Estimating present and future profits within the Namibian hake industry: a bio-economic analysis

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Namibia’s fishing industry is managed using a system of fishing rights and individual fishing quotas. This property rights system was intended to encourage the local fishing industry to exploit the resource responsibly. Unfortunately, unintended perverse incentives have promoted induced overcapacity and inefficient use of vessels. In combination with inconsistent quota allocations, the result has been persistent pressure on the already depleted biological resource. This paper uses a bio-economic model to estimate actual and potential profits in Namibia’s hake fishery. N$300 million annual profit was not realised due to the depressed state of the resource. Mean annual profits for the years 2007–2009 were N$80 million, which provides the fishing industry, as a whole, only about 36% of the potential normal profit. Theoretically this implies that the fishing industry would probably receive better returns with less risk if they invested their money elsewhere. This study demonstrates that by rationalising quotas and improving management, better efficiency and higher profits for the fishers and government could be obtained.

Keywords: freezer trawlers, Namibia, wetfish

Online supplementary material: A survey questionnaire used to obtain additional economic data from fish processing plant managers and freezer boat owners is available in Supplementary Appendix S1, at http://dx.doi.org/10.2989/1814232X.2014.920727.

Introduction

The Namibian economy is heavily dependent on mining, agriculture and fisheries as sources of income, foreign exchange and employment (Sherbourne 2010). Like most primary commodities, these sectors face unstable prices and volatile costs. In the case of fishing, an additional uncertainty is that stocks of fish are prone to collapse. The contribution of fishing and fish processing to the country’s gross domestic product (GDP) declined consistently, from 7.2% in 2003 to 3.7% in 2010 (NPC 2011; Figure 1a). The industry’s contribution to total Namibian exports has also been volatile. In the past decade, fishing’s share of total exports has fluctuated from a low of N$2.62 billion in 2000 to N$5.17 billion in 2009 (NPC 2011, p 35; Figure 1b). Despite declines in the resource, however, fishing remains an important source of employment, the hake (Merluccius capensis and M. paradoxus) industry alone employing some 10 000 workers (Ministry of Fisheries and Marine Resources [MFMR], unpublished data). Given the important status of fishing in the Namibian economy, its management is a serious matter. This paper uses a bio-economic model to compare and contrast some of the alternative management strategies available to the country’s fisheries managers. An attempt is made to estimate the current economic rent as well as potential future profits under different management strategies.

Historical and institutional background

From 1990 to 1993, the Namibian fishing industry enjoyed real growth rates >25% (Sherbourne 2010), but thereafter it stagnated initially and then, post-2004, declined consistently (NPC 2011; Figure 1a). The problem was partly associated with declines in the stocks of the major commercial species, viz. hake (Kirchner et al. 2012), sardine (De Oliveira et al. 2007) and horse mackerel (Kirchner et al. 2010), but also was due to a variety of economic challenges: high real rates of interest, unfavourable and volatile exchange rates (Figure 2a), high and variable fuel prices (Figure 2b). Despite these and other challenges in the past few years, most fishing companies have survived. Surprisingly, given the global economic downturn and the clearly limited hake resource, the fishing industry invested roughly N$200 million in the years 2007 and 2008, primarily in processing facilities and new factory technology for value addition, acquisition of fishing vessels, cold storage facilities and properties (MFMR unpublished data, released in 2009).

The Namibian hake industry often approaches the MFMR for support and assistance. Despite the frequency with...
which the total allowable catch (TAC) is not landed (14 of 21 years since independence) (Kirchner and Leiman 2014), the most common request is for increased quota, a short-term solution that exerts additional pressure on an already depleted resource. Other relief measures sought are the reduction of quota fees or extension of their payment schedule, and the conversion from wetfish quota to freezer quota – the industry believing freezer quota to be more profitable. Industry representatives point to the excess capacity of the fleet and factories relative to TAC, and the threat of worker retrenchment if the TAC is not increased. The Minister of Fisheries is the ultimate decision-maker, and the industry has on various occasions been invited to approach the Minister in the event of economic hardship (CHK pers. obs.). Such an ad hoc dimension to management makes analysis difficult, a problem worsened by the paucity of realistic data. Although economic information is provided by rights-holders as part of their quota applications, the functioning of the hake industry is complex and secretive, and interrelationships between various stakeholders are opaque (CHK pers. obs.).

