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An economic comparison of the commercial and recreational line fisheries in Namibia

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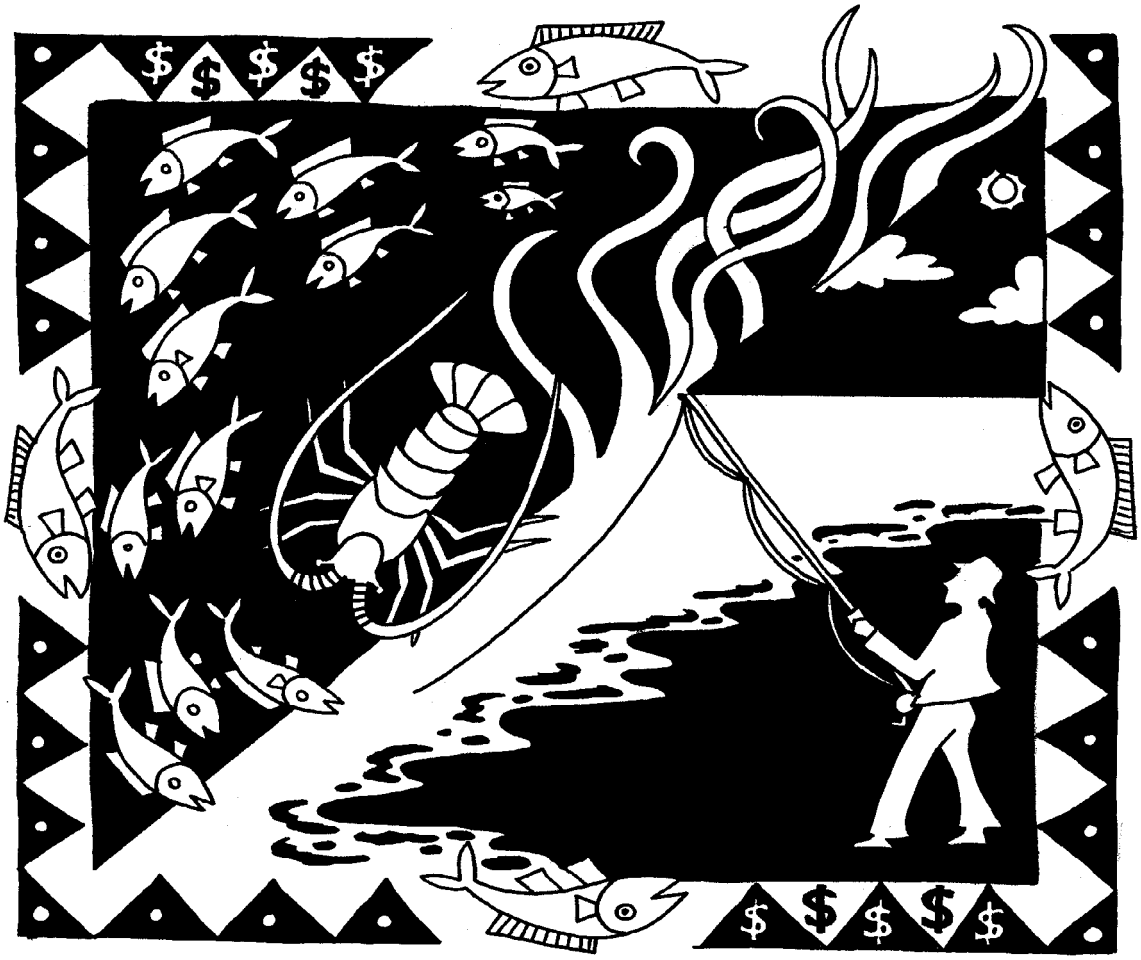

