



Estimating marine recreational fishing's economic contributions in New Zealand



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ABSTRACT

Economic information is critical for explaining why recreational fishing and marine stewardship is important to all citizens of a nation. Successfully raising public awareness of the importance of healthy and abundant marine fisheries is dependent on having reliable economic insights. These types of data can be used to inform discussions about how to institute better conservation policies, secure new partners and resources for conservation initiatives, and ultimately boost the long-term health and productivity of marine fisheries. Until now, the economic contribution of recreational marine fishing in New Zealand has not been measured, placing recreational fishing interests at a disadvantage compared to the commercial sector that has such information in various forms. This project filled that vacuum. Beginning with the \$946 million spent annually by more than 600,000 resident and visiting New Zealand fishers, these dollars circulate through the national economy, supporting 8000 jobs, stimulating \$1.7 billion in total economic activity, contributing \$638 million in Gross Domestic Product and \$342 million in salaries, wages and small business profits while adding nearly \$187 million in tax revenues. This study was built using data collection and analytical approaches available for use by other nations to increase public awareness of the critical economic importance of their marine fisheries.

1. Introduction

Management of New Zealand's fisheries is guided by the Fisheries Act of 1996. The Act provides for the conservation, utilization, enhancement, and development of fisheries resources to enable people to provide for their social, economic, and cultural well-being while maintaining the potential of fisheries resources to meet the reasonably foreseeable needs of future generations (Fisheries Act, 1996). Three key fisheries: 1) recreational, 2) commercial, and 3) customary are recognized by the Act. Customary being the non-commercial aboriginal seafood harvest for traditional purposes, under permit, of the Maori.

Recreational saltwater fishing is one of the most popular outdoor activities in New Zealand (Sports New Zealand, 2015). Expenditures made for the purpose of recreational marine fishing support a significant number of industries such as tackle retailers, boat builders, hotels, restaurants, and more. Despite the popularity of marine recreational fishing, the economic activity associated with marine recreational marine fishing has not yet been quantified.

Allocations across fisheries on an economic basis should consider changes 'at the margin' in the both consumer and producers surpluses

(Mcphee and Hundloe, 2004). However, implementing a consumer surplus study and developing marginal value and utility models for New Zealand can be cost-prohibitive. Value transfer, a method of estimating the non-market value based on available information from already completed studies, is an alternative approach to primary consumer surplus research.

Considering an original consumer surplus study to be cost-prohibitive, in 2011 the New Zealand Marine Research Foundation (Foundation) sponsored a scoping study to review all published international economic surveys on recreational fishing, with a view to using the value transfer method to estimate the non-market value (consumer surplus) of marine recreational fishing in New Zealand. Researchers from the Faculty of Commerce at Lincoln University found 27 unique studies worldwide that evaluated the worth of recreational fishing in the marine environment. These studies reported values per day, per trip, or per year. They differed greatly in terms of spatial scale and valuation method. The report concluded that the prospects for transferring values from other locations to accurately assess the value of the New Zealand recreational marine fishery were extremely slim (Kerr and Latham, 2011).

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An opportunity arose to leverage the latest data on the number of recreational fishers and number of fishing trips from the first National Panel Survey (NPS) of recreational fishers conducted by National Research Bureau, Ltd. (NRB) for the Ministry for Primary Industries (MPI). In light of this opportunity, the Foundation undertook a project to estimate the economic contribution, or the cycling of economic activity through an existing economy (Watson et al., 2007) associated with recreational fishers in New Zealand, which became the basis for this paper.

Economic contributions of recreational fishing to a regional or national economy has received investigation worldwide. McIlgorm and Pepperell (2013), Ernst and Young (2009), and Lyle et al. (2014) focus their research in Australia. Lovell et al. (2014, 2013), US DOI (2012), NMFS (2010), Southwick et al. (2010), Yong Chacon et al. (2010), and Pawson et al. (2007) focus their research efforts in North and Central America as well as the European Union. While the magnitude of the economic contributions vary by the size of the fisher population, their spending on fishing-related recreation and the linkages within the economy under study, suggest that recreational marine fishing is more than just a peaceful escape for some or an exhilarating experience of a catch for others.

Fishing-related activity spurs significant retail spending on items such as tackle, line, rods, and bait as well as food, lodging, and fuel. As this economic activity cycles through the economy, it generates indirect spending by manufacturers, wholesalers, and other supporting industries and makes substantial contributions to gross domestic product. It also supports numerous jobs and salaries in the fishing-related industry and service sectors. Economic information is critical therefore to explaining why a healthy recreational fishing industry and marine stewardship is important to public policy development (Watson et al., 2007). In combination with additional economic valuation studies, its results can be used to inform discussions about how to institute sustainable and equitable conservation policies, secure new partners and resources for conservation initiatives, and ultimately boost the long-term health and productivity of marine fisheries.