The hake industry is a restricted access fishery with 38 rights-holders, each having long-term rights allocated for 7 or 15 years. Each rights-holder is entitled to a predetermined share of the annually announced TAC. At the time of this study, the smallest of these shares was 0.6% of the TAC and the largest was 13.4%. However, those percentages may change from year to year and the resulting insecurity prevents rights-holders from planning effectively, reducing the advantages that would flow from a wholly secure property right. In addition, some quota is reserved for distribution in one-off rewards for investments made by rights-holders during any year, a policy that encourages overcapacity. Although rights are officially non-tradable, some rights-holders lease their TAC shares to others.

3 The number of rights-holders was increased in 2011 by 12 new group rights each consisting of five subsidiary companies (Paterson et al. 2013)
and some merge into joint ventures (Kirchner and Leiman 2014). As the TAC is shared between many, and the percentage shares are not totally secure, the quota system does not induce the rational, collective, rent-maximising behaviours one would hope for from individual quota systems, so it is understandable that rights-holders lobby for larger TACs. There is certainly little incentive for individual firms to invest in the resource by curtailing their present efforts.

Until recently, TAC recommendations have been submitted to the Minister of Fisheries and the Marine Advisory Council from biological and economic interest groups separately (Kirchner and Leiman 2014). However, in a management system whose objective is to maximise rents by avoiding the dissipation of abnormal profits, an objective bio-economic modelling approach would be an appropriate way of assessing the value of the different recommendations.

This paper presents economic information collected from the fishing industry and uses a bio-economic model to estimate the impacts of various management strategies on the hake fishery’s present value.

Material and methods

Biologists normally estimate fish stocks in units of mass, whereas bio-economics treats fish as financial assets; the hake fishery would therefore be valued as the net present value of the stream of earnings it is expected to generate (Lange 2000). This study generally follows the residual approach to rent estimation described by Clark (2006), but it allows catches to fluctuate with the estimated condition of the resource. Although exogenous factors such as fuel prices (Figure 2b), exchange rate and fish prices are kept constant, costs still fluctuate with stock status, because in this approach the abundance of hake determines the catch per unit effort (CPUE).

The biological part of the bio-economic model is described in detail in Kirchner et al. (2012). The hake resource is estimated to be well below the level required for the maximum sustainable economic yield (Kirchner et al. 2012), meaning that rebuilding the resource would increase the present value of the industry’s future earnings. Stock rebuilding takes place when only part of the replacement yield (RY) is harvested, the remainder being left to support stock-size increase. The TAC calculated using the biological model then becomes

\[
\text{TAC}_y = \beta \left[ \sum_{y} \left( \frac{\text{RY}_y}{5} \right) \right]
\]

(1)

where \( \beta \) is the proportion harvested of the 5-year average RY. Under Namibia’s management strategy, the TAC cannot be changed by \( >10\% \) from one year to the next except under extraordinary circumstances (Kirchner et al. 2012).

This TAC is then apportioned between freezer (F) and wetfish (ice, W) vessels following a policy (Japp and Steenkamp 2004; Kirchner and Leiman 2014) that currently restricts freezer vessels to 30% of the TAC. This policy aims to increase onshore processing and thereby increase employment in the hake wetfish sector.

\[
\text{TAC}_{yF} = \text{TAC}_y \times 0.3 \quad \text{and} \quad \text{TAC}_{yW} = \text{TAC}_y \times 0.7
\]

(2)

As the resource recovers, future CPUE levels increase and average costs decline:

\[
\text{CPUE}_{\text{fut}} = B_{\text{exp}} \times q
\]

(3)

where \( B_{\text{exp}} \) is the exploitable biomass per year in the biological assessment model and \( q \) the proportionality constant estimated by the model (Kirchner et al. 2012).

The predicted number of hours \( (h_i) \) needed to catch the calculated annual TAC for the two fishing sectors \( (i) \) is therefore:

\[
h_i = \frac{\text{TAC}_i}{(\text{CPUE}_{\text{fut}} \times m)}
\]

(4)

where \( m^W \) and \( m^F \) (raising factor) were set as 1 and 1.4 respectively. This should roughly represent the hours that are needed by the two fishing sectors to catch the TAC. Personal observations, supported by local landings data, suggest the wetfish vessel CPUE is typically 40% less than that of freezer vessels. The number of vessels of each type needed per year \( V_y \) to catch their portion of the TAC is:

\[
V_y = h_i / T / D
\]

(5)

where \( T \) is the average fishing time per day per vessel type and \( D \) the average number of annual trawling days per vessel type (Table 1). The predicted hourly costs per vessel type \( (C) \) can be calculated from:

\[
C^i = AC^i / T / D
\]

(6)

where \( AC^i \) refers to the average annual cost per vessel type (Table 1).

