Valuing New Zealand Recreational Fishing: An Assessment of the Validity of Contingent Valuation Methodology

Paper presented to 44th Annual Conference of the Australian Agricultural and Resource Economics Society, Sydney, 23-25 January 2000.

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I. Introduction

The scarcity of fish stocks has intensified the conflict between commercial and recreational fishers who compete for access to declining marine resources. Fishery managers are thus being increasingly called upon to intervene in these conflicts to determine the optimum distribution of fish stocks between the competing groups. An efficient distribution of fish stocks requires that the regulators compute and compare the marginal value of commercial fishing against that of recreational fishing. In Australia and New Zealand much effort has been devoted to calculating the economic value of commercial fisheries. However, owing to the inherent measurement problems of valuing a non-marketed resource, there have been relatively few published studies on the marginal value of recreational fishing. This paper seeks to augment the existing literature by providing estimates of the marginal value of the recreational fishery in New Zealand.

The study is based on a comprehensive contingent valuation study, with over 4,000 surveys conducted at boat ramps across New Zealand. The survey focused on the five main fish species which are targeted by recreational fishers and are often at the center of resource conflicts with commercial fishers. The fish included in this study are: snapper, rock lobster, kingfish, kawahai and blue cod. We provide separate estimates of the marginal and average value for each of these species.

Valuations based on contingent valuation studies have been the subject of much criticism over the years (Mitchell and Carson (1989) and Bennett, Morrison and Blamey (1998)). Among the litany of problems, the most fundamental concern is the possibility of strategic bias, which could potentially undermine the validity of the entire exercise. Strategic bias arises when respondents have an incentive to conceal their true willingness to pay for a good and thus provide misleading information. A related problem which has emerged in discussions of "embedding effects", is the criticism that the answers provided by respondents

may simply reflect the "warm glow" of giving, rather than a proper valuation of the good in question. An associated difficulty is the often hypothetical nature of the question, which it is argued, leads to unreliable responses.

In this paper we perform a series of statistical tests to determine whether any of these biases undermine the results. To our knowledge this is the first such attempt to assess the robustness of results in a contingent valuation study of a recreational fishery.

The remainder of this paper is organised as follows. Section II briefly describes the survey process and methodology as well as presenting the estimates of the value of each recreational fish. Section III deals with the issue of strategic bias, hypothetical bias and the warm glow effects in more detail (and tests the results for these potential biases), while Section IV concludes the paper.

II. Methodology and Estimated Results

The recreational value of fishing was estimated using the contingent valuation method (CVM). The estimates are based on a discrete choice "take it or leave it" elicitation question where respondents were offered a single bid. The "take it or leave it" approach was used in preference to the more frequently employed multiple bid technique because of the potential biases which could emerge from the latter. Recent econometric work suggests that when individual responses are correlated across bids the estimated willingness to pay (WTP) functions may yield biased results if derived from multiple bids (Cameron & Quiggin (1994), Poe *et al* (1997)). A further issue which is known to critically influence the results of CVM studies is the specification and distribution of bid amounts. The approach used in this study is based on an algorithm proposed by Cooper (1994). Stated briefly, this technique optimises information from bids in the centre of the distribution and those in the tails of the distribution. The greater is the negative (positive) skew of the data the wider is the spacing of bids to the

right (left) of the median. This process therefore maximises the information extracted from the survey across the distribution. Appendix One illustrates the responses to the bid distribution by fishers.

The study focused on the recreational value of the five main fish which are targeted by recreational fishers in New Zealand: snapper, kingfish, blue cod, kahawai and rock lobster. Snapper and blue cod are primarily used for eating purposes, whereas kingfish, kahawai and rock lobster are mainly used for sporting purposes. Snapper, kingfish, rock lobster and kahawai are primarily caught on the North Island, with blue cod caught mostly on the South Island. In what follows we present estimates of the value of each of these fish derived from separate regressions. The data used to determine the recreational value of each species included those people who either indicated that they had targeted a particular species and/or those who had kept or caught the fish species in question. The choice of what variable to use for caught or kept fish is largely an empirical one, and depends critically on the motivations of fishers targeting particular species.

