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Dolphin protection

Economic costs of restrictions on commercial fishing to reduce risks to Māui and Hector's dolphins

NZIER report to Fisheries New Zealand

August 2019

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NZIER was established in 1958.

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Key points

Purpose

Fisheries New Zealand (FNZ) has asked NZIER to peer review the methodol gy sed to estimate economic costs to commercial fishing arising from proposals cu rently subject to consultation.

Our aim is to provide an independent review of the approach tak n b MP and suggest any potential improvements that can be made to refine the final ad ic

An economy-wide model will provide extra assurance

We recommend the use of an economy-wide model wi h regional components[1] to further understand the economic costs. The use of n economy-wide model will improve credibility on the breadth of impacts an pr vid further assurance on the likely economic costs.

The current methodology used by FNZ s an appropriate way to achieve the type of output required by FNZ. The multiplier methodology is simple, saves time and resources, and has minimal distortion in r ions where affected fishing is a very small part of the regional economy. Further, the ass mptions are reasonable.

Why use an economy-wide model?

The use of an economy-wide mode will ncrease the robustness of the results which are likely to come under very high s utiny. An economy-wide model more closely represents the economic activity that is likely to happen as fishing activity reduces and resources move to other parts of t e fishing industry or into other industries.

It is also likely that n economy-wide model will reduce the value of the loss to fishers since the multipliers ar likely to be smaller as other sectors adjust to the restrictions imposed, i.e. it be ter represents the likely outcome. This is particularly the case where fishing is a signif cant sec or in the regional economy and reduction in activity has wide ramifications acro s the egion.

There's a t ade-off to be made: level of confidence in the results vs costs

What methods are decided upon by FNZ depends on how much confidence in the resu s is required for the purposes of the consultation. Making all the changes r commended will cover all the bases but increase the cost.

Wha ver methods are chosen will not stop challenges from industry or those supporting restrictions, who may have particularly detailed or localised information to argue their case. The value of an economy-wide model is that it goes beyond reporting the local impacts and gives an overview of effects across the region.

[1] Specifically, a Computable General Equilibrium (CGE) model.

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1. Introduction

Is this the 'right' methodology?

Fisheries New Zealand (FNZ) has sought from NZIER a peer review of t e m thodology used to estimate forgone economic value of commercial fishing arising from proposals currently subject to consultation. The purpose is to further underst nd if there are potential improvements that can be made to the final advice.

FNZ has used analytical tools to assess the economic impacts on the commercial fishery arising from proposals to implement spatial closu es. The method used is to estimate the expected reduction in current value caused b a y new restriction.

There are always trade-offs between the complexity of odels and the degree that these can be used in-house by FNZ to evaluate the c omic mplications of options. The consultation document presents the relative conomi impact of proposals rather than a full-scale analysis.

FNZ recognise that the economic impact of op ons developed under the Hector's and Māui dolphin Threat Management Pl n (TMP) for Ministers will be more important. NZIER's role is to ensure that FNZ are usi he best available information to quantify the impacts of the different options to assist cision makers to evaluate the choices between them.

Components of the assessment

FNZ is seeking to review the m thod l gy used in the consultation document.[2] The FNZ method used for estimating impacts on commercial fishing restrictions can be condensed into the f llowing m onents:

- Estimating the re uction in landed catch of all species (target and bycatch) from the rele ant fishery areas proposed for a restriction
- Estimat ng the revenue of affected catch from the quantity landed times the pri e for ea h species
- Estimating th economic value added for direct effects on harvesting and p oce s ng, indirect effects on suppliers and other industries, and induced effe ts o additional spending in the wider economy, using the multiplier ratio of value added to harvest revenue value outlined in NZIER (2016, pa e 22 Table 11).

The FNZ app oach estimates loss of business from the restriction on the assumption t at it will take 5 years to dissipate, using a discounted cash flow of future earnings forgone to calculate a net present value of the loss. A Treasury discount rate of 6% is used in these calculations.

The FNZ approach provides a relatively simple method for estimating likely loss of fish landings and the implications for value added in sectors within and beyond the seafood industry.

