New Zealand Marine Recreational Fishing Values

Report prepared for the New Zealand Marine Research Foundation

G.N Kerr
N. Latham

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Land Environment & People

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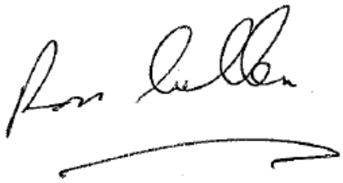

Professor Ross Cullen
Faculty of Commerce, Lincoln University

Contacts - email: leap@lincoln.ac.nz
web: http://www.lincoln.ac.nz/leap

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Chapter 1
Objectives

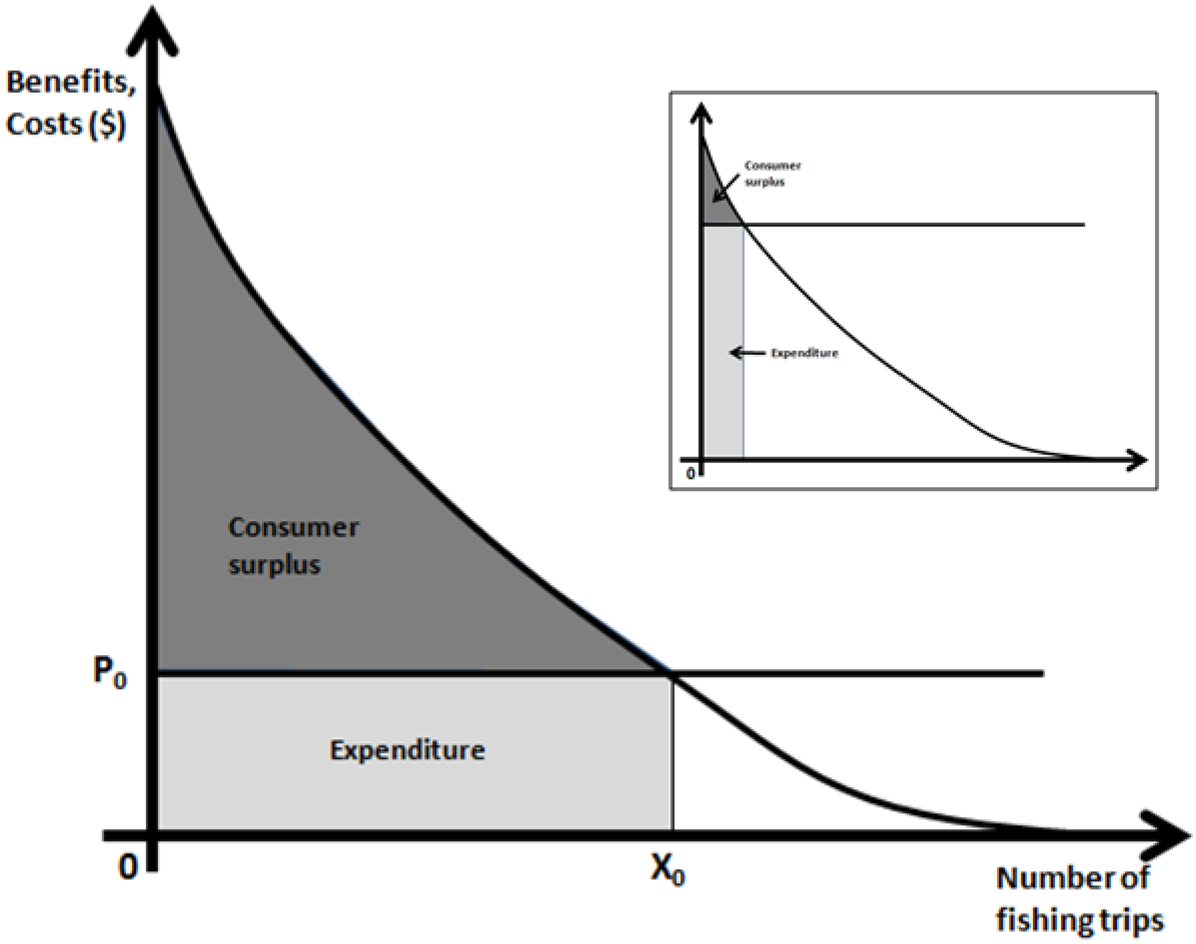
The New Zealand Marine Research Foundation has commissioned us to:

1. Undertake a scoping analysis of the potential for value transfer to provide useful estimates of the non-market value of New Zealand marine recreational fishing.
2. Evaluate existing studies of the mean non-market value of recreational fishing. The purpose is to produce an estimate of the likely order of magnitude of the mean value of marine recreational fishing to allow evaluation of the merits of undertaking a robust value transfer study.

1.1 The value of fishing

The value of fishing to fishers is measured by the concept of consumers' surplus (CS), which is the difference between the maximum amount that fishers would pay for their fishing activities (Gross Benefit) and what they actually do pay (Expenditure). These concepts are illustrated in Figure 1.