Our final choice of what variable to use to estimate marginal values of the fish was based on various statistical tests and comparisons. To summarise, the marginal values were obtained by using the form of specification that best reflects why the fish was caught. If the fish was found to be mainly caught for consumption purposes, then the proper specification is to use the Kept Fish[1] variable. If the fish was found to be mainly targeted for sporting reasons, then we used the Caught fish specification. The following discusses some of the results obtained from various models, as presented in Table 1.

[1] The kept fish variable consisted of the fish that the fisher took home from fishing that day. The caught fish variable consisted of the fish that was caught on the boat by the whole party fishing that day, including fish that was thrown back or given away to others.

All the information collected from the survey was initially included in a general regression. The coefficients and standard errors were computed using the well known method of Cameron and James (1986). The coefficients thus obtained provide a measure of the contribution of each variable to WTP. The final results presented in the tables below were arrived at through sequential testing down as suggested by Hendry et al (1980).

The results reveal that most of the variables in the regressions are well determined with expected signs and significance levels. Some fish species models performed better than others, especially the snapper model. For reasons of brevity, the snapper results are the only outcomes discussed extensively in this paper.

The regression presented in Table 1 suggests that the following variables have a positive impact on the WTP for snapper: being a member of a fishing club; working full-time; owning a boat with an echo sounder; a greater enjoyment associated with the fishing trip that day; an increase in the amount of time spent fishing that day[2]; a greater average amount of time usually spent on fishing trips; fishing with people apart from members of the household[3]; a higher importance of fishing as a recreational activity for the fisher; 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 to enjoy the outdoors, all had positive effects on WTP for a snapper fishing trip.

Table 1 indicates that the following variables have a significant, negative effect on WTP for a snapper fishing trip: a higher number of fishing trips per year[4]; fishing during the month of April[5]; targeting rock lobster on that trip that day; and if the main motivation for

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2 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.

3 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.

4 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.

5 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.

fishing was to catch fish for eating purposes, then this also had a negative effect on WTP for a snapper fishing trip.[6]

Consider the first explanatory variable in Table 1, which is the marginal willingness to pay (MWTP) of a snapper kept. The coefficient of 5.73 indicates that an additional snapper taken home by the fisher adds $5.73 to the WTP for a fishing trip.

Table 1
Influences on Willingness to Pay for a Day's Fishing Trip

Variable	SNA	KIN	BC	KAH	RL
Particular Species of fish kept	5.73 (3.04)*		1.61 (1.03)		
Particular Species of fish caught		19.76 (2.01)**		3.44 (1.45)****	6.54 (2.08)**
Sum of all Other Species of fish kept				3.07 (2.13)**	0.49 (0.6)
Sum of all Other Species of fish caught	1.09 (1.3)****	1.41 (1.39)****	4.04 (2.26)**		
Income of Fisher (logged)	89.46 (4.06)*	207.83 (4.25)*	80.72 (2.27)**	99.25 (2.86)*	210.60 (3.05)*
Importance of Fishing as a Recreational Activity	21.53 (2.48)*	75.32 (2.93)*	4.04 (2.26)**	23.29 (1.76)***	64.25 (1.84)***
Main Motivation to be with Family & Friends		129.02 (1.86)***	95.03 (2.01)**	67.05 (1.64)****	209.13 (1.68)***
Main Motivation to Enjoy the Outdoors	34.59 (2.39)*	67.79 (1.79)***	61.99 (1.68)***	36.81 (1.6)****	
Member of a fishing club	69.98 (4.1)*	53.93 (1.69)***		77.39 (2.99)*	
Fishing with members apart from their household	43.96 (3.3)*			42.78 (2.13)**	226.51 (2.77)*
Increase in the average amount of time spent fishing	6.28 (1.7)***	15.51 (2.18)**		18.07 (3.19)*	
Owning a boat with an echo sounder	28.53 (2.3)**		146.26 (2.71)*		
Increase in the Enjoyment experienced on the trip	13.14 (1.86)***				45.35 (1.74)***
Fishing during the month of April	-40.91 (-1.89)***	-108.69 (-2.42)*	-94.28 (-1.85)***		
Fishing during the month of March		-54.78 (-1.57)****		-37.46 (-1.68)***	
Main motivation was to catch fish to eat	-48.58 (-2.14)**			-124.8 (-2.88)*	-116.27 (-1.97)**

[6] 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 purchase 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.