2. Methods

There are three measures commonly used, and sometimes confused, to evaluate economic analysis, each using specific techniques and producing values, typically monetary, with different interpretations (Watson et al., 2007). Economic benefit analysis investigates social welfare measures, economic impact analysis investigates an economy in the presence or absence of a change to an industry, and economic contribution analysis investigates the level of economic activity associated with an industry.

To be clear, this study did not set out to estimate the value fishers derive over and above what they spend (economic benefit) nor can it estimate the shrinkage in the economy if recreational fishing did not exist (economic impact). What this study does do is provide a better understanding of the general size, nature, and importance across the New Zealand national economy; effectively creating a snapshot of the economic contribution associated with New Zealand marine recreational fishing in 2014–15. Commercial and customary fisheries are not considered.

The number of people participating in the activity under study and their spending associated with the activity provide the basis for the initial measure of economic activity, referred to as total direct spending. For this analysis, the number of participants, both resident and non-resident fishers, are derived from two existing sources of data. Their spending is estimated via a survey implemented as part of this study. One key issue associated with quantifying spending is to include purchases related to a trip, when fishing occurred in this case, while at the same time isolating only that proportion of spending attributable to the activity under study, as best as possible.

The additional activity stemming from total direct spending and

flowing through inter-industry linkages is estimated using output multipliers. When more than one set of multipliers are available, the selection is based on those that best reflect the study-region's economy and provide the level of required granular detail at the industry-level. More discussion as to the data sources, key issues, assumptions, and adjustments are provided in Sections 2.1 through 2.3.

2.1. Quantifying marine fishing participation in New Zealand

2.1.1. New Zealand residents

Fishing has been identified as one of the top five most popular outdoor recreational activities among New Zealand residents with 20% of residents 18 years and older participating each year (Sports New Zealand-www.sportnz.org.nz-2015). One of the critical needs for this research effort was to determine the size of New Zealand's resident marine fishing population, regardless of harvest and avidity. To do this, we relied on the Ministry for Primary Industries (MPI) nationwide panel survey implemented among marine fishers by the National Research Bureau (NRB) between October 2011 and September 2012 (Wynne-Jones et al., 2014).

Fishers were recruited into the NRB survey through face to face interviews using a random mesh block sampling frame of dwellings and random selection of one resident per household. More than 7000 marine fishers agreed to participate from 30,390 dwellings approached. Contact with survey participants was made at structured intervals over a twelve-month period and detailed information collected by phone interview on their level of fishing activity, location visited, platform used and harvest, if any.

By applying calculated expansion weights based on selection probability, multiple demographic characteristics, and fishing activity-level of this respondent group, NRB researchers estimated New Zealand's resident marine fisher population 15 years and older, the number of fishing trips, and harvest by species. Interested readers are encouraged to refer to the detailed report published by MPI for additional explanation about the techniques used to develop the expansion weights (Wynne-Jones et al., 2014; Heinemann et al., 2015).

The NRB restricts the target audience to people 15 years of age or older because of New Zealand's requirement of parental permission for persons younger than 15 years of age. The MBIE's International Visitor Survey discussed in Section 2.1.2 also applies this restriction to the target audience. This restriction may skew estimates of the fisher population toward a conservative count.

2.1.2. International visitors

The estimate of international visitors was based on the country's ongoing International Visitor Survey (IVS) managed by the Ministry of Business, Innovation, and Employment (MBIE). The framework for the most recently implemented survey was to randomly sample approximately 9000 visitors, age 15 years or older, to New Zealand each year. The population of sampled travelers was contacted after their trip and asked to share information about activities, locations visited, and spending. For an in-depth discussion about the IVS and the methodologies employed readers are encouraged to refer to the IVS website (MBIE).

The MBIE IVS data only provides the number of visitors who fished, not whether the primary purpose was for marine recreational fishing. As a proxy, we estimate the proportion of international visitors who travel for the primary purpose of marine fishing based on data gathered through a survey of New Zealand's charter operators undertaken as part of this research. Operators may not be precise historians of the number of their customers who come primarily to fish. Nevertheless, we rely on operator estimates in the absence of primary data from the international visitor survey.

2.2. Quantifying marine fisher spending

2.2.1. New Zealand residents

Expenditure data for resident marine fishers was collected via a Horizon Research online panel survey. The national market research firm, Horizon Research, specializes in collecting qualitative and quantitative research via online methods. We focused recruitment efforts through their HorizonPoll and ShapeNZ panels of New Zealand residents 18 years of age and over. Panelists were recruited to participate in general surveys, not angler-specific surveys, reducing potential bias introduced when angling-specific surveys attract disproportionate numbers of avid anglers. The survey itself was structured to gather information about the fisher's annual and seasonal activity, locations fished, and spending.

Fishers reported their spending profile in two parts: a) per-trip spending on consumables and travel-related items and b) annual equipment spending. Trip-related spending included items such as fuel, bait, food, lodging, and charter fees. It was reported as a per day measure and associated with both a season and location component (either region where fishing took place or region of residence).

There is the potential for fishing expenditure and activity behaviors to exhibit a seasonal trend. To evaluate the presence of seasonal differences, we grouped the twelve months of the year into two seasons (winter and summer) and asked fishers to tell us about their activity and trip spending in each season.