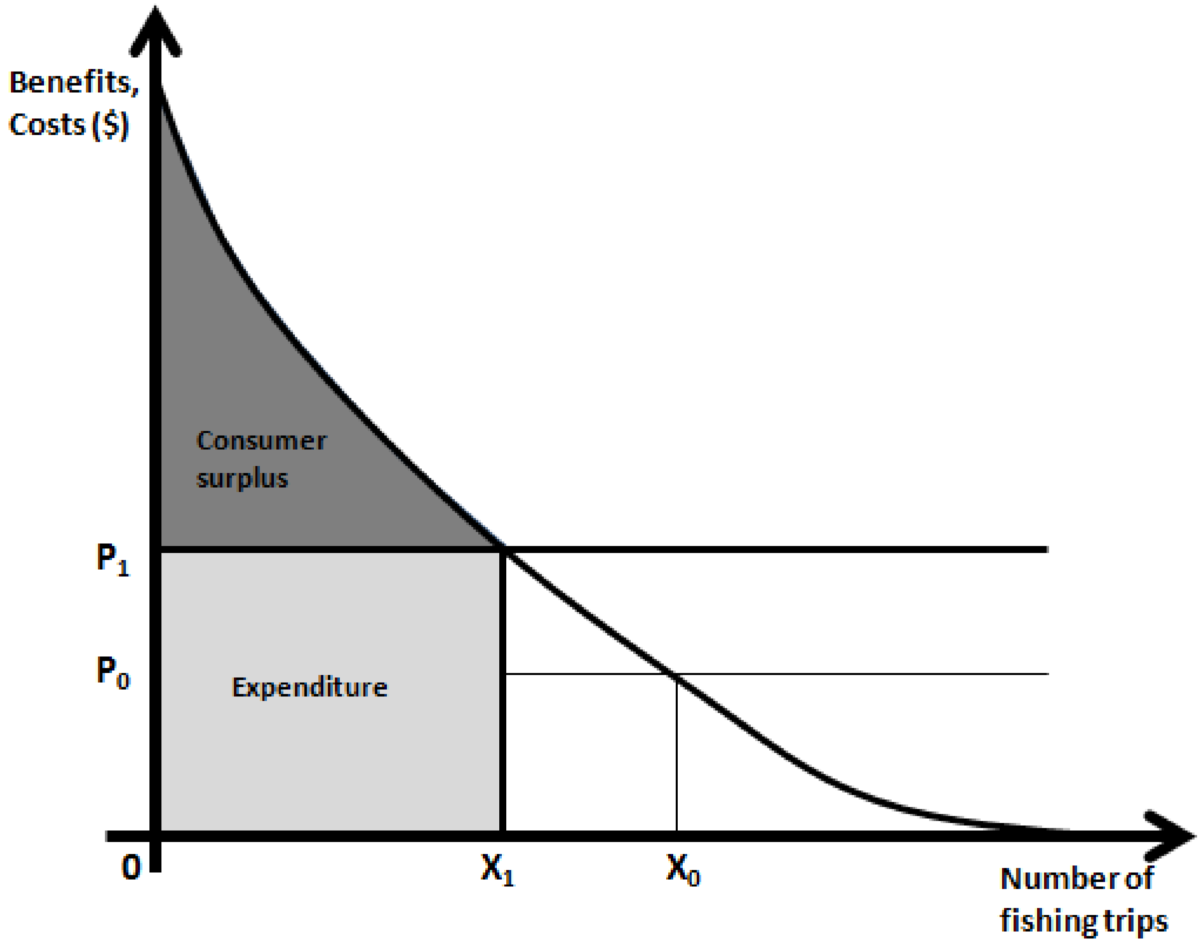
Figure 1
Non-market benefits of fishing



Demand for recreational fishing interacts with the cost of fishing to determine the number of fishing trips an individual (and, by extension, the community) takes. If the cost of fishing is P_0 then X_0 trips are made. This results in total expenditure of P_0X_0 and non-market benefits (consumer surplus) equal to the dark shaded area. Consumer surplus can exceed expenditure, as shown by the main part of Figure 1, or it may be small in relation to expenditure, as shown by the inset. This relationship is determined by the individual fisher's preferences and the cost of fishing. A keen fisher in a high quality fishery with low costs will be represented by the main part of Figure 1. Someone who is less keen, has poor fishing conditions, and has high costs will be represented by the inset.

Consumers' surplus is not directly related to expenditure, which is sometimes claimed to be a measure of benefits from non-market activities. Indeed, the two may be inversely related, as illustrated in Figure 2. Suppose the cost of fuel increases, making fishing more expensive. Nothing else changes. The increase in trip cost from P_0 to P_1 has two effects. Firstly, it reduces the amount of fishing from X_0 to X_1. In Figure 2 this results in an overall increase in expenditure, although that need not be the case. The second effect is on fishers. Their consumers' surplus declines because they are making fewer trips and some of the benefits from each trip are lost because of the increased cost per trip. So, in this case expenditure has increased, but fisher benefits have decreased. From Figures 1 and 2 it is clear that expenditure is not a measure of fisher benefits, nor is it a proxy for it.

Figure 2
Relationship between expenditure and consumer surplus



Fisher expenditures, whilst a cost to fishers, can be of benefit to others, particularly those who supply goods and services to fishers. The full expenditure itself is not a measure of value, but the profits it generates for suppliers (and their suppliers), measured as value added is of relevance. There are well-established techniques for measuring value-added, which is not the subject of this study. However, fisher expenditure increases are not necessarily related to value-added increases. For example, if the fuel price increase postulated in Figure 2 arose because of an increase in the world oil price, New Zealand fuel suppliers may be no better off than before.

Commercial fishery benefits are measured by producers' surplus (profits) and, as with the recreational fishery, there are benefits (value-added) to those supplying goods and services to commercial fishers. Just as recreational expenditures do not provide a valid measure of net benefits to recreators, commercial expenditures do not measure net benefits to or from the fishing industry, nor does commercial revenue.

The focus of the present study is on identifying consumer surplus from recreational fishing, which is a non-market value that cannot be measured by market indicators such as expenditure. The intention for this study is not to measure consumers' surplus directly, but to assess the potential for using consumer surplus estimates from existing studies to provide an estimate of likely magnitude for New Zealand. This process is known either as "value transfer" or "benefit transfer".

1.2 Methods

The methodology for addressing the study objectives employed the following stages:

1. Study identification
2. Study collection
3. Study evaluation
4. Value identification and summary

1.2.1 Study identification

Study identification entailed discovery of as complete as possible inventory of existing marine fishing valuation studies. Several approaches were adopted for this task, including:

- A thorough investigation of the EVRI database (www.evri.ca), which is an international repository of environmental non-market valuation studies funded by six governments, including New Zealand.
- Consultation with academics who regularly undertake non-market valuation.
- Electronic literature searches using databases available at the Lincoln University Library, as well as publicly accessible databases, such as *Google Scholar*.
- Scrutiny of references cited in fishing valuation studies.

1.2.2 Study collection

Not all of the studies that were identified could be obtained, either in electronic or hard copy format. Articles in peer reviewed academic journals were usually easily obtained. However, several studies appear in the "grey literature" as government agency or consultant reports. Some of these proved somewhat hard to obtain, were simply not available to the public, or have been removed from their electronic host sites.