Table 1 (Continued)
Influences on Willingness to Pay for a Day's Fishing Trip

Variable	SNA	KIN	BC	KAH	RL
Had difficulties fishing & blamed it on personal skills		-72.47 (-1.65)***		-73.96 (-2.12)**	
Targeting Rock Lobster on the trip	-133.42 (-3.3)				
Targeting Snapper on the trip					-147.71 (-2.06)**
Targeting Blue cod on the trip	127.48 (3.28)*			129.98 (2.86)*	
Targeting Kingfish on the trip	38.39 (2.4)*	62.04 (1.94)***	191.01 (2.63)*	74.46 (2.79)*	
Targeting Kahawai on the trip			-103.2 (-1.8)***		
Increase in time spent fishing on the day	8.42 (2.5)*				16.83 (1.76)***
Fishing from a Diving Platform					48.99 (1.08)
Being male				-63.53 (-1.95)**	
Fishing on the North Island			65.96 (1.7)***		-159.96 (-2.83)*
Being Polynesian				-199.31 (-1.92)**	
Main platform of fishing used was pots				-215.55 (-2.57)*	
Had difficulties fishing & blamed it on natural factors				-52.5 (-2.23)*	119.09 (1.85)***
Had difficulties fishing & blamed it on human factors				-59.83 (-2.28)*	
Weather					-29.98 (-1.39)****
Fishing during a Competition		164.42 (1.98)**			-309.50 (-1.23)
Had no difficulties fishing that day					-48.8 (-1.01)
Fishing in a Metropolitan Area			87.51 (2.49)*		
SAMPLE SIZE	2,010	709	505	1,181	501
LOG-LIKELIHOOD RATIO STATISTIC	394.4	124.0	124.3	254.7	161.0
PREDICTION SUCCESS: "No" Answers Correct	63 %	53 %	72 %	65 %	90 %
"Yes" Answers Correct	72 %	81 %	68 %	74 %	46 %

Notes: Asymptotic t-statistics in brackets * 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.

Table 2 indicates the marginal and average WTP for all five fish species.[7] When it comes to valuing recreational fishing for policy purposes, we suggest that there are two possible valuation methods. If the objective is to value recreational *fishing*, then we suggest

[7] For example, the average WTP per Snapper was calculated by the following: The average WTP for a Snapper fishing trip was $101.80 and each fisher kept on average 3.3 Snapper, implying that the average value of a Snapper is $30.85. As the average weight of a Snapper caught recreationally in New Zealand is 0.99 Kg (Bradford 1998), this implies an average WTP of $31.16 per Kg of fish caught, and a marginal WTP in terms of weight of $5.79 per Kg.

the use of average WTP of fish. This estimate captures the value of recreational fishing as a social activity, including the values of fishers who were willing to spend money fishing that day even though they were not successful. On the other hand, if the objective is to estimate the value of recreational *fish* caught, we recommend the use of marginal WTP, which estimates the value of the additional fish caught. Once again, the choice of variable depends on the policy question asked.

Table 2
Recreational Fishing Values

	Value Per Fish Kept/Caught		Value on a Fish Weight Basis*		Amount Spent ($)	
	MWTP $	AWTP $	MWTP $	AWTP $	Per Trip	Annual Expenditure
Snapper	5.73	30.85	5.79	31.16	35.80	417.25
Kingfish	19.76	181.10	3.26	29.83	49.68	128.08
Blue Cod	1.61	24.46	2.40	36.50	44.09	113.45
Kahawai	3.44	59.65	2.80	48.49	25.32	152.41
Rock Lobster	6.54	48.29	9.91	73.16	51.52	162.29

Source: * Fish weights are from Bradford (1998).

Figures in Table 2 reveal that rock lobster is the most highly valued fish (on a weight basis), followed by snapper, kingfish, kawahai and blue cod. These results accord with expectations and reflect what each species is used for, its abundance and location. For instance, in addition to its sporting qualities as a diving fish, rock lobster is a valuable eating fish. Among all the fish in this study, rock lobster retails at the highest price. The relatively high WTP on a weight basis (both marginal and average) for lobster thus reflects its scarcity and opportunity cost, amongst other things. In contrast, Kingfish is pursued primarily for recreational and sporting purposes and grow to world record sizes in the New Zealand seas. The scarcity of catching a large kingfish adds to its recreational value, hence the MWTP of a kingfish (per fish) is very large. It does not, however, have a relatively high MWTP when it is valued on a weight basis. This is due to two reasons; firstly the MWTP for kingfish is proportionally lower as much of its value comes from the experience of fishing. Secondly,

