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A numerical comparison of fish quota values and standard resource rent calculations using New Zealand's commercial fish resource

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A NUMERICAL COMPARISON OF FISH QUOTA VALUES AND STANDARD RESOURCE RENT CALCULATIONS USING NEW ZEALAND'S COMMERCIAL FISH RESOURCE

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1. Introduction

1. Monetary valuation of natural resources is important in order to gain an understanding of the interactions between economic activity and these resources. For many natural resources the methodology that can be used to produce a valuation is determined by data availability. This paper compares two different methods of valuing the New Zealand commercial fish stock: the market price approach and the residual value approach. The aim of this work is to increase the level of confidence with which valuations can be constructed based on either of these methods.

2. New Zealand is one of the few countries that have data enabling the valuation of fish stocks using both approaches. At present, an official monetary fish stock account for New Zealand is published using the market value approach. This paper outlines this method and, using data predominantly from the New Zealand national accounts, provides an alternative valuation using the residual value method. For most years, the two measures are quite different, both in levels and movements. The paper discusses possible reasons for these differences.

3. As the residual value approach is possibly the only viable alternative for valuing other natural resource assets, the study may provide a pointer to possible valuation problems likely to be encountered when it is employed for other resource accounts.

2. A market price approach for valuing commercial fish stocks using quota information

New Zealand's Quota Management System

4. In New Zealand, the Quota Management System (QMS) was introduced on 1 October 1986 with the passing of the Fisheries Amendment Act. While there have been numerous amendments to the act subsequently, the essence of the scheme remains the same. Within the QMS, a system of Individual Transferable Share Quota (ITQ) operates for each commercial fish stock. Commercial fishers own ITQ, which is a property right that can be bought and sold representing the shares they own in an individual fish stock.

5. Quota was initially allocated to the industry on the basis of catch history[1] and was valid in perpetuity. At the time quota was defined as a right to harvest a fixed tonnage of a particular species in a specific Quota Management Area (QMA). The actual tonnages were set annually as Total Allowable Commercial Catch (TACC) based on advice from various parties, the intent being to set a sustainable catch limit. As annual changes in the TACC required the government to issue or buy back quota tonnage – a complex and expensive process – the system was altered in 1990, to a share allocation system with only partial compensation to the quota owners. The ITQs now represented a percentage share of the TACC.

6. Quota is freely transferable, can be leased for varying periods and the quota owner can subdivide the quota for sale or lease as required. There are further restrictions on quota holdings such as those designed to ensure that only New Zealanders or New Zealand owned companies are able to purchase quota, and there are restrictions on maximum and minimum holdings in quota which differ from species to species.

7. In 2001 the system was further altered with the introduction of Annual Catch Entitlements (ACE) which created a clear separation between the permanent ownership of the harvest right and the right to harvest a specific amount in a given year. Under the new system, at the commencement of each fishing year, TACC for each species in each quota management area are declared, the quota holder's share is determined and an ACE is issued, the ACE being the right to harvest the current year's entitlement. ACE is freely transferable and the same ownership restrictions for quota equally apply. While you can hold ACE without holding quota, you cannot fish without ACE. In effect, the ACE has become a convenient way in which to lease quota.

8. Provided there are sellers, ACE can be purchased throughout the fishing year: prior to, during or after the harvest period. Actual harvest must be balanced each month against sufficient ACE, which can be purchased after the event (within limits) in order to comply with the law.

This change has led to a reduction in the number of quota trades while the number ACE transfers (essentially a 1 year lease) have increased steadily.

Valuing commercial fish stock using market information

9. Where fishing quotas are freely brought and sold in a well functioning market – as is the case in New Zealand – then, following the SEEA guidelines:

The value of quota holdings represents the NPV of the owner's expected income using the quota over its period of validity. If the fishery is managed with such quotas and the quotas are valid in perpetuity, the value of all quotas, at the market price, should be equal to the value of the use of the fish

[1] Recent changes made by Parliament mean that quota in all species introduced into the QMS from 1 October 2004, other than some limited exceptions, will be subject to a tender process. No quota will be allocated on the basis of catch taken by a fisher.
http://www.fish.govt.nz/en-nz/Commercial/Quota+Management+System/introduction+of+species+into+qms.htm

stock. If the quotas are valid for a single year only, the total should give an approximation to the resource rent in that year.[2]

10. As the ITQ are valid in perpetuity, the asset value based on quota valuations is equal to the average value of the traded quota ($/tonne) multiplied by the TACC.

11. Unfortunately, this simple and straightforward valuation method had to be modified post 2001. Since the introduction of ACE for the 2001/02 fishing year the number of quota trades recorded for many of the important species has declined and a supplementary method based on ACE transactions has been adopted where quota transfer information is not available for some species in certain quota management areas. The annual resource rent for the species / area concerned is estimated as the average $/tonne (from the ACE transaction data) multiplied by the TACC. As the fisheries are managed on a sustainable basis, this resource rent is assumed to hold for all future years and the asset value for the species is set equal to the NPV of the future resource rents.