[2] Protecting Hector's and Māui Dolphins: Consultation on proposals for an updated Threat Management Plan

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The proposed review of the economic assessment should consider but not be limited to impacts on whether:

- Estimates of the change in volume of fish caught are used appropr ately
- The prices to apply to the change in volume of catch are the be available
- The Input-Output tables could be refined from a fisheries pe spe tive
- We should account for the value of quota lost in the calculation
- Consider matters made in submissions
- Alternative methods and or models that could be used by NZIE to improve the economic analysis, within the available timefr me

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2. Background

Māui and Hector's dolphins are very rare and only found in New Zealand.[3] Tab e 1 se s out the basic facts.

Table 1 Estimated numbers, habitat range, and annual d aths

2019

	Estimated numbers	Where found	A nu death ate
Māui	63	West Coast of North Island	.02 (1.1 – .3)
Hector's	15,000	Waters around the South Island	92 (154 – 748)

Source: MPI Consultation document (2019)

The low numbers of Māui and Hector' dolph ns ns they are ranked as nationally vulnerable (Hector's) and nationally iti al (Māui) in the New Zealand Threat Classification System.

Deaths are categorised as:

- Non-fishing related dea hs: toxoplasmosis, a parasite transmitted through cat faeces is a significa t a thropogenic risk over and above natural causes
- Fishing-related deaths: set nets and inshore trawling.

As a result of scientific, p blic and government concern around the human-induced deaths a TMP was dev loped in 2008. The TMP was intended to be a medium-term planning documen t mitigate against human induced deaths of Māui and Hector's dolphins.

This TMP is now being reviewed in order to:

- Give iw he opportunity to shape the successful management of this taong species
- rov de direction for future monitoring and research needs
- Imp ov evaluation and assess new information that can improve ef ectiveness.

[3] Māui and Hector's dolphins are subspecies. It is estimated that there is only 63 Māui dolphins and around 15,000 Hector's dolphins.

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3. Framework

FNZ have asked NZIER to focus on the development of the methodology (reported in the Consultation document) and whether the methodology is suited to the questions being asked of it.

Below we outline the approach we think policy-makers should take.

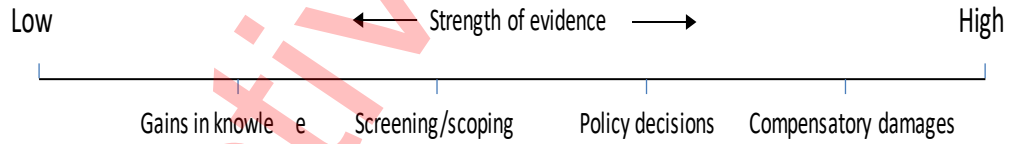
3.1. How much evidence is required?

While it is important that the evidence for an approach is as strong as possible, policy-makers are willing to expose themselves to "evidence error" to inform better policy making advice (OECD 2006).

Brookshire (1992) sets out an approach shown in Figure 1 which shows the strength of evidence required differs along a decision-making continuum. If the objective is to gain more information about a policy or development plan in an assessment, then a relatively low level of data or level of evidence is required (i.e. gaining knowledge or developing a pilot).

Whereas higher degrees of evidence are required if a national policy decision is being taken or money is being paid out for damages incurred. In such cases a compelling case that supports any particular approach may be required.

Figure 1 Continuum of decision settings



Source: Brookshire (1992)

However, this 'proportionate approach' depends on the assessment of the state of the evidence, which can be subjective.

In this instance evidence required is at the higher end of the spectrum given the possibility of irreversibility, i.e. if New Zealand gets these decisions (even slightly) wrong then there are large consequences from potentially an irreversible collapse of dolphin populations.

3.2. Other 'evidence' considerations

A number of areas of evidence need to be considered when developing a regulatory intervention. Evidence about the scale and workings of the problem, evidence about the different types of interventions and their technical effectiveness, and evidence from consultation to test the idea with the affected population and highlight likely responses which can be influential as to outcomes.

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From a policy-making standpoint the evidence about the problem needs to be considered along with the risks of doing nothing. The policy-maker also has to be aware that those investigating the problem can only give a 'snapshot' of current thinking.

Developing effective interventions that can mitigate against some of the dolphin mortality impacts will be a major challenge for policy-makers. Therefore the most accurate evidence needs to be provided.