kingfish are very large fish, further reducing the relative per kilo value. Similarly kahawai has a much higher value as a recreational fish than as an eating fish. Kahawai is the only fish studied in New Zealand that had a marginal WTP per kg higher than the average retail price paid in 1998-99 ($2.80 vs $2.31 per kilogram respectively). Snapper on the other is valued for both recreational and consumption purposes, and has extremely similar values on a fish and weight basis. Blue cod can be caught with comparative ease in New Zealand, hence the value of catching an additional blue cod is very low to recreational fishers. In addition, the low statistical significance of the blue cod variable reinforces its low value to recreational fishers.

While these results seem reasonable and accord with expectations, there remains the possibility that the estimates could be biased and unreliable as a result of the many problems which are known to undermine contingent valuation studies. Accordingly, in the following section we discuss and examine whether these results are affected by those biases considered to influence the validity of contingent valuation studies.

III. Robustness of Results

In this Section we discuss and test the robustness of the results. Perhaps the strongest criticism of contingent valuation studies is concerned with strategic bias, but there are also considerable potential problems identified with embedding effects and hypothetical bias.

3.1 Strategic Bias

Strategic bias arises mainly because of the public good nature of the resource being valued. The concerns focus on what respondents believe about their contributions and the perceived probability of actually having to pay for the good (Mitchell and Carson (1989)).

Thus, respondents will understate their true WTP if they believe that they will be asked to contribute to the good, when their contribution has a small impact on the supply of the public (open access) good. The most commonly proposed method of minimising such strategic behaviour is to use the discrete elicitation format, as employed in this study (Kealy and Turner (1993)).

In this paper we attempt to test for the presence of such strategic bias. At the end of the survey a random subset of 260 individuals were asked a supplementary question:

"Do you believe that the government will impose a recreational fishing tax in the next year or so?"

Clearly, if strategic motives bias the results then those individuals who believe that a tax is likely to be introduced are more likely to understate their true WTP in order to minimise their contribution to the good. Moreover, given the information provided to respondents there is clearly no strategic reason for them to provide misleading answers to this particular question. Responses to this question thus provide some indication of the likelihood of strategic bias.

Table 3 below summarises the results of a sub-sample regression of those individuals who answered that a tax was likely to be introduced and those who believed the reverse. The F-test reported in the table reveals that it is not possible to reject the null hypothesis that there is no statistical difference in the WTP of the two groups.

Table 3
Results of F-Chow Test for Strategic Bias on Sub-sample of Fishers

	Answers to the Tax Question					
	Said Yes		**Said No**		**Pooled Sample**	
	Coefficient	***Asymptotic t-statistic***	***Coefficient***	***Asymptotic t-statistic***	***Coefficient***	***Asymptotic t-statistic***
The No. of Kept Fish	2.54	**1.35******	8.85	**1.204**	3.48	**0.989**
The No. of Given Away Fish	1.96	**-1.751*****	-4.19	**-1.321******	-2.98	**-1.601******
Fishing on the North Island	-7.82	**-0.149**	-203.09	**-1.267**	-90.43	**- 1.063**
Being Maori	53.71	**1.932*****	120.46	**1.233**	92.70	**1.647*****
Length of time spent Fishing	11.12	**1.522******	46.87	**1.865*****	36.05	**2.532***
Importance of Recreational Fishing to the Fisher	4.18	**0.338**	42.32	**1.259**	26.41	**1.305******
Experienced difficulties and attributed it to human factors	-22.79	**-0.862**	-66.23	**-1.161**	-43.46	**- 1.158**
Age of fisher (logged)	46.23	**1.615******	7.24	**0.106**	37.27	**0.803**
Income of fisher (logged)	37.05	**1.565******	102.54	**1.422******	69.84	**1.686*****
Member of a fishing club	-16.20	**-0.644**	74.45	**1.181**	38.81	**1.086**
Owned boat with colour video	60.91	**1.921*****	-147.32	**-1.407******	-66.74	**- 1.258**
Had difficulties trying to catch all targeted fish	-17.33	**- 0.557**	-35.56	**- 0.628**	-62.97	**-1.424******
Level of Enjoyment experienced on that fishing day	-0.34	**-0.035**	48.19	**1.038**	16.66	**0.763**
Main Motivation for fishing was for Sporting and Eating Purposes	-24.53	**-1.073**	-54.15	**-0.917**	-55.91	**- 1.356******
RESIDUAL SUM SQUARES		6.05		37.41		46.95
SAMPLE		43		203		246
F TEST	1.08	(16,214)				
PREDICTION SUCCESS:						
"No" Answers Correct		85 %		57%		52 %
"Yes" Answers Correct		87 %		82%		82 %

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.