12. A summary of the use of ITQ share market prices and ACE transactions for valuing fish stocks is given in paper LG/12/11 presented to the London Group in December 2007. Statistics New Zealand has subsequently produced the *Fish Monetary Stock Account 1996-2007*, the main results are shown below.

Table 1

New Zealand's Commercial Fish Resource, 1996-2007[1]

(NZ$000)

Year ended September

species	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Hoki	642	556	398	580	512	973	700	815	695	541	627	693
Rock lobster	368	376	407	374	465	447	591	689	644	585	612	621
Paua	143	195	208	193	255	245	260	328	355	379	366	390
Snapper	289	272	191	185	197	249	282	298	282	258	226	252
Orange Roughy	233	262	194	208	197	157	237	225	324	300	277	250
Ling	143	162	153	185	141	155	201	172	196	219	197	231
Arrow Squid	167	140	76	136	132	81	52	103	240	138	298	170
Hake	110	102	100	112	109	106	108	141	147	123	188	141
Scampi[2]	..	..	..	..	..	..	..	..	..	116	125	117
Oreos	80	86	59	71	65	64	60	59	68	68	72	85
All other species	566	575	499	556	569	621	696	770	914	1,004	849	868
Total	**2,740**	**2,726**	**2,285**	**2,599**	**2,641**	**3,097**	**3,185**	**3,601**	**3,866**	**3,730**	**3,836**	**3,819**

1 As estimated in the *Fish Monetary Stock Account 1996-2007* using ITQ values

2 Scampi was introduced into the QMS on 1 October 2003

Species covered by the ITQs and the measurement of the fish stock

13. The value of the fish stock is taken as equal to the value of those species managed under the QMS. This assumption is made on the basis that non-ITQ

[2] SEEA 7.273

species will have zero rent and hence zero asset value. Over time, more species have been brought within the QMS resulting in an increase in the monetary valuation of the fish stock – effectively fish with zero rent value now acquire a non-zero value as their harvest is now restricted. In practice, this is not a major issue, as the QMS includes under its management, species that account for over 95 percent of the total commercial catch, by weight (Ministry of Fisheries, 2007b) although this percent was lower in the earlier years. Of about 130 commercial species, 96 are managed under the QMS in the year ending September 2007.

14. The *Fish Monetary Stock Account* makes the assumptions that under the management of the QMS, fish stocks have stabilised at current levels and that the current rent will continue into the future. Although these assumptions may not hold true for individual fish stocks on a year-to-year basis, they are made because the sustainable use of the fisheries resource is a major objective of the QMS.

Discount rate

15. A discount rate is a time preference for money, reflecting the fact that income received in the future is not as valuable as income received today. By discounting future income so that it is comparable with income earned today, an asset's value, based on future income, can be estimated. The choice of the discount rate to be used in estimating an asset's value is a pivotal variable and is often the subject of considerable debate[3].

16. For the market price approach, the choice of discount rate is only an issue for that portion of the fish stock valuation that is reliant on the NPV of the ACE. This applies post 2001 only. While the direct valuation of quota sales remains the predominant valuation source, the portion valued using the ACE method has increased, averaging just over 40 percent for the period 2005-07.

17. The draft SEEAF lists discount rates used by five countries in preparing their fisheries asset values[4]. The rates varied from a low of 3.5 percent in Norway to a high of 10 percent in Namibia. This account uses a discount rate of 9 percent and is chosen because it is consistent with the return on similar assets in the New Zealand economy over the period measured. The use of a social discount rate was not considered as the capture-fish harvest rights in New Zealand are freely traded and owned entirely by private individuals and organisations[5].

18. The fact that both quota and ACE values were available for some fish stocks over the period 2002–2006 meant that calculation of an implicit rather than an exogenous discount rate could also be considered. This produced an implied discount rate of between 8-9 percent. In addition, Newell (2002) examined the relationship between Quota sales and lease prices[6] and found that the implicit rate inferred by the relationship was, for the relevant years of

[3] 2003 SEEA 7.188
[4] 2004 SEEAF 202
[5] All new quota is auctioned to the highest bidder, individuals holding existing quota are free to sell it as they wish although there are some restrictions on minimum and maximum holdings, see Lock and Leslie (2007) section 3.5.
[6] Newell (2002) examine the data over the period 1986–2000, i.e. before the establishment of ACE.

this exercise, between 11 percent (in 1992) to 7 percent (in 1999). Interestingly, they found that the implied rate declined broadly in line with the fall in real interest rates over the period.

Validity of the ITQ approach

19. The information used to produce the published series of Fish Monetary Stock Accounts is supplied by FishServe. FishServe is an industry owned company providing administrative services to the New Zealand commercial fishing industry to support the 1996 Fisheries Act. FishServe maintains a register of all quota and ACE transfers and also acts as an auctioneer for quota and ACE (although these are not traded exclusively through FishServe). The FishServe quota register covers 100% of all quota and ACE holdings and transfers, and is therefore accurately representative of the entire population.