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Abbreviations

GNP gross national product

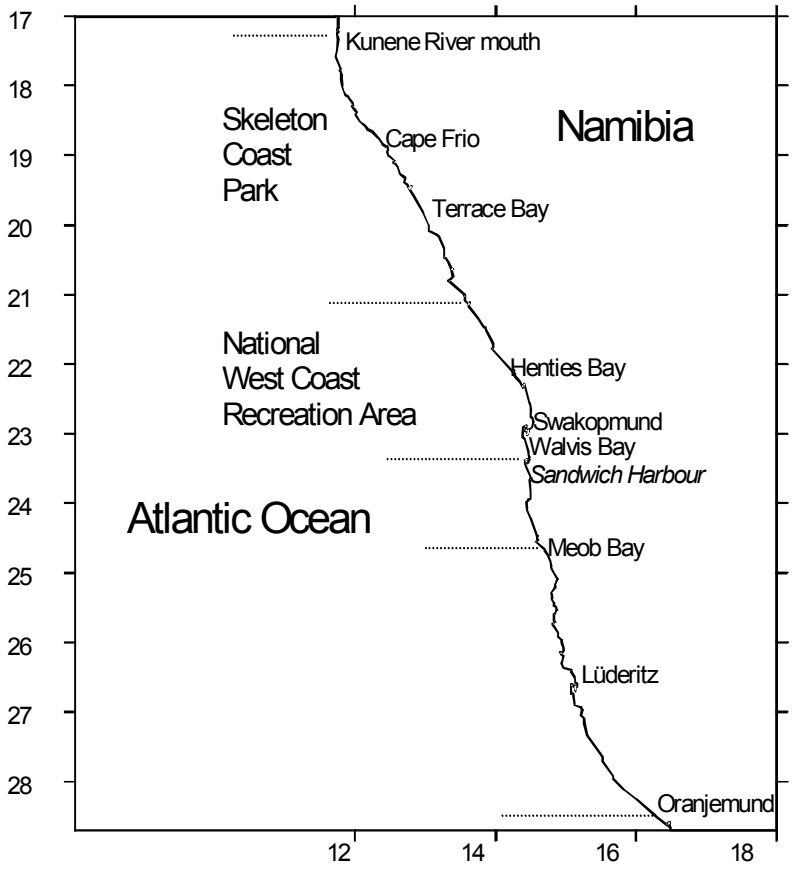
Abstract

*The most important Namibian line-fish species, the silver kob (*Argyrosomus inodorus*), is currently heavily exploited. In order to guarantee its survival, catch restrictions are being introduced. However, the kob is exploited both by recreational shore anglers and by commercial line-fishing vessels, and it is important to examine the economics of these fisheries in order to see where catch restrictions will do the least harm to the economy. We use data from a survey of commercial fishing vessels and compare our results with those from earlier surveys of recreational shore anglers in order to determine economic values and impacts from both fisheries sectors. We find that the economic benefits are greatest in recreational shore angling, less in commercial line fishing by large vessels, and least in commercial ski-boat line fishing. We also find that catch restrictions will do less harm to the economy if carried out in the commercial line-fishing sector than if carried out in recreational shore angling.*

1. INTRODUCTION

Shore angling in Namibia is restricted to approximately one-quarter of the 1,500 km coastline. Over 90% of the recreational shore angling[1] in the country takes place in the National West Coast Recreation Area, primarily in the vicinity of the three coastal towns of Henties Bay, Swakopmund and Walvis Bay (see Figure 1). Some limited shore angling also takes place further north at Terrace Bay and Torra Bay in the Skeleton Coast Park, in the south near Lüderitz, and near Oranjemund at the border with South Africa. Among the variety of species targeted by shore anglers, silver kob or kabeljou (*Argyrosomus inodorus*), west coast steenbras (*Lithognathus aureti*), galjoen (*Dichistius capensis*) and blacktail or dassie (*Diplodus sargus*) are the most important, though some shark species are also caught (Kirchner et al., 2000; Zeybrandt & Barnes, 2001). The Namibian coast was once legendary for the large catches regularly made by recreational shore anglers, with dozens of fish being caught per person on an average angling day. The average catch has gone down considerably since then, but angling along Namibia's coastline is still considered to be among the best in the world.

Figure 1. Map of the Namibian coastline



Commercial line fishing is carried out by ski boats and larger vessels. It is limited to vessels with a government permit, but permits are handed out freely and the number of registered permit holders in the sector has more than doubled in the past ten years. The main species

[1] Nearly all coastal angling is for recreational purposes. Subsistence angling is very limited along the coast and is ignored in this study.

targeted by commercial line fishing are kob and snoek (*Thyrsites atun*), though other species such as steenbras are also caught. Snoek, a migratory species, is caught by Namibian and South African line-fishing vessels (Attwood & Farquhar, 1999; Crawford et al., 1990). The Namibian kob is also a migratory species. It is found in Namibian waters throughout its lifespan (Kirchner & Holtzhausen, 2001), but in the coastal areas open to shore anglers, the very young (less than four years) and very old kob (more than ten years) dominate. These age classes are predominant in shore anglers' catches, therefore, while commercial fisheries also catch kob from the intermediate age classes in large numbers. Shore anglers and commercial line fishers catch roughly equal numbers of kob (Kirchner & Beyer, 1999), but since the kob caught by shore anglers are, on average, younger and smaller than those caught by the commercial line fisheries, the total mass in kilograms of kob caught by shore anglers is substantially less than that caught by commercial line fishers.

