they predominantly are older anglers; they have lower incomes; they have the highest female participation in fishing and they are more likely to be a member of a fishing club;
- for the current situation of Blue Cod fishing, the marginal WTP for an additional Blue Cod, excluding the impact of all other variables, was $1.61. This was lower than the average WTP for a Blue Cod of $24.46. The marginal WTP for a Blue Cod implies that catching and keeping an additional Blue Cod adds $1.61 to the WTP for a given fishing trip (*ceteris parabis*);
- variables such as being a member of a fishing club; fishing in a metropolitan area; specifically targeting Kingfish on that trip; owning your own boat with an echo sounder that has a colour video; an increase in the importance of fishing as a recreational activity; an increase in a fisher's income; fishing on the North

[44] Based on the 95 per cent confidence interval for the marginal WTP estimate (with a lower and upper limits of 1.50 and 1.72 per Blue Cod respectively) the recreational value of NZ Blue Cod per kg ranges from a lower limit of $1,627,459 to an upper limit of $1,876,093.

Island (as compared to the South Island) for Blue Cod; and if the main motivations for fishing was indicated to be to enjoy the outdoors and to fish with family and friends then this also had a positive effect on WTP for a Blue Cod fishing trip;

- the correct form of Blue Cod to use is the amount of Blue Cod kept, not the amount of Blue Cod caught; and
- the New Zealand recreational value for Blue Cod is estimated to be $1.8 (using a MWTP value) and $26.6 (using a AWTP value) million dollars.

7. Kahawai

7.1 Biological Information

Regarded as a fine light-tackle sportfish, Kahawai (*Arripis trutta*) are frequently targeted and caught by recreational fishers. Belonging to the *Arripididae* family, Kahawai are a schooling peiagic species which inhabit most of New Zealand coastal waters including around the Chatham Islands. They generally restrict themselves to depths of less than 200m with adult Kahawai preferring depths of around 100 metres. Juveniles, which can be regarded as those less than 40 cm in length, reside in protected shallower waters (less than 45m) than adults who migrate to deeper waters with age. As with other species such as Snapper and Kingfish, Kahawai are most plentiful in the Bay of Plenty of QMA 1, and off the north and east coasts of the North Island. While not scientifically confirmed, it is likely that Kahawai migrate southwards during the Summer months beyond the Banks Peninsula (Bradford 1996).

7.2 Characteristics of Recreational Kahawai Fishers

7.2.1 Fishing Locations of Kahawai Surveys

Table 7.1 records the number of interviews recorded by various location classifications displaying results as percentages of the total. The interesting points to note about this table includes:

- The most common survey location for Kahawai fishers was Raglan (34 per cent), followed by Tauranga (8 per cent), Parua Bay (7 per cent), Oriental Parade (6 per cent) and Te Kaha (6.1 per cent);
- The most common Quota Management Areas in which surveys were conducted were QMA 1 (39 per cent), and QMA 9 (34 per cent), followed by QMA 2 (24 per cent);
- The majority of surveys were conducted in the North Island (98 per cent); and
- 92 per cent of interviews were conducted in metropolitan areas.

7.2.2 Characteristics of Kahawai Recreational Fishing

Table 7.2 illustrates the enjoyment and importance of recreational fishing to Kahawai anglers. The interesting points to note about Table 7.2 includes:

- An average of 4 for enjoyment indicates that on average Kahawai fishers had a 'good' fishing trip; and
- Fishing is regarded as an 'important' recreational activity, with the average rating for importance of 4.3.

Table 7.1
Number of Interviews by Various Location Classifications: Kahawai

Region	%	QMA	%	Island	%	Area	%
Whitianga	1.8	1	38.8	North	97.7	Fishing location was in	
Waitangi	3.3	2	24.0	South	2.3	a metropolitan area	91.6
Tutukaka	4.6	3	1.3				
Te Kaha	6.1	7	1.0			Fishing location was in	
Tauranga	8.2	8	0.5			a non-metropolitan area	8.4
Takapuna	2.6	9	34.4				
Seaview Marina	4.1						
Raglan	34.2						
Paremata	2.0						
Parua Bay	6.6						
Oriental Bay	1.8						
Oriental Parade	6.1						
Ngunguru	1.8						
Miramar Wharf	2.8						
Island Bay	3.6						
Other	10.5						
Total	100.0						

Source: SACES

Table 7.2
Enjoyment and Importance of Recreational Fishing: Kahawai

	Enjoyment Factor	Importance Factor
Mean	4.0	4.3

Source: SACES

Table 7.3 illustrates the number of times Kahawai anglers fish per year, by island. The interesting points to note include:

- The most common number of fishing trips was between 6-15 times per year (34 per cent);
- Over 80 per cent of fishers targeting Kahawai made between 6 and 50 fishing trips per year; and
- For New Zealand as a whole, Kahawai fishers ventured out approximately 27 times on average per year.

Table 7.3
Number of Fishers by Trips Per Year and Island: Kahawai

Times Per Year	Island			
	North	South	Total	% of Total
1-5	35	3	38	9.7
6-15	115	1	116	29.6
16-25	99	2	101	25.8
26-50	101	2	103	26.3
51-100	25	1	26	6.6
100+	7	0	7	1.8
Total Average			**?**	

Source: SACES.

Table 7.4 reveals the primary motivation for fishing of Kahawai fishers. The interesting points to note include:

- The most common reason for fishing, given by the 392 fishers targeting Kahawai, was for 'Sporting and Eating purposes' (45.4 per cent), followed by 'to Enjoy the Outdoors' (28.8 per cent).

Table 7.4
Motivation for Fishing: Kahawai

	Sport Only Purposes	Eating Purposes	Sport & Eat Purposes	Enjoy Outdoors	Catch Large Fish	Family Purposes	Explore Outdoor	Custom Purposes	Other
% Indicating Reason	8.9	7.9	45.4	28.8	3.6	4.1	0.3	0.0	1.0

Source: SACES.

7.2.3 Characteristics of the Fishing Trip for Kahawai Fishers

Table 7.5 reveals Kahawai anglers fishing platform of choice and boat characteristics, some interesting observations are:

- The majority of anglers (82 per cent) fished from a boat. The high proportion of boat users is particularly due to interviewers targeting boat ramps for surveying purposes;
- Most fishers owned their own boat (67 per cent); and
- A majority of those who fished from a boat had an echo sounder (67 per cent). The most popular type of echo sounder was one that possessed a liquid crystal display (74 per cent) while colour video echo sounders were the only other significant format utilised (23 per cent).

Table 7.5
Fishing Platform and Boating Characteristics: Kahawai

Platform	%	Boat Ownership	%	Echo Sounder	%	Echo Sounder Type	%
Boat	81.6	Yes	67.3	Yes	67.0	Colour Video	22.6
Land	9.4	No	32.7	No	33.0	Liquid Crystal Display	74.0
Jetty	8.7					Paper Display	0.0
						Other	3.4
Total	**100**		**100**		**100**		**100**

Source: SACES.

Table 7.6 illustrates the number for fish caught and kept on the fishing trip. The interesting fact to arise from this Table is that:

- The most common fish caught by fishers targeting Kahawai was Snapper (average of 5), followed by Kahawai (2.7) and Blue Cod (0.9);
- The average number of fish caught for all species was 11.4;
- The most common fish kept by Kahawai fishers was Kahawai (average of 1.6) and Snapper (1.5), followed by Blue Cod (0.4); and
- On average a Kahawai fisher kept a total 4.6 fish.

Table 7.6
Fish Kept and Caught: Kahawai

Fish Species	Average Fish Caught Per Respondent for Targeted Species	Average Fish Kept Per Respondent for Targeted Species
Kahawai	2.7	1.6
Blue Cod	0.9	0.4
Kingfish	0.4	0.2
Snapper	5.0	1.5
Rock Lobster	0.2	0.1
Yellowtail	0.2	0.0
Trevally	0.4	0.1
Shellfish	0.5	0.0
Other	1.1	0.5
Total	**11.4**	**4.6**

Note: * Fish caught consisted of fish caught by all members of the party fishing, plus any fish thrown back.
Source: SACES.

Table 7.7 gives an indication of the magnitude of fishers difficulties in catching their targeted fish. The interesting fact to arise from this Table is that:

- Of the 392 fishers who were targeting Kahawai, 215 of those fishers kept no Kahawai. This represents 54.8 per cent of Kahawai fishers.

Table 7.7
Unsuccessful Fishers: Kahawai

	People Who Kept Nothing	
	Number	%
Kahawai	215	54.8

Source: SACES.

Details regarding fishers difficulties with catching their targeted fish is recorded in Table 7.8. Interesting observations include:

- Of those fishers targeting Kahawai, 53 per cent experienced some difficulty catching Kahawai; and
- Human factors (46.9 per cent) was the most common reason given for why fishers had difficulties in catching their targeted fish. Natural reasons (43.5 per cent) was another importance source for difficulties followed then by Personal factors (14.5 per cent).

Table 7.8
Difficulties With Targeted Fish and Reasons: Kahawai

Difficulties Experienced	%	**Reason**	%
Yes had difficulties	52.8	Personal	14.5
Had no difficulties	47.2	Natural	43.5
		Human	46.9
		Other	4.3

Note: It should be noted that the reasons for difficulty add up to more than 100 per cent as some fishers identified more than one cause.
Source: SACES.

Details regarding the time spent fishing on the trip and the average time spent fishing is recorded in Table 7.9. Interesting observations include:

- The average time usually spent fishing by fishers targeting Kahawai was 5.4 hours, and the average time spent fishing on the day they were surveyed was 5.0 hours.

Table 7.9
Average and Total Time Spent Fishing: Kahawai

Fish Species	**Average Total Time Per Fisher for Trip**	**Average Time Per Fisher**
Kahawai	5.0	5.4

Source: SACES.

7.2.4 Socio-Economic Characteristics of All Fishers

Details regarding the expenditure[45] of people on the fishing trip is recorded in Table 7.10. Interesting observations include:

- The most common expenditure by Kahawai fishers was $26-50 on their fishing trip (33 per cent), followed by those spending between $16-25 (22 per cent), $6-15 (19 per cent), and $0-5 (13 per cent); and
- The average amount spent by fishers per trip was $25.32 with fishers averaging almost 27 recreational fishing trips per year, which gives a total amount spent per year by an average all fish angler of $693.[46]

Table 7.10
Recreational Fishing Expenditure: Kahawai

Amt Spent on Trip	%	Average Fishing Recurrent Expenditure	Amount
0-5	13.0	Average Amount Spent	$25.32
6-15	19.4	Average Number of Trips Per Year	27.36
16-25	21.9		
26-50	33.2		
51-75	5.9		
76-100	4.6		
101-150	1.3		
151+	0.3		
		Total Amt Spent/Yr by Average Fisher	**$693.00**

Source: SACES.

Table 7.11 reveals certain social and economic characteristics of fishers with some interesting observations being:

- The most common age group for Kahawai fishers (32 per cent) was between 41-50 years of age, followed by those in the 31-40 age group (28 per cent), and the age group 21-30 (15 per cent);
- The split between kahawai fishers being blue collar or white collar was even with 31 per cent classified as blue collar workers and 32 per cent classified as white collar. Retirees represented 14 per cent of fishers;
- The most common earnings category for Kahawai fishers was between $0-20,000 per year (29 per cent), followed by fishers who earned $35-50,000 per year (27 per cent), and $20-35,000 per year (21 per cent);
- Kahawai fishers are more likely employed in full time employment (69 per cent) rather than part time (or no) employment (30 per cent);

[45] Note, recurrent expenditure only was asked for in the surveys.

[46] This figure must be interpreted with care. It can only be thought to be a reasonable estimate if it is thought that the fishers surveyed are generally representative of NZ Kahawai anglers.

- Kahawai fishers are overwhelmingly male (94 per cent); and
- 28 per cent of fishers belonged to a fishing club.

Table 7.11
Characteristics of Fishers: Kahawai

Age	%	Employment Status	%	Income $	%	Full-Time/ Part-Time	%	Sex	%	Fishing Club Member	%
15-20	2.6	Blue Collar	30.6	0-20,000	29.3	Full-time	68.9	Female	6.1	No	70.7
21-30	14.5	White Collar	32.1	20-35,000	20.7	Part-time	30.4	Male	93.6	Yes	28.3
31-40	27.8	Self-employed	8.2	35-50,000	26.5						
41-50	32.4	Retired	14.0	50-65,000	12.8						
51-60	11.5	Unemployed	7.1	65,000+	9.4						
61+	10.2	Student	4.3								
		Other	2.8								

Note: Figures do not add due to NA records.
Source: SACES.

A breakdown of fishers by recreational fishing expenditure and income group is provided in Table 7.12. Some interesting observations include:

- For Kahawai fishers it important to note that the number of fishers who spent $101-150, $151+ and N/A (5, 1 and 2 fishers respectively) is too small for conclusions to be drawn from the results;
- For fishers on incomes of between $0-20,000, the number of persons represented by this group decreases with each move to a higher expenditure group. For example, 53 per cent of fishers who spent $0-5 on their trip earned between $0-20,000 while only 11 per cent made up those fishers who spent $76-101;
- As expected, the proportion of fishers from the $65,000+ income group increases as fishing expenditure rises. Whereas only 6 per cent of fishers who spent between $0-5 dollars earned $65,000+, for fishers spending $76-101 this figure rises to 33 per cent ; and
- The basic trend to emerge from Table 7.12 is that as we move to a higher fishing expenditure group, a greater proportion of fishers are derived from higher income segments as would be expected.