20. This information is supplied on an annual basis to Statistics New Zealand at the close of the September fishing year. Where there is evidence of transfer pricing within the transfer register, trades for nominal amounts are able to be effectively removed from the calculations. Some unfeasibly high transfer prices are also removed before the calculation of weighted averages. These transfers may involve other assets or in the case of ACE transfers may represent forward agreements.

21. Since the introduction of ACE in October 2001, the number of quota trades has decreased (leases of quota have ceased) and ACE trades have increased. Quota trades fell from about 1500 in 1996 to less than 1000 in 2004. Newell et al (2005) found an average of 9,300 lease transactions[7] per year for the period 1986 to 2000 but these have increased significantly with the introduction of ACE. Over the years ending 2002–2007, the average number of ACE transfers per year has increased by over 50 percent from around 45,000 to over 70,000. ACE may change hands several times before it is fished and may be transferred up to 15 days after the close of the fishing year to allow for the catch balancing process.

22. A further advantage of using market prices is that information is given not only at the species level but by quota management area, which allows a more in-depth analysis of the data.

23. Newell (2002) concludes that in the New Zealand ITQ markets they "typically observe both a sufficient number of market participants and high enough levels of market activity to support a competitive quota market". Their analysis of market trades indicates that prices "are related in an expected manner with underlying economic fundamentals".

24. Accordingly, it is considered the market valuation method provides reasonably robust estimates of the commercial capture fish asset values, subject to the discount rate assumptions.

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[7] Prior to October 2001, 'lease' would be an appropriate term as quota could be leased for a period determined by the two parties to the transaction. After this, quota holdings split into two property rights; it is the annual catch entitlement (ACE) that can be purchased by a second party for the term of the fishing year. When not referring to pre-2001 transactions, the terms 'ACE transactions' or 'transfers' is used.

3. A residual value approach for valuing commercial fish

25. When asset markets do not exist, an alternative valuation option is to estimate the asset value based on the net present value of the implied resource rents accruing from holding or using the asset. However, the use of the residual value method is highly sensitive to assumptions about the discount rate and the rate of return to fixed capital, as well as values for income and produced capital provided from the national accounts or other sources of financial information on fishing activity.

26. This method makes the same assumptions as those made when using the ACE payments as an estimate of the resource rent, viz. that fish stocks have stabilised and are being harvested at a sustainable rate, and the resource rent is fixed for all future years. The residual value method discounts the sum of the future constant net income stream (or rent) in order to express its value at the present time. As with the ACE component of the market valuation method, a discount rate of 9 percent is used.

Estimating resource rent

27. In order to apply the residual value approach, it is necessary to first calculate the implied resource rent of the asset.

The derivation of the resource rent is based on a partition of the economic rent accruing for all assets (i.e. the gross operating surplus) into that part relevant to produced assets and that part relevant to non-produced assets. In this exercise, the only non-produced asset earning rent is taken to be the fishery.

This is set out in the SEEAF as[8]:

$$R = TR - (IC+CE+CFC+NIT+NP)$$

$$NP = i * K$$

Where

R	resource rent
TR	total revenue
IC	intermediate consumption
CE	compensation of employees
CFC	consumption of fixed capital
NIT	net taxes on production
NP	normal profit
i	the rate of return on capital
K	the value of fixed capital stock

[8] SEEAF para.184 The formula given in SEEAF is modified slightly to show net taxes on production.

28. With the exception of the return to fixed capital all the above variables are available from the national accounts published series.

The return to produced assets can be calculated by applying a normal real rate of return to the net stock of fixed capital in the fishing industry. For this exercise an 8 percent real rate of return to capital was used which is consistent with Statistics New Zealand's mineral accounts and with international practice.

Estimates of the fish stock using the residual value approach

Table 2 below sets out the derivation using the national accounts values.

Table 2

Residual resource rent calculations and estimate of the value of fish stock[1]

(NZ$000)

		1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Resource rent calculation:															
Total industry output	TR	610	695	700	751	779	822	881	910	906	962	1,009	914	928	916
less															
Intermediate consumption	IC	399	440	443	494	487	516	573	575	545	585	627	616	643	632
Compensation of employees	CE	44	51	56	66	75	84	88	88	94	90	116	107	95	87
Net taxes on production[3]	NT	34	17	17	22	32	28	25	34	28	24	26	-2	19	21
Consumption of fixed capital	CFC	60	63	62	60	54	56	59	64	74	87	85	83	80	82
Return to fixed Capital (8%)	NP	29	32	35	35	33	38	41	48	58	67	73	76	68	66
equals															
Resource rent	R	44	92	86	73	98	100	95	101	107	110	83	34	23	27
NP is calculated as 8% of the Net Capital Stock at start of year		366	397	439	443	408	477	507	606	723	835	912	944	855	830
Estimate of the value of the fish stock:															
Net present value of RR		491	1025	959	810	1094	1109	1060	1120	1192	1220	917	374	256	301
Fish Monetary Stock Account asset value[2]		1221	1878	2633	2642	2740	2726	2285	2599	2641	3097	3185	3601	3866	3730