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4. Impact assessments

4.1. Value includes market and non-market attributes

Value in economics is based on the preferences that people have for the flows of goods and services derived from a resource like the marine environment. Addressing how the flow of services changes with changes in policy is of particular importance.

Total Economic value (TEV) is a useful framework for organising the different classes of value that might be associated with a reduction in fishing and the planned preservation of dolphin species. A TEV approach includes

- Use values which are derived from using the resource. In this case, fishing activity. Use values include:
  - Commercial value generated where commercial fishing and downstream activities such as processing and marketing of fish occur
  - Indirect values are focused on non commercial fishing activity such as recreational fishing and customary rights
  - An option value occurs where an entity or person may have access to or has bought the right to a resource which they can use now or sometime in the future
- Non use values are independent of the current use of the resource and can be described as:
  - Existence values where individuals derive benefit from knowing a resource exists
  - Bequest values where there is value generated from handing a resource on to a new generation.

TEV is not the only method of representing value. The Ecosystem Services Approach (ESA) is another method that divides services from the natural environment between provisioning (supply of food and materials), regulating (e.g. erosion control and emission sequestration), cultural (recreation and heritage protection), and supporting (e.g. nutrient cycling, waste assimilation).

The ESA scopes out the scale of effects caused by a policy change but is complementary rather than alternative to the TEV and the use of specific methods to value different components of ecosystem services. We have used the TEV approach because it captures all values: use and non use.

Estimating the economic value of a resource with mixed uses often requires a variety of valuation methods. Market prices may be used to value changes in goods and services with marketable value, such as the commercial fish catch, and sometimes costs avoided can be used to value changes that are tangible but not valued often (such as potential erosion damage from removing shore-side materials).

But for non-use values and some indirect and option values of the marine resource, it is necessary to use a non-market valuation technique that either infers public value from observing market behaviour for similar goods and services, or directly questions

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a selection of the public about their preferences and willingness to pay for particular outcomes.

4.1.1. Iwi values

While TEV covers all values it does not fully describe values important t iwi While values differ from iwi to iwi, three concepts are important:

- The importance of reciprocity where anything taken (f od r o er resources) is balanced by giving. This requires the restora on to ensure the on-going functioning and completeness of the envi o ment Important values include Kaitiakitanga (guardianship), Mau i (life pr nciples), and Whānaungatanga (maintaining and valuing relatio ships . Failure to look after the local environment may be seen as a lo s of mana. Any deterioration in quality may be reflected i e inab lity to produce traditional food or other resources iconic to a local environment
- The importance of mātauranga Māori (kn wledge) and whakapapa (sharing of knowledge with future gene ation). Management and use of fisheries, and the relationship with fishing pra ti , provides resources for the group but also builds knowledge and ro ides educational experiences that can be passed on to future generations There is a marginal increase in knowledge with increased protection of dolphins because it increases potential use of a resource that has opportunities for education
- The importance of spe fic envi onment and its use to the cultural identity of the group. Whānau a hapū are defined with respect to the environment and res urces that they relate to, whereby the loss of ability to use a resource reduc s their identity as a group.

These are not all the i i values "at play" in this policy development, but they do illustrate that iwi ha e signif ant values at stake in this policy environment.

4.1.2. Application of Total Economic Value

How much is New Z land prepared to pay to reduce the probability of dolphin deaths and popul tion e tinction?

New Zealand pays if it incurs expenses in protecting dolphins, and also if it forgoes valuable portunities in favour of retaining dolphins and their habitats.

The FNZ met odology provides a means of valuing impacts on the commercial fishery when a e ulatory intervention is required to correct a market failure, in this case a f ilure of the market to protect non-market values (e.g. species preservation). Figure 2 illus rates one way of thinking about these values.

We have also included iwi values to signal their importance, but acknowledge that the TEV does not fully describe the types of non use and use values important to iwi. Iwi values have their own framework covering all aspects of value, but it is beyond the scope of this document to fully explore these values.