1.2.3 Study evaluation

Study relevance was evaluated against the following criteria:

Criteria	Comments
Study location	Manuscript titles, and even abstracts, did not always clearly identify the location of fishing activities valued. Only studies clearly focussed on marine fishing were included. Studies of freshwater fisheries and studies which concurrently valued freshwater, estuarine and marine fishing were excluded.
Fish species	Some studies focussed on particular fish species which were judged to be of little relevance to New Zealand. Examples include shrimp, clams and grunion. Such studies were excluded.
Value focus	• Studies reporting the value of a fishing day, a fishing trip, or the annual value of fishing were included. • Many studies addressed the value of change in fishery attributes (catch rate, fish size, water quality, etc.), but did not provide an estimate of benefits obtained from the fishery in its existing state. These studies were excluded. • A large number of studies identified the value of a marginal fish. Whilst that is an important consideration for management, it is not relevant for valuation of the status quo, so such studies were excluded. • Some studies reported the average value of fish caught. Such studies that

	did not report the number of fish caught, which would permit calculation of the value of a trip, were excluded.
Study quality	Studies that used unacceptable or ad-hoc valuation approaches, or which were based on questionable assumptions have been excluded.
Substitutes	Studies differed markedly in the way they treated fishing locations and substitute fishing sites. Some were highly disaggregated. Some valued loss of fishing at all sites, whereas others valued loss of an individual site or a subset of sites. Studies were not excluded on the basis of treatment of substitutes, but care has been taken to identify the implications of the different approaches to incorporation of substitutes and the assessment of fishery values.
Study date	Valuation methods have improved dramatically since the pioneering studies of the 1970s and 1980s. Recent studies are more valuable. Many early studies are not available in electronic media, making them difficult or impossible to obtain. Because of their relatively low value, little effort was expended to locate hard to find studies published prior to 1990.

Studies have been categorised into three groups:

1. Studies that provide values suitable for transfer to estimate the status quo value of New Zealand recreational marine fisheries. These studies are listed in Appendix 1.
2. Studies that provide estimates of the value of fish, but that do not provide a basis for aggregation to determine fishery value in the status quo. These studies are listed in Appendix 2.
3. Studies that provide estimates of the change in value of the fishery contingent upon a change in fishery attributes or environmental conditions. These studies are listed in Appendix 3.

The annual value of marine recreational fishing can be estimated as either:

1. Number of fishers * Number of days/fisher/year * Number of fish caught/day fished * Value/fish caught
2. Number of fishers * Number of days/fisher/year * Value/fisher/day fished
3. Number of fishers * Number of trips/fisher/year * (Number of fishers per party$)^{-1}$ * Value/party/trip
4. Number of fishers * Number of trips/fisher/year * Value/fisher/trip
5. Number of fishers * Value/fisher/year

Valuation studies have recognised these diverse approaches and have consequently valued different things, i.e.

- Value/fish caught
- Value/fisher/day fished
- Value/party/trip
- Value/fisher/trip
- Value/fisher/year

This diversity of values complicates value transfer, requiring transformation into an equivalent unit of value. For example, choosing the <u>value of the fishing trip for the individual fisher</u> as the standard unit of value under the approaches listed above entails (at least) five alternative possible derivations of the target value:

- (Value/fish caught) *(Number of fish caught/angler/trip)
- (Value/fisher/day fished) *(Days fished/trip)
- (Value/party/trip) *(Number of fishers/party)$^{-1}$
- (Value/fisher/year) *(Trips/fisher/year)$^{-1}$
- Value/fisher/trip [no adjustment required]

These valuation strategies entail conversion of the estimated value using some adjustment factor (the second part of the preceding equations). If the adjustment factor is not available the estimates must remain incommensurable. An example is Kaoru *et al.* (1995), which provides estimates of value/party/trip, but does not provide information on the number of fishers in parties.

New Zealand studies

There has been little effort applied to measuring consumer surplus from marine recreational fishing in New Zealand. The South Australian Centre for Economic Studies (SACES) undertook a large scale survey of mainly boat fishers in early 1999 to apply the contingent valuation method (Lindsay *et al*. 1999, Lindsay & Damania 2000, Wheeler & Damania 2001). Contingent valuation was also used by Kerr, Hughey & Cullen (2003) to estimate the annual value of fishing, and by Schischka & Marsh (2008) to estimate consumers' surplus from Whangamata-based fishing trips. Before proceeding to address the international literature, we first assess the information contained in these three New Zealand studies.

- SACES

This study used responses from over 3500 interviews undertaken between 28 December 1998 and 11 April 1999 to assess the value of individual fish species. Boat fishers were 94% of the sample. The national average frequency of participation was 24.7 fishing trips per year (North Island 26.2 trips/year, South Island 17.7 trips/year). The SACES study used the take-it-or-leave-it approach to estimate consumers' surplus from the current trip, which is a valid approach. Table 1 reports key SACES results (Lindsay *et al*. 1999).

Table 1
Key SACES results

	Snapper	Kingfish	Blue Cod	Kahawai	Rock Lobster
Average amount spent per trip	$35.80	$49.68	$44.09	$25.32	$51.52
Average trips per year	25.9	25.8	18.4	27.4	31.5
Consumer surplus per trip	$101.8	$117.7	$112.5	$101.4	$169.0
CS per trip standard deviation	$52.6	$65.7	$72.8	$54.0	$74.7
Specific target species caught	10.3	1.33	10.6	3.3	8.5
Specific target species kept	3.3	0.65	4.6	1.7	3.5
Other species caught	5.2	14.9	9.6	12.5	13.7
Other species kept	2.4	5.8	3.4	4.4	7.1
Didn't keep target species	28.5%	71.6%	26.0%	54.8%	19.1%

SACES results are reported on the basis of species targeted. Fishers could be targeting several species on the same trip, so categories are not exclusive. However, it is apparent from Table 1 that catch of the specific target species under analysis was often less than for other species. In addition, many other factors were important drivers of consumer surplus, as illustrated in the models reported in Tables 4.13, 5.13, 6.13, 7.13 and 8.13 in Lindsay *et al*. (1999). Consumer surplus is two to four times expenditure, indicating that value-added from recreational fishing is likely to be very small in comparison to consumers' surplus.