This result is further confirmed in Table 4 which introduces a dummy variable which is given a value of 1 where respondents believe that a tax will be introduced. The t-statistic is insignificant, which implies that there is no statistical difference in the results. It therefore seems reasonable to conclude that strategic considerations do not appear to bias our results.

Table 4
Strategic Bias Test - Fish Tax Dummy

Variable		Coefficient	Asymptotic t-Statistic
The No. of Kept Fish	b3	4.22	**1.056**
The No. of Given Away Fish	b2	-2.84	**-1.509******
Indicated Yes to Fish Tax	b4	-27.27	**-0.718**
Fishing during the month of April	b5	73.56	**1.203**
Fishing during the month of March	b6	98.97	**1.105**
Level of Enjoyment experienced on that fishing day	b7	60.55	**1.745*****
Being Maori	b8	71.06	**1.365******
Fishing on the North Island	b9	-208.54	**-1.842*****
Fisher's Income (logged)	b10	46.24	**1.033**
Average time usually spent fishing	b11	22.86	**1.632******
Length of time spent Fishing	b12	35.07	**2.491***
Importance of Recreational Fishing to the Fisher	b13	36.77	**1.586******
Sea conditions experienced	b14	-29.08	**-1.342******
Experienced difficulties and attributed it to human factors	b15	-51.75	**-1.306******
Working Full-time	b16	83.48	**1.292******
Had difficulties trying to catch all targeted fish	b17	-41.88	**-1.047**
Was a Pensioner	b18	96.83	**1.381******
Fished from a Boat Platform	b19	-131.77	**-1.511******
SAMPLE SIZE	246		
PREDICTION SUCCESS: "No" Answers Correct	61%		
"Yes" Answers Correct	81%		

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.

3.2 Embedding Effects

A further problem identified with contingent valuation studies is that of "embedding effects". In a number of studies it has been discovered that respondents are willing to pay the same amount for goods that (*i*) differ in quality and (*ii*) different amounts of the same good (Carson and Mitchell (1995) and Bennett, Morrison and Blamey (1998)). This clearly contradicts a fundamental tenet of economics which predicts that individuals should have a higher WTP for more preferred goods. Some critics argue that this reflects the fact that individual responses in these studies simply reflect the "warm glow" of giving, rather than proper valuation of the good in question. It is clearly of interest to determine whether our results suffer from such problems. The presence, or otherwise, of these effects should be able

to be identified from the data set. Firstly, the five New Zealand fish studied all differed in terms of their recreational fishing experience, consumption and sporting qualities. If embedding effects were present, there would be no significant differences between the marginal WTP of various fish among fishers despite these differences. As can be seen from the results shown in Tables 1 and 2 this was clearly not the case, and indeed the values obtained seemed to correctly reflect the differing qualities of each fish studied.

Also, if embedding effects are present in the regression results, then an individual with a catch of (say) one fish of a given species will have the same marginal WTP as an individual who has caught (say) ten fish. In contrast, if individuals value their catch in the manner suggested by consumer theory, then by the law of diminishing marginal utility, fishers with the larger catch should have a lower *marginal* WTP than those with a smaller catch. Table 5 below summarises the results of a test on the snapper regression for the presence of such embedding effects. In order to test for embedding effects the sample of fishers was arbitrarily divided into two sets: those who caught and kept more than 4 snapper and those who caught and kept less than 3 snapper on the trip and the MWTP for kept snapper was re-estimated.[8] From Table 5 it can be seen that fishers who caught less than 3 fish have a marginal WTP of $10.25 while those who caught and kept more than 4 fish have a marginal WTP of $2.94 for snapper, which is both higher and lower respectively than the average MWTP of snapper at $5.73.