1 National Accounts values are for March years, and are in current prices.

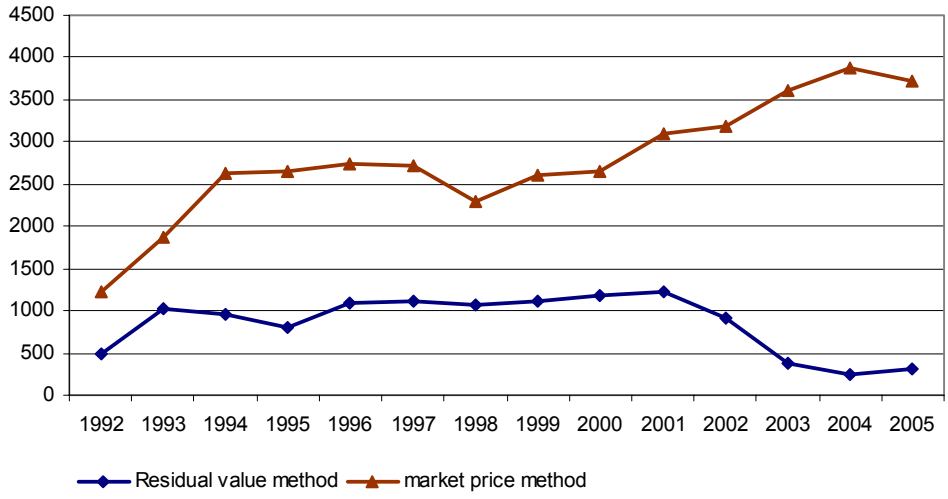
2 Values for the 1996-2007 years are official statistics published in the *Fish Monetary Stock Account*. Values for the period 1992-1995, although produced from the same data source, are considered indicative.

3 The 2003 figure is shown net of a return to the fishing industry of levies collected between 1994 and 2002.

29. The residual method is applied in those cases where there are no actual market transactions for quota. This is not the case in New Zealand which has a QMS regime in operation and quota trades occur. Therefore, when deriving the gross operating surplus (GOS) figure, and from there the resource rent residual, it is important to ensure that all quota related transactions are excluded from income and expenditure in the industry, i.e. to draw up an account ***as if*** there was no QMS.

30. In practice, this is quite straight-forward and in fact requires no adjustments to the national accounts derived GOS as (i) ITQ are classified as intangible non-produced assets, and any trades will be classified as capital transactions not current, and (ii) quota leases and/or ACE sales/purchases are classified as rent and are excluded from intermediate consumption. [9] Hence, the transactions shown in Table 2 exclude any related to actual sales / purchases of ACE or quota.

Figure 1: Fish Stock Valuations
$(000)



31. As can be seen in Figure 1, the final asset value figures calculated from the residual method differ substantially from the market valuation estimates although there was some consistency in the trend observed until 2001.

32. One further adjustment that should be made – but has not been for this exercise – is to remove from GOS an estimate of the return to labour of the self-employed. While New Zealand's commercial catch is dominated by a number of large companies, there are still a significant number of self-employed fishers whose GOS will include a return to both capital and labour. Removing this labour compensation for the self-employed would further

[9] Note that an adjustment for net non-life insurance premiums, a current transfer implicitly included in GOS should be made. However, as this value is quite small and would not materially alter the results for this exercise, this refinement has not been done.

reduce the resource rental calculated by the residual approach – indeed, it would become negative in the later years.

4. Discussion on the results

Differences in the scope of fishing activity

33. The resource rent estimate derived from National Accounts variables could, in theory, be higher than that implicit in the quota valuation method due to differences in fishing coverage. The National Accounts fishing production account covers ANZSIC96 classes A0711 Commercial Fishing and A0712 Aquaculture. The QMS applies to most, but not all, species fished in A0711 but does not apply to species fished / farmed in A0712.

34. A0711 includes New Zealand fishers who harvest non-ITQ species within the EEZ and also deepwater species found in international waters. To the extent that these are unrestricted fisheries (although subject to New Zealand Government fishing permits), resource rent would (in theory) be zero. However, given the risks and nature of this fishing, and the possibility of limited access control via the permit regime, it is highly likely that economic rent or "super-profits" (or losses) may be earned by fishers catching these non-ITQ species. This will then impact on the residual rent calculation.