- Kerr et al. (2003)

The data for this study were collected in a 2002 survey of registered voters randomly selected from across the country. The study addressed perceptions of the environment (Hughey *et al*. 2002). A single question assessed behavioural response of the 269 active marine fishers in the sample to a national marine fishing license, the cost of which was varied across respondents. Notably, 85.1% of those fishers did not think that recreational fishers should have to obtain a licence to fish in the sea, suggesting a high possibility of strategic responses. Indeed, results indicated that only 66.5% of respondents would obtain a fishing licence, even if it were free. Nearly all the rest indicated they would continue to fish without a licence. Addressing only the respondents who would obtain a licence if they were free (N=151), mean WTP was $109 per year (95% confidence interval = $84 to $196). The magnitude of WTP for those who would not purchase a licence on principle relative to those who would is unknown.

- Schischka & Marsh (2008)

This study used responses from 72 door to door interviews undertaken in Whangamata in June 2007 to apply dichotomous choice contingent valuation. Mean expenditure per trip was $38. Lower and upper bound Turnbull estimates of consumer surplus were $48 and $60, respectively.

Value identification

Table 2 lists, in temporal order, all studies we identified that meet the criteria set out above. These studies are referenced in Appendix 1. Some studies address a single site, although sites vary in scale from small localities to nations. Other studies assess the value of several local or regional sites, most notably those studies using national datasets. Examples include the two Australian studies that used data from the National Survey of Recreational Fishing (Raguragavan *et al*. 2010, Zhang *et al*. 2003) and American studies based on the Marine Recreational Fishery Statistics Survey (Haab *et al*. 2000, Haab *et al*. 2006, Hicks *et al*. 1999, McConnell *et al*. 1994, Whitehead and Haab 2000). It should be noted that the values derived from these studies are not independent. Consequently, while there are many site values reported, they would need appropriate weighting for value transfer.

Table 2
Source value estimates

Source	Notes	Value/day	Value/trip	Value/year
McConnell (1979)	Household Production & Travel Costs. USA, Rhode Island. Data year not stated. Use Freeman (1995) reported values in 1991$US (HP=$1169, TCM=$524) Flounder.		HP TCM	US$515 US$233
Bockstael *et al*. (1989)	Random Utility Model. USA, East Florida. 1987/1988 data. All species. (Min & Max values reported)	Brevard County Palm Beach	US$0.81 US$7.94	
Morey *et al*. (1991)	Random Utility Model Travel Cost Method. All fishing at Clatsop County. USA, Oregon. 1981 data. All species.		Clatsop Tillamook Lincoln Lane Douglass Curry Multnomah Deschutes	US$175 US$106 US$61 US$29 US$19 US$9 US$94 US$21
Cameron (1992)	Joint contingent valuation & travel costs. USA, Texas. 1987 data. All species. 17.4 day trips per year	US$198	US$198	US3451
	Contingent Valuation. WTS one year of access to the entire east coast. USA, Mid and South Atlantic. 1988/89 data. All species	Mid-Atlantic Chesapeake South Atlantic All States		US$692 US$653 US$652 US$566
McConnell *et al*. (1994)	Contingent Valuation. WTS one year of access to the entire east coast. USA, Mid and South Atlantic. 1988/89 data. All species	New York New Jersey Delaware Maryland Virginia N. Carolina S. Carolina Georgia Florida (East)	US$26 US$28 US$30 US$20 US$31 US$26 US$21 US$3 US$28	US$604 US$579 US$596 US$550 US$587 US$571 US$538 US$588 US$585
	Random Utility Travel cost Model USA, Mid and South Atlantic. Access to individual states. 1988 data (MRFSS). All species.	New York New Jersey Delaware Maryland Virginia N. Carolina S. Carolina Georgia Florida (East)	US$58.32 US$33.90 US$11.02 US$26.59 US$46.18 US$66.21 US$68.12 US$41.74 US$80.37	US$322.0 US$182.0 US$12.3 US$118.5 US$197.6 US$300.7 US$118.9 US$23.3 US$888.0

Table 2 continued: Source value estimates

Source	Notes	Value/day	Value/trip	Value/year
Hausman *et al.* (1995)	Random Utility travel cost model. USA, Alaska. 1989 data. All species.	MNL NMNL	US$119 US$148	
Kling & Herriges (1995)	Random Utility Travel cost Model USA, Southern California. 1989 data. All species	Offshore Shore-based	US$27-44 US$8-17	
Downing & Ozuna (1996)	Contingent valuation. USA, Texas. 8 bays. 1987-1989 data. All species.	1987 1988 1989 All	US$130.42 US$88.89 US$108.30 US$109.20	
Bell (1997)	Production function USA, Florida. 1984 data. All species.	US$53.25 US$35.29		East Florida West Florida
Greene *et al.* (1997)	RUM Travel Cost Method. WTP/fisher/trip (10.8 trips/year). USA, Tampa Bay, Florida. 1989/90 data. All species.	Tampa Bay Tampa + Pinellas	US$1.68 US$3.66	US$18.14 US$39.53
Lipton & Hicks (1999)	Random Utility Model. WTP for striped bass fishing. USA, Chesapeake Bay. 1994 data. Striped Bass.	Virginia Maryland	US$69.95 US$62.22	
Hicks, *et al.* (1999)	Random Utility Model. WTP for fishery access. USA, North Eastern States. 1994 data (MRFSS). All species.	Virginia Maryland Delaware New Jersey New York Connecticut Rhode Island Massachusetts New Hampshire Maine	US$42.33 US$12.09 US$1.43 US$14.12 US$21.58 US$3.07 US$4.23 US$8.38 US$0.85 US$6.40	
Whitehead & Haab (1999)	Random Utility Model Travel Cost Method. Loss of site access/fisher/day. USA, 7 South Eastern states. 1997 data (MRFSS). All species.	US$1.08 US$1.44 US$0.18 US$2.69 US$7.72 US$0.36 US$0.36 US$3.95	N. Carolina S. Carolina Georgia Florida East Florida West Alabama Mississippi Louisiana	
SACES: Lindsay & Damania (2000) Lindsay *et al.* (1999) Wheeler & Damania (2001)	Contingent valuation. Access per trip by species targeted, mostly by boat-based fishers. New Zealand. 1999 data.	Snapper Kingfish Blue cod Kahawai Rock Lobster	$102 $118 $113 $101 $169	
Haab *et al.* (2000)	Nested Random Utility Model. Access per trip (Table 6-3). USA, South Eastern states. 1997 data (MRFSS). All Species.	N. Carolina S. Carolina Georgia Florida (SA) Florida (Gulf) **Florida (All)** Alabama Mississippi Louisiana **Gulf Coast** **South Atlantic**	US$15.83 US$6.70 US$2.58 US$12.01 US$45.88 US$202.52 US$1.56 US$3.63 US$11.68 US$82.22 US$109.31	