Equipment spending included fishing equipment (rods, reels, tackle, electronics, clothing, maps) and big equipment (vehicles, boats, trailers, campers, holiday homes), reflecting those items that can be used on more than one trip. Both were reported as an annual measure and associated with a location component. The list of equipment items, including durable items such as boats and vehicles, was modeled after the U.S. Fish and Wildlife Service's *National Survey of Fishing, Hunting, and Wildlife-Associated Recreation* (US DOI, 2012).

The amount of reported equipment spending into the expenditure profiles was based on the proportion of time an item was used for fishing versus other activities. In the case of equipment purchased specifically used for saltwater fishing in the last 12 months, all reported spending was included. In the case of spending in the last 12 months on larger equipment items which may be used for other activities, only a portion of spending was included in the spending profile. The portion is based on the reported percent of time that item was used during marine fishing activity.

Spending by fishers who are minors is expected to come in large part from within the family. Adult fishers are asked to include equipment expenses incurred for minors thereby capturing a least a portion of spending associated with minors.

There are some known or expected biases with online panel surveys used here to collect expenditure data, such as self-selection and strategic bias.¹ The impact of these was reduced by applying a post-stratification multivariate weighting adjustment using the iterative rake weighting procedure available through SPSS to balance our respondent sample with NRB's National Panel Survey. The weighting variables include activity and demographic data available in both surveys (avidity, gender, age, and region of home residence). Household income has an influence on expenditures but this information was not collected in the National Panel Survey and could not be included in the weighting. The goal was to align the distributions within the two samples to more accurately estimate average spending by the nation's fisher population.

¹ Self-selection bias occurs when individuals select themselves for the study by responding to a widely broadcast survey, potentially impacting the ability of the respondent sample to accurately represent the population. Strategic bias occurs when respondents provide answers to knowingly or otherwise influence a particular outcome.

Response bias and recall bias are two additional effects which can impact the validity of survey responses, regardless of implementation method. Response bias is a general term used to describe the adjustment of a respondent's behavior as a result of various factors within the survey such as the question wording or the general topic explored. To reduce the likelihood of response bias, our respondent sample was developed using a "generalized" screening question about outdoor recreational activities engaged in during the last year. Only those who selected marine fishing were asked to complete the remainder of the survey.

Recall bias describes the error introduced in to the data due to incomplete recollection by the respondent. To minimize the influence of recall bias, we asked fishers to think about their most recent fishing trip rather than a typical or average trip during the prior season, assuming that the accuracy of recall declines as the length of the recall period grows.

Testing the degree of response or recall bias through alternative methodologies was beyond the scope of this research effort. As an alternative, we evaluated the raw data in great depth using details about fishers' demographics and activity. Less than 1% of observations were identified as outliers, where reported activities and expenditures appeared inconsistent. These outliers skewed the mean spending per trip per day upward by 18%. These outliers observations were filtered at the variable-level. We also explore comparative studies in a later section as a way to broadly benchmark estimates of spending.

2.2.2. International marine fisher

Quantifying the amount of spending by international marine fishers took a two-fold approach. MBIE's International Visitor Survey (IVS) collected both activity and spending information allowing the development of the average spending profile per international tourist. The IVS does not, however, provide detailed expenditures based upon the type of activities in which the visitor engaged nor does it provide insight as to whether fishing was or was not the primary purpose of the trip. Both factors impact the type of spending and the degree to which it can be attributable to the fishing activity. Therefore, the lack of data required a number of assumptions be made to estimate their spending.

Spending profiles for the estimated proportion visiting with the primary purpose of fishing were developed using spending data from IVS, assuming that international marine fishers allocated their expenditures to spending categories in a fashion similar to those of all international tourists. We recognize that international fishers may spend more or less than the average international non-fishing visitor but opt to utilize average visitor spending in the absence of activity fishing-specific estimates. For those international visitors who travelled to New Zealand with a different primary purpose, we utilized five categories (food, equipment rental, bait, etc.) within the resident fisher expenditure profile as a proxy to capture the contribution of this group to the recreational marine fishing economy. For the proportion of the visiting international fisher population assumed to also hire a charter service, a weighted average charter boat hire rate is added to the spending profiles. All other spending by visitors not considered applicable to marine fishing were excluded from the study.

The sensitivity of the economic contributions to changes in these assumptions are not evaluated as part of this research effort. At a minimum, results are reported for resident and international fishers to evaluate the relative contributions of each group. We would encourage stakeholders, as they move forward, to exploit the current survey systems in place, either through additional analysis or methodological changes, in order to gather primary data directly from New Zealand's resident and international fishers.

2.3. The economic contribution of marine fishing in New Zealand

Recognizing the purpose of this research was to evaluate the current magnitude of the recreational marine fishing economy, our approach

took a broader view. Spending by all New Zealand resident fishers was incorporated within the models, including spending which would have simply shifted from one sector of the economy to another. Spending by international and resident fishers who would not otherwise spend in the absence of the opportunity to marine fish was also included. Based on the way fishers allocate their money on fishing trips and the linkages that currently exist within the nation's economy, a revealed preference approach was used to estimate the gross effects in economic activity associated with marine fishing.