Table 7.12
Fishers (%) by Recreational Fishing Expenditure and Income Group: Kahawai

Amt Spent on Trip	$0-20,000	$20-35,000	$35-50,000	$50-65,000	$65,000+	NA	Totals
0-5	52.9	17.6	9.8	11.8	5.9	2.0	100.0
6-15	43.4	17.1	22.4	5.3	11.8	0.0	100.0
16-25	32.6	31.4	25.6	7.0	3.5	0.0	100.0
25-50	14.6	20.8	36.9	16.2	10.0	1.5	100.0
51-75	17.4	21.7	26.1	34.8	0.0	0.0	100.0
76-100	11.1	0.0	22.2	27.8	33.3	5.6	100.0
101-150	20.0	0.0	20.0	0.0	60.0	0.0	100.0
151+	0.0	0.0	100.0	0.0	0.0	0.0	100.0
NA	50.0	0.0	0.0	0.0	0.0	50.0	100.0

Source: SACES.

7.3 Kahawai Recreational Economic Value Results

Based on the motivations of Kahawai fishers, the database utilised consisted on the people who indicated they were targeting Kahawai, and the people who indicated they caught Kahawai.[47]

Table 7.13 presents the variables that are the most significant in influencing WTP for a given Kahawai fishing trip. Descriptions of variables are provided in Appendix Five.

Table 7.13
The Preferred Model for Kahawai

Variable		Coefficient	Asymptotic t-statistic
Catch Kahawai	b2	3.44	**1.448****
Fish kept other than Kahawai	b3	3.07	**2.132****
Average Time usually spent fishing	b4	18.07	**3.186***
Club	b5	77.39	**2.988***
Date March	b6	-37.46	**-1.676*****
Log Income	b7	99.25	**2.860***
Ethnic Polynesian	b8	-199.31	**-1.921****
Working Full-time	b9	95.37	**2.800***
Gender (Male)	b10	-63.53	**-1.947****
Fishing with people other than their own Household	b11	42.78	**2.132****
Importance of Fishing	b12	23.29	**1.758*****
Motivation to Enjoy the Outdoors	b13	36.81	**1.595******
Motivation to Catch Fish for Eating Purposes Only	b14	-124.75	**-2.880***
Motivation to Fish with Family & Friends	b15	67.05	**1.637******
Using Pots as the main platform for fishing	b16	-215.55	**-2.565***
Experienced difficulties fishing & attributed those difficulties to Human Factors	b17	-59.83	**-2.282****
Experienced difficulties fishing & attributed those difficulties to Personal Factors	b18	-73.96	**-2.122****
Experienced difficulties fishing & attributed those difficulties to Natural Factors	b19	-52.50	**-2.225****
Was targeting Blue Cod	b20	129.98	**2.862***
Was targeting Kingfish	b21	74.46	**2.785***

Notes: * T-statistic significant at 99 per cent level.
** T-statistic significant at 97.5 per cent level.
*** T-statistic significant at 95 per cent level.
**** T-statistic significant at 90 per cent level.
Log-likelihood Ratio Statistic: 254.7
Source: SACES.

The first explanatory variable, 'Catch Kahawai', is defined as the Kahawai caught by persons on the boat, this adds $3.44 to the WTP for a fishing trip. That is, the marginal

[47] This decision was one of the hardest to make. The Ministry of Fisheries indicated to the Centre that fishing for Kahawai was generally undertaken for eating motives. However, within the Centre's database it was found that other motives such as sport, outdoors and enjoyment were more important than the eating motive for Kahawai fishing. Therefore, the caught database (and the caught Kahawai variable) was used.

value of a Kahawai, excluding the impact of all other variables in the model, is $3.44.[48] Like the Blue Cod kept variable coefficient, the Kahawai caught coefficient is not significant at the 95 per cent level (although it is very close). Once again, this illustrates that this is a lesser valued fish by anglers. The second term is the number of other fish that was kept on the day's fishing trip by the party. The marginal value of other fish is 3.07.

Table 7.13 indicates that the following variables have a significant, positive effect on WTP for a Kahawai fishing trip: being a member of a fishing club; an increase in the average amount of time usually spent fishing; working full-time; being a female; fishing with people other than members of the fisher's household; specifically targeting Kingfish on that trip; specifically targeting Blue Cod on that trip; an increase in the importance of fishing as a recreational activity; an increase in a fisher's income; and if the main motivations for fishing was indicated to be either to enjoy the outdoors or to fish with family and friends, then this also had a positive effect on WTP for a Kahawai fishing trip.

Table 7.13 indicates that the following variables have a significant, negative effect on WTP for a Kahawai fishing trip: fishing during the month of March; being a male; being Polynesian[49]; if the main form of fishing platform used that day was pots[50]; if fishers had difficulties fishing that day and attributed those difficulties to personal, natural and human factors; and if the main motivation for fishing that day was indicated to be for eating purposes only.

The signs and sizes of these coefficients all appear to be reasonable. Table 7.14 describes the prediction success of the Probit model. The figures suggest that this model correctly predicted 334 out of 571 (59 per cent) "no" responses and 373 out of 610 (61 per cent) "yes" responses correctly.

Table 7.14
Prediction Success of the Kahawai Model

		Actual	
		0	**1**
Predicted	**0**	334	237
	1	237	373
	Total	571	610

Source: SACES.

For policy purpose the average values of these variables in the Kahawai database used may well be of some interest and these are presented in Table 7.15 below.

[48] Based on a 95 per cent confidence interval, we can be sure that our mean marginal WTP per Kahawai caught lies between $3.33 and $3.55.

[49] Note: it is important to be careful in this interpretation as there were only a small number of Polynesians within the Kahawai database.

[50] This indicates that people using pots (who were primarily fishing for Rock Lobster and not Kahawai that day) had a negative WTP for a Kahawai fishing trip.

Table 7.15
Average Values of Some Key Variables

Variable	Mean	Dispersion
Number of Kahawai caught	3.3	min = 0, max = 50, sd = 4.2, skew = 3.6
Number of Kahawai kept	1.7	min = 0, max = 20, sd = 2.7, skew = 3.3
Number of other fish caught	12.5	min = 0, max = 226, sd = 14.1, skew = 5.2
Number of other fish kept	4.4	min = 0, max = 210, sd = 7.7, skew = 15.9
Willingness to pay	101.4	min = 0, max = 855, sd = 54, skew = 4.1

Where: min = minimum; max = maximum; sd = standard deviation; skew = skewness.

Table 7.15 indicates that average WTP for a fishing trip is $101.40 and that each fisher kept on average 1.7 Kahawai. This suggests that the average value of Kahawai is: (101.40/1.7) = $59.65.[51] If we assume that the average weight of a Kahawai is 1.23 Kg[52]; this implies an average WTP of 59.65/1.23 = $48.49 per Kg of fish caught. From Table 7.13 we know that the marginal WTP for Kahawai is $3.44. Thus, the marginal WTP in terms of weight is given by: 3.44/1.23 = $2.80 per Kg.

Once again, there is a large difference between average and marginal WTP for a Kahawai. Although many more fishers caught (over 85 per cent of fishers caught at least one Kahawai on their trip) and kept Kahawai (over 57 per cent of fishers kept at least one Kahawai), the distribution of fish kept was still skewed. Of the Kahawai kept, 12 per cent of fishers caught over 44 per cent of the total Kahawai. This indicates that the distribution of Kahawai kept is highly skewed, and a more even distribution may reflect a higher marginal WTP.

7.4 Total Recreational Value of Kahawai in New Zealand

To estimate the total recreational value of Kahawai fishing in New Zealand, calculations of the marginal value of a Kahawai are applied to estimates of the total Kingfish catch in the region. For explanation of this theory — see Section 2.2.

Hence, the recreational value Kahawai in New Zealand is calculated in the following ways:

Marginal WTP per kg of Kahawai x Catch of Kahawai = Recreational Value of NZ Kahawai
$2.80 per kg x 1,518,000 kg (see Section 3.2.4) = $4,245,463

Average WTP per kg of Kahawai x Catch of Kahawai = Recreational Value of NZ Kahawai
$48.49 per kg x 1,518,000 kg = $73,613,199

[51] That is WTP /(number of Kahawai kept) = (101.40/1.7) = $59.65.
[52] As estimated from Bradford (1998).

Hence, the total recreational value of Kahawai fishing in New Zealand using a marginal WTP per kg is estimated to be $4.3 million[53], and $73.6 million using an average WTP per kg.

7.5 Conclusion

This section has outlined the Centre's analysis on Kahawai recreational fishing in New Zealand. The main points can be summarised as follows:

- as compared to "All fishers" — Kahawai anglers go fishing significantly more times per year; they are more likely to fish for Eating purposes; they are more likely to fish from jetty or land platforms; they are slightly more likely to catch and keep additional fish; they are more likely to blame their difficulties in trying to catch fish on human factors; they have a lower average fishing trip expenditure; they have a higher male participation; and they are more likely to be a member of a fishing club;
- for the current situation of Kahawai fishing, the marginal WTP for an additional Kahawai, excluding the impact of all other variables, was $3.44. This was lower than the average WTP for a Kahawai at $59.65. The marginal WTP for a Kahawai implies that catching and keeping an additional Kahawai adds $3.44 to the WTP for a given fishing trip (*ceteris parabis*);
- variables such being a member of a fishing club; an increase in the average amount of time usually spent fishing; working full-time; being a female; fishing with people other than members of the fisher's household; specifically targeting Kingfish on that trip; specifically targeting Blue Cod on that trip; an increase in the importance of fishing as a recreational activity; an increase in a fisher's income; and if the main motivations for fishing was indicated to be to enjoy the outdoors and to fish with family and friends, then this also had a positive effect on WTP for a Kahawai fishing trip.
- the correct form of Kahawai to use is the amount of Kahawai caught, not the amount of Kahawai kept; and
- the New Zealand recreational value for Kahawai is $4.3 (using a MWTP value) and $73.6 (using a AWTP value) million dollars.

[53] Based on the 95 per cent confidence interval for the marginal WTP estimate (with a lower and upper limits of 3.33 and 3.55 per Rock Lobster respectively) the recreational value of NZ Kahawai per kg ranges from a lower limit of $4,105,066 to an upper limit of $4,385,860.

8. Rock Lobster

8.1 Biological Information

Two species of Rock Lobster (often referred to as crayfish) inhabit New Zealand waters: the spiny or red Rock Lobster (*Jasus edwardsii*) and the packhorse or green Rock Lobster (*Jasus verreauxi*). Both species can be found predominantly in the rocky coastal areas surrounding New Zealand. Red Rock Lobsters are 'most often found in groups hiding in crevices on and around reefs but occasionally venture out on to open ground' (MAF 1989). Packhorse Rock Lobsters occur in smaller numbers than red Rock Lobsters, and their most prominent location (which is their main breeding ground) is the open ground adjoining Cape Reinga (MAF, 1989).

It takes between five and ten years for the legal size to be reached where growth rates vary spatially. Legal sizes vary by sex and species where minimum sizes are 60 mm (tail width) for female and 54 mm for male red Rock Lobsters and 216 mm (tail length) for packhorse Rock Lobster. Rock Lobster can live for over 30 years. The packhorse grow much larger than the red and are in fact the largest Rock Lobster in the world. They can reach a size of 60 cm with a weight of 15 kg whereas the red can reach 54 cm in overall length possessing a weight of 8 kg.

8.2 Characteristics of Recreational Rock Lobster Fishers

8.2.1 Fishing Locations for Rock Lobster Surveys

Table 8.1 records the number of interviews recorded by various location classifications displaying results as percentages of the total. The interesting points to note about this table includes:

- The most common survey locations for Rock Lobster fishers locations were Te Kaha (16.4 per cent) and Whitianga (13 per cent), followed by Waikawa (10 per cent) and South Bay (6 per cent);
- The majority of surveys for Quota Management Areas were conducted in QMA 1 (55 per cent), followed by QMA 7 (15 per cent) and QMA 2 (15 per cent);
- The majority of surveys were conducted in the North Island (74 per cent); and
- 57 per cent of interviews were conducted in metropolitan areas.

8.2.2 Characteristics of Recreational Fishing for Rock Lobster Fishers

Table 8.2 illustrates the enjoyment and importance of recreational fishing to Rock Lobster fishers. The interesting points to note about Table 8.2 includes:

- An average of 4 for enjoyment indicates that on average Rock Lobster fishers had a 'good' fishing trip; and
- Fishing is regarded as an 'important' recreational activity, with the average of 4.3.

Table 8.1
Number of Interviews by Various Location Classifications: Rock Lobster

Region	%	QMA	%	Island	%	Area	%
Te Kaha	16.4	1	54.8	North	74.2	Fishing location was	
Whitianga	13.2	2	15.2	South	25.8	in a metropolitan area	57.2
Waikawa	9.5	3	9.7				
South Bay	6.1	5	0.4			Fishing location was	
Tutukaka	5.1	7	15.4			in a non-metropolitan	
Island Bay	5.1	8	1.6			area	42.8
Chickens	4.9	9	1.8				
Oakura Bay	4.1						
Moa Point	3.9						
Picton	3.4						
Kaikoura	3.0						
Dixon's Basin	2.8						
Paremata	2.8						
Raglan	1.8						
Mokohinaus	2.0						
Seaview Marina	1.8						
Sandspit	1.8						
Other	12.4						
Total	**100.0**						

Source: SACES.