The kob has become heavily exploited, and there is concern that stocks are becoming depleted (Holtzhausen et al., 2001; Kirchner, 2001). If the kob resources are to be preserved, it will probably be necessary to regulate their exploitation. In order to minimise the negative impacts on the Namibian economy, these regulations should be based on a solid understanding of not only the biological, but also the economic aspects of the kob fisheries.

In 2001, the bag limit for recreational shore anglers was reduced to 10 fish per day and a fishing licence fee of N$14 per month[2] was introduced. However, these restrictions and fees are not believed to be enough to halt the decline of the stocks. Most shore anglers catch far less than the total catch limit in any case, and experiences from South Africa (Attwood & Bennett, 1995) suggest that restricting total catches, rather than the catches of individual species, can be an ineffective method of protection. The new Namibian regulations, therefore, also include size limits on kob catches: shore anglers are obliged by law to release any kob smaller than 40 cm and are only permitted to catch two large kob (defined as larger than 70 cm) per shore-angling day. The rationale for limiting catches of large kob is that these are important for spawning and, thus, for the regeneration of the stock (Kirchner et al., 2001).

The decline in fish stocks and the large number of new entrants to the commercial line-fishing industry has led to lower profitability. Apart from the new regulations on recreational shore angling, therefore, regulation of the commercial line-fishing sector has also been discussed. Regulations could entail reducing the number of permit holders or introducing size limits, total allowable catches, and/or closed seasons (Holtzhausen et al., 2001; Kirchner, 2001). So far, however, commercial line fishing is not subject to any restrictions other than the permit requirement.

Commercial line fishing and recreational shore angling both have economic impacts on the coastal economy that go beyond the direct incomes generated. Commercial line fishing generates profits for boat-owners, income for their employees, and revenue for other firms that sell inputs to the commercial line-fishing firms. Income is spent on goods and services, generating income and employment for others. Similarly, shore anglers spend money on a number of goods and services connected to their shore angling, generating revenue for the firms and employment for the people involved in selling such items to them. In order to evaluate the relative economic importance of the different fisheries and determine where catch limits would do the least harm, it is not enough, therefore, to study what direct incomes

[2] At the time of writing, one Namibia Dollar (N$1) is the equivalent of one South African Rand (R1) or 0.15 US Dollars.

are generated. It is also necessary to look at the indirect effects caused by linkages from these activities to the rest of the economy. This is typically analysed using multiplier effects either from input-output tables (see McGrath et al., 1997, for an example from the South African line-fishing industry), or from social accounting matrices, which capture more of the indirect effects than input-output tables do and, thus, provide a more complete picture. Such multiplier calculations have not been feasible for Namibian line fishing until now, because Namibia has not had an input-output table or a social accounting matrix showing the detailed linkages between different sectors in the economy. However, there is now ongoing work (Lange et al., 2004) on compiling such a matrix for Namibia and, by using preliminary figures from this work, it is now possible to compare the overall economic impacts of recreational shore angling and commercial line fishing.

2. OBJECTIVES OF THE STUDY AND METHODS EMPLOYED

The Ministry of Fisheries and Marine Resources carries out a survey of the fishing industry each year in order to provide data for economic analysis. In principle, all Namibian fishing companies are required by law to participate in this survey. However, in respect of all the fishing subsectors – including line fishing – compliance with this regulation has been limited.

In order to provide data for a more detailed study of profitability in commercial line fishing, therefore, a separate survey was carried out. This survey was based on the official one, but fewer items were included. Information was collected on catches of kob, snoek, steenbras and other fish (measured in kilogram), and on the revenue generated from each of these species. The survey also collected information on different types of variable expenditure such as labour and fuel, on what quantities of each of these items were used, and on capital stock and capital expenditure. The survey was carried out in late 2002 and covered the period from 1995 through 2001.

The economics of Namibia's recreational shore angling has been analysed in several previous studies (see Barnes et al., 2004, for an overview), providing the necessary economic information for a comparison with the commercial fisheries. A survey was carried out from 1996 to 1997 to determine different shore-angler groups' expenditure on various items related to this activity. Overall figures were reported in Kirchner et al. (2000), where a rough estimate of multiplier effects (based on national accounts data and aggregate expenditure information) was also made. The collected expenditure information was subdivided by category, although the breakdown was not reported in that study. In order to make these expenditure figures comparable to those for commercial line fishing, they were inflated from 1996/97 to 2001 price levels. Where available, item-specific price indices were used; where they were not available, the consumer price index was used. With these inflated expenditure figures, it was possible to use the preliminary social accounting matrix to calculate the backward multipliers for each shore-angling group and see what the effect was on gross national product (GNP).