The hake industry’s total costs \( (\text{TotC}_y) \) have two components, fishing and processing costs:

\[
\text{TotC}_y = \sum_i \left( h_i \times C^i \right) + \left( \text{TAC}_y \times FC^i \right)
\]

(7)

where \( h_i \) is the time taken to catch the TAC, and \( FC^i \) refers to the factory costs per quota tonne for the different fishing types.

Total revenue \( R_y \) is estimated from:

\[
R_y = \sum \left( \text{TAC}_y \times p^i \right)
\]

(8)

where \( p^i \) is the price per quota tonne. Profit follows as:

\[
P_y = (R_y - \text{TotC}_y)(1 - 0.15) \times (1 + pc)
\]

(9)

which is increased compounded by \( pc \) (‘profit-creep’), set currently at 5%. The Namibian hake fishery is still developing by employing innovative business strategies that lower costs; this issue is not included in the current total cost, so the ‘profit-creep’ has been allowed for in the base case.

Net present value (NPV) is then calculated from:
The short, simple questionnaire used to obtain additional economic data, some of which are listed in Table 1, is available online as Supplementary Appendix S1. It was completed by fish processing plant managers and freezer boat owners, the intention being to cover the complete fishing industry population.

**Results**

Revenues of the industry depend largely on the stock of natural capital (Kirchner et al. 2012), the size distribution of the catch (Table 3), international prices and the prevailing exchange rate (Figure 2a), whereas fishing costs are driven by catch rates, fuel prices (Figure 2b) and wage rates (Leiman and Harris 2009). In 2009, 30% by weight of the hake caught in Namibian waters were <35 cm (Table 3). As smaller fish fetch lower prices per unit weight, it also

\[
\text{NPV} = \sum P_y \left( \frac{1 + d}{d} \right)^n \tag{10}
\]

where \(d\) is the discount rate and \(n\) the number of years in the future, with 2010 being \(n = 1\) and 2030 being \(n = 20\).

Namibian hake rights-holders have exclusive 15-year fishing rights (Kirchner and Leiman 2014), with the remaining life of a right, together with the probability that it will be renewed, influencing the value its holder attaches to future stocks and catches. Identifying the appropriate discount rate in this evaluation is a challenge; the lower the discount rate the more weight that is attached to future yields. High discount rates imply a short time horizon (and raise the incentive to overfish). The risk caused by natural processes such as environmental variation is not considered in this process. Expected cash flows and discount rates change over time and affect NPVs (Damodaran 2002), but in this case the decision-making process is independent of both, because the NPVs of the different management scenarios (Table 2) are being compared over the same time-period. According to Ulibarri and Wellman (1997), a real discount rate of 7% is the highest that would be used in the USA. However, the Asian and African development banks routinely use real rates of 10% and 12% (COMPAS 2008). Given the risks associated with the industry and its consequent high hurdle rate, and recognising Namibia’s ‘developing country’ status, a 10% real discount rate would seem to be reasonable for the next 20 years.

Employment is estimated to be

\[
\text{TotE}_y = \sum \left( \left[ V_y \times E_i \right] + \left( \frac{TAC_y}{1000 \times FE_i} \right) \right) \tag{11}
\]

where \(E_i\) is the number of employees per vessel type and \(FE_i\) the number of employees per 1 000 quota tonnes for each fishing type.