Table 2 continued: Source value estimates

Source	Notes	Value/day	Value/trip	Value/year
Whitehead *et al.* (2001)	Dichotomous Contingent Valuation. Annual license. USA, North Carolina. 1998 data. All species			US$67
Criddle *et al.* (2003)	Binomial Choice. WTP/fisher/day. USA, Alaska. 1997 data. Halibut, Coho, Steelhead.	US$83 US$119	Alaskans Out of State	
Gillig *et al.* (2003)	Travel Cost Method, Contingent Valuation, Joint Travel Cost Method/Contingent Valuation. USA, Gulf of Mexico. 1991 data. Red Snapper.		TCM CVM Joint	US$9.85 US$85.70 US$14.50
Kerr *et al*. (2003)	Contingent behaviour. NZ, national marine fishing license. 2002 data. All species.			NZ$110
Zhang *et al.* (2003)	Random Utility Model Travel Cost Method. Shore-based fishing access to 16 individual sites. Australia, WA. 2000/01 data (NSRF). Multiple Species. (5 fish model results reported here)	Geraldton Esperance Broome Albany Port Hedland Point Samson Busselton W. Kimberley Mandurah Swan/Canning R Fremantle Bunbury Lancelin Hillary Denmark Augusta	AU$11.52 AU$10.01 AU$5.52 AU$3.63 AU$2.48 AU$2.15 AU$1.57 AU$1.49 AU$1.42 AU$0.67 AU$0.66 AU$0.47 AU$0.43 AU$0.40 AU$0.38 AU$0.15	
Toivonen *et al.* (2004)	Contingent valuation. Access (1999 US$). Nordic countries. 1999/2000 data. All species.		Denmark Finland Iceland Norway Sweden	US$71 US$73 US$140 US$82 US$56
Haab *et al.* (2006)	Random Utility Model Travel Cost Method. WTP for a one day trip. USA, Pacific coast. 1994 & 1997 data (MRFSS). All species.	US$43-71 US$13-34 US$64-94 US$174-284	Washington Oregon N. California S. California	
Haab *et al.* (2008)	Random Utility Model Travel Cost Method. Small area closure. USA, Oahu, Hawaii. 1998 data. All species. A= Small moored boat B= Small trailered boat C= Large moored boat D= Large trailered boat	US$13.44 US$5.91 US$35.02 US$14.37	A B C D	
Schischka & Marsh (2008)	Contingent Valuation. WTP for the LAST trip. New Zealand, Whangamata. 2007 data. All species.		NZ$48 ~ 60	
Raguragavan *et al*. (2010)	Random Utility Model Travel Cost Method. Access to 48 individual sites. Australia, WA. 2000/01 data (NSRF). Multiple Species.	Mean (all sites) Shark Bay Oceanic Coral Bay	AU$3.61 Min=AU$1.91 Max=AU$14.46	

Table 2 continued: Source value estimates

Source	Notes	Value/day	Value/trip	Value/year
Prayaga *et al*. (2010)	Travel Cost Method. Site access values. [12.98 trips/year] Australia, Capricorn Coast. 2007 data. All species.		AU$167 (128~243)	[AU$2170]
Whitehead *et al*. (2011)	Combined revealed/stated preference. Site access, charter fishery. USA, North Carolina. 2007 data. Snapper-Grouper, King Mackerel.		US$273	

In addition to the studies cited in Table 2, which we have been able to access, we are aware of a number of studies cited in Freeman (1995) and Pendleton and Rooke (2007), which we have not been able to access. These are reported in Appendix 5. Because some studies known to us that have been cited by these two sources address freshwater, or assess changes in values contingent upon altered environmental conditions, and because Pendleton and Rooke (2007) does not identify the base year for valuation, we have not included any of these unsighted studies in our analysis.

In order to make the data in Table 2 commensurable the values have been adjusted to third quarter (Q3) 2010 New Zealand dollars. This was a two stage process. Firstly, consumer price indices for each of the countries were used to adjust to Q3 2010 values in the currency concerned. Official government statistics were used for this adjustment (Australian Bureau of Statistics 2011, Statistics NZ 2011, US Bureau of Labour and Statistics 2011). The second stage entailed currency conversion using consumer purchasing power parity rates (OECD 2011). To facilitate comparison, these adjusted values are reported in Tables 3-5, according to the value type of estimate provided in the particular study (Day/Trip/Year).