35. The QMS species coverage has increased over time. As noted above, over time, an increasing number of species has been brought under the management of the QMS. At 1 October 1986 there were 26 species, but this had increased to 96 by the year ending September 2007. New species, including many by-catch species, are brought into the QMS if it is considered that the current utilisation is affecting the sustainability of the fish stock. The original 26 species were high value, mainly deepwater species, and in 2007 these species represented 58 percent of the total asset value estimated in the Fish Monetary Stock Account. Skipjack and albacore tuna are the remaining high value species that are not managed under the QMS.

36. In terms of tonnage caught, the ITQ species clearly dominate and, as shown in Table 3 below, in recent years the relative catch proportions between ITQ and non-ITQ species have been reasonably stable. Nevertheless, the

Table 3

Summary of total landed catch[1] in New Zealand (EEZ and ET)[2]

	1997	1998	1999	2000	2001	2002	2003	2004	2005
Total non-ITQ catch	44570	42892	47368	47779	42153	90876	69771	45900	35217
Total ITQ catch	532600	545604	507311	501148	506621	500427	487018	477939	485168
Combined total catch	577170	588496	544679	548927	548774	591303	556789	523839	520385
Total TACC (tonnes)	649143	660255	671925	708329	710520	659178	668441	658096	608464

Catches are to the nearest tonne and are for the period 1 October to 30 September in each fishing year

expansion of the QMS species coverage effectively translates into an increase in the dollar value of the commercial fish stock, as non-ITQ species (with zero value rent) are introduced with a non-zero rent value. To the extent that the non-ITQ species may already be generating an element of rent prior

to their inclusion, the evolution of the fish stock values via the two methods can be expected to differ.

37. Aquaculture too is outside the QMS but this again is not an issue in the comparison if the resource rent is zero. However, as aquaculture is a controlled activity that (generally) requires resource and other consents, it is probable that implicit resource rents are earned. Ideally, one would separate out the aquaculture figures from those for commercial fishing but given the data sources this is not possible. Based on export statistics the aquaculture industry contributes around 15 percent of output.

Fishing and fish processing

38. In New Zealand there is a high level of integration between the fishing industry and fish processing within the manufacturing industry. This occurs both as a result of technology employed - where catch is processed and prepared for export onboard freezer vessels - and as a result of vertical integration through the establishment of separate units within the same legal enterprise or enterprise group. In the latter case where the same company (or parent company) handles both fishing and fish processing, fish may be transferred from fishing to fish processing without a monetary transaction or via a transfer price that may not represent a market price.[10]

39. The SEEAF states that in the case of vertical integration, a true estimate of resource rent may only be obtainable if the boundary between the fishing and fish processing industries is relaxed and the residual method applied to both activities[11]. This has not been done in this study as separate data on the vertically integrated fish catch / fish processing enterprises is not available.

40. Furthermore, separate financial information is not available for the entire fish processing industry, as, in the economic sample surveys that collect the financial data, Fish Processing is combined with Other Food Manufacturing, such as processing of fruit, vegetables, bakery goods, confectionary and animal feed.

41. Even if it was possible to obtain the Fish Processing industry data separately, the residual value method would possibly be compromised as the assumption that the residual value rent is solely a return to a natural resource would weaken unless there was complete data on all of the assets employed by the enterprise. For example, an enterprise may use intangible assets such as trade marks and brand names all of which would need to be included in the return to capital when estimating the “normal profit”. While this is also an issue with companies solely engaged in fishing, it is likely to become a larger issue as the range of activities in vertically integrated fishing enterprises increases, e.g. some enterprise structures may be quite complex and involve separate units in fishing, fish processing, wholesaling, retailing, and quota ownership. In principle, all may need to be included in order to derive a meaningful resource rental residual.

[10] SEEAF 188.
[11] SEEAF 189.

42. Danielsson (2001) argues that the high asset values derived from ITQ based valuations is influenced by the fact the decisions on quota prices are made not only in the fishing industry but also in the fish processing industry. There is little doubt that this is also the case in New Zealand.

43. During the initial phases of quota allocation in the early stages of the QMS, deepwater fisheries operators needed to prove that they had both the ability to access the fishery and the processing investment necessary to process the catch before an allocation was made (Lock and Leslie, 2007). It is likely that this has contributed to the high level of vertical integration between the fishing and fish processing industries, although it is not known whether this situation exists to a greater degree in New Zealand than elsewhere or if it would have come about regardless of the introduction of the QMS.

44. In order to examine the extent to which quota might be held outside the fishing industry, quota holdings[12] were examined for eight of the main finfish species, representing 51 percent of the asset value estimated by the Fish Monetary Stock Account in 2007. The following Table 4 illustrates the extent to which the ownership of quota is largely in the hands of companies that are not directly engaged in fishing. A number of the quota holders will now operate solely as asset holders earning rent from the sale of ACE but some will be associated companies within group enterprises, engaged in both fishing and processing. This is likely to be the case for the 23 units in manufacturing (fish processing) where a number of alternative arrangements might hold: (i) ownership of quota but no longer directly engaged in fishing; (ii) ownership of quota and with an associated company classified to fishing; or (iii) ownership of quota and engaged directly in fishing but as part of a single company classified to fish processing on the basis of predominant activity.