An Input-output (IO) model was used to analyze the effects within the nation's economy attributable to angler spending on fishing activities. IO models are based on the inter-relationship between industries involved with producing the final good and services demanded by fishers and the supply and demand of intermediate goods needed. The model was provided by Insight Economics, a New Zealand based economics firm. The national economic input-output models for this research effort were built using the accounts which break down New Zealand's economy into 55 economic sectors (Insight Economics, 2013). This breakdown illustrates how expenditures in one sector impact sales, imports and more in other sectors. Recreational fishing, however, is not included as a single sector or industry. Instead, other sectors that serve recreational fishers are commonly used, including various retail segments, fuel, and transportation, as well as sports and recreation.

Total direct spending by fishers in New Zealand was calculated using the detailed spending profile for the average fisher multiplied by the estimated number of marine fishers. Direct spending was adjusted to reflect only that proportion of the amount spent by fishers which continued to cycle through the recreational marine fishing industry, as the IO model was not structured to internally adjust spending flows based on either the Goods and Services Tax (GST) or the spending on imported items. The balance reflects the tax amount generated by marine fishers. In 2014, the GST rate in New Zealand was 15%. In the case of imports, an industry-specific proportional adjustment was applied to direct spending based upon the ratio of total demand relative to imports within an industry. The goal was to remove the fisher spending which is "leaking" from or leaving the New Zealand economy.

To apply the economic models and determine indirect and induced effects associated with direct fisher spending, expenditures for marine fishing activities were matched to the appropriate industry sector affected by the initial purchase. In the case of service sectors such as accommodations or restaurants, the entirety of fisher spending was allocated to that particular sector. In the case of goods purchased, the fisher spending was allocated across the retail, wholesale, and manufacturing sectors applicable to that item. The allocations were based on the reported margin on sales described in *Statistics New Zealand's Annual Enterprise Survey (2013)*.

Each effect was then estimated with multipliers based on models of the whole New Zealand economy. Four specific types of multipliers were applied to fishers' direct spending: output, value added, employment, and income multipliers. Output multipliers report the total value of all dollars that change hands as a result of fishers' spending, and by nature includes double-counting as it measures the total sales in each level of the supply chain. In other words, it includes the total value of all manufacturers' sales, plus the total value of wholesale and retail sales. Value added multipliers – also known as Gross Domestic Product – adjust for this double counting and only include the net value added at each level of the supply chain. Employment multipliers reflect the number of full-time equivalent jobs supported by the many cycles of spending. Income multipliers reflect the contributions to household incomes by those individuals employed in jobs either directly or indirectly supporting marine fishing activities; these include profit generated by business owners such as charter boat operators and fishing tackle shops. The methodology described above only summarizes the approach used to estimate various measures. The authors encourage the

reader to explore each piece of top-line and technical documentation associated with this research (Holdsworth et al., 2016; Heinemann et al., 2015; Insight Economics, 2013; Ministry of Business, Innovation, and Employment, 2015).²

3. Results

3.1. Participation

In 2011–12 the National Panel Survey estimated that 595,662 New Zealand residents 15 years old or older fished marine waters and completed more than 2.652 million fishing trips that year (Holdsworth et al., 2016).³ This equates to roughly 4.5 marine fishing days per fisher per year. It is important to note that the report by Wynne-Jones et al. (2014) reflect fisher participation and trips where at least one marine species was harvested. For this report, we included the number of people that went fishing and the number of trips made whether fish were kept or not, assuming spending still occurs and at a similar rate, even if the trip was unsuccessful or catch and release only.

New Zealand hosted more than 2.52 million international visitors, in 2014, with an estimated 108,811 (4%) taking part in marine fishing activities.⁴ Based on charter boat operator feedback, we estimated 26% (28,091) of travelers visit New Zealand primarily to fish marine waters and would not have visited in the absence of these opportunities. The remaining 74% (80,720) was assumed to have travelled to New Zealand even if marine fishing was not available. Results from the Charter boat operator survey also suggested a total of 38,203 international visitors hired a charter boat during their trip. The balance of visiting international fishers (70,608) were assumed to engage in marine fishing using alternative approaches such as a land-based platform or a boat owned by friends or family.

3.2. Average spending

A total of 1460 New Zealand resident fishers responded to the Horizon Research online survey on fishing related expenditure in 2014–15. Evaluating this sample in relation to the population of resident fishers based on the NRB National Panel Survey, we found a smaller proportion of: 1) fishers classifying themselves within the most avid group, 2) male fishers, and 3) younger fishers (44 years of age or younger). Had we not weighted our analyses, these differences may have introduced bias into our estimates.