Table 3
Value per day (2010 NZ$)

Source	Notes		Value/day
Cameron (1992)	Texas, USA. All species.		$602
Bell (1997)	Florida, USA. All species.	Florida East Florida West	$177 $117
Whitehead & Haab (1999)	USA, 7 South Eastern states. Site access. All species.	Alabama Florida East Florida West Georgia Louisiana Mississippi North Carolina South Carolina	$0.78 $5.84 $16.75 $0.39 $8.57 $0.78 $2.34 $3.12
Criddle *et al*. (2003)	USA, Alaska. Halibut, Coho, Steelhead.	Alaskan fishers Out of State fishers	$180 $258
Haab *et al*. (2006)	USA, Pacific coast. Site access. All species.	Washington Oregon Northern California Southern California	$93 ~ $154 $28 ~ $74 $139 ~ $204 $378 ~ $616
Haab *et al*. (2008)	USA, Oahu, Hawaii. Small area closure. All species.	Small moored boat Small trailered boat Large moored boat Large trailered boat	$29 $13 $75 $31
Range			**$0.39 ~ $616**

Table 4
Value per trip (2010 NZ$)

Source	Notes		Value/trip
Bockstael *et al*. (1989)	USA, East Florida. All species.	Brevard County	$2.45
		Palm Beach County	$24.06
Cameron (1992)	USA, Texas, All species.		$602
McConnell *et al*. (1994)	USA, Mid & South Atlantic. Access to individual states. All species. RUMs	New York	$170
		New Jersey	$99
		Delaware	$32
		Maryland	$78
		Virginia	$135
		North Carolina	$193
		South Carolina	$199
		Georgia	$122
		Florida (East)	$235
	USA, Mid & South Atlantic. Access to individual states. All species. Contingent Valuation models.	New York	$72
		New Jersey	$78
		Delaware	$83
		Maryland	$55
		Virginia	$86
		North Carolina	$72
		South Carolina	$58
		Georgia	$8
		Florida (East)	$78
Hausman *et al*. (1995)	USA, Alaska, All species.	MNL model	$333
		NMNL model	$414
Kling & Herriges (1995)	USA, Southern California. All species.	Offshore	$76-123
		Shore-based	$22-48
Downing & Ozuna (1996)	USA, Texas, All species. Average of median values for 8 different bays.	1987	$397
		1988	$260
		1989	$303
		All	$319
Greene *et al*. (1997)	USA, Tampa Bay, Florida. Access. All species.	Tampa Bay	$5
		Tampa + Pinellas	$10
Lipton & Hicks (1999)	USA, Chesapeake Bay. Access to individual states. WTP for striped bass fishing.	Virginia	$164
		Maryland	$146
Hicks *et al*. (1999)	USA, North Eastern States. Access to individual states. All species.	Virginia	$99
		Maryland	$28
		Delaware	$3
		New Jersey	$33
		New York	$50
		Connecticut	$7
		Rhode Island	$10
		Massachusetts	$20
		New Hampshire	$2
		Maine	$15
Haab *et al*. (2000)	USA, South Eastern states. Access to individual states. All Species.	North Carolina	$34
		South Carolina	$15
		Georgia	$6
		Florida (South Atlantic)	$26
		Florida (Gulf)	$100
		Florida (All)	**$439**
		Alabama	$3
		Mississippi	$8
		Louisiana	$25
		Gulf Coast	**$178**
		South Atlantic	**$237**

Table4 continued: Value per trip (2010 NZ$)

Source	Notes		Value/trip
SACES: Lindsay & Damania (2000) Lindsay *et al*. (1999) Wheeler & Damania (2001)	New Zealand. Mostly boat-based fishing. By species targeted (but multiple target species per trip).	Snapper Kingfish Blue cod Kahawai Rock Lobster	$137 $158 $151 $135 $226
Zhang (2003)	Australia, WA. Shore-based fishing access to individual sites. Multiple Species. (5 fish model reported here)	Geraldton (Max) Augusta (Min)	$16 $0.20
Schischka & Marsh (2008)	New Zealand, Whangamata. WTP for the LAST trip. All species.		$52 ~ $65
Raguragavan *et al*. (2010)	Australia, WA. Access to individual sites. Multiple Species.	Mean-all sites Coral Bay (Max) Shark Bay Oceanic (Min)	$5 $20 $3
Prayaga *et al*. (2010)	Australia, Capricorn Coast. All species.		$187
Whitehead *et al*. (2011)	USA, North Carolina. Charter fishery. Snapper-Grouper, King Mackerel.		$458
Range			**$0.20 ~ $602**

Only six studies reported values per fishing day (Table 3). The diversity of values is considerable, ranging from less than one dollar per day to several hundred dollars per day. Values in Table 3 are assessments of impacts of specific area closures. The scale of area closure differs markedly between these studies. Whitehead and Haab (2000) and Haab *et al*. (2006) used USA states as the unit of closure. Note, however, that Bell's (1997) estimates for Florida are an order of magnitude larger then Whitehead and Haab's (2000) estimates. Similarly, the three value estimates for South Carolina are $199, $58 and $15.

Haab *et al*. (2008) assessed closure of a very small part of the fishery around the island of Oahu. Consequently, the smaller values associated with the Oahu fishery, relative to the West Coast mainland fisheries (Haab *et al*. 2006) and Alaska fisheries (Criddle *et al*. 2003) is reasonable. The smaller values for trailered boats in the Oahu study are likely to have arisen because of substitution effects. Closure of a specific area has less affect for fishers who can trailer their boats to an alternative launching point. Fishers with moored boats have no alternative, but must travel by sea to their new fishing location.

Table 4 reports values per fishing trip. There is expected to be some overlap between values per day (Table 3) and values per trip (Table 4) because many, but not all, fishing trips are single day events. Again, there is great diversity of value estimates, ranging from less than a dollar for a trip to Augusta in West Australia (Zhang 2003) to over $400 per trip for charter fishing in North Carolina and $600 for Texas. The SACES New Zealand estimates fall near the middle of this range. Scale differences are apparent in Table 4 too. For example, Haab *et al*. (2000) assessed values for three areas of Florida; the Gulf Coast ($100), the South Atlantic Coast ($26), and all of Florida ($439). Fishers who would have used one of the sub sites could transfer their effort to the other location should one site close (e.g. if the Atlantic Coast closed they could fish on the Gulf Coast). They do not have that opportunity when both coasts close, resulting in a much higher value for loss of access to all of Florida. Estimates of value loss for large coastal areas (All the Gulf Coast, $178; All the Atlantic Coast, $237) are considerably larger than for loss of access to individual states. The two West Australian studies (Raguragavan *et al*. 2010, Zhang 2003) used the same dataset, which addressed a large number of small sites. The loss of any individual site in this context is not important because fishers can transfer to another site. Consequently, the low value of the West Australian sites compared to others is realistic.