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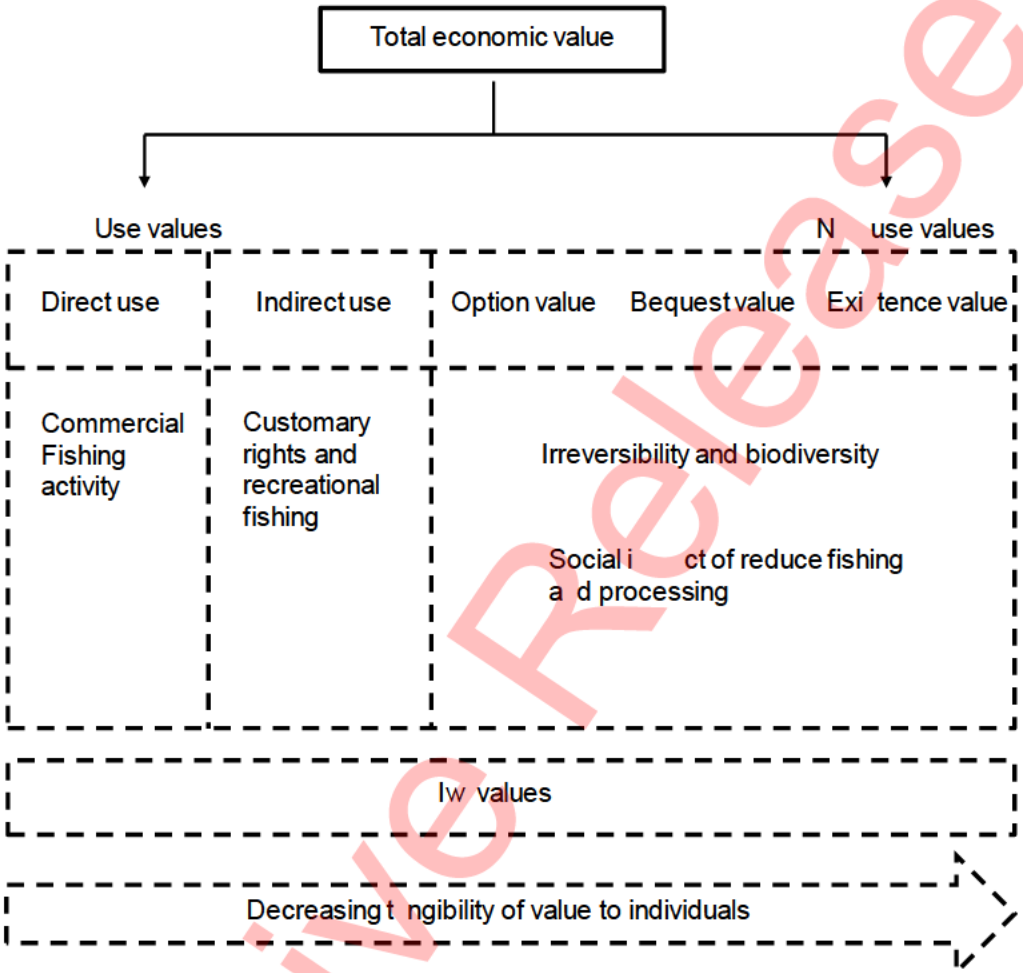
Figure 2 What individuals' value



Source: NZIER

4.1.3. Non-market considerations

Non-market d iwi values are not considered in this report. Other parts of the FNZ consultati n p oc s will look at these areas of value in more detail.

4.1 4. Economic considerations

The methodology needs to estimate the expected reduction in current value caused by a new restriction (as set out in the scenarios). It also needs to show how it impacts on he capital value of investment in the fishery, excluding double counting between these two aspects.

This requires using the inter-industry production (i.e. Input-Output) tables of Stats NZ's System of National Accounts either by themselves or with the overlay of an economy-wide model such as a Computable General Equilibrium (CGE) model.

Input-output tables and data shows the connections between industries, the goods and services they produce, and who uses them. FNZ have used this information to create a picture of the wider economic impacts of reducing fishing activity in specific

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areas associated with the Hector's and Māui dolphins. Input–output analysis does this by predicting what changes in overall economic activity as a result of, say p licy change. Multipliers are calculated from the input-output accounts. They me sur tot change throughout the economy for a given sector. Of particularly interes are the Type II multiplier effects.[4]

Table 2 shows the value-added multipliers used to calculate the i tial cost of commercial fishing restrictions in the TMP. These were estimated as rati of value added to fish harvesting sector total output – from the Table of multi li rs taken from NZIER (2016). These are set out below. Note that the latest Input-Output tables used are from 2016.