### Table 1: Variables used within the bio-economic model to determine current and future economic rent of the Namibian hake resource

| Variable | Freezer | Wet | Data source |
|----------|---------|-----|-------------|
| Average trawling days \((D)\) | 202 | 178 | Based on commercial trawling data from 1992 to 2009, but only including vessels that fished for 5 years or more in Namibian waters \((n = 27\) for freezers and \(n = 43\) for wetfish) (data from MFMR) |
| Average fishing time per day in hours \((T)\) | 15.8 | 13.1 | Based on data from 1992 to 2009, but only including vessels that fished for 5 years or more in Namibian waters \((n = 27\) for freezers and \(n = 43\) for wetfish) |
| Annual fishing hours per vessel | 3 236 | 2 317 | Trawling days \(\times\) fishing time |
| Number of employees on each vessel \((E)\) | 73 | 23 | Based on data supplied by the fishing industry |
| Number of employees per 1 000 quota tonnes in a factory \((FE)\) | 15 | 66 | This information is currently a ‘guesstimate’ for freezers, but wetfish information is from the fishing industry |
| Average price per quota tonne \((N\$) \((p)\)\) | 15 000 | 17 500 | Data based on information obtained from the fishing industry (for freezers based on 2009 data only) |
| Annual operating cost of a vessel \((\text{million N\$}) \((AC)\)\) | 50 | 15 | Data based on information obtained from the fishing industry |
| Fishing costs per hour \((N\$)\) | 15 450 | 6 474 | Fishing costs divided by annual fishing hours |
| Operating costs in a factory \((N\$ per quota tonne) \((FO)\)\) | 100 | 5 000 | The freezer factory only repacks, so overheads are low. Wetfish costs are estimated from data obtained from the fishing industry |
| Discount rate \((d)\) | 0.1 | 0.1 | |
| Annual increase in profit \((pc)\) | 0.05 | 0.05 | The profit is compounded by this each year (‘profit-creep’) |
indicates how excessive effort can simultaneously raise the costs per unit and lower average revenues.

Namibia is a price-taker (i.e. the industry has no control to dictate prices; their selling transactions have no effect) in the world market for hake, making exchange rates and production costs particularly important drivers of profitability. Historically, Spain has been Namibia's main market for hake (Rey and Grobler 2011), so as the N$ strengthens against the €, so revenues fall. This effect was especially severe in the years 2003–2005 and again post-2009 (Figure 2a). Further, Spain’s recent economic downturn has caused demand for the relatively expensive Namibian hake to decrease (Steenkamp 2012), further damaging Namibian revenues.

Demersal trawling is fuel-intensive. It is therefore unsurprising that the oil price is a source of rent volatility. For the wetfish segment, and at 2007 prices, wages constituted about 30% of the total expenses, followed by fuel at 20%. At that time, the annual average fuel price was N$6.4 per litre (€0.6/US$0.76) (MFMR unpublished data, released in 2007). Wetfish vessels stay at sea no longer than seven days, so a large proportion of their fuel is used in travelling to and from the fishing grounds. Although freezer trawlers stay out longer (up to three months), they are even more fuel-intensive (typically 35–40% of their operating costs) because they use fuel to run the processing plant on the vessel. When the N$ was strong it partly compensated for high fuel costs, but this benefit was outweighed by the negative impact on export revenues. Since then, fuel’s share of fishing costs has been driven up by sharp rises in the price of oil and the rapid weakening of the N$ (Figure 2a, b).

Nature, politics and economics all make fishing risky (Figure 2), and vessel/factory owners need to perceive a potential benefit that will compensate for the level of risk they are taking. The opportunity cost of capital (‘normal profit’) is the cost of borrowing capital plus an appropriate risk premium. In her work on fisheries satellite accounts for Namibia, Lange (2000) set the opportunity cost of capital at 30%. Although it would be reasonable to follow Lange’s lead, 10–12% is the standard elsewhere in the developing world (IPCC 2001), but that level does not recognise the special risks implicit in fishing. Unfortunately, data on capital costs in the Namibian hake sector are not available, so a conventional ‘normal’ profit cannot be calculated. Instead, to represent opportunity costs, a 10% addition has been added here to operating costs, and the remaining ‘abnormal’ profit, if any, has been regarded as additional resource rent (rent above that which the industry pays for quota fees, corporate tax and contributions to the research fund [Kirchner and Leiman 2014]).

Information on the total revenue and costs was collected from the hake industry. The response rate of 50% could be a source of inaccuracy in the interpretation of the state of the hake industry, especially in segments whose population sizes are very small, e.g. freezer trawlers and fish processing plants. In addition, some of the provided information was variable in quality (see for example ‘cost per tonne’ in Figure 3). It is likely that the data provided by vessels 5, 19, 21 and 23 are incorrect, as they indicate considerably higher costs than the others. Similar variations were found throughout the dataset.