Table 5
Value per year (2010 NZ$)

Source	Notes		Value/year
McConnell (1979)	Rhode Island, USA. Flounder fishing.	HP model TC model	$1,312 $594
Morey *et al*. (1991)	Oregon, USA. All fishing at Clatsop County. All species.	Clatsop county residents Tillamook county residents Lincoln county residents Lane county residents Douglass county residents Curry county residents Multnomah county residents Deschutes county residents	$656 $398 $229 $109 $71 $34 $352 $79
Cameron (1992)	USA, Texas.		$10,497
McConnell *et al*. (1994)	USA, Access to the whole Mid & South Atlantic. All species. CVM models.	Mid-Atlantic Chesapeake South Atlantic	$2,006 $1,893 $1,890
	USA, Access to individual states. All species. CVM models.	New York New Jersey Delaware Maryland Virginia North Carolina South Carolina Georgia Florida (East)	$1,675 $1,606 $1,653 $1,525 $1,628 $1,583 $1,492 $1,631 $1,622
	USA, Access to individual states. All species. RUM models.	New York New Jersey Delaware Maryland Virginia North Carolina South Carolina Georgia Florida (East)	$940 $531 $36 $346 $577 $878 $347 $68 $2,593
Greene *et al*. (1997)	USA, Tampa Bay, Florida. All species.	Tampa Bay Tampa Bay plus Pinellas	$50 $110
Whitehead *et al*. (2001)	USA, North Carolina. All species.		$143
Gillig *et al*. (2003)	USA, Gulf of Mexico. Red Snapper.	Travel Cost Method Contingent Valuation Joint TCM/CV	$25 $219 $37
Kerr *et al*. (2003)	New Zealand. National marine fishing license. All species.		$137
Toivonen *et al*. (2004)	Scandinavia. Access. All species.	Denmark Finland Iceland Norway Sweden	$148 $152 $291 $171 $116
Prayaga *et al*. (2010)	Australia, Capricorn Coast. Site access. All species.		$2,430
Range			**$25 ~ $10,497**

There are ten studies that allow derivation of annual values. Two of those (Greene *et al*. 1997, Prayaga *et al*. 2010) provide values aggregated by multiplying values per trip (reported in Table 5) by the average number of trips taken in a year. Because many fishers make more than a single trip in a year, it is expected that annual values should be higher than trip values and this is what is found in Table 5. Again, value estimates are diverse, ranging from $25 for the Gulf of Mexico Red Snapper fishery (Gillig *et al*. 2003), to several thousand dollars for access to Queensland's Capricorn Coast (Prayaga *et al*. 2010) and the United States eastern seaboard (McConnell *et al*. 2004), up to $10,000 for Texas (Cameron (1992). The counties furthest from Clatsop County (Douglass, Curry and Deschutes) in Morey *et al*. (1991), unsurprisingly, have the lowest values for fishing at Clatsop, whereas Clatsop has the highest value, followed by its neighbour Tillamook. The large potential differences in value from alternative valuation methods are amply demonstrated by Gillig *et al*. (2003), where contingent valuation estimates are an order of magnitude larger than other methods.

1.3 Previous Benefit Transfer Studies

Freeman (1995) reports values from several United States studies, differentiating between single-species and multi-species fisheries and providing per trip and annual values. Freeman (1995: 403) commented on the "substantial variation in value measures across studies". We were unable to access many of the studies Freeman utilised, but the studies we accessed, most of which are more recent, lead to the same conclusion.

Downing & Ozuna (1996) undertook concurrent contingent valuation studies at 8 different Texas bays for three consecutive years. Their results do not bode well for transfer of fishing values. In nearly all cases it was not possible to transfer values across years for the same sites, or across sites. Their results are reported in Table 6. Downing and Ozuna (1996) report confidence intervals for these estimates and there are many significant differences. They are not reported here in the interests of simplicity. Even so, it is apparent that estimates of median WTP vary significantly across sites and across years. For example, the upper bound estimate for Galveston in 1988 is $82.42, which is dramatically different to the lower bound estimates for the same location in 1987 and 1989 ($191.89 and $248.89, respectively). Galveston is not unique in this respect.

Table 6
Downing & Ozuna (1996) value estimates (median WTP US$)

Bay	1987	1988	1989	Average Across years
Sabine	84.77	62.25	38.12	61.71
Galveston	201.40	80.92	258.20	180.17
Matagorda	118.73	70.32	45.20	78.08
San Antonio	103.12	79.65	81.71	88.16
Aransas	152.70	127.7	119.22	133.21
Corpus Christi	121.81	85.02	85.91	97.58
Upper Laguna Madre	130.25	106.67	83.06	106.66
Lower Laguna Madre	130.59	98.55	154.95	128.03
Average across sites	130.42	88.88	108.30	**109.20**

More recently, Pendleton & Rooke (2007), who evaluated several United States studies, found a similarly broad range of values; $15 to $216 per fishing day and $1 to $407 per fishing trip. Ranges of value estimates for marine recreational fishing benefit transfer studies are summarised in Table 7. All ranges are extremely large.

Table 7
Benefit transfer study value estimate ranges

Study	Value Year / Currency	Day	Trip	Year
Freeman	1991 $US	-	$0.44 ~ $799	$0.51 ~ $4,261
Downing & Ozuna	1987-89 $US	-	$38 ~ $258	-
Pendleton & Rooke	Unknown $US	$15 ~ $216	$0.63 ~ $407	-
This study	2010 $NZ	$0.39 ~ $616	$0.20 ~ $602	$25 ~ $10,497

1.4 Prospects for Benefit Transfer

Whilst a large number of fishery valuation studies were identified in our literature review, very few of them were of relevance to estimating the value of fishing *per se*. A number of studies have addressed the value of a marginal fish, which has management relevance, but does not assist with valuation. Johnston *et al*. (2006) have recently undertaken value transfer analysis for fish. Most of the recent studies have addressed management matters, such as the value of better quality fish, changed catch rates, or environmental quality. These studies do not provide estimates of site value, *per se*.