Table 4

Quota shareholding for selected species[1] by industrial classification[2]

ANZSIC division	Percent
A Agriculture, Forestry and Fishing	2
C Manufacturing	23
F Wholesale Trade	1
L Property and Business Services	46
M Government Aministration and Defence	24
unalocated	3

1 hake, hoki, ling, orange roughy, oreo, scampi, snapper, squid

2 Australian and New Zealand Standard Industrial Classification (ANZSIC) 1996 version 4.1

45. For New Zealand to adopt the residual valuation method, the main requirement would be the need to aggregate the fish catching and fish processing industries. Industrial classifications are based on predominant activity and a number of New Zealand's largest fishing fleets are included in the fish processing industry as this is the predominant activity of the companies involved. Ideally, a finer establishment-level industry structuring

[12] Quota holdings are represented as shares rather than volumes of allocation. TACC may differ across QMAs but the sum of shoes holdings for each QMA is 100,000,000 shares. The New Zealand government owns the quota in administrative area 10 but in most cases the TACC in this area, which is not fished, is set at 10 tonnes.

would be used, but if the financial reporting structures in the companies involved do not permit this, then predominance is used.

Accounting or economic valuations?

46. One would expect the market value of quota – as revealed in the actual sales prices of quota or ACE transactions – to be based on historic cost accounting conventions, i.e. the price that a purchaser would be willing to pay will have had factored in past costs such as fixed asset purchases valued at their historic cost, not their current replacement cost. A seller establishing a selling price would likely follow similar accounting conventions.

47. However, the resource rent obtained from the residual value method above is based on national accounting (economic) valuations. The major difference will be the valuation of the fixed assets which, in the national accounts, are derived from a perpetual inventory model and are valued at current replacement cost in each year. This, in turn, leads to estimates of consumption of fixed capital valued at replacement cost and the current asset values will also affect the rate of return on fixed assets calculation.

48. In contrast, the accounting resource rent implicit in the quota sales prices or the ACE sales will be based on historic or book value asset prices which, in most cases will be less than the current replacement cost values. The asset lives and depreciation rates used in the accounting depreciation calculation will also differ from those used in the PIM (perpetual inventory model).

49. While economic theory would indicate that the asset values should be based on current replacement cost valuations, as the object of this exercise is to compare the two methods and attempt to explain any differences, the relevant national accounts values are replaced by their historic cost book value equivalents. This is done in Table 5 below.

50. In order to calculate a normal rate of profit, as the fixed assets are now valued at historic cost, a nominal rate of return is used. The rate chosen is the rate of borrowing capital which is equated to the commercial bank base lending rate plus 2 percent[13].

51. One further, minor, change is made, viz. instead of using a fixed discount rate this is varied to track real market rates (see the next section).

52. As can be seen in Figure 2, using book values along with a nominal rate of return has made little difference to the fish stock values using this method. The levels are little changed and the gap between the two valuation methods remains. The divergence in values post 2001 is still apparent. And, as noted earlier, this gap would be larger if a deduction was made from the gross operating surplus as a labour reward for the self-employed fishers.

[13] This rate is indicative only and not based on actual borrowing rates faced by the industry. The base lending rate would be a minimum rate while the 2 percent is added to reflect industry risk. This may be too low – or too high. This rate tracks closely the 5-year Government bond rate (which could be seen as a risk free rate) plus 6 percent.

Discount rate

53. The residual value method requires the explicit use of a discount rate in order to estimate the net present value of the stream of future resource rents. In the initial exercise above, a rate of 9 percent was used, the same rate used in the market value when supplementing the ITQ sales data with ACE-sourced estimates. What is the appropriate rate?

Table 5

Residual resource rent calculations using historic costs and alternative rates

(NZ$000)

		1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Resource rent calculation:															
Total industry output	TR	610	695	700	751	779	822	881	910	906	962	1,009	914	928	916
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Intermediate consumption	IC	399	440	443	494	487	516	573	575	545	585	627	616	643	632
Compensation of employees	CE	44	51	56	66	75	84	88	88	94	90	116	107	95	87
Net taxes on production	NT	34	17	17	22	32	28	25	34	28	24	26	-2	19	21
Consumption of fixed capital	CFC	29	38	41	43	49	54	60	55	48	55	63	59	66	57
Return to fixed Capital	NP	38	39	37	47	53	64	69	62	62	68	77	78	70	74
equals															
Resource rent	R	67	111	105	79	84	76	66	96	129	141	100	55	36	44
Nominal rate of return		15	13	12	12	14	14	14	12	11	12	12	12	12	13
Net Capital Stock at start of year		251	297	308	388	377	459	495	518	566	563	642	649	580	573
Estimate of the value of the fish stock:															
Discount rate		10	10	10	10	9	9	8	8	8	8	8	8	8	8
Net present value of RR		671	1107	1053	791	930	842	821	1202	1611	1763	1256	692	448	550
Fish Monetary Stock Account asset value[2]		1221	1878	2633	2642	2740	2726	2285	2599	2641	3097	3185	3601	3866	3730