Table 3: The percentage of hake <35 cm long caught by the Namibian fishery by weight and number

| Year | Total catch (x 10³ t) | Weight (%) | Number (%) |
|------|-----------------------|------------|------------|
| 1998 | 107                   | 5          | 20         |
| 1999 | 158                   | 12         | 34         |
| 2000 | 171                   | 9          | 24         |
| 2001 | 174                   | 17         | 43         |
| 2002 | 156                   | 28         | 64         |
| 2003 | 189                   | 25         | 52         |
| 2004 | 174                   | 24         | 58         |
| 2005 | 148                   | 29         | 62         |
| 2006 | 137                   | 34         | 69         |
| 2007 | 126                   | 29         | 63         |
| 2008 | 126                   | 16         | 38         |
| 2009 | 145                   | 30         | 71         |

Source: Ministry of Fisheries and Marine Resources (MFMR) TAC reports.

4 A normal profit (opportunity cost) is the potential profit, if time and money would be invested elsewhere (Carbaugh 2006)

Figure 3: The cost per tonne of hake in 2009 for the 31 wetfish vessels that responded to the questionnaire
The data indicate that many of the wetfish vessels are either underutilised or did not report the total quota caught. Figure 4 indicates how the cost per tonne decreases substantially as the annual quota caught by individual vessels increases. Some of the outliers are obvious in Figures 3 and 4, and by visual inspection alone it appears that a cost per tonne between N$6 000 and N$10 000 for wetfish vessels is probably a reasonable estimate. Wetfish vessel costs of more than N$15 000 per tonne do not seem plausible. For the 2007–2009 quota years, an average of N$10 994 (CV 0.10) was estimated if all the data were included, which declined to N$9328 (CV 0.08) when only vessels that caught more than 1 000 t were averaged.

Two of the five processing plants reported higher costs per tonne than the other three (Figure 5a); the costs averaged N$5 806 (CV 0.19) per quota tonne. The average cost per tonne for a wetfish vessel (N$10 994 [CV 0.10]) has to be added to the average cost of the processing plant per quota tonne to obtain the total cost of catching and processing a wetfish quota tonne, which totalled N$16 800; 10% of this value was considered as opportunity costs and added to the total costs (Table 4). Product price per tonne ranged between N$11 000 and N$25 000 per quota tonne (Figure 5b), with an average of N$17 331 (CV 0.10) (Table 4); this variability in price could be due to the plants producing different products. Once the opportunity costs per tonne (10% of costs) are added to the operating costs, it is shown that the wetfish fishery is short by N$1 149 per tonne for achieving its normal profit (Table 4).

Only six of the 12 freezer vessels submitted data (Figure 6a) and some of the reported costs appear to be unreasonably high. All freezer vessels reported catching 3 000 t or more of hake per year and Figure 6 suggests that costs decrease substantially if >4 000 t are caught (i.e. when fixed overheads are spread more widely). The average cost per freezer quota tonne was calculated as N$13 270 (CV 0.08) per tonne whereas the average price of hake product landed from freezer trawlers was reported to be N$13 940 (CV 0.14) per tonne (Table 5). However, the reported price was highly variable (Figure 6b), with one enterprise reporting prices >N$20 000 per tonne, well exceeding the prices for product from the wetfish processing plants.

The results obtained from the six freezer vessels (Table 5) also showed an annual deficit of normal profit of N$657 per quota tonne from 2007 to 2009. Given a TAC that year (2010) of 140 000 t, of which 30% was awarded to the freezer fleet (i.e. 42 000 t), the resulting annual accounting profit (revenue-operating costs) would have been N$28.14 million. For the wetfish fleet (Table 4), an accounting profit of N$531 per quota tonne is estimated, providing N$220 million for the freezer industry to be compensated for their opportunity costs, they should have made in the order of N$220 million.

The potential for efficiency gains is shown by excluding wetfish vessels that land <1 000 t (Figure 3). Average vessel costs then fall to N$9328 (CV 0.08) per tonne, which means that after ‘normal’ profit has been deducted (10% of the total cost), the economic rent/additional resource rent for the wetfish sector would have averaged ~N$67 million per year between 2007 and 2009.