3. RESULTS

3.1 Economic impacts and values generated by commercial line fishing

At the time of the survey, 20 firms were registered as permit holders in the line-fishing industry; 7 of these were ski-boat operators, and 13 were larger commercial vessels. Out of the 20, 4 (1 ski-boat operator and 3 of the larger firms) could not be reached during the time

that the survey was being carried out, and 5 (2 of the ski-boat operators and 3 of the larger firms) had ceased operations. In the end, therefore, the data set included only 11 line-fishing companies.

Several of the surveyed firms reported years in which they had made net losses. In some cases firms even reported years in which they had run operating deficits, giving an indication of the uncertainty in the industry. A number of firms also expressed concern that fish stocks could not support the current fishing pressure and that line fishing was becoming unprofitable. One proprietor noted that some commercial vessels had begun catching sharks, which were previously only caught by recreational shore anglers. While shore anglers normally released sharks after capture, however, commercial fishermen did not. The interviewee expressed concern that, with the new pressure from commercial fishing, the shark stocks would also become depleted.

The total multiplier effects on the economy were calculated for 2001, based on the nine commercial line-fishing enterprises (four ski boats and five larger commercial vessels) that were able to provide complete data for that year. The estimates are given in Table 1 below.

Table 1. Direct and indirect economic impacts of the commercial line-fishing sectors, 2001

Economic impact	Larger commercial vessels (N$ million)	Ski boats (N$ million)	Total (N$ million)
Direct contribution to GNP	6.6	0.4	7.0
Total GNP generated	12.8	1.2	14.0

Source: Survey data and authors' calculations, scaled in order to account for the firms that did not respond to the survey.

If one assumed that the nine firms responding to the survey were representative of all 15 firms that had not officially ceased operations, the total economic impact of the commercial line fishery was to increase GNP by approximately N$14 million in 2001. The ski-boat sector accounted for about N$1.2 million, with the larger vessels accounting for the rest.

However, the overall economic contribution from commercial fishing does not, in itself, give a clear indication of what the economic effects would be if commercial fishing were reduced. If regulations were introduced, firms would adapt their behaviour, not only by catching less kob, but also by changing their catches of other species and by altering their use of labour and other inputs. Thus, in order to determine the economic impact of a reduction in commercial fishing, one needs to examine the structure of production in the commercial fisheries so that the effects of changes in catches, rather than overall catches, can be determined. This can be done by estimating one or several supply and/or demand functions for the firms' various outputs and inputs, as functions of the prices of these outputs and inputs (Squires & Kirkley, 1991).

There are a variety of different functional forms available for estimating output functions for a multi-output, multi-input firm such as a fishing company (see Sadoulet & De Janvry, 1995 for an overview). In this study, three different functional forms were used: the translog, the generalised Leontief, and the normalised quadratic. All three have frequently been used in economic studies of fisheries.

The kob supply functions for the two fisheries were, therefore, estimated as follows:

$$q = \frac{\pi}{p_1}\left(a + b_1 \ln\left(\frac{p_1}{p_4}\right) + b_2 \ln\left(\frac{p_2}{p_4}\right) + b_3 \ln\left(\frac{p_3}{p_4}\right) + c \ln z\right) \qquad \text{(1; translog)}$$

$$q = b_1 + b_2\sqrt{\frac{p_2}{p_1}} + b_3\sqrt{\frac{p_3}{p_1}} + b_4\sqrt{\frac{p_4}{p_1}} + cz \qquad \text{(2; generalised Leontief)}$$

$$q = a + b_1\frac{p_1}{p_4} + b_2\frac{p_2}{p_4} + b_3\frac{p_3}{p_4} + cz \qquad \text{(3; normalised quadratic)}$$

where π is the operating surplus, and a, b_i and c denote statistical coefficients. The symbols p_1, p_2, p_3 and p_4, respectively, denote prices of kob per kilogram, the average price of other fish per kilogram, the average costs of labour per full-time working year, and a price index for other variable input factors. For simplicity, this price index was set to 1 for the year 2001. The firms' capital stocks, z, primarily consisted of the estimated values of the fishing vessels used, and were assumed to be fixed for the duration of each fishing season. Firms are assumed to operate with the aim of covering at least their short-term operation costs; when they do not, this is generally caused either by unexpectedly poor catches due to unpredictable variation in fish availability, or by poor management. Observations where firms reported operating deficits were, therefore, removed from the sample, as they did not give a representative picture of best-practice fishing technology. This reduced the number of observations to 13 for the larger fishing vessels, and 8 for the ski boats.