Table 8.2
Enjoyment and Importance of Recreational Fishing: Rock Lobster

	Enjoyment Factor	Importance Factor
Mean	4.0	4.3

Note: * The averages of fishers response to the question that asked them to rank their trip in terms of 'enjoyment' and the 'importance' of fishing as a recreational activity to themselves on a scale of 1 to 5 with 1 representing 'terrible' and 'not important' while 5 represented 'excellent' and 'extremely important' respectively.

Source: SACES.

Table 8.3 illustrates the number of times Rock Lobster fishers fish per year, by island. The interesting points to note include:

- The most common number of fishing trips per year by those targeting Rock Lobster was between 6-15 times per year (30 per cent), followed by 26-50 (22 per cent) and 16-25 (20 per cent);
- Over 70 per cent of fishers targeting Rock Lobster made between 6 and 50 fishing trips per year; and
- The average number of fishing trips per year was 31.5.

Table 8.3
Number of Fishers by Trips Per Year and Island: Rock Lobster

Times Per Year	Island			Per Cent of Total
	North	South	Total	
1-5	45	12	57	11.2
6-15	108	44	152	30.0
16-25	72	27	99	19.5
26-50	82	29	111	21.9
51-100	52	14	66	13.0
100+	25	4	29	5.7
Average Trips				31.5

Note: NA indicates information not available.
Source: SACES.

Table 8.4 reveals the primary motivation why Rock Lobster fishers fish. The interesting points to note include:

- The most common reason for fishing, given by the 506 fishers targeting Rock Lobster who gave a motivation, was for 'Sporting and Eating purposes' (42.1 per cent), followed by Eating Purposes' (29.8 per cent) and 'to Enjoy the Outdoors' (13.2 per cent).

Table 8.4
Motivation for Fishing: Rock Lobster

	Sport Only Purposes	Eating Purposes	Sport & Eat Purposes	Enjoy Outdoors	Catch Large Fish	Family Purposes	Explore Outdoor	Custom Purposes	Other
% Indicating Reason	6.9	29.8	42.1	13.2	1.4	2.6	1.4	0.2	2.4

Source: SACES.

8.2.3 Characteristics of the Fishing Trip for Rock Lobster Fishers

Table 8.5 reveals rock lobster fishers fishing platform of choice and boat characteristics, some interesting observations are:

- Diving was the most common fishing method used by those targeting Rock Lobster (49 per cent);
- Most fishers owned their own boat (62 per cent); and
- A majority of those who owned their own boat had an echo sounder (74 per cent). The most popular type of echo sounder was one that possessed a liquid crystal display (69 per cent) while colour video echo sounders were the only other significant format utilised (28 per cent).

Table 8.5
Fishing Platform and Boating Characteristics: Rock Lobster

Platform	%	Boat Ownership	%	Echo Sounder	%	Echo Sounder Type	%
Boat	35.9	Yes	61.5	Yes	74.4	Colour Video	28.0
Diving	49.1	No	38.5	No	25.6	Liquid Crystal Display	69.0
Pots	15.8					Paper Display	0.9
Land	0.2					Other	2.2
Jetty	0.0						
Total	100		100		100		100

Note: It is important to note that the percentages for platform add up to more than 100 as there were a small number of people who indicated that they had both dived and used pots.
Source: SACES.

Table 8.6 illustrates the number for fish caught and kept on the fishing trip. The interesting facts to arise from this Table is that:

- The most common fish caught by fishers targeting Kahawai were Shellfish (average of 8.9)and Rock Lobster (9), followed by Snapper (2);
- The average number of fish (of all species) caught by Rock Lobster was 22;
- The most common fish kept by fishers targeting Rock Lobster were Shellfish (average of 4) and Rock Lobster (4), followed by Snapper (1); and
- On average a Rock Lobster fisher kept 10 fish.

Table 8.6
Fish Kept and Caught: Rock Lobster

Fish Species	Average Fish Caught Per Respondent for Targeted Species	Average Fish Kept Per Respondent for Targeted Species
Rock Lobster	8.7	3.6
Shellfish	8.9	4.4
Blue Cod	0.2	0.1
Kingfish	0.1	0.1
Snapper	1.6	0.7
Kahawai	0.3	0.1
Trevally	0.1	0.1
Other	2.0	1.0
Total	21.9	10.1

Note: * Fish caught consisted of fish caught by all members of the party fishing, plus any fish thrown back.
Source: SACES.

Table 8.7 gives an indication of the magnitude of fishers difficulties in catching their targeted fish. The interesting fact to arise from this Table is that:

- Of the 507 fishers who were targeting Rock Lobster, 97 of those fishers kept no Rock Lobster. This represents 19.1 per cent of Rock Lobster fishers.

Table 8.7
Unsuccessful Fishers: Rock Lobster

	People Who Kept Nothing	
	Number	%
Rock Lobster	97	19.1

Source: SACES.

Details regarding fishers difficulties with catching their targeted fish is recorded in Table 8.8. Interesting observations include:

- Most Rock Lobster fishers had no difficulties (67 per cent) in trying to catch their targeted species; and
- Natural reasons (54 per cent) was the most common reason given for why fishers had difficulties in catching their targeted fish. Human factors (41 per cent) was another importance source for difficulties followed then by Personal factors (22 per cent).

Table 8.8
Difficulties with Targeted Fish and Reasons: Rock Lobster

Difficulties	%	**Reason**	%
Yes had difficulties	33.5	Personal	22.4
Had no difficulties	66.5	Natural	53.5
		Human	41.2
		Other	11.2
Total	**100**		**100**

Source: SACES.

Details regarding the time spent fishing on the trip and the average time spent fishing is recorded in Table 8.9. Interesting observations include:

- The average time usually spent fishing by fishers targeting Rock Lobster was 4.3 hours, and the average time spent fishing on the day they were surveyed was 3.9 hours.

Table 8.9
Average and Total Time Spent Fishing: Rock Lobster

Fish Species	**Average Total Time Per Fisher for Trip**	**Average Time Per Fisher**
Rock Lobster	3.9	4.3

Source: SACES.

8.2.4 Socio-Economic Characteristics of Rock Lobster Fishers

Details regarding the expenditure[54] of people on the fishing trip is recorded in Table 8.10. Interesting observations include:

- The most common expenditure range for Rock lobster fishers was between $26-50 on their fishing trip (21 per cent), followed by those spending between $6-15 (18 per cent), $76-100 (14 per cent), and $51-75 (13 per cent);
- The average amount spent by fishers per trip was $51.52 with Rock lobster fishers averaging almost 32 recreational fishing trips per year, which gives a total amount spent per year by an average RL fisher of $1,623[55].

Table 8.10
Recreational Fishing Expenditure: Rock Lobster

Amt Spent on Trip	%	Average Fishing Recurrent Expenditure	Amount
0-5	11.2	Average Amount Spent	$51.52
6-15	17.9	Average Amount Trips	31.50
16-25	10.7		
26-50	20.9		
51-75	13.0		
76-100	13.8		
101-150	8.1		
151+	4.3		
Total	**100.0**	**Total Amt Spent/Yr by Average Fisher**	**$1,623**

Source: SACES.

Table 8.11 reveals certain social and economic characteristics of fishers with some interesting observations being:

- The most common age of Rock Lobster fishers (32 per cent) was between 31-40 years of age, followed by those in the 41-50 age group (27 per cent), and the age group 21-30 (17 per cent);
- The split between fishers being blue collar or white collar workers was relatively even with 35 per cent of anglers classified as blue collar workers and 37.5 per cent classified as white collar. Retirees represented 15 per cent of fishers;
- The most common earnings category for Rock lobster fishers was between$35-50,000 per year (26 per cent), followed by fishers who earned $0-20,000 per year (25 per cent), and $20-35,000 per year (20 per cent);
- Fishers are more likely to be in full time employment (72 per cent) rather than part time (or no) employment (28 per cent);
- Rock Lobster fishers are overwhelmingly male (92 per cent); and
- 26 per cent of Rock lobster fishers belonged to a fishing club.

54 Note, recurrent expenditure only was asked for in the surveys.

55 This figure must be interpreted with care. It can only be thought to be a reasonable estimate if it is thought that the fishers surveyed are generally representative of NZ Rock Lobster fishers.

Table 8.11
Socio-Economic Characteristics of Fishers: Rock Lobster

Age	%	Employment Status	%	Income $	%	FT/PT*	%	Sex	%	Fishing Club Member	%
15-20	1.6	Blue Collar	35.3	0-20,000	24.9	Full-time	71.8	Female	8.1	No	71.4
21-30	16.6	White Collar	37.5	20-35,000	19.9	Part-time	27.8	Male	91.9	Yes	25.6
31-40	32.0	Self-employed	4.1	35-50,000	26.4						
41-50	26.6	Retired	15.0	50-65,000	17.6						
51-60	8.1	Unemployed	4.3	65,000+	9.9						
61+	14.4	Student	2.0								
		Other	0.8								
Total	100		100		100		100		100		100

Note: Figures do not add due to NA records.
* FT and PT represent Full-time and Part-time work respectively.
Source: SACES.

A breakdown of fishers by recreational fishing expenditure and income group is provided in Table 8.12. Some interesting observations include:

- For fishers on incomes of between $0-20,000, the number of persons represented by this group decreases with each move to a higher expenditure group. For example, 64 per cent of fishers who spent $0-5 on their trip earned between $0-20,000 while only 4.5 per cent made up those fishers who spent over $151, although the result for expenditure of $101-150 was anomalous;
- As expected, the proportion of fishers from the $65,000+ income group increases as fishing expenditure rises. Whereas only 3.6 per cent of fishers who spent between $0-5 dollars earned $65,000+, for fishers spending $151+, this figure rises to 27.3 per cent; and
- The basic trend to emerge from Table 8.11 is that as we move to a higher fishing expenditure group, a greater proportion of fishers are derived from higher income segments as would be expected.

Table 8.12
Fishers (%) By Recreational Fishing Expenditure and Income Group: Rock Lobster

Amt Spent on Trip	$0-$20,000	$20-$35,000	$35-$50,000	$50-$65,000	$65,000+	NA	Totals
0-5	64.3	16.1	10.7	3.6	3.6	1.8	100.0
6-15	54.9	11.0	18.7	8.8	6.6	0.0	100.0
16-25	22.2	18.5	27.8	24.1	5.6	1.9	100.0
25-50	13.2	22.6	27.4	21.7	12.3	2.8	100.0
51-75	3.0	30.3	31.8	28.8	6.1	0.0	100.0
76-100	5.7	24.3	38.6	20.0	10.0	1.4	100.0
101-150	17.1	17.1	26.8	14.6	22.0	2.4	100.0
151+	4.5	13.6	36.4	18.2	27.3	0.0	100.0

Source: SACES.

8.3 Rock Lobster Recreational Economic Value Results

Based on the motivations of Rock Lobster fishers, the database utilised consisted on the people who indicated they were targeting Rock Lobster, and the people who indicated they caught Rock Lobster.[56]

Table 8.13 below presents two models. Model One is the preferred model, however given the problem with the surveys it is not a robust one, and some of the variables are not statistically significant. The Model was re-run twice — without the least significant variable for Kept Fisher Other RL. Descriptions of variables are provided in Appendix Five.

Table 8.13
The Preferred Models for Rock Lobster

Model One				Model Two			
Variable		**Coefficient**	**Asymptotic t-statistic**	**Variable**		**Coefficient**	**Asymptotic t-statistic**
Catch Rock Lobster	b2	6.54	**2.081****	Catch Rock Lobster	b2	6.56	**2.068**
Kept Fish Other RL	b3	0.49	**0.569**	—	—	—	—
Date December	b4	-141.43	**-1.794*****	Date December	b3	-146.29	**-1.836*****
Enjoyment	b5	45.35	**1.735*****	Enjoyment	b4	44.15	**1.691*****
Island	b6	-159.96	**-2.825***	Island	b5	-168.87	**-3.008***
Fishing time	b7	16.83	**1.758*****	Fishing time	b6	17.40	**1.800*****
Household	b8	226.51	**2.774**	Household	b7	229.26	**2.770***
Weather	b9	-29.98	**-1.389******	Weather	b8	-28.84	**-1.339******
Competition	b10	-309.50	**-1.233**	Competition	b9	-311.52	**-1.229******
Had no Difficulties	b11	-48.80	**-1.015**	Had no Difficulties	b10	-51.72	**-1.067**
Log Income	b12	210.60	**3.045***	Log Income	b11	211.71	**3.028***
Importance	b13	64.25	**1.840*****	Importance	b12	66.25	**1.871*****
Motivation Eat	b14	-116.27	**-1.968****	Motivation Eat	b13	-113.51	**-1.929****
Motivation Family	b15	209.13	**1.682*****	Motivation Family	b14	208.93	**1.667*****
Motivation Sport	b16	237.02	**2.382***	Motivation Sport	b15	238.96	**2.376***
Platform diving	b17	48.99	**1.084**	Platform diving	b16	50.87	**1.115**
Reasons for difficulties natural	b18	119.09	**1.845*****	Reasons for difficulties natural	b17	118.11	**1.823*****
Targeting Snapper	b19	-147.71	**-2.055****	Targeting Snapper	b18	-148.54	**-2.046****

Notes: * T-statistic significant at 99 per cent level.
** T-statistic significant at 97.5 per cent level.
*** T-statistic significant at 95 per cent level.
**** T-statistic significant at 90 per cent level.
Log-likelihood Ratio Statistic: 161.0
Source: SACES.