There was a seasonal trend effect with more fishing trips in summer than winter, consistent with that seen in the NRB data. Examination of the data for seasonal variation in spending finds no statistically significant difference in the average amount spent on trip-related goods and services in winter or summer.⁵ Spending by fishers reported at the seasonal-level was then pooled prior to calculating the estimated average spent during the trip at the national level.

² The full technical report "Estimating Marine Recreational Fishing's Economic Contributions in New Zealand-Technical Steps" is available on request.

³ The NPS estimates the coefficient of variation of total resident fishers is between 3 and 5%, respective to groupings by avidity from low to high.

⁴ In 2013, MBIE's IVS was designed to achieve a relative mean error of 5%.

⁵ Seasonal differences in spending patterns was assessed at a regional level. Three distinct and exclusive regions of the country are defined within the context of this research effort. These regions are: 1) Upper North Island (Te Ika a Maui), 2) Lower North Island, and 3) South Island (Te Waipounamu). The regional definitions are based around two types of boundaries: fisheries management areas and regional tourism organizations. P-values for each region were: Upper North Island $p=0.1232$, Lower North Island $p=0.0504$, South Island $p=0.3419$. Given that all p-values were above 0.05, spending by fishers reported at the seasonal-level was then pooled prior to calculating the estimated average spent during the trip at the regional and national level.

Table 1
Direct spending profiles of resident fishers (NZ\$).

New Zealand marine fishers trip and equipment spending	
<i>Total trip-related spending per day</i>	\$99.45
Food and lodging	38%
Transport	41%
Other	22%
<i>Total equipment item spending per year</i>	\$998.04
Fishing equipment	46%
Boats & vehicles	31%
Accessories	10%
Other	14%

In total, resident marine fishers spent an average of \$99.45 (RME 7.5%) per day on trip-related goods and services (Table 1).⁶ Fishers also spent an average of \$998.04 (RME 17.0%) on fishing and big equipment items per year.

International visiting marine fisher spending was estimated using two approaches based on the purpose of the visit to New Zealand. First, for those travelling primarily to go marine fishing, in-country trip-related spending was approximately \$3000 per fisher (\$2931 if hiring a charter and \$2790 if not hiring a charter). For those who travelled primarily for other reasons but who engaged in marine fishing during their time in New Zealand, the entirety of their trip-related expenses cannot be attributed to marine fishing. In this case, fisher spending was estimated to be either \$62 or \$202, dependent upon use of charter boat services or not (Table 2).

Equipment spending by international visitors was not included in this analysis as it was assumed most international visitors use equipment provided by a charter boat or by another person rather than purchase it for essentially one-time use. While it is possible for this group to purchase some items which would be used during their fishing trip while in New Zealand, it was assumed that these amounts are minimal.

3.3. Economic contribution of marine fishing in New Zealand

3.3.1. Direct spending

Direct spending reflects the total amount spent by all marine fishers for fishing-related goods and services. This research found that resident marine fishers spent an estimated \$264 million dollars over the year on trip-related spending, based on consumer-level prices (Table 3). They spent an additional \$274 million on fishing equipment items and \$319 million on the proportion of big equipment items used while recreational fishing. The total direct spending by resident recreational marine fishers in New Zealand was an estimated \$857 million dollars, annually (Table 3).

International visitors, those who visited for the primary purpose of marine fishing and those who travelled for other reasons but used a charter boat service, spent an estimated \$89 million dollars in New Zealand over the course of the year (Table 3). Collectively, residents and non-residents' trip-spending in New Zealand attributable to marine fishing was an estimated \$352 million.

Combining the direct spending by residents and international visitors for trip and equipment items, recreational marine fishers in New Zealand spent an estimated \$946 million dollars on goods and services directly attributable to fishing activity (Table 3).

3.3.2. Economic contributions

Expenditures by fishers generate additional economic effects throughout the New Zealand economy (Table 4). Captured within the total effects are the direct spending by fishers as well as the indirect

Table 2
Direct spending profiles of visiting fishers (NZ\$).

International visitor trip-related spending	No charter service used during visit	Used a charter service during visit
<i>Spending by visitors with fishing as a primary purpose</i>		
Total spending (\$ per trip)	\$2790	\$2931
Food and lodging	38%	36%
Transport	25%	24%
Retail & other tourism products or services	37%	40%
<i>Spending by visitors with fishing as a secondary purpose</i>		
Total spending (\$ per fishing day)	\$62	\$202
Transport, food & lodging	79%	24%
Fishing equipment items & services	21%	76%

Table 3

Total annual direct spending by resident and nonresident recreational marine fishers in 2014/15 (includes GST).