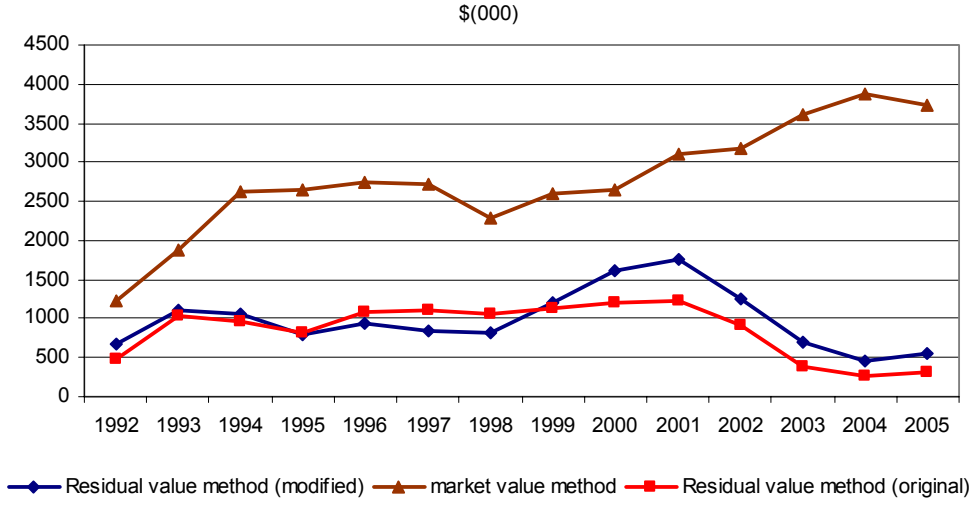
1 National Accounts values are for March years, and are in current prices.

period 1992-1995, although produced from the same data source, are considered indicative.

54. The quota asset sales prices implicitly incorporate a discount factor, i.e. it is assumed that fishers act rationally, and they are willing to pay a quota price that reflects the discounted future income stream they will earn from the fish harvest. Newell (2002) analysed quota prices and quota leases for the period 1986-2000 and found that the implied discount rate fell by about half, from 14 percent to 7 percent, which approximately matched a similar fall in market

rates (as measured by New Zealand Treasury bills). For the period 1992-2000, the implied discount rate falls from 11 percent to 7 percent.

Figure 2: Modified fish stock valuations



55. Undertaking a similar exercise comparing ACE prices with quota prices for the period 2002-2007 indicated an implied discount rate of 8-9%. These studies suggest that while the original rate of 9 percent appears reasonable, there may be a good case: (i) to lower the rate over time, to reflect the progressive increase in certainty as the QMS matures, property rights become entrenched and more knowledge on fish populations and sustainable TACC is acquired; and (ii) to allow the rate to fluctuate in line with changes in real market interest rates. This has been done in Table 5, with the discount rate modified slightly to reflect the trend in 5-year Treasury bond rates and the lower rate of 8 percent in the latest years.

Cost recovery levies and appropriation of the resource rent

56. When the QMS was initially introduced, resource levies were imposed with the stated intention of appropriating the resource rent for the government. However, this intention has never been actively pursued and what now remains in place are levies that are intended to recover the government's costs of managing the QMS[14]. The levies are paid by the quota holders.

57. It is not at all clear whether these levies should be regarded as part of the resource rent that is being appropriated by the government, or whether they should be treated as operating expenses of the fishers. To date, they have been treated as operating expenses (other taxes on production) and have not been classified as part of the resource rent which has been assumed to be

[14] The purpose of the fisheries cost recovery regime is to enable the Crown to recover its cost in respect of the provision of fisheries services and conservation services. These services consist of research and the on board observer programme. See: http://www.fish.govt.nz/en-nz/Commercial/Cost+Recovery+Levies/default.htm

totally appropriated by the quota owners. If the latter treatment was adopted the fish asset values that are currently published, based on quota sales, would understate by the NPV of these levies.

58. In Table 2, most of the row *Net Taxes on Production* is made up of the cost recovery levy. For this exercise, no adjustment to the fish asset values estimated by either the market value or the residual value approaches is made. The same value would need to be added in both approaches and so this adjustment would not contribute to explaining the differences.

Expected catch compared to actual catch

59. The quota sales prices are based on expected catch volumes and prices. The market value method that has been adopted estimates the value of the fish stock based on (i) the maximum allowable catch – the TACC – on the assumption that the quota holders intend to derive benefits from their full entitlement and (ii) the fishers' estimates of expected fish prices.