[56] Within the Centre's database it was found that there was a mix of motives for Rock Lobster fishing, with eating and sport motives cited the most often. Therefore, the caught database (and the caught Rock Lobster variable) was used. As explained previously, the Rock Lobster database was structured differently to the other fish. As the initial bid distribution was set too high for Rock Lobster fishers, in the final database the Centre excluded surveys that asked a bid amount higher than $300. If these surveys were included, the result would have been a downward bias on the WTP for a Rock Lobster fishing trip.

Consider the first explanatory variable (in Model One) — "Catch Rock Lobster".[57] This is defined as the Rock Lobster caught on the fishing trip. It adds $6.54 to the WTP for a fishing trip. That is, the marginal value of a Rock Lobster, excluding the impact of all other variables in the model, is $6.54.[58] The second term is the number of other fish that was kept on the day's fishing trip by the party. The marginal value of other fish is 0.49.[59] As Table 8.13 shows, there is very little difference between the two models, hence for the purposes of this project we will use Model One values, as Kept Fish other than RL is considered to be an important variable to include within the model.

Table 8.13 indicates that the following variables have a significant, positive effect on WTP for a Rock Lobster fishing trip: an increase in the amount of time spent fishing that day; fishing with people other than members of the fisher's household; an increase in the enjoyment associated with the fishing trip on that day; an increase in the importance of fishing as a recreational activity; an increase in a fisher's income; fishing for Rock Lobster by diving; experiencing difficulties with catching Rock Lobster that day and associating those difficulties to natural reasons[60]; and if the main motivations for fishing was indicated to be for sporting reasons and to fish with family and friends then this also had a positive effect on WTP for a Rock Lobster fishing trip.

Table 8.13 indicates that the following variables have a significant, negative effect on WTP for a Rock Lobster fishing trip: fishing during the month of December; fishing on the North Island for Rock Lobster[61]; experiencing no difficulties at all in trying to catch the targeted fish[62]; an improvement in weather conditions; fishing during a fishing competition; if Snapper was targeted on the Rock Lobster fishing trip; and if the main motivations for fishing was indicated to be for eating purposes only then this also had a negative effect on WTP for a Rock Lobster fishing trip.

The signs and sizes of these coefficients all appear to be reasonable. Table 8.14 describes the prediction success of the Probit model. The figures suggest that this model correctly predicted 291 out of 362 (80 per cent) "no" responses and 68 out of 139 (49 per cent) "yes" responses correctly.

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57 It must be noted that both models are not robust, in that all variables do not reach a 95 per cent level of confidence. Most variables however do reach a mathematical level of significance.

58 Based on a 95 per cent confidence interval, we can be sure that our mean marginal WTP per Rock Lobster caught lies between $6.31 and $6.77.

59 Note, the Kept other than RL variable was not significant at all. This implies that within the RL database, people targeting Rock Lobster were on the whole not concerned with keeping other fish. Once again, this effect is difficult to discern given the wide range of other species fished for at the same time as targeting RL.

60 This seems to be a strange result, however what it implies is that people who experienced difficulties that day trying to catch Rock Lobster and whom associated those difficulties with natural factors had a higher WTP than people who associated their difficulties to human, personal or other factors.

61 One has to be careful with this result as the majority of surveys for Rock Lobster fishing were conducted on the North island.

62 Again, this effect of this variable is hard to explain. One could suggest that the easier it is to catch Rock Lobster (through diving or pots) on the day, the less effort (i.e., sport) is required by the fisher and hence they do not appreciate their catch as much as fishers who experience difficulties in trying to catch Rock Lobster.

Table 8.14
Prediction Success of the Rock Lobster Model

		Actual	
		0	1
Predicted	0	291	71
	1	71	68
	Total	362	139

Source: SACES.

For policy purpose the average values of these variables in the Rock Lobster database used may well be of some interest and these are presented in Table 8.15 below.

Table 8.15
Average Values of Some Key Variables

Variable	Mean	Dispersion
Number of Rock Lobster caught	8.5	min = 0, max = 50, sd = 8.2, skew = 2.1
Number of Rock Lobster kept	3.5	min = 0, max = 24, sd = 3.1, skew = 1.9
Number of other fish caught	13.7	min = 0, max = 400, sd = 38.1, skew = 5.1
Number of other fish kept	7.1	min = 0, max = 206, sd = 20.5, skew = 5.2
Willingness to pay	169.0	min = 50, max = 560, sd = 74.7, skew = 0.9

Where: min = minimum; max = maximum; sd = standard deviation; skew = skewness.

Table 8.15 indicates that average WTP for a fishing trip is $169.00 and that each fisher kept on average 3.5 Rock Lobster. This suggests that the average value of Rock Lobster is: (169.00/3.5) = $48.29.[63] If we assume that the average weight of a Rock Lobster is 0.66 Kg[64]; this implies an average WTP of 48.29/0.66 = $73.16 per Kg of fish caught. From Table 8.13 we know that the marginal WTP for Rock Lobster is $6.54. Thus, the marginal WTP in terms of weight is given by: 6.54/0.66 = $9.91 per Kg.

Once again, there is a large difference between average and marginal WTP for a Rock Lobster. Although 17 per cent of fishers did not keep any Rock Lobster from their trip, the distribution of fish kept was still skewed. Of the Rock Lobster kept, 24 per cent of fishers caught over 51 per cent of the total Rock Lobster. This indicates that the distribution of Rock Lobster kept is skewed, and a more even distribution would reflect a higher marginal WTP.

8.4 Total Recreational Value of Rock Lobster in New Zealand

To estimate the total recreational value of Rock Lobster fishing in New Zealand, calculations of the marginal value of a Rock Lobster are applied to estimates of the total Rock Lobster catch in the region. For explanation of this theory — see Section 2.2.

63 That is WTP / (number of Rock Lobster kept) = (169.00/3.5) = $48.29.
64 As estimated from Bradford (1998).

Hence, the recreational value of Rock Lobster in New Zealand is calculated in the following ways:

Marginal WTP per kg of Rock Lobster x Catch of Rock Lobster = Recreational Value of NZ Rock Lobster
$9.91 per kg x 313,000 kg (see Section 3.2.5) = $3,101,546

Average WTP per kg of Rock Lobster x Catch of Rock Lobster = Recreational Value of NZ Rock Lobster
$73.16 per kg x 313,000 kg = $22,899,134

Hence, the total recreational value of Rock Lobster fishing in New Zealand using a marginal WTP per kg is estimated to be $3.1 million[65], and $22.9 million using an average WTP per kg.

8.5 Conclusion

This Section has outlined the Centre's analysis on Rock Lobster recreational fishing in New Zealand. The main points can be summarised as follows:

- As compared to "All fishers" — Rock Lobster fishers go fishing significantly more times per year (the majority of trips are to check pots); they are more likely to fish for Eating purposes; they are more likely to fish from Boats for diving and pot platforms; they are less likely to own a boat; they catch and keep additional fish; they are less likely to have experienced difficulties in trying to catch their targeted fish; they are more likely to blame their difficulties on personal and human factors; they spend less time fishing per trip; they have a significantly higher average fishing trip expenditure; they are more likely to be in white collar employment; they have larger incomes; they have a higher male participation; and they are more likely to be a member of a fishing club;
- For the current situation of Rock Lobster fishing, the marginal WTP for an additional Rock Lobster, excluding the impact of all other variables, was $6.54[66]. This was lower than the average WTP for a Rock Lobster at $48.29. The marginal WTP for a Rock Lobster implies that catching and keeping an additional Rock Lobster adds $6.54 to the WTP for a given fishing trip (*ceteris parabis*);
- Variables such an increase in the amount of time spent fishing that day; fishing with people other than members of the fisher's household; an increase in the enjoyment associated with the fishing trip on that day; an increase in the importance of fishing as a recreational activity; an increase in a fisher's income; fishing for Rock Lobster by diving; experiencing difficulties with catching Rock Lobster that day and associating those difficulties to natural reasons; and if the main motivations for fishing was indicated to be for sporting reasons and to fish

[65] Based on the 95 per cent confidence interval for the marginal WTP estimate (with a lower and upper limits of 5.85 and 6.83 per Rock Lobster respectively) the recreational value of NZ Rock Lobster per kg ranges from a lower limit of $2,991,621 to an upper limit of $3,211,470.

[66] Once again, the Centre believes this represents an underestimate of the value of a kept Rock Lobster given the problems experienced with the surveys.

with family and friends then this also had a positive effect on WTP for a Rock Lobster fishing trip;

- The correct form of Rock Lobster to use is the amount of Rock Lobster caught, not the amount of Rock Lobster kept; and
- The New Zealand recreational value for Rock Lobster is $3.1 (using a MWTP value) and $22.9 (using a AWTP value) million dollars.

9. Overall Results

9.1 Application of Theory

Table 9.1 below illustrates the overall results from the regression analyses, under marginal willingness to pay (MWTP) and average willingness to pay (AWTP) — per fish, per kg, and total recreational value.

The divergence between values of the species is due to the type of fish it is, what it is used for, the abundance of its stock, the area where it is fished for and the equipment needed to catch it. For example, Kingfish is primarily a recreational sporting fish. It is one of the prime fish targeted by tourists. As Kingfish grow to world record sizes in New Zealand, it is one of the species most hunted for in the North Island. The scarcity of catching a Kingfish (especially a very large one) adds to its recreational value. This implies that there is no close substitute for catching a Kingfish — people are not catching it for eating motives, they are catching it for other recreational motives. The other values of some of the other four fish species imply that the recreational value of catching the fish is more of a substitute for buying that fish in the shop. Section 9.3 examines the difference between prices paid for the fish in question and its recreational value.

There is a difference between marginal and average WTP per species. Sections 4 to 8 (and Appendix Eight) have already explained why the two values diverge so much for the different species. The question arises as to which value should be used for policy purposes — marginal WTP recreational value or average WTP recreational value? The average WTP value is considerably higher than marginal WTP.[67] This dilemma can only be solved by understanding what question is being sought. There are three types of question policy makers may seek:

(1) The value of recreational *fishing* as a whole — to work out what fishing is worth to New Zealand. This takes into consideration anglers who are willing to go out and spend money trying to catch fish even though they are not successful.

(2) The value of recreational *fish* — in order to compare the value of recreational fishing to commercial fishing.

(3) The value of the expenditure made by fishers — to estimate how much money the local economy may derive from recreational fishers.

The Centre's suggestion is that marginal WTP values are the best illustration of how much recreational fish are worth to New Zealand recreational fishers. These are the values that should be used for policy purposes, i.e., cost-benefit analysis, fishery allocation, legal situations and for comparing recreational values against commercial fishing economic values.

On the other hand — if the Ministry's purpose is to illustrate the general value of recreational fishing in New Zealand, then average WTP values may provide more information.

[67] The average WTP was worked out by dividing the mean WTP in a species database by the mean number of fish species kept. This implies that values of anglers who did not catch anything (but were willing to spend money) were included in the average value. Marginal WTP values are only calculated on people who caught and/or kept a particular fish.

Table 9.1
Overall Results from the Regression Analyses

	Species Fish MWTP per fish	All Other Fish MWTP per fish	AWTP $ per fish	MWTP $ kg	AWTP $ kg	MWTP Total Value - $Kg	MWTP Total Value - $Fish	AWTP Total Value - $Kg	AWTP Total Value - $Fish	Lower Limit MWTP Total Value - $Kg	Upper Limit MWTP Total Value - $Kg
Snapper	5.73	1.09*	30.85	5.79	31.16	15,806,697	15,889,290	85,098,194	85,542,848	15,616,046	15,997,348
Kingfish	19.76	1.41*	181.1	3.26	29.83	1,243,545	1,462,240	11,395,615	13,399,692	1,205,327	1,281,764
Blue Cod	1.61*	3.04	24.46	2.40	36.50	1,751,776	1,742,020	26,610,156	26,461,957	1,627,459	1,876,093
Kahawai	3.44*	3.07	59.65	2.80	48.49	4,245,463	4,241,520	73,613,199	73,544,824	4,390,636	4,690,964
Rock Lobster	6.54	0.49*	48.29	9.91	73.16	3,101,546	3,492,360	22,899,134	25,784,571	2,991,621	3,211,470
TOTAL						**26,149,027**	**26,827,430**	**219,616,299**	**224,733,892**	**25,545,519**	**26,752,535**

Note: * Indicates fish variable was not significant at the 95 per cent level of confidence.

Estimates of the total amount spent per year by a fisher targeting a particular species will provide a rough estimate of the amount of expenditure spent in the economy. However, it must be noted that these figures are based on recurrent expenditure only, they may be over-estimates (as explained previously) and they do not take into account any multiplier effects.

9.1.1 Average WTP — Value of Recreational Fishing

Out of the five species the Centre studied, the fish species that is valued the highest in New Zealand recreational fishing on a fishing trip is Kingfish, which adds $181.10 to the average WTP for a fishing trip. Kahawai is the second highest, adding $59.65, then Rock Lobster $48.29, Snapper $30.85 and Blue Cod $24.46.

On a weight AWTP basis, the fish species that is valued the highest in New Zealand recreational fishing on a fishing trip is Rock Lobster, which adds $73.16 to the willingness to pay for a fishing trip. Kahawai is the second highest, adding $48.49, then Blue Cod $36.50, Snapper $31.16 and Kingfish $29.83.

The Centre has calculated average values for the total recreational fishing estimates on a fish and weight basis. The fish species that has the highest recreational fishing value estimate is Snapper, with $85.1 million. Kahawai is the second highest, with $73.6 million, followed by Blue Cod $26.6 million, Rock Lobster $22.9 million, and Kingfish $11.4 million[68].