There are methods to update the tables based on domes ic p oduction volumes and values and export/import volumes and values. This c n be d ne up to the 2018 March year.

Table 2 Estimates of direct, indirect and i duced multipliers

New Zealand (national)

	2013/1
Direct harvesting impact	0.24
Processing impact	0.57
Indirect impact	1.69
Induced impact	0.32
Total	**2.82**

Source: NZIER

Other areas which r uire in stigation are set out below.

Estimates of the change in volume of fish caught are used appropriately

A starting poin is to estimate revenue losses from an expected change in quantity of landings t mes the p ice of the respective species. The volume assessment is based on estimated comm rcial tonnage catch records (based on the average yearly landings from he la t 10 fishing years).

Whi this is a reasonable approach, do we know how fishers will respond to future exclusio since it is future behaviour that drives the success or otherwise of the pr posed policy. Do they:

- Stop fishing and voluntarily retire part of their quota?
- Attempt to make up any loss of catch by fishing elsewhere?
- Incur additional costs (e.g. fuel, steaming time) in fishing new areas that would not be their first choice or most productive areas in the absence of restriction?

[4] Type II multipliers include direct and indirect spending plus household spending based on income earnt from the direct and indirect effects (so called induced effects).

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- Continue to fish in the area using new methods that do not violate the restriction?

Some discussion of these issues is required since they have a bearing on the ut omes Of particular importance is that there is a risk of overstating outcomes/imp t (in terms of reduction of fish caught) when potentially participants just go else ere.

Some comment about likely fisher behaviour is required where restrictions a e likely to be imposed. Since it is that behaviour that will drive volume reducti ns in the future.

Prices applied are reasonable?

The estimates of price per tonne have been taken from Be (20 7) nce they are likely to better reflect actual earnings (these are revenue- ased e port es imates). The other alternative, port prices, do not appear to be consistent cross all species. There does appear to be a systematic under-valuation of the effects on ecific species from port prices.

Port prices are estimated from observed transactio between fishers and licensed fish receivers in ports but may miss the tran actio s and transfer prices that occur within vertically integrated companies whe e ther i external transfer of fish to be observed.

Taking the revenue-based export estimates a proach (Berl, 2017) more accurately reflects participants revenue streams. This is an approach to pricing we endorse.

The Input-Output table could be refined from a fisheries' perspective

There may be considerations that could improve the Input-Output tables further (other than updating to the latest year – 2018). The principal purpose of the Input-Output tables in FNZ' cur nt estimation method is to consider the flow on impacts of harvest and catch li itation, through the application of economic multipliers.

The FNZ metho currently applies value-added multipliers from the NZIER report (2016). These a e Type I multipliers that cover the flow-on effects from changes in direct harvest leve processing levels, the indirect impacts on businesses that supply the harves ing d processing sectors, and the induced impact on businesses serving the added consumption spending arising from the income derived from the level of harvest and p oce sing.

The multipl rs are calculated at an aggregate all fishing industry level. As such they may ot acc rately reflect the actual impacts of the fishing activity affected by the protection areas of Māui and Hector's dolphins. Two ways in which it might be useful to efine the multipliers is distinguishing them by:

- Principal fishing methods affected by the protection measures (i.e. set netting and inshore trawling), if individual methods have markedly different economic flow-on effects from each other
- Principal fish species caught that are affected by the protection measures, if individual species have markedly different flow on effects from each other.

In either case, this would require amending the Input-Output tables from which the multipliers are derived. These would mean splitting fish species or fishing methods out

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into their own rows and columns in the Input-Output table, identifying the cost structures that apply to them and their linkages to all other sectors.

This can be done in an Input-Output table, but not necessarily to a high eg ee o accuracy. This is because an Input-Output table is an aggregate-level constru t fr m which it is difficult to extract highly disaggregated breakdowns of cost and v lues.