60. Asset values using the residual method should also be based on expected values. Clearly, the annual rent values derived in Tables 2 and 5 reflect the actual harvest experiences each year and, in these circumstances, the two approaches are unlikely to produce similar values. The GOS will fluctuate depending on actual catch volumes and market price fluctuations. If the residual value method was used in practice, an expected resource rent possibly based on a multiple year moving average would be preferred.

5. Conclusion

61. It is not uncommon to find that fishing rents are zero or even negative and in these cases the asset value of the fishery is considered to be zero[15]. This occurs when revenues from fishing do not adequately cover costs and is often the case where governments subsidise fishing or in open access fisheries where fishing activity expands until rents are eliminated.

62. In New Zealand there is no government subsidisation of the fishing industry and access to the resource is controlled by the quota management system giving rise to resource rents. It can be seen that the resource rent when estimated by a residual method applied to the operating surplus of the fishing industry is very much lower than that given by the use of market prices.

63. There are a number of possible explanations for this difference and until the data issues, which hinder a true comparison, have been resolved it is difficult to draw conclusions on how well the two approaches align. However, it is clear from the divergence between the two estimates, especially post 2001, that there are factors outside the fishing industry itself that are influencing quota and ACE prices.

64. The analysis suggests that the rent earned by the industry, as reflected in the national accounts, is simply too small to adequately account for the

[15]SEEAF 203.

income that can be earned from holding quota. As the ACE prices can be purchased throughout the harvest period, they can be expected to reflect fish market prices with some certainty. Consequently, it is possible to estimate a theoretical resource rent that could be earned through holding quota by multiplying the ACE price per tonne by the TACC. For 2005, this figure is approximately $310m. This can be contrasted with either of the resource rents derived above ($27m in Table 2 or $44m in Table 5). It is clear that much of the resource rent is being captured outside the fishing industry (as defined in the national accounts), most likely in fish processing and possibly asset investing.

65. This exercise illustrates that using national accounts based industry data to estimate resource rents via the residual value approach is fraught with difficulties. Indeed, in New Zealand's case, it suggests that had the residual method been used to estimate resource rents and to value the fish stock, then without resolving a number of the data and classification / coverage issues, the results could be quite misleading.

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Appendix
The New Zealand fishing industry

In the year ending December 2007 the total value of New Zealand seafood exports was $1.1 billion[16] of which approximately $220 million was aquaculture[17] exports. This makes seafood exports the number 8 ranked export, with the 2007 figure representing 3 percent of total exports. The fishing industry contributed $261 million to GDP in the March 2005 year or 0.2 percent of the total.

New Zealand: Exports by Harmonised System Chapter Heading

(NZ$000 FOB) - ranked

Year ended December

Rank	HS	Description	2001	2002	2003	2004	2005	2006	2007
1	04	Dairy	6,366,030	5,210,168	4,762,817	5,006,682	5,198,076	6,254,810	7,557,397
2	02	Meat	4,315,960	4,285,979	4,160,290	4,575,828	4,655,088	4,668,107	4,345,697
3	44	Wood	2,253,676	2,500,580	2,078,866	2,098,573	1,909,825	2,131,524	2,084,301
4	84	Machinery	1,093,924	1,107,148	1,175,284	1,368,189	1,434,260	1,578,949	1,569,022
5	76	Aluminium and articles	1,225,342	1,113,012	928,615	1,058,134	1,082,032	1,479,838	1,513,222
6	27	Mineral fuels	846,846	705,305	523,240	485,703	448,880	550,442	1,458,802
7	08	Fruit	1,000,862	1,104,565	997,884	1,388,743	1,165,844	1,200,468	1,283,048
8	03	Fish	1,348,364	1,374,007	1,067,473	1,129,824	1,131,510	1,194,143	1,095,106
9	35	Starch	1,549,319	1,213,139	1,015,692	880,581	840,016	934,943	1,052,587
10	98	New Zealand misc provisions(1)		201,915	239,930	493,238	846,303	1,052,424	1,032,654
Total exports			**31,575,917**	**29,820,534**	**27,306,577**	**29,509,145**	**29,471,732**	**32,717,778**	**35,033,863**

Contribution to Gross Domestic Product by Industry

Current prices

	Year ended March						
	1999	2000	2001	2002	2003	2004	2005
Industry	$(million)						
Agriculture	5,187	5,933	7,981	9,159	6,924	7,539	7,656
Forestry and logging	1,080	1,112	1,273	1,210	1,217	1,021	1,016
Fishing	309	336	350	351	274	268	261
Mining	1,143	1,202	1,388	1,437	1,489	1,339	1,581
Gross domestic product	**103,381**	**109,629**	**115,906**	**124,632**	**130,996**	**139,928**	**149,936**

[16] All monetary figures are given in New Zealand dollars. At the time of writing one New Zealand dollar equalled approximately .47 Euro.

[17] Mussel, salmon and oyster exports for the calendar year 2007