9.1.2 Marginal WTP — Value of Recreational Fish

Out of the five species the Centre studied, the fish species that is valued the highest in New Zealand recreational fishing on a fishing trip is Kingfish, which adds $19.76 to the marginal WTP for a fishing trip (holding all other variables constant). Rock Lobster is the second highest, adding $6.54, then Snapper $5.73, Kahawai $3.44 and Blue Cod $1.61.

On a weight MWTP basis[69], the fish species that is valued the highest in New Zealand recreational fishing on a fishing trip is Rock Lobster, which adds $9.91 to the WTP for a fishing trip (holding all other variables constant). Snapper is the second highest, adding $5.79, then Kingfish $3.26, Kahawai $2.80 and Blue Cod $2.40.

The total New Zealand recreational fishing values estimated here for 1999 depends critically on how representative the estimates of recreational catch were in 1996.[70] Also, the size of the estimate of recreational value for each species depends on the total recreational catch of that species in New Zealand. The Centre has calculated values on a

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68 Once again, these values depend critically on estimates of mean weights and recreational catches of the five species. It is also important to note that average WTPs per fish are influenced strongly by the distribution of the catch among the fishers in the database. The more unequal the distribution of catch — the larger the AWTP is as compared to the MWTP of the fish species. Distribution statistics were presented in Sections 4 to 8, and the theoretical discussion is presented in Appendix Eight.

69 Note that per kilogram estimates depend critically on the average mean estimate of a recreational catch. As the estimates used were from recreational catch caught in 1996, it is highly likely that recreational fishing in 1998/99 may have caught considerably different fish weights. However, these figures should be updated at a later stage to take into consideration new figures derived from the 1999/2000 Recreational Fishing Survey.

70 Remember the Centre used estimates of recreational catch derived in Section 3, and it has been indicated that they may be seriously underestimated (personal communication, Rick Boyd).

fish and weight basis. The fish species that has the highest recreational fishing marginal value estimate is Snapper, with $15.8 million. Kahawai is the second highest, with $4.3 million, followed by Rock Lobster $3.1 million, Blue Cod $1.8 million and Kingfish $1.2 million. Table 9.1's last two columns illustrate the lower and upper limits of the MWTP recreational value per kilogram for each fish species.

9.1.3 Money Spent Fishing

For the five species in question (plus an estimate of all fishers within the database and an average of the five species) Table 9.2 details the average money spent fishing on a trip, the total amount spent per year by a fisher and the total population estimates of recurrent recreational fishing expenditure.[71]

Taking into consideration the problems associated with these estimates, the species that had the highest average amount spent per trip was Rock Lobster, with $51.52. The second highest expenditure per trip was for Kingfish $49.68, then Blue Cod $44.09, Snapper $35.80 and Kahawai $25.32.

Given the estimates of the population of New Zealand fishers who fish for each species in a given year, the largest total recurrent expenditure for a fish in a given year was Snapper fishing, with $417.3 million dollars, followed by Rock Lobster fishing $162.3 million, Kahawai $152.4 million, Kingfish $128.1 million and Blue Cod $113.5 million. These figures imply a total recreational expenditure of $973.5 million dollars for fishing all five species in New Zealand.

The largest total amount spent per year by a fisher for a species was again Rock Lobster, with $1,623, then Kingfish $1,281,[72] Snapper $927, Blue Cod $810, and Kahawai $693.

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71 There is need for caution when using these estimates. Firstly, the estimates for the five species were calculated by only selecting fishers who indicated they were targeting that species on the day (hence different records were used as compared to the econometrics analysis). Secondly, the average amount spent can only be considered to be a reasonable estimate if it is thought that a representative sample of fishers were surveyed. For example, the majority of surveys were conducted at boat ramps, hence there was a higher proportion of anglers who spent more on fishing trips surveyed because of their boat, diving and charter expenses. This average figure may be considerably higher than what an 'average' fisher in New Zealand generally spends. Our average estimates may therefore be an overestimate. Our estimates also assume that the fisher in question generally always targets the fish indicated when fishing during the year, an assumption that is clearly unlikely. Therefore, caution is urged in the interpretation of these statistics. However, it is also important to note that recurrent expenditure only was asked for, the surveys specifically asked respondents to ignore expenditure on items such as fishing rods, boats, depreciation issues, etc.. Hence — the total amount spent per year by an average fisher would be considerably higher if these factors were taken into consideration. Also - there is an element of double-counting of expenditure among fish species, given that people target more than one species at a time. Hence - the total estimate for expenditure may involve some double-counting, though it is difficult to suggest how much given the lack of sound information about the fishers that target particular species in New Zealand.

72 The Centre suggests that the Kingfish and Rock Lobster estimates of total recurrent expenditure per year have the largest amount of problems.

Table 9.2
Money Spent Fishing

	Snapper	Kingfish	Blue Cod	Kahawai	Rock Lobster
Average amount spent $	35.8	49.68	44.09	25.32	51.52
Average fishing trips per year	25.9	25.8	18.4	27.4	31.5
Total amt spent per year by an average fisher $	927	1,281	810	693	1,623
Population of NZ fishers*	450,000	100,000	140,000	220,000	100,000
Total recurrent expenditure	417,249,000	128,075,040	113,452,388	152,406,144	162,288,000

Note: * The population of NZ fishers were provided by Todd Sylvestor of Ministry of Fisheries.[73]
Source: SACES.

9.2 Value of Recreational Fishing in New Zealand

Table 9.3 illustrates the value of Recreational Fishing to New Zealand. It presents three different estimates: the value of fishing as a whole, the value of the actual catch, and the value of money actually spent fishing.

1. Value of Recreational Fishing

The total value of *fishing* recreationally in New Zealand was estimated to be $219.6 million.

This value should only be used purely as an illustration basis by the Ministry in valuing recreational fishing.

2. Value of Catching Fish

The Centre calculated the total value of *catching fish* recreationally in New Zealand to be $26.2 million.[74] Based on a 95 per cent confidence level, the mean ranges from a lower limit of $25.6 million to an upper limit of $26.8 million.

This value is what the NZ Ministry of Fisheries should use when comparing recreational values to commercial values, or for policy purposes of any kind.

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[73] Todd indicated that these figures of the population of recreational fishers were based on 1987 estimates and local knowledge and may be questionable. Consultation with E. Bradford also indicated that she had no estimates of the number of recreational fishers in New Zealand. The Centre therefore estimated its own population of recreational fishers — by dividing the total recreational catch of a species (estimates provided by NIWA) by our average fish caught and kept. This gave a proxy for the number of recreational fishers who catch (note: not target) a particular species. We did not end up using this estimate as although it was reasonably similar to Todd's figures, the numbers of recreational fishers fishing for some species (namely Snapper, Blue Cod and Kahawai) were considerably higher. The problem with this method is that it assumes there is a reasonably equitable distribution of catch — which we know there is not. Hence, it was deemed that Todd's figures were most likely more reliable than our estimates. The Ministry may wish to collect more accurate results in the future.

[74] This estimate uses the MWTP estimates of each fish species. It is also crucial to note that the Centre has in no way attempted to estimate the value of catching other fish species than the five studied in New Zealand. As explained previously to the Ministry of Fisheries, to place values on other fish species would involve a considerable number of assumptions and arbitrary guesswork, and the Centre is not qualified to venture such guesses.

3. Money Spent

The total value of recreational fishing expenditure in New Zealand was estimated to be $973.5 million dollars.[75]

This value should only be used by the Ministry for illustration purposes for showing the expenditure of recreational fishers.

Table 9.3
Value of Recreational Fishing in New Zealand

	Value of Recreational Fish Caught	Value of Recreational Fishing	Value of Money Spent Fishing
Total $	26,149,027	219,616,298	973,470,572

Source: SACES.

9.3 Prices paid by Consumers in New Zealand for the Five Species of Fish

Table 9.4 illustrates the prices paid commercially (by port and retail) for the five species by island in New Zealand.

Table 9.4
Port and Retail Prices Paid for the Five Species by Island - 1998

Area of NZ	Snapper	Crayfish	Blue Cod	Kahawai	Kingfish
Northern part of the North Island					
- Port price per kg	$4.20	$31.00	$2.10	$0.60	$2.65
- Retail price per kg	$10.50	$50.00	$9.50	$3.02	$7.50
Southern part of the North Island					
- Port price per kg	$3.10	$26.00	$2.10	$0.30	$2.65
- Retail price per kg	$9.00	$50.00	$7.50	$2.20	$7.00
South Island					
- Port price per kg	$2.70	$20.00	$2.10	$0.25	$2.65
- Retail price per kg	$12.00	$45.00	$8.00	$1.70	$9.00
Average Port price per kg	$3.33	$25.67	$2.10	$0.38	$2.65
Average Retail price per kg	$10.50	$48.33	$8.33	$2.31	$7.83

Note: Port prices is the price the Licensed Fish Receiver pays to the fisher) per Kilogram for whole fish (not gutted or filleted) and wholesale price is usually a bit more than the port price.
Source: Todd Sylvester Ministry of Fisheries.

The Centre's estimates of the MWTP per kg for each species illustrate that the recreational value of fish is higher than the port (and perhaps wholesale) value of commercially bought fish. The key exception is Rock Lobster. However, in all cases the MWTP $ per kg of species is significantly lower than the retail price per kilogram of fish. The exception is Kahawai, where the MWTP $ per kg value is $2.80 and the average

[75] The Centre suggests this figure be recalculated when additional information becomes available. For example, when a more concise estimate can be placed the population of recreational fishers it would be worthwhile re-analysing fishers recreational expenditure.

retail price paid is $2.31 per kg, illustrating that Kahawai have a much higher value as a recreational fish than a commercial or eating fish.

If AWTP $ per kg estimates are used, then these values are significantly higher than the retail prices paid for all fish species. This illustrates that as an activity, recreational fishing has far greater value than the prices consumers pay at shops.

9.4 Gross Production Value of Commercial Fishing in New Zealand

The gross production value of commercial fishing in New Zealand in 1998 was estimated to be[76]:

- Snapper — $70 million;
- Kingfish — $3 million;
- Kahawai — $4 million;
- Blue Cod — $15 million; and
- Rock Lobster — $120 million.

Remembering that gross production value does not equal commercial economic value (because it does not take into consideration producer and consumer surplus[77]), it is shown that all species value as a recreational activity (using AWTP estimates) are higher than their counterpart commercial gross production value (with the key exception of Rock Lobster[78]).

The only species where the value of the recreational fish caught themselves was higher than the commercial gross production value is Kahawai. The next largest difference (apart from Rock Lobster) between recreational and commercial values is Kingfish, where the value of general recreational Kingfish fishing (using AWTP figures) exceeds the gross production value by almost four times. Rock Lobster by contrast has gross value of commercial production forty times that of the value of recreational fish caught, and is 5.5 times larger than the value of Rock Lobster recreational fishing.

These differences illustrate that Kahawai and Kingfish are valued very strongly as sporting fish, and Rock Lobster has its highest values as a commercial eating fish (whether for consumption or exports etc.).

All in all, the total value of recurrent fishing expenditure in New Zealand is approximately 4 times greater than the value of recreational fishing, which in turn is approximately 8 times greater than the value of catching and keeping fish.

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76 As provided to the Centre by Todd Sylvester of Ministry of Fisheries.

77 Generally, commercial economic value will be less than gross production value.

78 Once again, the Centre is the least confident about the Rock Lobster results given the problem with the surveys and believes that the RL figures are likely to be underestimates.

10. Future Research Possibilities

The Centre has been asked to comment on future research possibilities that may arise out of this project REC9801. We have identified a number of areas that the Ministry of Fisheries may wish to pursue. A brief synopsis of each research area is provided below:

10.1 Recreational Expenditure by Region

Additional research that may be helpful to the Ministry is to estimate the recreational expenditure of fishers by region within New Zealand. This work would extend the estimates already provided by the Centre within the report, providing that we could get figures of recreational catch by region.

In addition the Centre could examine the potential multiplier effects that occur with recreational fishing, and place a potential value on them. In hindsight, a valuable question on the Centre's surveys would have been a question asking if they were a tourist to the area, or asking where the fishers usual residence was located.

10.1.1 Average Willingness to Pay/Value of Recreational Fishing by Region

In addition, the Centre may be able to provide average willingness to pay values by region. As these values are averages from the database, estimating them by region should be reasonably straightforward to do — depending if all the information required was available. This may then provide the Ministry with estimates of the value of recreational fishing by region.

10.1.2 Marginal Willingness to Pay/Value of Recreational Fish by Region

On the other hand, the Centre cannot provide marginal WTP figures by region, as breaking down the survey records into regions would imply statistical significance would be lost and results would be practically worthless. However — this is not to say that no marginal WTP figures by region could be provided. For example, if it was found that there was enough Snapper records within the Auckland area, then there is a potential that marginal willingness to pay values per Snapper could be provided for the Auckland area. The Ministry of Fisheries may then have some idea how the value of an additional fish varies within regions.

10.2 Commercial Fishing Value

The second natural extension of REC9801 is to estimate the marginal value of a commercial fish for the five fisheries in question. If the recreational marginal WTP is higher than the commercial marginal value, then the Ministry could increase the total value of all fishing (recreational plus commercial) by reallocating some of the commercial quota to the recreational sector. If the commercial marginal value function was estimated, then one could calculate the allocation that maximises the total value of recreational and commercial fishing.[79]

[79] Thanks goes to Jon Sutinen for providing commentary on this point.

10.3 Additional Recreational Values of Other Fish

The third extension of this current research is to look at the viability of providing other marginal WTP values for other species of fish. There is the potential that, given enough records, average and marginal values may be able to be provided for other species of fish caught recreationally in New Zealand (using the Centre's current database). The Centre has not pursued this possibility given its time and budget constraints. This additional information may be valuable for the Ministry to have.