[8] This corresponds to approximately 40 and 60 per cent of the distribution respectively.

Table 5
Diminishing Marginal Utility of Catching Snapper

	Kept 4+ Snapper		Kept from 0 to 3 Snapper	
	Coefficient	***Asymptotic t-Statistic***	***Coefficient***	***Asymptotic t-Statistic***
The No. of Kept Snapper	2.94	**1.012**	10.25	**1.267**
The Total Catch other than Snapper	-0.17	**-0.131**	1.63	**1.351******
Member of a fishing Club	68.62	**2.938***	81.77	**3.071***
Owning their own boat with an echo sounder	18.43	**0.999**	41.97	**2.281****
Level of Enjoyment experienced on that fishing day	29.93	**2.324****	12.57	**1.314******
Length of time spent Fishing	16.21	**3.510***	10.97	**2.630***
Fishing with people other than household	35.77	**1.827*****	55.43	**2.720***
Fisher's Income (logged)	71.17	**2.245****	114.06	**3.308***
Worked full-time	91.78	**2.654***	39.89	**1.434******
Main Motivation for fishing is to Enjoy Outdoors	35.66	**1.553******	41.92	**2.024****
Was Targeting Kingfish on the trip	69.08	**2.875***	28.38	**1.211**
Was Targeting Rock Lobster on the trip	-169.18	**-2.550***	-141.34	**-2.403***
Was Targeting Blue cod on the trip	128.16	**2.047****	137.27	**2.445***
SAMPLE SIZE		776		1,240
PREDICTION SUCCESS:"No" Answers Correct		56 %		68 %
"Yes" Answers Correct		83 %		63 %

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.

The above results suggest that valuation of the catch is dependent on the number of fish caught and/or kept, so that the results are not undermined by "embedding effects".

3.3 Hypothetical Bias

A final issue which warrants consideration is that of hypothetical bias. Hypothetical bias is said to occur because respondents are unfamiliar with the hypothetical situation they are being asked to value. It is argued that the accuracy of responses is improved when respondents are asked to value familiar and real world scenarios. This does not appear to be a concern in the present study. Respondents were all interviewed at boat ramps at the end of their fishing trip and were asked their WTP for the days fishing rather than some hypothetical situation. They were also well aware of the money that they had spent on fishing that day and the number of times they fish each year (hence had some idea of their demand for the

environmental good). The instrument choice used for payment in the study of additional payment experienced on the day also eliminates any problems with hypothetical bias.

In addition, Graphs I and II in Appendix One clearly depict a downward sloping demand curve for recreational fishing, behaviour that is consistent with rational economic thinking. It therefore seems reasonable to assume that respondents were familiar with the good being valued and hypothetical bias was not present within the study.

IV. Conclusions

This paper has presented estimates of the recreational value of fishing in New Zealand. The data was obtained from a large-scale interview process conducted at boat ramps across New Zealand. The results suggest that the recreational value of a species depends critically on the reasons why it is pursued. The marginal value of fish which are targeted for eating purposes appears to closely reflect the market price of the fish (i.e. the opportunity cost). In contrast, those species which are sought mainly for recreational purposes, have a higher value, the scarcer the fish is and the larger its' average size.

The results appear to be both reliable and intuitively plausible. Moreover, in contrast to many CVM studies an attempt has been made to test for the presence of biases. The statistical tests performed indicated that there was no evidence of either strategic bias, or embedding effects. It was further suggested that hypothetical bias is not likely to distort the estimates presented in this study. It is thus hoped that these results can be used as a reliable guide to allocating declining marine resources in the New Zealand fishery.

References

Bateman I., Turner R., (1993) "Valuation of the Environment, Methods and Techniques: The Contingent Valuation Method, Sustainable Environmental Economics and Management, Belhaven Press, London.

Bennett J., Morrison M., Blamey R., (1998) "Testing the Validity of Responses to Contingent Valuation Questioning", *Australian Journal of Agricultural and Resource Economics*, Vol. 42 (2) pp. 131-48

Blamey R.K., Driml S. (1998) "Valuing Changes in Angler Success Rates in the Bays and Inlets of Victoria", paper presented at the 42nd AARES Annual Conference.

Bradford, E. (1998), Harvest comparisons for major recreational species between the regional and national diary surveys. *Draft NIWA Technical Report*.