The most practical approach would be to apportion a share of total value added to species or harvest method, which could give a reasonable approxim tion where the species or method is a major component of total fishing value. Whe e t t is not the case the proportional split could disproportionately over- or under-state the significance of the species/method and the impacts of the i ter ention.

In all cases Input-Output tables are open to challenge from hose closer to the industry with better knowledge of cost structures. Using the agg egate multipliers at present may only give results that are roughly right, but with d e consideration of their approximations they can still be useful. But seeki g greater precision through constructing species- or method- specific multipl ers will ot necessarily preclude all the challenges to the results.

And if there are more than one si nifican sp cies impacted by the extended protection measures, the added comp xity of creating multiple species-specific sub-industries under the fishing sector simply adds assumptions rather than accuracy to the resulting multipliers.

Quota and ACE values a e intertwined

ACE is an annual entitlement the f hers must hold to legitimise their catch, so its price responds to short term condi ions of supply and demand and is likely to rise in response to fishing restri tions, a long as demand remains firm. But it would require a highly inelastic demand for ACE for the price rise to outweigh the reduction in volume of ACE, so owners may face a reduction in the value of their ACE-holding, even as ACE prices rise.

ACE are created ut of quota, so the discounted cash flow of future ACE prices is one factor affecting he value of quota. Quota are held as long-term assets against the risk of a long-term incr ase in scarcity of catching rights and they are traded infrequently. Many quo a hol ers do not wish to trade their quota. The prices do not appear to fluctuate n l ne with changes in potential catch volumes affected by regulatory changes

Bec use the CE reflects short run considerations and the quota value reflects longer run value pe ceptions in the market, short to medium term regulatory interventions may impact on ACE values and quota values in different ways.

This lates to the discussion on volumes landed set out above. The impact of fishing restrictions is highly dependent on further understanding the behaviour of participants in the industry.

This is likely to be a difficult calculation since:

- Each region is likely to have different drivers that impact on a participant to fish outside the restricted area
- There is likely to be uneven impact on processing for similar reasons to the set of incentives facing fishers.

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Possibly the best way to address this is through an uncertainty matrix (See Table 3).

Table 3 Dealing with uncertain behaviour of participants in the face of restrictions

Impact on fishers' ability to generate revenue from fishing	High	Unlikely scenario since impact on operations is low	Fisher faces heavy burden Impact dependent on size of company and alternatives	Worst case scenario value of whole quota restriction lost by fisher
	Medium	Unlikely scenario since impact on operations is low	Highly dependent on size of company and ability to re configure operations	Highly dependent on size of company and ability to re configure operations
	Low	Best case scenario where the impact is low and lost revenue is low	Partly able to find alternative fishing grounds and/or other species	Able to find alternative fishing grounds and/or other species
		Low	Medium	High
		Impact on fishers arrestictions imposed		

Source: NZIER

In practice, quota values do not appear to be that sensitive to regulatory changes, perhaps because expectations of future increases in value of fish offset the possibility of reductions in volume (see Newell et al 2002).[5]

The intertwined nature of the ACE and the value of the quota means there will be double counting if changes in the value of ACE and quota are considered to be additive, with each other and with other measures of income stream. The ACE is an annual instrument whose value reflects short term impacts of policy on supply and demand; the quota is a long term instrument whose value is less affected by short term restrictions.

A change in quota value is another way of looking at a change in future catch values. But as quota values do not appear in practice that sensitive to regulatory changes, and as quota holders or users have the option of changing their method or location of activity to avoid the impacts of the regulatory change, in most cases quota values are unlikely to be significantly affected by the dolphin regulations and should not be regarded as additional to stream of earnings' changes if they are.

If, however there are localised situations where dolphin protection measures do have a significant impact on the value of quota, for instance where they preclude fishing in an exceptionally productive location for a species, it is possible they could significantly impact on quota value.

Consider matters made in submissions

A consideration is unintended consequences of restrictions. Careful study of the submissions is required to ensure that all aspects of loss of value are considered (as far as is practicable).

[5] Newell concludes that controlling for other factors, increasing quota prices are consistent with increasing profitability.