The results of estimating equations (1) through (3) above for the larger line-fishing vessels are shown in Table 2.

Table 2. Results from an estimation of the kob supply equation for the larger commercial line-fishing vessels, 2001

Coefficient	Translog	Generalised Leontief	Normalised quadratic
a	-7.941	Not applicable	-28,193.600
	(36.017)	Not applicable	(84,049.600)
b_1	1.909	109,330	2,445.230
	(18.086)	(189,787)	(8,864.140)
b_2	-2.420	176,747	7,535.340
	(8.173)	(154,874)	(6,584.570)
b_3	4.865	89.49	-0.003
	(3.666)	(848.83)	(0.856)
b_4	Not applicable	-664,938	Not applicable
	Not applicable	(683,892)	Not applicable
c	-2.663	-0.0097	-0.011
	(3.745)	(0.0242)	(0.024)
R^2	0.209	0.2745	0.288

Note: Numbers in brackets denote standard errors.

The statistical fit, measured by R^2 (the share of the variation in the data explained by the estimated equations), is poor for all three functional forms, but the normalised quadratic outperforms the other two forms. For all three functional forms, most of the estimated

coefficients (notably, the b_1 coefficient related to the kob price, which is expected to be positive) were consistent with economic production theory.

For the ski-boat sector, the statistical fit was substantially better for all three functional forms (Table 3), although the translog form – which had the worst fit – produced several coefficients that were not consistent with economic production theory. The normalised quadratic functional form performed best for the ski-boat sector as well.

Table 3. Results from an estimation of the kob supply equation for commercial ski boats, 2001

Coefficient	Translog	Generalised Leontief	Normalised quadratic
a	-3.774	Not applicable	20,497.0
	(3.962)	Not applicable	(2,969.92)
b_1	-0.495	57,667.600	2,156.64
	(1.641)	(9,110.020)	(357.963)
b_2	-0.617	-71,481.500	-3,265.38
	(1.356)	(8,268.060)	(365.167)
b_3	0.685	-710.571	-1.3775
	(0.433)	(108.107)	(0.2005)
b_4	Not applicable	91,749	Not applicable
	Not applicable	(21,665)	Not applicable
c	0.167	-0.004	-0.0025
	(0.153)	(0.003)	(0.0028)
R^2	0.916	0.970	0.9730

Note: Numbers in brackets denote standard errors.

Using the normalised quadratic estimates, since they fit the data best, it is possible to estimate the economic impacts of the different regulatory policies being discussed. As for recreational shore angling, a minimum kob size of 40 cm has been discussed. In a line-fishing operation, however, the scope for gear selectivity is rather limited; so as with recreational shore angling, size limits would have to be implemented by returning smaller fish to the water after capture – rather than by introducing gear that permits smaller fish to escape on their own. A decrease in overall fishing pressure has also been discussed (Kirchner, 2001, suggests a 25% reduction), which could be achieved either by limiting the total catch for each vessel or by decreasing the number of vessels. A combination of minimum size restrictions and reduced overall fishing pressure could also be carried out. Estimates of the direct and total impacts of these proposed policies are shown in Table 4.

Setting minimum size limits at 40 cm would reduce the direct GNP generated by the larger vessels by approximately 17%, but by almost half in the ski-boat sector, where small fish account for a larger share of the catch. An overall reduction in fishing pressure would have different impacts, depending on how it is carried out. Setting quotas to reduce fishing by each firm would cut profits for each firm, leading to a commercial line-fishing sector with even lower overall profitability, and to a loss of almost half of the direct GNP generated by the two subsectors. Reducing fishing by limiting the number of permit holders, on the other hand, would of course destroy the profits of the firms that lose their permits, but would not impact on the remaining firms. The overall economic loss would, therefore, be less if reductions in overall fishing pressure are carried out by reducing the number of permit holders, rather than by reducing catches across the board for all firms.

Table 4. Estimated economic impacts of potential management options for the commercial line-fishing industry, 2001 prices