![Figure 4: The quota tonnes caught by Namibian wetfish vessels and the cost thereof from 2007 to 2009](image1)

![Figure 5: (a) Costs and (b) prices per tonne for the processing of wetfish catches of hake from 2007 to 2009 (n = 5)](image2)
Setting the input parameters of the bio-economic model required a number of assumptions to be made (Table 1). The cost of a freezer vessel is about 4x that of a wetfish vessel and the price received for freezer vessel product is typically less than that of wetfish product. The annual costs of running a freezer vessel were set at N$50 million and wetfish vessels at N$15 million. The price received per quota tonne of hake by freezer vessels was externally set at N$15 000 (approximate price for 2009), and for wetfish vessels N$17 500. The net present value profit stream for the hake industry (with and without ‘profit-creep’) was calculated for different management scenarios (Table 2) over 20 years and is compared in Figure 7.

The TAC in 2010 was 140 000 t. Maintaining it at that level for the following 20 years (Scenario 11) yields the lowest NPV of all the scenarios. The profit would decrease after only three years and become negative in 20 years (Figure 8). The highest NPV would be provided by closing the fishery for three years and then fishing it at 80% of mean RY computed over the preceding five years (Scenario 8), but the closure of the fishery is obviously not feasible. Scenario 1, which politically seems the most acceptable, suggests fishing the resource at 80% of RY on an annual basis (Figure 9); the discounted profit stream only declines slightly before starting to rise again. From the analysis it seems unlikely that the TAC will exceed 150 000 t at the end of 20 years under any of these management scenarios. Discounted resource rent to be expected is some N$550 million or N$200 million in 20 years (Scenario 1) with and without the inclusion of ‘profit-creep’, respectively, with ~N$300 million lost on an annual basis by the resource being depressed.

As the resource increases, CPUE will increase, which will result in a drop in the number of vessels and consequently employees needed by the fishery. If Scenario 1 (20% of RY used to rebuild the resource) is followed, the number of freezer vessels would decrease from 16 to 7, wetfish vessels from 71 to 30, and the total number of employees by ~1 000. Overall, though, the CPUE would increase by 2.6 times over the 20-year period.

Using the information collected in this study from the fishing industry indicates that the current total accounting profit would be some N$80 million. Taking the model results, the present value for 2010 for Scenario 1 would be estimated to be N$240 million. Marsden and Sumaila (2008) estimated the resource rent to be N$222 million.

Table 5: Results based on robust data collected from the fishing industry for freezer vessels (n = 6), averaged for 2007–2009, with the CV in parenthesis. Imputed normal profit is taken as 10% of overall costs

| Parameter                        | Value (N$)                  |
|---------------------------------|-----------------------------|
| Average price per quota tonne   | 13 940 (0.14)               |
| Average costs per tonne (factory) | 13 270 (0.08)               |
| Accounting profit               | 670                         |
| Imputed normal profit per tonne | 1 327                       |
| Abnormal profit per tonne       | −657                        |

Table 4: Results based on robust data collected from the fishing industry for wetfish vessels (n = 31) and factory owners (n = 5), averaged for 2007–2009, with the CV in parenthesis. Imputed normal profit is taken as 10% of overall costs

| Parameter                        | All data included | Vessels that caught more than 1 000 t |
|---------------------------------|-------------------|--------------------------------------|
| Average price per quota tonne   | 17 331 (0.10)     | 17 331 (0.10)                        |
| Average costs per tonne (factory) | 5 806 (0.19)     | 5 806 (0.19)                        |
| Average costs per tonne (vessel) | 10 994 (0.10)    | 9 328 (0.08)                        |
| Total operational costs (N$)    | 16 800            | 15 134                               |
| Accounting profit (N$)          | 531               | 2 197                                |
| Imputed normal profit per tonne | 1 680             | 1 513                                |
| Abnormal profit per tonne       | −1 149            | 684                                  |

Figure 6: (a) Costs and (b) prices per tonne for freezer vessels processing hake from 2007 to 2009
Similar to the estimate of N$227.5 million obtained using the de facto selling price quota (Kirchner and Leiman 2014), although Namibia’s market for quota is inefficient, and such a valuation exceeded expectations. Net present value (for the base case) for the different management scenarios ranged from N$4.4 billion (Scenario 11) to N$15.6 billion (Scenario 7). NPV for Scenario 1 is estimated to be some N$10 billion over 20 years, a value also estimated by Sumaila (2000, 2001). However, this could only be achieved if the wetfish fishery aligns itself into a more profitable arrangement over the next 20 years. For the current situation, the NPV for Scenario 1 would be only ~N$6 billion (Figure 7).