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Alternative methods and or models that could be used by NZIER to improve the economic analysis

There are two typical approaches for impact assessments:

- Input-output analysis (often called multiplier analysis), which anal es the sale and receipt of goods and services from one sector to ano her
- Computable general equilibrium analysis (CGE), which mo ls the workings and constraints of an economy.

Input-output analysis has a severe limitation: it assumes resou ces are infinitely available. This might not matter for a small localised project in an area whose firms and workers are under-utilised such that there will be no eff cts on prices (Wallis et al. 2012). But it can lead to exaggerated impacts for m ny larg rojects.

As an example, Table 4 compares and contrasts the ty ical m ltipliers used. CGE model multipliers are typically much smaller than those gen rated by input-output models because CGE models do assume limits to resour es avail ble which cause prices to change in face of new demands made by hanging activity, and they allow for reallocation of input resources across industri s that offsets the effect of the principal change in activity.

Table 4 Comparing and contrasting typical multipliers

	Inpu Out ut model		CGE model	
	Regional	**National**	**Regional**	**National**
Output multiplier	2.2	2.3	1.2	0.9
Value added multiplier	8	0.8	0.4	0.3
Employment multiplier	2	11.6	6.2	2.5

Source: Dwyer et l (2015)

For major piece of work there has been a growing realisation of the problems with input-out ut nal sis. Government agencies have progressively moved away from using it towa ds cost-benefit analysis and/or CGE analysis. For example, the Ministry of Bu ines Innovation and Employment (MBIE) in its Post-Event Economic Evaluation Guidelines is discouraging the use of Input-Output multiplier studies. [6] [7] [8]

[6] enniss, R. (2012) *The use and abuse of economic modelling in Australia*, Australia Institute Technical Brief No. 12.

[7] See Gretton, P. (2013) *On Input-output Tables: uses and abuses*. Australian Productivity Commission Staff Research Note for a thorough discussion of what multipliers are, how they are constructed and their short-comings as tools for assessing economic impacts.

We also note that the Australian Bureau of Statistics has ceased to provide multiplier estimates from its input output tables. http://www.abs.gov.au/ausstats/abs@.nsf/Previousproducts/5209.0.55.001Main%20Features4Final%20release%202006-07%20tables?opendocument&tabname=Summary&prodno=5209.0.55.001&issue=Final%20release%202006-07%20tables&num=&view=

[8] For an overview of these weaknesses, see the New Zealand Treasury and MBIE. Both documents, and Gretton (2013), clearly state that multipliers over-state economic impacts and thus lack credibility for economic analysis. Or in Treasury's words: "Unless there is significant unemployment of people with the requisite skills, **it is therefore likely that multiplier effects do not exist**".

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In the case of valuing the impact of further restrictions to fishers the impacts generated by the Input-Output analysis are relatively small in each option. **These figures a e ikely to overvalue the (in this case negative) economic impact of further restrict ons**

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5. Implications

While we believe that this analysis is fit for purpose the amount of public and olitical interest in the restrictions is exceedingly high. Therefore, it is worth considering some refinement of the FNZ approach to assessing impact to provide som inc eased robustness against challenges made in consultation.

5.1. The Input-Output table should be updated

Updating the Input-Output table to March 2018 is requ ed. T i n be done relatively easily based on Statistics New Zealand production and exp rt numbers.

It may not make much difference (to the multi lie s) but it is required for completeness and to avoid criticism by using the mo t updated estimates we have.

5.2. The multipliers look reasonable

Appendix 5 of the supporting documentatio to the Consultation Document[9] details the multipliers used. Table 5 sets out the multipliers used. We believe that using the multiplier coefficients set out in the ble is reasonable.

This is despite multiplier metho ologies eing well-known to overestimate economic impacts. We base our assessment n:

- The multipliers themse ves (combined 2.8) are towards the middle rather than the outside of th r nge commonly given for Type II multipliers (>3.5)
- Multiplier distort ns are greatest when the project of policy change constitute a ignificant scale and disruptive impact on the local economy, which is likely be the case if regulatory impacts apply to only two fishing methods in regions where fishing is not a particularly significant part of the r gional economy, such as Taranaki, Manawatu-Whanganui and W s Cost (see NZIER 2016, Table 1).