Cameron T., (1992), "Combining Contingent Valuation and Travel Cost Data for the Valuation of Nonmarket Goods", *Land Economics*, Vol. 68, (3), pp 302-17.

Cameron T., Quiggin J., (1994) "Estimation Using Contingent Valuation Dichotomous Data with Follow Up Questionnaire" " *Journal of Environmental Economics and Management, 27, 218-34.*

Carson R., Mitchell R., (1995) "Sequencing and Nesting in CV Surveys" *Journal of Environmental Economics and Management,* 28, 155-173.

Cooper J.C., (1994) "Optimal Bid Selection for Dichotomous Choice Contingent Valuation Surveys", *Journal of Environmental Economics and Management*, 24, pp. 25-40.

Holland P., Lal P., Power P., (1992), "Valuing Fish in Recreational Fishing", *Australian Fisheries*, Vol 51 (8), pp 24-27.

Loomis J., (1989) "Estimation of and Variation Site Marginal Values for Recreational Fishing", *Journal of Environmental Economics and Management;* Vol 29, pp 183-191.

McKonnell K., (1979), "Values of Marine Recreational Fishing: Measurements and impact of Measurement", *American Journal of Agricultural Economics,* Vol. 61(5), pp 921-5.

Mitchell R., Carson R., (1989) Using Surveys to Value Public Goods, Resources for the Future, Washington DC

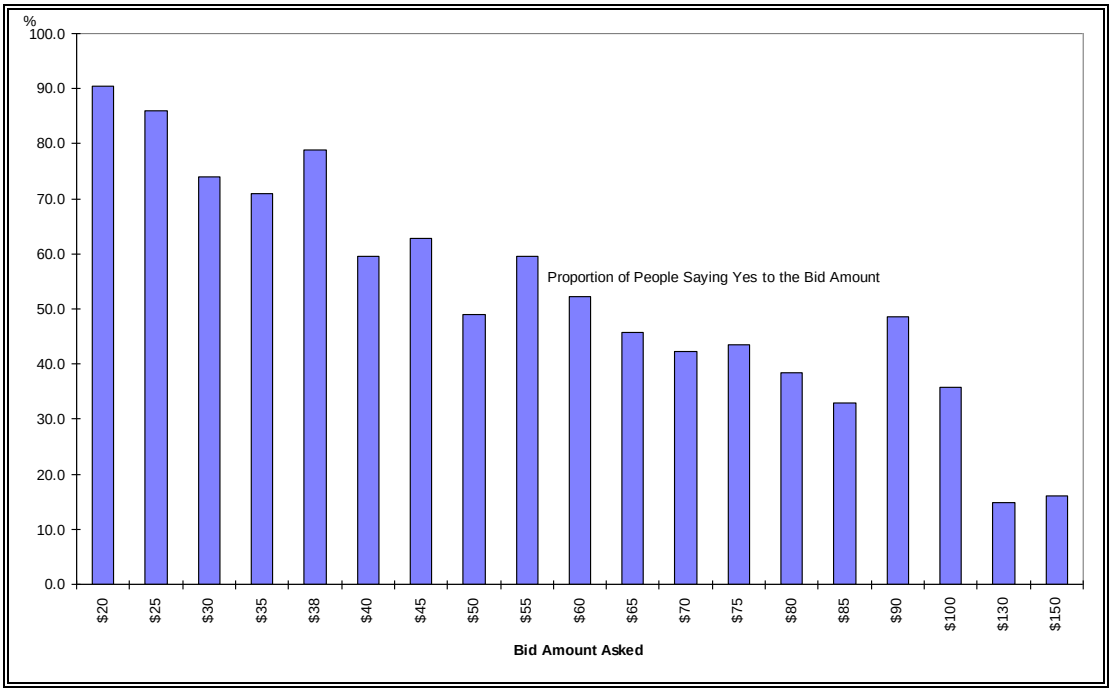
Poe G., Welsh M., Champ P., (1997) Measuring the Willingness to Pay when Responses are Not Independent, *Land Economics* 73, 255-67.

South Australian Centre for Economic Studies (1997), "The Economic Value of King George Whiting and Snapper", report prepared for PIRSA, June.