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Appendix One
Example Of Fishing Questionnaire Used

NZ RECREATIONAL FISHING QUESTIONNAIRE FOR SNAPPER, KINGFISH, KAHAWAI AND BLUE COD

Date of Interview: _____ **Time of Interview:** _____

Approximate Temperature: _____ **Name of Interviewer:** _____

Location of Interview: _____

Please circle one of the following:	Rain	Drizzle	Windy	Cloudy	Sunny
From worst to best:	1	2	3	4	5

PLEASE ASK THE FOLLOWING BEFORE BEGINNING THE SURVEY:

1. Were you fishing for recreational purposes today on your trip? Yes ❑ No ❑
(If the answer is no, end the survey, if not, go to Question 1, Section A)

PLEASE ANSWER THE FOLLOWING AFTER COMPLETING THE SURVEY:

1. Has the respondent refused to answer any questions: Yes ❑ No ❑

2. How confident are you about the sincerity of the respondents answers?
Very Confident ❑ Confident ❑ Fairly Confident ❑ Not Confident ❑

3. How well do you think the respondent understood the questions?
Very Well ❑ Well ❑ Not Well ❑

A. GENERAL QUESTIONS

1. How enjoyable was today's fishing trip? ***(Please rank from 1 to 5):***

Terrible	Poor	Satisfactory	Good	Very Enjoyable
1	2	3	4	5

2. What were sea conditions like during your fishing trip today?

Terrible	Poor	Satisfactory	Good	Excellent
1	2	3	4	5

3. How important is fishing as a recreational activity to you?

Not Important	Minor Importance	Average	Important	Extremely Important
1	2	3	4	5

B. INDIVIDUAL FISHING DETAILS

1. **How many times have you been fishing in the past 12 months?** _____ times

2. **What did you fish from today:**
Boat ❑ Jetty/Wharf ❑ Land (shore) ❑

3.a **Do you own your own boat?** *(If no go to question 4)* Yes ❑ No ❑

3.b **Does your boat have a fish finder?** *(If no go to question 4)* Yes ❑ No ❑

3.c **Does your fish finder have:**
Colour Video ❑ Liquid Crystal Display (LCD) ❑ Paper Display ❑ Other ❑

4. **How much time did you spend fishing today?** _____

5. **On average how long do you stay out fishing on each trip?** _____ hours

6. **What fish were you targeting on today's trip?**
Any ❑ Blue Cod ❑ Kingfish ❑ Snapper ❑ Kahawai ❑
Other (*please detail*) ❑ _____ _____
_____ _____ _____

7.a **Of the fish you were targeting, which species did you experience difficulties with in trying to catch?** ***(If no difficulties were experienced go to Question 8)***
None ❑ All targeted ❑
Blue Cod ❑ Kingfish ❑ Snapper ❑ Kahawai ❑
Other (*please detail*) ❑ _____ _____
_____ _____ _____

7.b **What do you think the difficulties experienced were the result of?**
Personal factors, *ie, not fishing for long, wrong equipment* ❑ Natural factors, *ie, biological* ❑
Human factors, *ie, over-fishing, pollution* ❑ Other ❑

8. **Did the people fishing from your boat today come from *MORE* than one household?**
Yes ❑ No ❑

9. **Of the people with whom you were fishing with, what did today's catch consist of (including the fish thrown back) and how much did you take home for yourself?**

CAUGHT		**KEPT**	
Species	**Number**	**Species**	**Number**
Blue Cod	_____	Blue Cod	_____
Kingfish	_____	Kingfish	_____
Snapper	_____	Snapper	_____
Kawahai	_____	Kawahai	_____
Other*(please detail)*		Other*(please detail)*	
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

10. **What is your *main* motivation for going fishing? *(tick only ONE box…)***

Sporting Purposes ❑ Eating Purposes ❑ Sporting and Eating Purposes ❑

To Enjoy the Outdoors ❑ To Catch a Large Amount of Fish ❑

To be with Friends and Family ❑ To Explore New Areas ❑ Customary Purposes ❑

Other *(please specify)* ❑ _____

11. **How much did you spend on your fishing trip** *TODAY* **on items such as:**

Bait _____ Ice, food and drinks _____

Fuel for the boat and car _____ Ramp fees _____

Fishing equip. used, ie, lures *(Exclude major items of equipment such as reels and rods etc)*

Miscellaneous _____ …… _____

TOTAL EXPENDITURE $_____

12. **Now suppose that it had cost you more than this amount to go fishing today, because the price of these items had risen. If it had cost you an *EXTRA* $ __ on these items would you have still gone fishing today? Please remember here that there are many other calls on income….**

Yes ❑ No ❑

C. DEMOGRAPHIC CHARACTERISTICS

To make sure that we are interviewing a wide cross section of people I need to ask you a few more questions.

1. **Record Gender of Participant:** Male ❑ Female ❑

2. **Record Ethic Group of Participant:** European ❑ Maori ❑ Asian ❑ Polynesian ❑ Other ❑

3. **Are you a member of an organised fishing club?** Yes ❑ No ❑

4. **Which of the following age groups do you fit into?**

A 15-20 years **B** 21-30 years

C 31-40 years **D** 41-50 years

E 50-60 years **F** 61+ years

5.a **What is your occupation?** *(If unemployed or retired on a pension end interview)*

_____

5.b **Do you work full-time or part-time?** Full-time ❑ Part-time ❑

6. **Could you please indicate the category of your *GROSS* income *BEFORE TAX* or anything else is taken out?**

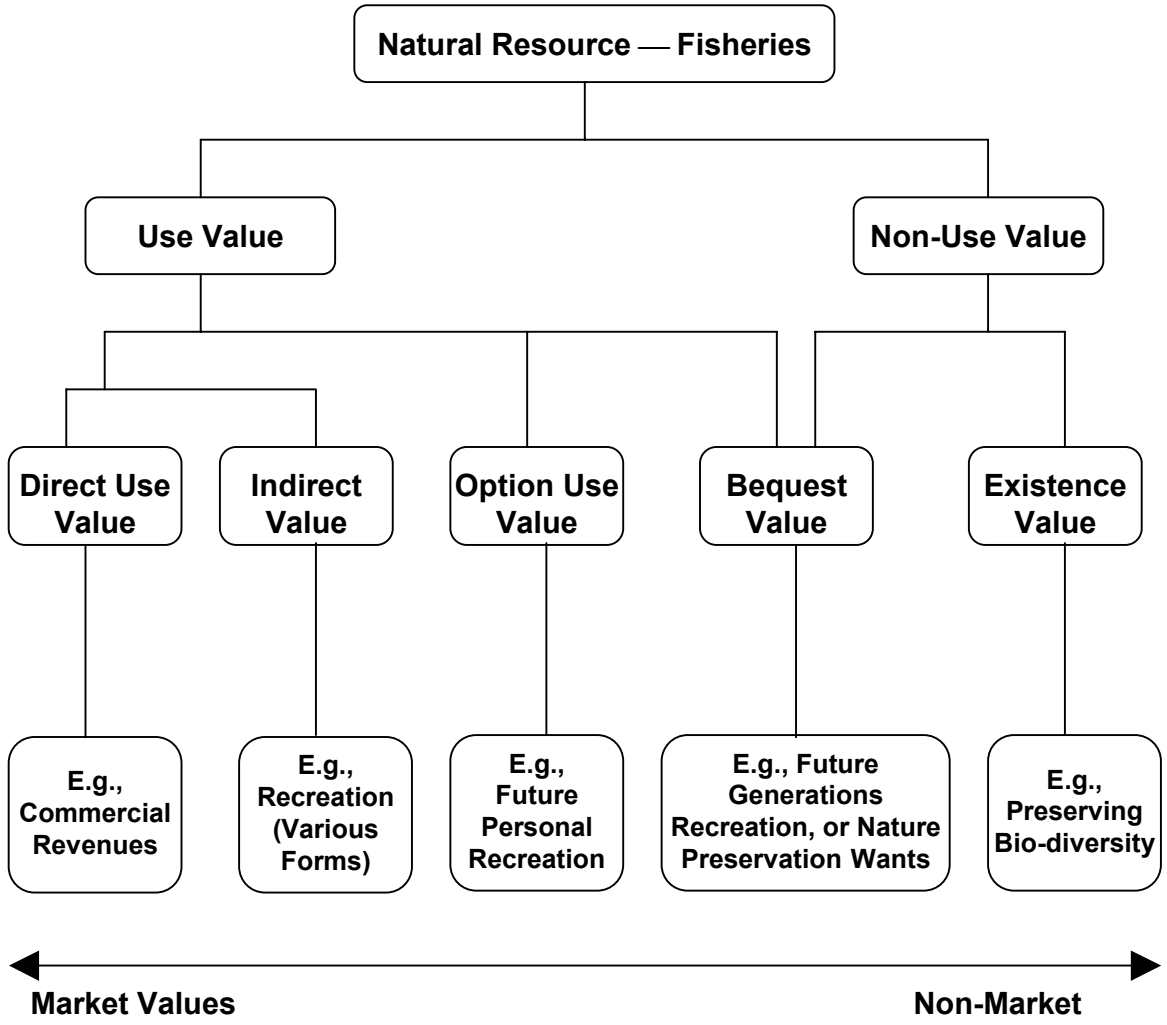
A Under $20,000 **B** $20,000 - $35,000

C $35,000 - $50,000 **D** $50,000 - $65,000

E More than $65,000

Appendix Two

Environmental Economics Methodology and Terms



(Adapted from D. Pearce *et al,* 1994)

The above diagram gives a graphical representation of the total economic value of fisheries. The following section provides a brief description of the individual terms involved:

Use Values: Derived from the actual use of the environment, i.e., commercial and recreational fishing.

Direct Use Values: Sum of traded value of what people paid for the resource.

Indirect Use Values: Values that people do not pay for, or fully pay for, under present circumstances, i.e., recreational fishing.

Option Use Values: The value one places on something which one might want access to. For example, someone who has never fished before but wants fish available in case one day they themselves want to go fishing.

Bequest Values: The value one places on the environmental good for one's descendants. For example, for a fisher it is the value they put on knowing that the resource will be there for the children to enjoy in the future. Bequest values are classified as both use and non-use values.

Non-Use (Intrinsic) Values: A value expressed by humans for environmental resources which are unrelated to human use. These values include concern, sympathy and respect for the rights or welfare of non-human beings.

Existence Values: Similar to bequest values, it is basically the desire to know that something still exists. For example, there is large concern for the plight of blue whales in the world, although most people will never see them or use them.

The above diagram provides a comprehensive breakdown on the total economic value of fisheries to humans. It is important to note a number of factors from this:

- this study was not commissioned to estimate the total economic value of New Zealand's recreational fisheries, indeed this would be a complex and costly task to undertake. The purpose of this study was to provide an estimate of the indirect use of five main fisheries (Snapper, Kingfish, Blue Cod, Kahawai and Rock Lobster) through recreational fishing; and
- even if the total economic value of these five fisheries were estimated it is important to recognise that by no means does this capture the *total value* (note the emphasis!) of them. For example, biological factors and other species dependence on the fisheries can never be fully taken into account by total economic value. These other factors may be just as important as the values humans place on the resource.

Taking all these factors into consideration, we now turn to see the various methods by which economists can place a value on indirect values such as recreational fishing. There are two broad ways by which this can be done, direct and indirect approaches.

Direct Approaches

Questionnaires (surveys)

There are two choices of direct approaches that could be made; the contingent ranking method (CRM) and the **contingent valuation method** (CVM). CRM rank preferences that are obtained and later compare them to prices observed in the market. CVM ask direct questions on "what they are willing to pay (or willing to accept) for some change in a provision of a good or service (i.e., fish catches)". They create hypothetical markets for the resource in question, collect information and then econometric techniques are applied to find the mean bid value of the willingness to pay. Some common factors that must be considered before deciding to use CVM as the method to elicit fishers preferences include:

1) CVM is the only technique available from which non-use values can be estimated, for example, trying to estimate intrinsic and option value to calculate total economic value. Therefore, before any decisions are made it must be

clearly understood exactly what questions or values the policy makers want solved or estimated.

2) A sufficient sample size, or survey return, must be obtained before any results from CVM can be justified. It must also be recognised that CVM are not cheap, and a properly designed survey and analysis will be expensive.

3) Proper understanding of the context with which fishers will respond to the survey. The design of questions must also include distinguishing between willingness to pay and willingness to accept, as theoretically they should elicit the same preferences but in reality preferences differ (see Tietenberg 1996 for more discussion).

4) Application of econometric models to infer a favoured response central tendency.

5) Response validity of preferences must be tested by relating willingness to pay responses to respondent socioeconomic and demographic characteristics. Other validity tests can be done to assure the policy maker of the reliability of the results from the survey.

It is important to realise that there are a lot of problems associated with CVM. Many studies have been criticised, and rightly so, for simply unbelievable results. However, it is important to realise the value of CVM, and applied correctly with proper testing they can provide extremely important results that are essential to resource policy making. In order for them to make such a contribution, structures and testing in their design and implementation must be followed. The Centre based the CVM methodology for the framework on the report of the National Oceanic and Atmospheric Administration Panel on the Contingent Valuation Method, 1993, by Arrow K., et al. This report established the guidelines for conducting contingent valuation studies.