Potential management options	Larger commercial vessels		Ski boats	
	(N$ million)	%	(N$ million)	%
Direct GNP generation	**6.6**	100	**0.4**	100
Effect on direct GNP of –				
Minimum size limits	-1.1	-17	-0.2	-41
Reducing fishing pressure by 25% across the board	-2.9	-43	-0.2	-43
Reducing fishing pressure by 25% by reducing the number of permits issued	-1.6	-25	-0.1	-25
Minimum size limits and reducing fishing pressure by 25% across the board	-3.5	-53	-0.3	-72
Minimum size limits and reducing fishing pressure by 25% by reducing the number of permits issued	-2.5	-37	-0.2	-56
Total GNP generation	**12.8**	100	**1.2**	100
Effect on total GNP of –				
Minimum size limits	-1.6	-13	-0.2	-17
Reducing fishing pressure by 25% across the board	-4.2	-33	-0.2	-18
Reducing fishing pressure by 25% by reducing the number of permits issued	-3.2	-25	-0.3	-25
Minimum size limits and reducing fishing pressure by 25% across the board	-5.2	-41	-0.4	-31
Minimum size limits and reducing fishing pressure by 25% by reducing the number of permits issued	-4.4	-34	-0.5	-38

A combination of size limits and decreased fishing pressure for those fish large enough to still be caught would further reduce the economic gains from the commercial line fishing sector. With multiplier effects included, the total economic impacts of the various proposed catch restrictions would be to decrease overall GNP by between N$2 and N$6 million, depending on the restrictions chosen and on how they are implemented.

3.2 Economic impacts and values generated by recreational shore angling

As mentioned previously, shore-angling expenditure figures from a 1996–1997 survey were inflated to approximate 2001 levels. Using these inflated figures, the effect on GNP was calculated (Table 5).

Apart from the increase in the price levels, the calculated effects are smaller than the crude estimates made in Kirchner et al. (2000), especially the estimated impact of foreign shore anglers. This is because a large share of shore-angling expenditure consists of fuel costs related to travel to and along the coast; since all fuel is imported, this expenditure has little impact on the Namibian economy – except for increasing government tax revenue. Despite this, the estimated overall economic impact of recreational shore angling is considerably larger than the overall economic impact of commercial line fishing.

Table 5. Estimated number of shore anglers and shore-angling days, amount of daily and total expenditure, and economic impacts in the shore-angling fishery, 1996–1997 (inflated to 2001 prices)

Shore-angling area and group	No. of shore anglers	No. of shore-angling days	Expen-diture per shore-angling day (N$)	Total expen-diture (N$ million)	GNP generated per shore-angling day (N$)	Total GNP generated (N$ million)
National West Coast Recreation Area						
Coastal Namibians	1,279	52,929	153	8.1	36	1.9
Inland Namibians	3,156	37,579	343	12.9	200	7.5
Foreigners	3,836	70,953	316	22.5	171	12.1
Terrace Bay	231	5,110	447	2.3	268	1.4
Torra Bay	296	6,540	328	2.1	147	1.0
Total	8,798	173,111	276	47.9	138	23.9

Notes:

1. See text for a discussion of why the figures for GNP generation by shore anglers of Namibian origin may not be relevant for a comparison between different fishing activities.
2. Anglers at Terrace Bay and Torra Bay were not subdivided by origin in the survey, but it may be noted that these groups are in any case substantially smaller than the others.

Arguably, if the shore-angling activity had not been available, Namibian shore anglers would probably have spent their money on something else. This expenditure would then have generated multiplier effects in turn (see McGrath et al., 1997 and Storey & Allen, 1993 for a discussion of this issue). According to this line of reasoning, coastal Namibians would have had other expenditure in the coastal region, creating economic impacts of roughly the same size as those from shore angling. Inland Namibians would presumably have spent their money on other activities in Namibia (though perhaps not in the coastal region), so their expenditure would also have generated multiplier effects within the Namibian economy. Certain foreign tourists, however, are attracted to Namibia by the shore angling, and if this activity had not been available they would have spent their money elsewhere.

With this line of reasoning, therefore, when examining the overall effect of shore anglers' expenditure on Namibia's economy, one should only consider the multiplier effects associated with foreign shore-anglers' expenditure. For effects on the coastal economy, one should only consider the multiplier effects from foreign shore anglers and shore anglers from other parts of Namibia, and exclude the effects of the expenditure of shore anglers that live at the coast.

On the other hand, in addition to the multiplier effects there is the value of the additional satisfaction created for shore anglers – over and above the amounts that they actually pay. The value of this additional satisfaction is usually measured using the concept of *consumer surplus*, that is, the sum of the additional amounts that shore anglers would have been willing to pay for their chosen activity, over and above the amounts that they actually paid. The consumer surplus created for Namibian shore anglers benefits members of the Namibian economy and should, thus, be included in a complete economic consideration of the management of this fishery. As for foreign shore anglers, since their consumer surplus does not create any benefits for the Namibian economy, it should not be included in estimates of

the value generated for Namibia.[3] The consumer surpluses created for different shore-angler groups have been estimated in two previous studies (Kirchner et al., 2000; Zeybrandt & Barnes, 2001) and are given in Table 6, with the figures inflated in order to account for the increase in price levels up to 2001. Zeybrandt and Barnes (2001) estimated the consumer surpluses for the shore-angler groups fishing in the National West Coast Recreation Area using two different methods: the travel cost method, and the contingent valuation method. The two methods produced largely similar estimates.