Spending category	Total direct spending (in millions of NZ\$)		
	New Zealand resident marine fishers	International Visiting marine fishers	All marine fishers
<i>Trip-related spending</i>			
Transportation	\$107.4	\$20.2	\$127.6
Accommodations & food	\$99.2	\$32.8	\$132.0
Guide or charter services	\$13.3	\$5.4	\$18.7
Other (Includes bait, ice, equipment rental, and other retail or tourism products)	\$43.7	\$30.4	\$74.1
<i>Sub-total trip-related</i>	<i>\$263.6</i>	<i>\$88.8</i>	<i>\$352.4</i>
<i>Fishing equipment spending</i>			
Rods & reels	\$53.3	na	\$53.3
Line & leaders	\$15.3	na	\$15.3
Lures, jigs, flies, & art. bait	\$17.9	na	\$17.9
Other terminal tackle	\$10.3	na	\$10.3
Gear (rod holders, landing nets, down rigger, etc.)	\$16.9	na	\$16.9
Electronics	\$23.1	na	\$23.1
Processing or taxidermy	\$1.1	na	\$1.1
Repair or maintenance of special equipment (vehicle, boat, motor, ATV, trailer)	\$82.8	na	\$82.8
Clothing	\$13.9	na	\$13.9
Maps & charts	\$2.4	na	\$2.4
Other equipment used for fishing	\$11.5	na	\$11.5
Trailer registration & other government fees	\$25.5	na	\$25.5
<i>Sub-total fishing equipment</i>	<i>\$274.0</i>	<i>na</i>	<i>\$274.0</i>
<i>Big equipment spending</i>	<i>\$319.5</i>	<i>na</i>	<i>\$319.5</i>
<i>Total direct spending</i>	<i>\$857.2</i>	<i>\$88.8</i>	<i>\$946.0</i>

plus the induced effects. Indirect effects capture when a local business, such as boat builders, purchase raw or intermediate goods and services from other sectors of the economy, such as fiberglass suppliers. Induced effects capture household spending by individuals employed by businesses either directly or indirectly linked to marine fishing.

Spending by all marine fishers, resident and international, for trip-related and equipment items (Total contributions column in Table 4) resulted in direct output (excluding indirect and induced effects) of \$687 million, once leakage outside the New Zealand economy was accounted for. The value added (GDP) to the country's economy was

⁶ Relative mean error (RME).

Table 4

Economic contributions of recreational marine fishing in New Zealand by residents and visitors listing direct spending and the total of direct, indirect, and induced spending.

	Trip related contributions (Million NZ\$)		Equipment related contributions (Million NZ\$)		Total contributions (Million NZ\$)	
	Direct	Total	Direct	Total	Direct	Total
New Zealand resident marine fishers						
Direct spending*	\$263.7		\$593.5		\$857.2	
Output	\$192.0	\$474.6	\$423.7	\$1033.8	\$615.7	\$1508.4
Value Added (GDP)	\$71.1	\$172.4	\$191.3	\$398.0	\$262.4	\$570.4
Employment	1461	2440	2622	4607	4083	7048
Income	\$45.8	\$87.6	\$134.0	\$219.6	\$179.8	\$307.1
International visiting marine fishers						
Direct spending*	\$88.7		na		\$88.7	
Output	\$71.2	\$177.4	na	na	\$71.2	\$177.4
Value Added (GDP)	\$30.5	\$68.0	na	na	\$30.5	\$68.0
Employment	715	1076	na	na	715	1076
Income	\$19.4	\$34.7	na	na	\$19.4	\$34.7
Spending all marine fishers						
Direct spending*	\$352.4		\$593.5		\$945.9	
Output	\$263.2	\$652.0	\$423.7	\$1033.8	\$686.9	\$1685.8
Value Added (GDP)	\$101.6	\$240.4	\$191.3	\$398.0	\$292.9	\$638.4
Employment	2176	3516	2622	4607	4798	8124
Income	\$65.2	\$122.3	\$134.0	\$219.6	\$199.2	\$341.8

* Direct spending values reflect consumer-based prices. Prior to applying the economic multipliers, these values were adjusted to exclude import leakages and the goods & service tax. All output, value-added (GDP), employment, and income values reflect the contributions based on the adjusted direct spending.

\$293 million. Direct spending supported an estimated 4800 full-time equivalent jobs and \$199 million in household income.⁷ Spurred by the direct spending, the additional indirect and induced spending occurring within supporting industries was \$999 million (calculated as the Total column minus the Direct column under the grouped Total contributions columns in Table 4). The value added (Gross Domestic Product) to the economy by spending among supporting industries was \$345 million. An additional 3300 jobs and \$143 million in household income were supported through spending by the other industries in the supply chain. Collectively, the total output from all direct, indirect, and induced effects was an estimated \$1685 million, value added (or Gross Domestic Product) was \$638 million, supporting 8000 jobs, and \$342 million in household income (Table 4). IO model results for trip-related and equipment spending are presented in Table 4 allowing for similar interpretations for each sub-category.

Lastly, we estimated marine recreational fishing's contribution to tax revenue, at least in part. Tax revenues were calculated outside of the input-output model based on their limited data. In calculating fishers' total spending, current tax rates of 15% for the Goods and Service Tax (GST) were applied, which amounts to \$136 million dollars (Table 5). Upon considering fishers' total contribution to employment and income, we estimated the impact on personal income tax to be \$52 million. The total minimum contribution to tax revenues was, therefore,

⁷ Confidence intervals are not traditionally a byproduct of Input-output (IO) models which are deterministic in nature. The point estimates of economic contributions do have an underlying stochastic component. This variation stems from spending and fisher count estimates included in our analysis for which we have included statistical quality measures, relative mean error or coefficient of variation.