Indirect Approaches

Indirect valuations for natural resources can be classified into two categories, surrogate market approaches and conventional market approaches. Some conventional market approaches include dose-response and replacement cost techniques which won't be considered here as it is difficult to apply them to valuing fisheries. Surrogate market techniques involve looking at markets for private goods and services which are related to the environmental commodities of concern. Individuals can reveal their preferences with how they use the resource, hence leaving a "behavioural trail" behind them with which preferences can be elicited. Some surrogate market techniques include hedonic price and wage techniques and the travel cost method. However the only indirect technique that is suggested as a tool to estimate the value of recreational fishing is the travel cost method.

Travel Cost Method

This approach uses observed expenditures on the travel to recreational sites to estimate the benefits arising from the recreational experience. It includes the money and time spent by people to get to a site to estimate willingness to pay for a sites characteristics. Note that this is similar but not exactly the same as to how much was spent on the fishing trip by the recreational fisher. Also, the only values specified by this method is the use values. There are a number of problems associated with this indirect method. Data requirements for this method are substantial, with a survey needed to establish the

required information needs. This method helps to value the tourism aspect involved with fishing as well.

Appendix Three

NZ Fisheries Contingent Valuation Methodology

Traditionally CV surveys have three components. In the first the researcher describes the change being considered. This study was commissioned to evaluate the current situation, hence this issue is not relevant to the survey.

The second component involves determining a mechanism for eliciting value. This is central to the CV technique. Following a comprehensive survey of the CVM by Nobel laureates and other experts, the US courts recommended the use of the *Discrete Choice* approach over the *Open Ended Approach*. More recent work by Cameron and Quiggin (1994) further suggests that distributional considerations warrant using the *take or leave it* variant of the *Discrete Choice* approach over other alternatives. Thus, the elicitation question used in this study is of the *take or leave it* variety. This is in accordance with the recommendations of US Federal Register (1996) and circumvents the difficulties cited in Cameron and Quiggin (op cit). After much pre-testing it was discovered that a concise, comprehensible and simple question was required. The elicitation questions took the following form:

Question 11

How much did you spend on your fishing trip TODAY on items such as:

Bait _____ *Ice, food and drinks* _____

Fuel for the boat and car _____ *Ramp fees* _____

Fishing equip. used, ie, lures **(***Exclude major items of equipment such as reels and rods etc)*
Miscellaneous _____ …… _____

TOTAL EXPENDITURE $_____

Question 12

Now suppose that it had cost you more than this amount to go fishing today, because the price of these items had risen. If it had cost you an EXTRA $ __ on these items would you have still gone fishing today? Please remember here that there are many other calls on income….
ANSWER YES / NO

The "bid amount" (i.e., $x) asked of each person was determined by the algorithm developed by Cooper (1994). This technique was developed to minimise statistical and distributional biases in the elicitation questioning. The bid amounts satisfies an optimising criterion. If a bid is set too high it results in a wasted observation since people are unlikely to be willing to pay an excessively high amount to go fishing. A bid set too low would result in little sample information, since most people would be willing to pay this amount. The technique therefore optimises between response information received from concentrating bids in the centre of the distribution and the information received from placing bids in the tails of the distribution. Another feature of this technique is that the greater the positive (negative) skew of the data the wider is the spacing of bids to the right (left) of the median. Monte Carlo studies reveal that this technique produces more efficient surveys which maximise the information which can

be extracted. Use of this method goes beyond the requirements of the US Courts as outlined by the Department of the Interior.[80]

The bid distribution was utilised for all five fisheries. However, the Centre took into account that the value of Rock Lobster fishing was most likely considerably higher than the other four fisheries. The bids for Rock Lobster were then set 100 per cent higher than in the general survey.[81]

Finally, CV surveys elicit questions on socio-economic and other characteristics of respondents. Once more trial and error and the need for brevity determined the nature and type of questions used in the survey. The most contentious question was left to the very end when respondents were asked to nominate a range for their gross incomes. The ranges were intentionally broad in order to overcome the widespread reluctance to disclose personal information. The income question was preceded by a question asking the respondent about their occupation. This provided some indication of the accuracy of the reported income. Where the discrepancy seemed large or implausible the survey was excluded from the sample.[82] Data on income are essential to the analysis. Economic reasoning strongly suggests that the WTP will be highly dependent upon income levels. It is therefore necessary to standardise for differences in the WTP which arise from differing income levels.

The US Department of the Interior has established a set of key guidelines for CVM studies which are summarised below. Every effort has been made to meet all of these guidelines. It should also be noted that these guidelines are designed to determine actual monetary damages payable by defendants in court cases. In contrast, where CVM studies are to be used for cost-benefit studies the Department suggests that there is little need to follow the strict guidelines outlined here. However it is believed that all the results yielded provide reliable and conservative estimates of the recreational value of the five fisheries.

Brief Summary of Department of the Interior Guidelines:

1. Use personal interviews not phone surveys or mail surveys.

   This recommendation was followed for the pilot and main surveys.

2. Elicit willingness to pay, not willingness to accept, even though the latter is the theoretically appropriate measure.

   This recommendation was followed.

3. Use "discrete choice" approach and seek to emulate real world market situations in the elicitation questions.

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80 Federal Register (1996).

81 This calculation was based on information provided by the Ministry of Fisheries that Snapper could be bought recreationally for $20 to $25 dollars per kg, while Rock Lobster cost approximately $50 per kg. Hence, Rock Lobster bids followed the same distribution as the other fisheries but were set 100 per cent higher. It was found that this RL Bid distribution was set too high, especially for RL pot fishers. Hence, the Centre had to change this bid distribution in January to be more in line with the other species distribution. This unfortunate mishap meant that a number of RL surveys with extremely large bids could not be used.

82 103 records that the Centre deemed to be unreliable were deleted from the overall database at the end. Within the econometrics itself, if there was a missing variable in the survey then the econometrics package automatically deleted it. Hence — the end results were based on a much smaller amount of surveys.

This has been achieved by asking what would occur if the cost of goods required for a fishing trip were to rise. People purchase these goods in real markets prior to a fishing trip.

4. Hypothetical scenario change must be described comprehensively and understandably in the survey introduction.

   This study was not specifically commissioned to assess any hypothetical changes. The Terms of Reference clearly require an evaluation of the current situation.

5. Remind respondents there are many other calls on their income, so they should not inflate their willingness to pay for the good in question.

   During the pre-testing stage and through the entire surveying process this reminder when used, was found to be totally unnecessary. It was still however included in the final survey, although the Centre cannot guarantee that all interviewers reminded their respondents.

6. Cross check the results for "warm glow effects".

   A priori reasoning suggests that this is unlikely to be a problem because of the nature of the good being valued here.

7. Perform statistical tests to ensure that income and willingness to pay are both statistically significant in the regressions.[83]

   The asymptotic t-tests are reported in the tables.

[83] In all regressions income and WTP were both positive and statistically significant.

Appendix Four

Summary of the Cameron and James Method

This Appendix draws heavily on Cameron and James (1986). Knowledge of this material is not essential to the Report.

WTP for fishing (WTPi) depends on a number of factors such as fishing experience, income etc., which we denote by a vector X^T. In stochastic form we have:

$$(1) \qquad WTPi = X^T b + \varepsilon$$

where: ε is an error term which is iid ~ $N(0, \sigma^2)$.

In the CVM take it or leave it approach individuals are asked "Would you be willing to pay \$$t_i$ to go fishing today?" The answer is either "Yes" denoted by 1, or "No" denoted by 0. Thus the probability that we get a Yes response is:

$$(2) \qquad Pr(1) = Pr(WTPi \geq t_i)$$

Using (1) this implies:

$$= Pr(X^T b + \varepsilon \geq t_i)$$
$$= Pr(z_i \geq (t_i - X^T b)/\sigma)$$

where: z is the standard normal random variable. Thus:

$$(3) \qquad Pr(1) = 1 - \Omega((t_i - X^T b)/\sigma)$$

where: Ω is the standard cdf.

To estimate the marginal WTP Cameron and James suggest first running a Probit regression with the offer amount t_i as an explanatory variable. Thus let y_i = 1, 0. The Probit regression is:

$$(4) \qquad y_i = b_i t_i + X^t b \equiv a^T Z^T$$

It is shown that the following transformation can then be used to recover the parameters of WTP and the other explanatory variables:

$$(5) \qquad (t_i, X^T)\begin{bmatrix} -1/\sigma \\ b/\sigma \end{bmatrix} = - a^T Z^T$$

The results reported in Table 1a are based on the transformation in (5). It is perhaps worth noting parenthetically that t_i is defined as the answer to question (11) of the questionnaire. It is the additional WTP for the day's fishing which is the appropriate variable used. This is in keeping with the Cameron- James procedure.

Appendix Five

Variables Used In The Econometrics

Variable	Description of Variable and how it was Coded within the Database
C	A constant term was included in each regression
WTP	Willingness to pay was the dependent variable used in the econometrics. If people answered yes to the additional bid amount asked the answer was Coded as 1 and no answers were Coded as 0
Bid	Bid was the bid amount asked in each survey plus the total amount spent that day by the respondent. Bid was included in all econometrics
Kept - Snap/RL/BC/Kah/Kf	Depending on the recreational fish being valued, the kept variable was the amount of that fish taken home by the respondent on that fishing trip
Kept Other Fish	Depending on the recreational fish being valued, this was the sum of all the other fish kept by the respondent on that fishing trip
Caught - Snap/RL/BC/Kah/KF	Depending on the recreational fish being valued, the caught variable was the amount of that fish caught by the entire boat on that fishing trip
Caught Other Fish	Depending on the recreational fish being valued, this was the sum of all the other fish caught by the entire boat on that fishing trip
Given Away - Snap/RL/BC/Kah/KF	Depending on the recreational fish being valued, the given away variable was the total catch amount take the total kept amount of that fish
Pensioner	This was a dummy variable where a pensioner/retiree was Coded as 1 and all others 0
Notworking	This was a dummy variable where people who were classified as not working (pensioners, retirees, students and the unemployed) were Coded as 1 and all others 0
Fullparttime	This was a dummy variable where people who were classified as working full-time were Coded as 1 and all others 0
Age	This was a variable that was based on the average of the range of age indicated by the respondent
Age^2	This was age squared
Avtime	Average time was the amount of time that the respondent usually spent fishing on a trip
Fishingtime	Fishing time was the amount of time that the respondent spent fishing on the trip that day
Boatown	This was a dummy variable, where fishers who owned a boat were Coded as 1 and all others 0
Club	This was a dummy variable, where fishers who were members of a fishing club were Coded as 1 and all others 0
Echo	This was a dummy variable, where fishers who owned their own boat which had an echo sounder were Coded as 1 and all others 0
Cvtech	This was a dummy variable, where fishers who owned their own boat which had an echo sounder with a colour video screen were Coded as 1 and all others 0
Competition	This was a dummy variable, where fishers who were participating in a fishing competition at the time of the survey were Coded as 1 and all others 0
Date - Dec/Jan/Feb/ March/April	These were dummy variables where surveys that were conducted in a certain month were Coded as 1 and all others 0

Datecode	This was a scalar variable where surveys that were conducted in December were Coded as 1, January 2, February 3, March 4 and April 5.
Log income	This was the log of income. The income variable was determined by the average of the range of income indicated by the respondent.
Diff - All/None/Snap/KF/BC/ Kah/RL/Oth	These were dummy variables where if difficulties were encountered with a particular fish it was given a value of 1 and all others 0.
Enjoyment	This was a scalar variable of how much the fisher enjoyed the fishing trip they just undertook, where 1 = terrible and 5 = very enjoyable
Island	This was a dummy variable, where surveys conducted on the North Island were Coded as 1 and South Island surveys as 0.
Ethnic - Asian/Eero/Maori/ Poly/Oth	These were dummy variables where a 1 indicated that the respondent was of a particular ethnicity and 0 for all others.
Gender	This was a dummy variable where male fishers were Coded as 1 and females as 0.
Household	This was a dummy variable where fishers who fished with people from more than one household were Coded as 1 and those who did not as 0.
Importance	This was a scalar variable of how important fishing was as a recreational activity to the respondent, where 1 = not important and 5 = extremely important.
Metro	This was a dummy variable where if surveys were conducted in metropolitan areas they were Coded as 1 and non-metropolitan areas as 0.
Motivate - Enjoy/Eat/Sport&Eat/ Family/Large/ Customary/Oth/ Explore	These were dummy variables, where a 1 indicated the main motivation for going fishing by the respondent, and a 0 for all others. Enjoy = to enjoy the outdoors, eat = to catch fish for eating purposes, sport and eat = to catch fish for sport and eating purposes, family = to do something with family and friends, large = to catch large fish, customary = to catch fish for customary reasons, explore = to explore the outdoors and oth = other reasons for going fishing.
Platform - Boad/Land/Diving/ Pots/Jetty	These were dummy variables, where a 1 indicated the main platform the fisher had used on his fishing trip that day, and 0 for all others.
Reas - Human/Personal/ Natural/Oth	These were dummy variables, where if the respondent had indicated that they experienced difficulties in fishing for particular fish that day, they gave an explanation as to why they thought they experienced that difficulty. The main difficulty was Coded as 1 and all others 0. Human difficulties were attributed to commercial fishing and/or pollution, personal difficulties were attributed to a person's own fishing skills, natural difficulties were attributed to biological reasons and other difficulties included other reasons such as weather.
Sea	This was a scalar variable of the sea conditions experienced by the fisher on the fishing trip, where 1 = terrible and 5 = excellent.
Targ - All/None/Snap/KF/ BC/Kah/RL/Oth	These were dummy variables where if fishers indicated they were targeting a particular fish the record was given a value of 1.
Weather	This was a scalar variable of the weather conditions indicated by the interviewer on that day, where 1 = rain and 5 = sunny.
Yrtimes	This was the number of times the fisher indicated that they go fishing per year.