_____, (1999), "Value of New Zealand Recreational Fishing", report prepared for Ministry of Fisheries, November.

Appendix One
Responses to Bid Amounts

Graph I
Percentage Distribution of Yes Answers to the WTP Question for the Snapper Model

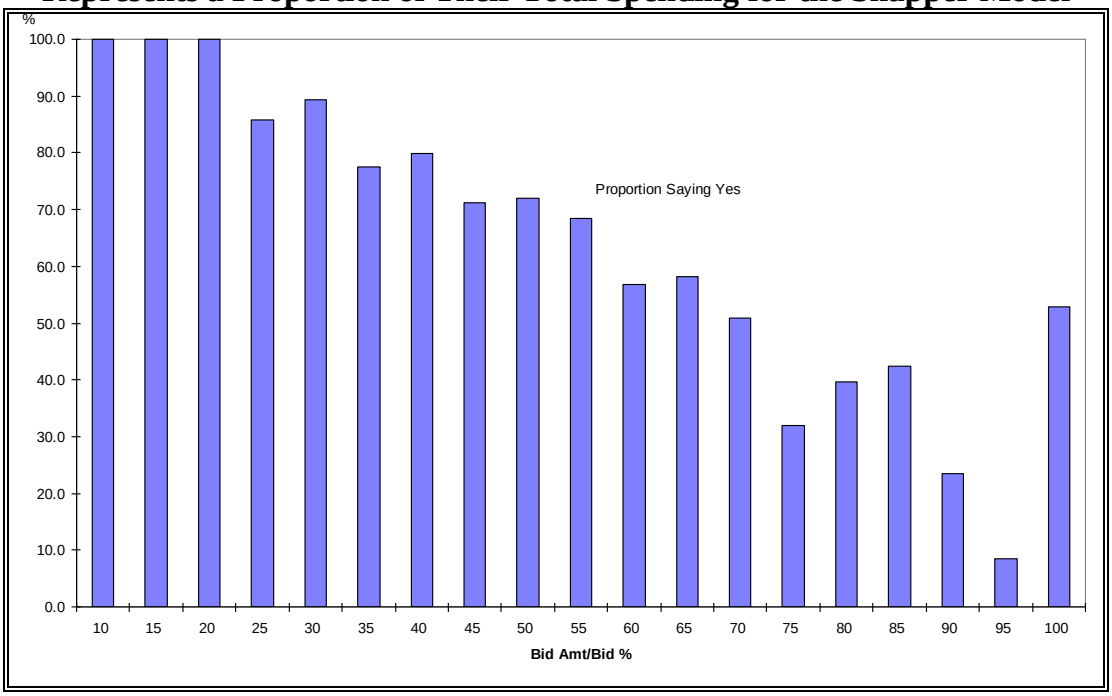


Graph I illustrates that the proportion of people answering yes to the additional bid amount question falls consistently as the bid amount increases in value. This result is consistent with rational expectations and provides an indication of the demand curve for recreational fishing.

Graph II illustrates the proportion of fishers answering yes to the additional bid question with their total spending for that day taken into consideration. The bid amount was divided by the total value faced by the fishers — which was the bid amount plus how much they had spent that day. The graph therefore reflects how fishers answered to the additional bid question when it represented a proportion of their total spending. For example, Graph II shows that when the bid amount only represented 10 to 20 per cent of the fisher's total spending for that day, 100 per cent of fishers within the Snapper model said yes to the additional bid question. When the bid amount represented half of what the fisher had spent on

the day's fishing trip, the proportion of people answering yes to the bid amount fell to 72 per cent, and then to only 9 per cent when the bid amount represented 95 per cent of their total day's expenditure. Interestingly, when the bid amount represented 100 per cent of the fisher's expenditure (i.e. they had not spent any money that day fishing), about half replied that they would have still gone fishing that day if it had cost them money to do so. This result is understandable when one considers that many people go fishing with family and friends or on work trips but do not pay any money. However, just because they didn't pay any money doesn't mean that the trip had no value to them, and many would have been willing to have paid the bid amount for that day's fishing experience.

Graph II
Percentage Distribution of Yes Answers to the WTP Question where the Bid Represents a Proportion of Their Total Spending for the Snapper Model



Both these tables confirm the belief that embedding bias, hypothetical bias and strategic bias were not present in the contingent valuation performed on the value of recreational fishing in New Zealand.

Appendix Two
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.

Variable	Description of Variable and how it was Coded within the Database
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.