Table 5

Taxes generated by marine fisher spending and contributions to household income.

Tax category	Amount (Million NZ \$)
Goods and services tax collected	\$135.8
New Zealand resident marine fishers share	90%
International visiting marine fishers share	10%
Personal income tax associated with the contribution of fisher spending to income	\$51.8
Total minimum tax revenues	\$187.7

\$188 million (Table 5).

The estimation of tax effects is deliberately conservative considering the additional contributions generated by the indirect and induced spending are not included. To incorporate those effects, detailed information about how and where government spends its receipts would be needed. Considering that the size of indirect and induced spending can be 140% of the original direct spending, the total tax revenues generated by fishers' expenditures could be upwards of \$400 million to \$450 million.

4. Discussion

4.1. Comparison with other studies

In the absence of historical estimates of spending by New Zealand residents on goods and services associated with marine fishing activity, we turn to a number of studies from outside of the country to corroborate average spending estimates reported here. A thorough review of the available literature was done and two factors drove the selection of the four studies discussed below: geographical proximity to New Zealand and similarity in methodology. Three of the studies focus on Australian fishers: 1) New South Wales recreational saltwater fishing in 2012 (McIlgorm and Pepperell, 2013), 2) all recreational fishing in Victoria during 2008–09 (Ernst and Young, 2009), and 3) all recreational fishing in Tasmania during 2012–13 (Lyle et al., 2014). The assumption being that where fishing opportunities and conditions are similar, fishers and their spending patterns would also be fairly similar, relative to studies of fishers in other areas. The fourth study focuses on saltwater anglers in the United States and provides comparison to similar methodologies employed elsewhere (US DOI, 2012).⁸ Minimizing the differences between studies strengthens the overall comparability of the results.

While we cannot provide direct comparisons across the studies for each detailed spending category, we were able to identify those categories that are consistent. Table 6 reports the estimated spending per fisher in common categories across two groupings: trip and equipment related expenditures. Trip spending reflects the amount spent per day per fisher while the equipment reflects the amount spent per year per fisher. The second column shows estimated spending by New Zealand fishers. The remaining columns show the estimated spending reported in each of the comparative studies.

Taken collectively, we believe these studies provide a diverse and robust benchmark from which to evaluate estimated fisher spending in New Zealand. They do not validate the method or estimates. Instead, the key point is that similar methods in comparable economies give broadly consistent estimates of spending. A few notable points should be borne in mind when interpreting this table, most especially the differences between the focus of each study at either the category or sub-category level. The next few paragraphs discuss those differences.

⁸ Confidence intervals are readily available for the US DOI Fishing, Hunting, and Wildlife-associated Recreation study and the estimated RME is 10%.

Table 6
New Zealand resident fisher spending relative to estimates provided in comparative studies (Adjusted to 2014 NZ\$).

Spending categories	New Zealand	Australia			United States
		New South Wales	Victoria	Tasmania	
Total trip (\$/fisher/day)	\$99.45	\$110.35	\$155.51	n/a	\$97.06
Lodging & food	\$37.41	\$52.90	\$60.47	\$5.43	\$31.45
Fuel & oil	\$40.50	\$59.12	\$39.20	\$42.69	\$20.50
Charter	\$5.03	\$3.47	\$9.41	n/a	\$7.66
Fishing equipment (\$/fisher/year)					
Rods & reels	\$89.65	\$181.69	\$104.42	\$131.28*	\$89.63
Minor fishing equip.	\$73.10	\$98.71	n/a		\$72.49
Clothing	\$23.40	\$23.37	\$33.90	\$18.21	\$11.86
Maintenance (\$/fisher/year)	\$139.17	\$208.29	\$65.18	\$116.02	\$271.52
Special equipment purchase (\$/fisher/year)	\$449.15	\$470.50	\$288.23	\$244.49	\$192.44

* Defined as spending on fishing equipment, which would include rods, reels, and minor fishing equipment.

With respect to the category level, spending values focus only on saltwater anglers in New Zealand and the United States (US DOI, 2012). Trip spending values in New South Wales reflect saltwater angler spending, while expenditure on maintenance and special equipment reflect both fresh and saltwater anglers (McIlgorm and Pepperell, 2013). Spending values reported for Victoria and Tasmania reflect both fresh and saltwater anglers (Ernst and Young, 2009; Lyle et al., 2014). Assuming that the spending profiles of saltwater fishing trips and equipment are different than for freshwater, the inclusion of expenditures associated with both water types in the spending profile has the potential to skew spending. However, the direction and magnitude are unknown with the data at hand.