We were able to access 27 unique studies that evaluated the worth of recreational fishing in the marine environment. There are six studies reporting values per day, sixteen reporting values per trip and ten reporting values per year. However, these studies differ greatly in terms of spatial scale and availability of substitutes. These differences may account for some of the diversity of value estimates, but there are many other potential influences, such as length of the season, method restrictions, and quality of the fishery. Consequently, the small number of studies does not permit application of meta-analysis, which is one way to address such matters (Kerr and Woods 2010). The broad ranges of values, coupled with the small number of studies for any one type of value measure, suggests that there are potentially very large errors in value transfer. Little confidence could be placed in any benefit estimate derived from value transfer, and such values are most likely, and rightly, to meet stern intellectual and political challenges.

1.5 Conclusions

There are relatively few studies of the benefits obtained by saltwater recreational anglers. Those studies have occurred over about three decades, have used a variety of valuation methods, cover several countries, measure different units of value, sometimes assess individual or groups of species or the whole fishery, cover diverse fishing modes, and vary greatly in geographic extent and availability of substitutes. Even where the same method is applied at the same location in different times, or concurrently in different locations, value estimates are significantly different. These factors manifest themselves in extremely broad ranges of value estimates. The prospects for transferring values from other locations to accurately assess the value of the New Zealand recreational marine fishery appear extremely slim.

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Appendix 4
Data commensurability

Price Indices

Date	NZ CPI	NZ Index	Australia CPI	Australia Index	USA CPI	USA Index
2010Q3	1111.000	1.000				
2007Q3	1025.000	0.923				
2002Q1	830.430	0.802				
1999Q1	891.015	0.747				
2010Q3			173.3	1.000		
2007Q3			158.6	0.915		
2000Q4			131.3	0.758		
2010Q3					218.439	1.000
2007Q3					208.490	0.954
1999Q3					167.9	0.769
1998Q3					163.6	0.749
1997Q3					161.2	0.738
1994Q3					149.4	0.684
1991Q3					137.2	0.628
1989Q4					126.1	0.577
1989Q3					125.0	0.572
1988Q4					120.5	0.552
1988Q3					119.8	0.548
1987Q4					115.4	0.528
1987Q3					115.0	0.526
1984Q3					105.0	0.481
1981Q4					94.0	0.430
1981Q3					93.2	0.427

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Currency conversions

2010	New Zealand	Australia	USA
Exchange Rate	1.387	1.090	1.000
PPP Private Consumption	**1.600**	1.556	1.000
PPP Individual Consumption	1.456	1.509	1.000
Exchange Rate	1.272	1.000	0.917
PPP Private Consumption	**1.028**	1.000	0.643
PPP Individual Consumption	0.965	1.000	0.663
Exchange Rate	1.000	0.786	0.721
PPP Private Consumption	1.000	0.973	0.625
PPP Individual Consumption	1.000	1.036	0.687

Source: OECD http://stats.oecd.org/Index.aspx?DataSetCode=PPPGDP Accessed 11 August 2011.

Appendix 5
Valuation studies reported elsewhere, but not located by us

Cited by Freeman (2005). All values are 1991$US

Source	Notes	Value/day	Value/trip	Value/year
Arnsdorfer & Bockstael (no date)	TCM. Multi-species.	Florida	US$222-770	US$399-1387
Bell *et al*. (1982)	CVM. Multi-species.	Florida	US$58	US$243
Norton *et al*. (1983)	TCM. Striped Bass.	Mid-Atlantic South Atlantic New England Chesapeake	US$279 US$190 US$142 US$164	
Rowe *et al*. (1985)	RUM. Salmon.	California Oregon Washington	US$7.43 US$6.00 US$0.44	
Wegge *et al*. (1986)	CVM, TCM. Multi-species. Southern California.	TCM CVM	US$30-799 US$16-79	US$463-4261
Bergland & Brown (1988)	RUM. Multi-species.	One Oregon port		US$350
Huppert (1989)	TCM. Striped Bass. San Francisco Bay	OLS NLLS ML	US$376 US$170 US$77	US$2331 US$1054 US$477
Leeworthy (1990)	TCM. King Mackerel	Florida	US$56.40	US$1376
Kaoru & Smith (1990)	RUM. Multi-species.	N. Carolina Sounds	US$4.30-7.77	
Kaoru (1991)	RUM. Multi-species.	Albemarle Sound	US$3.09	
Kahn (1991)	TCM. Multi-species. Long Island.	Charter Boat Party Boat		US$440 US$1220

Cited by Pendleton & Rooke (2007). Base value year not stated (but not original values)**. US$**

Source	Notes	Value/day	Value/trip	Value/year
Crutchfield & Schelle (1978)	CVM. Washington	US$55.48		
Bell *et al*. (1982)	CVM. Florida	US$82.90 US$61.86 US$77.00		Residents Non-residents Both
Norton *et al*. (1983)	TCM. North Eastern USA.		US$94-407	
Rowe (1985)	RUM. Pacific NW. Salmon		US$116.07 US$100.52	Oregon Washington
Rowe *et al*. (1985)	RUM. Pacific NW. Pacific Salmon		US$8.65 US$0.63	Oregon Washington
Wegge *et al*. (1986)	TCM. Southern California	US$16-35 US$15-59		TCM CVM
Bockstael *et al*. (1986)	CVM. South Carolina	US$97.92		
Jones & Stokes Associates (1987)	RUM. Alaska.		US$8-34 US$10-31 US$7-23 US$4-18	Halibut King Salmon Silver Salmon Other species
Wegge *et al*. (1988)	RUM. Pacific Salmon. Alaska		US$69.94	
Leeworthy (1990)	TCM. Florida		US$81.33	
McConnell *et al*. (1993)	CVM. Mid-Atlantic/Eastern States	US$215.85		
Hamel *et al*. (2000)	CVM & TCM. Alaska Halibut & Salmon	US$99.39 US$146.14 US$119.62		Residents Non-residents Both

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