Table 6. Estimates of consumer surpluses for different shore-angler groups, 1996–1998 (inflated to 2001 prices)

Shore-angling area and group	No. of shore anglers	No. of shore-angling days	Consumer surplus per day (N$)	Total consumer surplus (N$ million)
National West Coast Recreation Area				
Coastal Namibians	1,279	52,929	199–251	10.5–13.3
Inland Namibians	3,156	37,579	155–163	5.8–6.1
Foreigners	3,836	70,953	127–220	9.0–15.6
Terrace Bay	231	5,110	189	1.0
Torra Bay	296	6,540	136	0.9
Total	8,798	173,111	157–213	27.2–36.9

Notes:
1. See text for a discussion of why consumer surplus estimates for foreign anglers may not be relevant for a comparison between different fishing activities.
2. Anglers at Terrace Bay and Torra Bay were not subdivided by origin in the survey, but are assumed in the analysis to be mostly of Namibian origin.

Conservative estimates of the total benefits to Namibia generated by the different shore-angler groups, and by the shore-angling sector as a whole, were then calculated. This was done using the sums of the value added generated for Namibia through multiplier effects induced by shore angling, and the lower estimates of the consumer surpluses generated for Namibian shore anglers. The estimated benefits are provided in Table 7.

Table 7 also provides average economic benefits per shore-angling day, and per kilogram of fish caught (based on estimates of daily catches from Zeybrandt, 1999), generated for Namibia by the different shore-angler groups. The benefit per kilogram of fish caught is lowest for the foreign tourists, mostly because of their larger catches, but even for this group the average benefit per kilogram caught is approximately N$19 per kilogram. For the Namibian groups the benefits are even higher.

The economic effects of catch constraints on shore angling can, in principle, be evaluated in the same way as for the commercial firms, by assessing the marginal benefits to the Namibian economy of reducing or increasing catch levels for each shore-angler group. Unfortunately, it is difficult to estimate the impact of the recently introduced size limits, because none of the surveys that have been carried out studied the effects that changes in the amount of fish caught have for the individual shore-angler's decision on how often to fish. This should,

[3] However, by measuring the consumer surplus of foreign shore anglers, one can get an idea of how much extra they would be prepared to pay for, e.g., licence fees.

therefore, be evaluated in future research, either through a new survey, or through studying the long-term changes in shore-angler numbers that result from the size limits.

Table 7. Conservative estimates of benefits to the Namibian economy generated by shore angling, 2001 prices

Shore-angling area and group	GNP generated (N$ million)	Consumer surplus remaining in Namibia (N$ million)	Total value for Namibia (N$ million)	Benefit per shore-angling day (N$)	Average catch per shore-angling day (kg)	Average benefit per kilogram caught (N$)
National West Coast Recreation Area						
Coastal Namibians	0.0	10.5	10.5	198.8	3.89	51.1
Inland Namibians	0.0	5.8	5.8	154.8	3.49	44.3
Foreigners	12.1	0.0	12.1	171.0	9.04	18.9
Terrace Bay	0.0	1.0	1.0	189.0	Not available	Not av.
Torra Bay	0.0	0.9	0.9	135.9	Not av.	Not av.
Total	12.1	18.2	30.3	205.6	Inestimable	Inestimable

Note: Data on average catches were not collected for the Terrace Bay and Torra Bay anglers, making it impossible to calculate average catches or average benefits for the entire shore-angling activity.

On the other hand, it is straightforward to evaluate the economic impacts of a hypothetical 25% reduction in shore-angling pressure, along the lines of the similar reduction studied for the commercial sector. Such a reduction could be carried out by raising licence fees drastically so that the number of shore anglers can be reduced (in which case the economic losses from reduced shore angling would be partly offset by increased government revenues from licence fees), or simply by introducing a limit on the number of shore-angling days permitted per fishing season (in which case there would be no offsetting gains).

If shore-angling pressure is decreased by 25% through the introduction of higher licence fees, the shore anglers that are discouraged from fishing will be those who have the lowest consumer surplus to begin with. Using the results from the travel-cost analysis carried out by Zeybrandt and Barnes (2001), we may conclude that the 25% decrease would be spread approximately equally among the three shore-angler groups – coastal Namibians, inland Namibians, and foreigners – with a slightly larger percentage reduction in the number of foreigners and a slightly smaller percentage reduction in the number of coastal Namibians. The economic impacts of such a reduction in shore angling in the National West Coast Recreation Area are shown in Table 8.