With respect to the sub-category level, Tasmanian fishers spend notably less on lodging & food, relative to the comparative studies (Lyle et al., 2014). The geographical size of the state places fishing access points in close proximity to its residents, lowering the demand for overnight accommodations during fishing trips. Spending by fishers in New South Wales on maintenance and other special equipment items reflects boat expenditures only, suggesting that expansion of spending categories to mirror those included in this study would be in excess of the sum of the two categories, \$678 (McIlgorm and Pepperell, 2013). Spending by fishers in the United States on fuel for personal vehicles is reflected in category focused on transportation spending (US DOI, 2012). Boat fuel spending is bundled together with boat maintenance and other boat related spending in the maintenance category. This suggests that reallocation of boat fuel would increase the fuel and oil spending and decrease the maintenance spending by U.S. anglers.

4.2. Advantages of building on other New Zealand national fisher studies

The New Zealand Marine Research Foundation's objective was to improve the understanding of the social and economic issues relating to the use and conservation of marine resources and ocean recreation. This particular research effort to generate specific economic measures (expenditures, jobs, tax revenues, income, and other economic contributions) associated with New Zealand's marine recreational fisheries based on statistically valid data and replicable methods is particularly timely, providing quantitative evidence of the economic contribution of the recreational fishing sector.

This study leverages off large scale government funded surveys on both marine fishing harvest and activity and the number of international visitors who fished in the sea. The National Panel Survey

conducted by NRB during the 2011–12 season was a comprehensive survey conducted in New Zealand with 30,390 dwellings approached for the survey using a sophisticated population-based known-probability sampling method. Robust estimates of the total number of New Zealand residents who reported fishing in 2011–12 and the total number of trips were generated. This presented the opportunity to implement a cost-effective survey to collect fisher economic data and scale it by the data from the National Panel Survey, assuming that national recreational fishing effort was similar in 2014. The approach also avoided large scaling errors common in smaller surveys using telephone surveys and population-based sampling frames.

The country's fishing resource is managed for sustainable use based around regional and species-specific Total Allowable Catches (TACs). Within the TAC, the fisheries minister sets allowances for recreational as well as non-commercial customary fishing interests while commercial fishing is controlled via a quota management system. Economic contributions of the overall fisheries resource or of particular segments (customary, recreational, or commercial) to the New Zealand economy are not an explicit component of the allocation management decisions, yet there is potential for it to be an underlying factor.

4.3. Application to fisheries management

Marine recreational fishing is an industry. Like any industry, its lifeblood is the revenues received from its customers who, in this case, are fishers. Like any industry, the many firms who support fishers and their suppliers, such as marinas, retailers, boat builders, tackle manufacturers and more, employ thousands of people who work hard to help ensure a fisher will enjoy his or her day outdoors and become a long-term customer. Through all this economic activity, the dollars multiply, generating significant economic contributions.

For New Zealand, the \$946 million spent by more than 700,000 fishers, these dollars circulate through the national economy, supporting 8000 jobs, stimulating \$1.7 billion in total economic activity, contributing \$638 million in Gross Domestic Product, which is about 0.5% of New Zealand GDP, and \$342 million in salaries, wages and small business profits plus adding at least \$188 million in tax revenues to help keep New Zealand functioning. The estimation of tax effects is deliberately conservative considering the additional contributions generated by the indirect and induced spending are not included. To incorporate those effects, detailed information about how and where government spends its receipts would be needed. Considering that the size of indirect and induced spending can be 140% of the original direct spending, the total tax revenues generated by fishers' expenditures could be upwards of \$400 million to \$450 million.

This research achieves the Foundation's goal to take steps toward filling the knowledge gap regarding New Zealand's marine recreational fishing by quantifying its economic contributions. It also adds to the body of knowledge regarding economic contributions of fishing activity in the region and around the world. We do find evidence that recreational marine fishers collectively make substantial expenditures in pursuit of a peaceful day on the water or the excitement of a catch, which in turn is multiplied through the economy. These findings are consistent with earlier research efforts within the region and around the world to measure contributions attributable to recreational fishing.

Subsequent research would be prudent to substantiate and refine these results for New Zealand. Nevertheless, the economic insights of this project can inform fisheries management and policy advice, which previously included commercial economic data but very little on the contribution of the recreational fishing industry. Additionally, this research can also provide the necessary starting point to encourage the government to invest in economic surveys, such as a consumer surplus study, on a similar scale to the harvest surveys. A consumer surplus study would reveal the difference between what fishers would be willing to spend on a day of fishing relative to what they actually do spend. There is also the potential for fishing to provide social and

cultural benefits ranging from food security to a sense of community among fishers to improved individual health and well-being. The high rates of participation in recreational marine fishing among the New Zealand population suggests that collectively these market and non-market benefits could be significant.

While economic information is critical for explaining why marine conservation and recreational fishing is important to all New Zealanders, it is only one source of information guiding pragmatic decisions on fisheries management. The Fisheries Act explicitly provides for utilization that enables people to provide for their economic as well as social and cultural well-being while ensuring a level of sustainability to meet the foreseeable needs of future generations. This paper expands public knowledge regarding how marine fisheries contributes to New Zealand's economic well-being.

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