Appendix Six
Another Model For Snapper

The Centre recognises that recreational values for each species could have been derived using the whole database of records for all species, not just records for those who targeted and kept/caught a particular fish. We tested the results using a variety of databases, and concluded that the best database to use was that of the targeting/caught/kept records.

As an illustration, consider Table A.6.1 below. The regression utilised the variables that proved to be the most significant in our Snapper database in our all records database (i.e. consists of all people surveyed in New Zealand fishing for all different species). All the variables are not now significant at the 95 per cent level, and other variables have also become a lot more significant that should have been included. The variable for Catch other than Snapper is also now strongly significant, which would be expected given our database.

Take our coefficient variable for Kept Snapper, it is now $4.36 per fish instead of our most preferred estimate of $5.73. Including other records in a database that obviously place no value on Snapper fish (because they weren't targeting it and did not catch/keep any) will therefore underestimate the true value of a Snapper fish. This is why the Centre chose to structure the databases the way we did — to make sure we weren't underestimating values.

Table A.6.1
Model for Snapper Using the All Records Database

Variable		Coefficient	Asymptotic T-Statistic
Keptsnapper	B2	4.36	**1.662**
Catchothsnap	B3	1.60	**3.682**
Dateapril	B4	27.72	**1.207**
Club	B5	85.24	**3.971**
Echo	B6	52.77	**3.135**
Enjoyment	B7	26.73	**2.926**
Fishingtime	B8	14.51	**3.114**
Household	B9	63.28	**3.665**
Avtime	B10	8.07	**1.657**
Importance	B11	36.97	**3.363**
Lnincome	B12	159.17	**5.096**
Fullparttime	B13	67.15	**2.732**
Motivatenjoy	B14	46.03	**2.473**
Motiveat	B15	-84.57	**-.992**
Yrtimes	B16	-0.04	**-0.129**
Targkingfish	B17	42.00	**1.838**
Targbluecod	B18	101.78	**3.389**
Targrl	B19	-122.13	**-3.276**

Source: SACES.

Table A.6.2 illustrates the Centre's most preferred model for Snapper (using the Snapper database of course). Note that there are two values for Snapper: Kept value and Given away Snapper. Snapper was the only database where the Given away variable was significant at the 95 per cent level.

The Given away Snapper variable consists of fish caught by other members of the boat, fish caught by the fisher themselves and thrown back into the sea and fish that the fisher caught but gave away. The coefficient for Kept Snapper was 4.35 and 2.06 for Given away Snapper. These values suggest that most value is gained from taking Snapper home for the fisher's household. However, there is also value gained from giving away Snapper (be it from catching it yourself and throwing it back into the sea to fight for another day or giving it to another person to eat) and watching/helping other people catch Snapper on your boat. Note that this value is less than half the value of keeping Snapper for yourself ($4.35), however it is still significantly large at $2.06 a fish.

Without the Give Snapper variable, the coefficient for Kept Snapper is higher. This illustrates that Kept Snapper is taking on some of the additional value of the Given away Snapper variable.

Table A.6.2
Another Preferred Model for Snapper

Variable		Coefficient	Asymptotic t-statistic
Kep tsnapper	b2	4.35	**2.251**
Give snapper	b3	2.06	**2.561**
Catch oth snap	b4	0.98	**1.144**
Date april	b5	-40.08	**-1.818**
Club	b6	70.54	**4.076**
Echo	b7	30.50	**2.406**
Enjoyment	b8	11.99	**1.675**
Fishingtime	b9	7.55	**2.201**
Household	b10	38.46	**2.866**
Avtime	b11	7.23	**1.900**
Importance	b12	21.15	**2.381**
Lnincome	b13	89.27	**3.972**
Fullparttime	b14	54.54	**2.652**
Motivatenjoy	b15	35.57	**2.399**
Motiveat	b16	-44.20	**-1.913**
Yrtimes	b17	-0.47	**-1.841**
Targkingfish	b18	38.85	**2.381**
Targbluecod	b19	138.41	**3.425**
Targrl	b20	-130.97	**-3.223**

Source: SACES.

The most theoretically correct way to place values on the total recreational catch of Snapper would be to divide recreational catch into two estimates of kept and given away and apply the two values respectively. The Centre's database illustrated that 32 per cent of the total catch was kept and 68 per cent was given away. However, the problem is that NZ recreational catch figures are only provided for fish caught and kept, hence

there is no way to allocate the two different values for Kept and Given away Snapper to proportions of the total recreational catch.

If in time the NZ Ministry of Fisheries collects fish catch statistics similar to what the Centre collected, then it may be possible to allocate the two different values for Kept and Given away Snapper to proportions of the total recreational catch.

Appendix Seven
Additional Results for All Species

Although the additional variables included in the fish regressions were not significant at the 95 per cent level, they still provide interesting information on the signs and hence effects on WTP for a given fishing trip. The Centre has provided some additional commentary on three key demographic variables for all species: age; gender; and ethnicity, plus any other interesting results[84].

Snapper

- as age increases, so does WTP for a Snapper fishing trip, indicating that older fishers have a higher WTP than younger fishers for a Snapper fishing trip;
- females have a higher willingness to pay for a Snapper fishing trip than males, a result that is consistent with most contingent valuations;
- as compared to New Zealand Europeans, Asians and Maoris have a higher willingness to pay for a Snapper fishing trip, while Polynesians have a lower willingness to pay (note that there was extremely little significance for the Maori result); and
- anglers who fish from a boat and land platform have a higher WTP for a Snapper fishing trip than anglers who fish from other platforms (and the coefficient for land platform is higher than boat platform).

Kingfish

- as age decreases, WTP increases for a Kingfish fishing trip, indicating that generally younger anglers value Kingfish fishing more than older anglers;
- males have a higher WTP for a Kingfish fishing trip than females;
- as compared to New Zealand Europeans, Asians have a higher WTP for a Kingfish fishing trip, while Polynesians and Maoris have a lower WTP.

Blue Cod

- as age decreases, WTP increases for a Blue Cod fishing trip, indicating that generally younger anglers value Blue Cod fishing more than older anglers;
- males have a higher WTP for a Blue Cod fishing trip than females; and
- as compared to New Zealand Europeans, Asians, Maoris and Polynesians have a lower WTP for a Blue Cod fishing trip.

Kahawai

- as age increases, so does WTP for a Kahawai fishing trip, indicating that generally older anglers value Kahawai fishing more than younger anglers; and
- as compared to New Zealand Europeans, Asians, Maoris and Polynesians have a lower WTP for a Kahawai fishing trip.

[84] Most variables were significant at least an 80 per cent level. Where variables were not significant at this level, it is noted in the text.

Rock Lobster

- as age decreases, WTP increases for a Rock Lobster fishing trip, indicating that generally younger anglers value Rock Lobster fishing more than older anglers (one would assume this is directly linked to the diving aspect of Rock Lobster fishing); and
- as compared to New Zealand Europeans, Maoris and Polynesians have a lower WTP for a Rock Lobster fishing trip, while Asians have a higher WTP for a Rock Lobster fishing trip.

Appendix Eight

Difference Between Marginal Versus Average Willingness To Pay

A sufficient condition for the law of diminishing marginal utility to hold is that for each individual in the sample WTP for a FISH1 must be increasing and concave in the number of FISH1. Writing WTP as an increasing and concave function of FISH1 caught and kept:

(1) $WTPi = f(FISH1^i)$

where: WTPi is WTP of individual i=1,...,n, and $FISH1^i$ = number of FISH1 kept by i = 1,..,n

The property that the marginal WTP is increasing in its argument implies:

(2) $$mWTPi \equiv \frac{\partial(WTP^i)}{\partial(FISH1^i)} > 0$$

Concavity of a function further requires that

(3) $$\frac{\partial^2(WTP^i)}{\partial(FISH1^i)^2} < 0$$

The average WTP is defined as:

(4) $$aWTP \equiv \frac{\sum_{i=1}^{n} WTP^i}{\sum_{i=1}^{n} FISH1^i}$$

Define the difference between the aWTP and mWTP for person i as:

(5) $\Delta^i = (aWTP - mWTPi)$

Let $\Delta^* = Max(\Delta^i)$ (i=1,....n). By concavity of WTP the individual identified in Δ^* has the largest catch. Refer to this individual as person j.

Consider a redistribution of the catch such that Δ^* declines, holding the total catch constant. Clearly, from (2) and (4) this requires either a decrease in $\sum_{i=1}^{n} WTP^i$, or an increase in $\frac{\partial(WTP^j)}{\partial(FISH1^j)}$, or both. If the catch of individual j is reduced then the mWTP of person j rises by equation (3). For $\sum_{i=1}^{n} WTP^i$ to decline we require that the decline in person j's total WTP exceed the rise in WTP of the recipients of her catch. That is:

(6) $$\sum_{r=1}^{k} wtp^{r} < WTP^{j}$$

where; r = 1, ...k (k < n) denotes recipients of j's catch

Whether or not (6) holds depends critically upon the properties of the WTP function and the extent of the distribution.[85] More generally, to reduce the gap between aWTP and mWTP we simply require that following a redistribution the mWTP (i.e., $\frac{\partial(WTP^{i})}{\partial(FISH1^{i})}$) rises more rapidly than aggregate total WTP (i.e., $\sum_{i=1}^{n} WTP^{i}$). Once more this depends on the functional form of WTP.

[85] For instance if the WTP function is concave in FISH1, but highly skewed to the right and we redistribute from a person at the peak to individuals deep in the tail then it can be mathematically demonstrated that (6) holds. Stated differently much depends on the precise functional forms involved.

Appendix Nine

Jon Sutinen's Comments

Professor Jon Sutinen was asked to review the draft report of the Value of Recreational Fishing. He provided comments to the Centre on what he thought could be improved with the study.

The Centre took on board most of Sutinen's comments, however there were some areas where we disagreed with his views. We have provided a summary here of areas where the Centre and Sutinen disagreed.

1. Sutinen disagreed with the use of marginal values in calculating total values[86]. He suggested that average values provide a better measure of total values, giving the example of:

> *Now, suppose there are two individuals, each with their own values of Q. One individual has the amount Q_1 and the other individual has amount Q_2. Total value, by both individuals is $T^1(Q_1) + T^2(Q_2) = TV$, calculated by using either the marginal or the average value functions. Now suppose we alter the amounts each has. We take away a unit from the first individual and give it to the second individual. Total value is now given by $T^1(Q_1 - 1) + T^2(Q_2 + 1) = TV'$, which is NOT equal to TV if the individuals have diminishing marginal values in Q. In fact, the difference $TV - TV' = M^2(Q_2) - M^1(Q_1)$.*
> *Now suppose that these two individuals are two recreational fishers; and you conduct a contingent valuation study to estimate the average and marginal WTP functions for the two of them combined. Let the average amount they catch to be $Q_A = (Q_1 + Q_2)/2$. Let your estimates be given by $A(Q_A)$ and $M(Q_A)$. The total value is given by multiplying $A(Q_A)$ times the number of fishers (2), and by multiplying the integral of $M(Q_A)$, from 0 to Q_A, times the number of fishers. This will give the total value for the current distribution of catches and number of fishers.*

The Centre agreed with Sutinen that the absolutely correct way of calculating total values is to take the integral of the marginal values from 0 to QA. However, as Sutinen knows, this is an extremely difficult exercise to do, and is a job for a mathematician, if the functional form could be estimated at all, given the use of the logit approach within the model. No economists ever report total values in such ways when using the probit model.

Sutinen's second suggestion of using average values for total values is something we consider not to be correct. We agree that marginal values will vary among different fishers who catch different amounts of fish, and that as a consequence marginal values will be below the average value of willingness to pay — however this does not imply that we should only use average values to calculate total values. The Centre was commissioned to place values on the catch of the NZ fish, and given that the catch is unevenly distributed among fishers, than the marginal values are going to be lower than

[86] Sutinen agreed with the worth of the marginal value per recreational fish by itself, and believes it is a very valuable tool for a direct comparison with the marginal value of a commercial fish for policy allocation purposes. As Sutinen stated "Total values are not particularly useful for allocation purposes".

the average values. If the catch distribution changed, then marginal values may become closer to average values, however, as the situation stands, they are not. This is not a reason why marginal values should not be used.

The other argument against the use of average values is that they are a gross overestimate of the value of the day's catch, as reported in the academic literature (Cameron and James 1986). Average values take into consideration the willingness to pay for the DAY'S fishing trip, not the value of the fish caught themselves. Marginal values extract the influence of all other variables on willingness to pay for an additional fish.

These are the reasons why the Centre has chosen to still report and emphasise marginal values total values, rather than average total values of recreational fish/fishing. However, average values are still reported in the text for management purposes.

2. *The other main problem that Sutinen had with the study that we did not address is placing site dummies into the regression and calculate individual affects on WTP.*

The Centre did test for location differences - we placed island dummies and metropolitan/non-metropolitan dummies into the regressions. These were significant for some of the fisheries. It is unclear whether Jon realised this or not. On the other hand, we did not test for specific site differences. This was due to the fact the surveys were done on a national basis, to account for all areas where the fish was fished for. If we were to include dummies for all sites fished at, the regression would have become incredible cumbersome and unwieldy. For example, it would have meant we would have had to sub in an extra 50 variables into the Snapper regression. The Centre didn't consider this choice to be feasible.