Reducing shore-angling pressure by 25% through higher licence fees would lead to overall losses for the Namibian economy of approximately N$7 million. The gains in government revenue would be small compared with the lost multiplier effects and the lost consumer surpluses. The size of these economic losses may be compared with the effect of reducing commercial fishing pressure by the same proportion, which (as shown earlier in Table 4) would have an overall impact of between N$3.5 and N$4.5 million, depending on how the reduction were carried out. Since the two fisheries catch roughly equal numbers of kob (but with the commercial sector catching more of the older and heavier kob), reducing fishing pressure by 25% would reduce the number of fish caught by roughly equal numbers – regardless of the sector in which the reduction was carried out. The overall costs to the

economy would, however, be substantially lower if the reduction were carried out in the commercial line-fishing sector.

Table 8. Estimated economic impacts of reducing the fishing pressure from shore anglers in the National West Coast Recreation Area by 25% through increased licence fees, 2001 prices

Shore-angler group	Impact on GNP generation (N$ million)	Impact on consumer surplus (N$ million)	Impact on total value for Namibia (N$ million)
Coastal Namibians	0.1	-2.3	-2.2
Inland Namibians	0.2	-1.8	-1.6
Foreigners	-3.2	0.0	-3.2
Total	-2.9	-4.1	-7.0

4. DISCUSSION

The commercial line-fishing and recreational shore-angling sectors catch roughly equal numbers of kob annually, but have considerably different impacts on the Namibian economy. The overall economic impact of commercial line fishing, when multiplier effects are included, is to increase GNP by approximately N$14 million. Conversely, shore angling increases GNP by over N$12 million through multiplier effects, and increases Namibians' consumer surplus by at least N$18 million, generating a total benefit of approximately N$30 million for the Namibian economy.

Reducing fishing pressure by 25% in either sector would have roughly similar effects in terms of reducing the numbers of kob caught. However, if the reduction were carried out in the commercial line-fishing sector, the overall economic losses would only be about half of what they would be if the reduction were carried out in the recreational shore-angling sector. Judging from this, to the extent that kob fishing needs to be reduced, the harm to the Namibian economy would be less if the cuts were made within the commercial line-fishing sector.

However, two caveats are in order:

- Firstly, the statistical analysis of the production structure in the commercial line fishery is based on very few observations, and many of the observations used to estimate the kob output functions for the commercial line fisheries were from 2000 and 2001. By that time, kob stocks were already in decline and profitability had fallen. Once stocks have recovered and profitability in the commercial sector improves, the economic benefits from those commercial line-fishing operations that have survived might become comparable with the benefits from shore angling. Also, if response rates to the annual fisheries surveys improve, data from these surveys can be used to assess profitability in the commercial line-fishing sector on a regular basis.

- Secondly, although calculating multiplier effects and overall impact on GNP is an important tool for evaluating a sector's economic importance, one drawback of this approach is that it neglects the issue of the capital already invested in the sector. If commercial line fishing is reduced quickly, part of the capital invested in the sector in the form of boats and equipment will become worthless, since it cannot easily be

transferred to other activities. The results above definitely suggest that further investment in commercial line fishing should be discouraged for the time being, and that firms already established in the sector should be discouraged from replacing their capital when it becomes run-down. However, this could be done in such a way that the capital already invested in the sector is not lost. For instance, charging gradually increasing catch fees would reduce catches and profitability, but would still permit firms to operate in the short term. If this were done, firms would run down the capital that they already have but would not reinvest, leading to a phasing out of the least profitable firms until overall fishing pressure has been reduced to levels that guarantee the long-term survival of the kob stock.

5. CONCLUSION

The goal of Namibia's fishing policy is to "utilize the country's fisheries resources on a sustainable basis and to develop industries based on them in a way that ensures their lasting contribution to the country's economy and overall development objectives" (Ministry of Fisheries and Marine Resources, 1991). At first glance, therefore, one might think that commercial line fishing is more important for fulfilling the long-term goals of the government's fishing policy: commercial line fishing generates easily noticed economic activity and creates visible employment, while recreational shore angling is just a hobby pursued by relatively well-off Namibians and foreigners. However, when the indirect effects and benefits of the two activities are also included in a comparison of the two sectors, the importance of recreational shore angling in terms of generating economic benefits and promoting development in the economy as a whole become far more apparent. Thus, economic analysis can provide a powerful tool for making sure that the goals of the country's fishing policy are met.

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