Discussion

The most influential factor driving the hake industry’s revenue is the exchange rate (ZAR [South African Rand] to the €). Because most of Namibia’s hake resource is exported to Europe, in particular to Spain (Rey and Grobler 2011). For example if Namibia exports 50 000 t of hake valued at €2 kg\(^{-1}\) at an exchange rate of N$10 = €1, and the N$ strengthens by 50 c, Namibia would lose about N$50 million. Indeed, in 2010, the N$ was strong against the €, so the hake industry was foregoing considerable revenue. In weakening by >25% against the € recently, the industry has benefitted.

The labour intensiveness of the Namibian operation means that the wetfish sector’s greatest expense is its wage bill. For that reason, rights-holders are often successful when they approach the Ministry of Fisheries for additional quota and threaten that ‘workers will otherwise have to be laid off’. Such a short-term approach by industry has worked in the past, but it is detrimental to the biological resource and hence to future rents and employment.

Fuel also contributes extensively to the cost, so it would be of great value if rights-holders could work more closely together in order to rationalise such costs. Fishing vessels, however, especially those in the wetfish sector, are not used particularly efficiently (see also Kirchner and Leiman 2014), keeping the cost per tonne of hake high. Figure 4 shows that vessels that catch more than 1 000 t annually are able to keep their costs below N$10 000 per tonne. Another confounding factor is that some fish processing plants have much higher costs than others; it is possible for plants to operate at about N$5 000 per tonne, allowing a break-even price of N$15 000 per quota tonne for the best-performing wetfish vessels and plants. Unfortunately, the data provided for this study reveal that some operators are struggling to survive and that many are actually making a loss at the current time (2007–2009).

Only six of the 12 freezer vessel owners responded to the survey, but contrary to popular belief, those six freezer vessels are struggling to make a ‘normal’ profit ($28.14

The N$ is tied to the ZAR which has oscillated between strong and weak for many years in the past (Figure 2a). Despite this, the fishing industry has survived.
million), which represents only 5% of the total costs, half of their opportunity costs. One reason is that few vessel owners have sufficient quota to utilise their vessels optimally. As a result they are forced to lease quota, the cost of which can make up 20% of their total expenses. Most rights-holders have a small amount of freezer quota, which is sold informally to the 'highest bidder'. Freezer operators made an average accounting profit of N$670 per quota tonne over the years 2007–2009. The non-operating quota-holders, on the other hand, sell their freezer quota at a price of N$2 000–N$2 500, and other than a low quota fee (wetfish quota, N$600; freezer quota, N$850 per quota tonne) and corporate tax, they face no expenses and avoid the risks involved in the fishing operation. The wetfish fishery made only one third of its expected normal profit during the sampled time period. This means that if it invested its money in the bank it would get a better return with less risk on its investment. In order to run the bio-economic model, average values, such as the cost per fishing hour, are needed to evaluate the viability of the fishing methods. Some of the data provided for this analysis by industry may well be of doubtful accuracy, but the function of the model is to compare alternative management scenarios, so the relative magnitude of the figures is more important than their absolute values. If one is willing to accept the industry’s stated estimates of productivity and assumes additional innovative streamlining in the wetfish fishery, then approximately N$300 million annually in sustainable harvests is being lost due to the stock currently being depressed. The model does make it clear that increasing the pressure on the stock can maintain jobs and foreign exchange flow in the short term, but it will result in much lower overall benefit in the long term. Responsible management, i.e. mainly in the form of rebuilding the stock, would be in the best interests of all.

In the past, TAC recommendations were considered only in biological terms and only current returns were taken into account. The trade-offs between present and future jobs and income have never been evaluated rigorously. Incorporating such economic information, although there are reservations about the accuracy of some of the commercial data and model assumptions, does reveal the likely costs of mismanagement. The stock externality (unintended cost incurred by the industry) caused by there being excess effort for the TAC may be more easily recognised by industry members than the cost of mismanagement in Namibia’s post-Independence hake fishery. Fisheries Centre Working paper 2008-05. University of British Columbia, Vancouver.

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