Table 5 Multipl ers used in the Consultation document

Dir ct harves ng inco e	Value added	0.24	Gross revenue from fish landed
Direct processing inc me	Value added	0.57	Gross revenue from fish landed
Indirect income	Value added	1.69	Sectors supplying the fishing sector
Induced income to broader economy	Value added	0.32	Impact on broader economy

Source: FNZ and Department of Conservation

[9] Hector's and Māui Dolphin Threat Management Plan. Fisheries New Zealand and Department of Conservation.

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5.3. Why use a CGE model?

We should state clearly that the current approach is an appropriate way to a hieve th results that FNZ and the Department of Conservation require. The metho logy s straightforward to apply thereby allowing FNZ to save on resources and staff time. We find the assumptions employed reasonable.

A CGE model is likely to reduce the value of the loss to fishers sinc he mu pliers are likely to be smaller as other sectors adjust to the restrictions im ose .

Why would you use a CGE approach? It may be that FNZ want to h ve further surety that the approach is going to come under very high scrutiny Tw approaches could be taken:

- Continue to use the input-output multiplier approach and vary the updated multipliers by 25% to develop a range. This is beca se it is well known that multiplier methodologies overestimate result and are increasingly being seen as less credible
- Use a CGE model not as a repla ement but to triangulate the results already developed.

The economic effect of the dolphin prote ti n measures is ultimately broader than the impact on the commercial fishing activity alon Protection measures also affect other harvesting activities by recreational fishers and customary fishers, and they impact on national wellbeing if their implem ation can significantly reduce the probability of the dolphin populations declini g to ext nction. There is a societal value in avoiding extinction of wildlife, as is eviden in current willingness to pay to reduce species loss through such activities as gov rnment funding of Department of Conservation and public subscription to WWF, Forest and Bird and other organisations working with similar aims.

While the current mu tiplier do not appear excessive in the context of regional fishing activity and other econ mic multiplier estimates sometimes seen in public reports, their continued use is likely to overstate the impact of dolphin restrictions to some degree, becaus they omit the offsetting effects that occur when prices respond to scarcity and input esou ces move between economic activities. Setting ranges around those imp cts would provide some allowance for inaccuracies in the multiplier estimates (either rom the multipliers themselves, or from over-stating the direct impacts by misestimating the potential for quota to be utilised elsewhere). CGE mod lling ould provide an indication of how much smaller the impacts could be.

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6. Conclusions

We have examined FNZ's approach to estimating the potential impacts on commercial fishing of regulatory changes to improve protection for Māui and He tor's dolphins. This involves estimating direct impacts through reductions in the a ail ble arvest from the areas affected by the new measures, and the indirect effects on the national economy through multiplier impacts of reduced harvests on p oce sing and other sectors.

This method is relatively simple, transparent and easily un e tood Although there are well-known limitations with economic multipliers in exaggera ing the impacts of major changes by not accounting for resource con traints rice changes and input reallocation across sectors, in this case we do not expec these to be very signif icant, because the direct industry impacts will not hav major mpact on the regional economies in which they occur, and because the multipli r coefficients used are well within the range commonly encountered.

That said, there is a case for updating t e mu tipliers to 2018 figures from the 2016 figures underpinning the model on wh ch the urrent multipliers are used.

It would be possible to refine the model to ave separate sectors for inshore trawling and set netting or to deal with separate species articularly impacted by the proposed new protection measures. In either case the adjustments to Input-Output tables are likely to be relatively rough and the would not insulate the FNZ method against challenges for lack of accuracy w h respe t to 'real-world' impacts.

It would also be possible to apply a C E model to obtain an estimate of impacts that are robust against the criticism f multiplier-based estimates. This would require the 'shock' of impacts of the new r g lations to be well defined, and if the impacts are small relative to the regi nal economies in which they occur, this may not result in significant impacts.

What modificati n to methods would be worthwhile depends on what would be sufficient evide tial standard for the purposes of consultation. Doing all the changes that cover all of the b ses comes at additional cost and does not preclude the possibility f c allenges from those closer to the industry and in possession of more specific d ta o so of the likely impacts. But broader levels of approximation of both direct and in irect impacts are still useful indicators of the scale of impacts, given recognitio of their caveats and limitations.

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