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AN ECONOMIC VALUATION OF THE NAMIBIAN RECREATIONAL SHORE-ANGLING FISHERY

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A roving creel survey of recreational shore-anglers in Namibia was used to determine catch and effort of linefishing. A stratified sample of 240 anglers was surveyed to determine expenditures. Results showed that, between October 1996 and September 1997, some 8 800 anglers spent around 173 000 days angling and had direct expenditures of N$29.7 million. In all, 93% of angling took place in the West Coast Recreational Area. Some 44% of anglers were foreign visitors who contributed 55% of the expenditures. Value added to gross national income within the shore-angling fishery was N$14 million, equivalent to 3.6% of the value of the whole fisheries sector. The expenditures ultimately amounted (through a multiplier) to a gross national income of N$3 069 per angler, or N$27 million in aggregate. These amounts could be sustainable if policies to reduce fish mortality without affecting angler numbers are implemented.

The Namibian coast is renowned for its angling opportunities, particularly in the central and northern regions, and each year thousands of local and foreign anglers visit the coast. Although the diversity of linefish species is low (Sakko 1998), abundances have been high in the past. Between 12 December 1989 and 28 March 1990, around 25 000 linefish were caught (8 300 angling days) along a 20-km stretch of coastline in central Namibia (Lenssen *et al*. 1991). Many coastal businesses cater to the needs of anglers and rely on their financial input. Most of Namibia's approximately 1 500 km coastline is closed to shore-angling, except near the mouth of the Orange River and Lüderitz in the south, along 235 km of coastline between Sandwich Harbour and the Ugab River in central Namibia (West Coast Recreational Area), and along 50 km of coastline around Torra Bay and Terrace Bay in the north (Fig. 1). Angling effort is concentrated mostly in central Namibia.

Coastal angling in Namibia is part of the marine linefishery, which consists of four categories: commercial linefishing from skiboats, recreational angling from skiboats, commercial linefishing from larger vessels, and shore-angling. The last two sectors catch the most fish. With recent apparent declines in catch per unit effort (*cpue*) of linefish along the Namibian coast (Kirchner 1998), recreational and commercial fishers have been taken to blaming each other. Some commercial fishers feel that recreational fishing threatens their livelihood, whereas recreational anglers believe that the activities of commercial linefish boats and trawlers have caused stocks to decline. Given this conflict, there is a need to determine the economic value of the different components of the fishery.

Resource economic theory reveals that a lack of restrictions on fishing effort in a fishery (open access) results in depletion of the stock and dissipation of net economic benefit. Neither the recreational fishery nor the commercial linefishery operate on a quota system, but the commercial fishery is restricted through the number of boats that are licensed. Recreational fishers are faced with liberal daily bag limits, but there are no restrictions on the number of fishers or the number of fishing days. Thus, the recreational component of the fishery is effectively open access in nature, and the fishery would be expected to grow and the resource to become depleted to the point where returns to fishers are eliminated. Even with restrictions on access there is a tendency for rent dissipation (Dupont 1990). It is therefore important to evaluate measures for access restriction in this light.

This study attempts to evaluate the economics of the recreational shore-angling fishery, as well as assessing the impact the fishery has on the Namibian economy. The paper forms part of a series of studies on the management and biology of important Namibian linefish species (Kirchner and Beyer 1999, Kirchner and Voges 1999).

MATERIAL AND METHODS

The numbers and daily expenditures of shore-anglers were determined in three regions along the Namibian coast where most shore-angling takes place: the West

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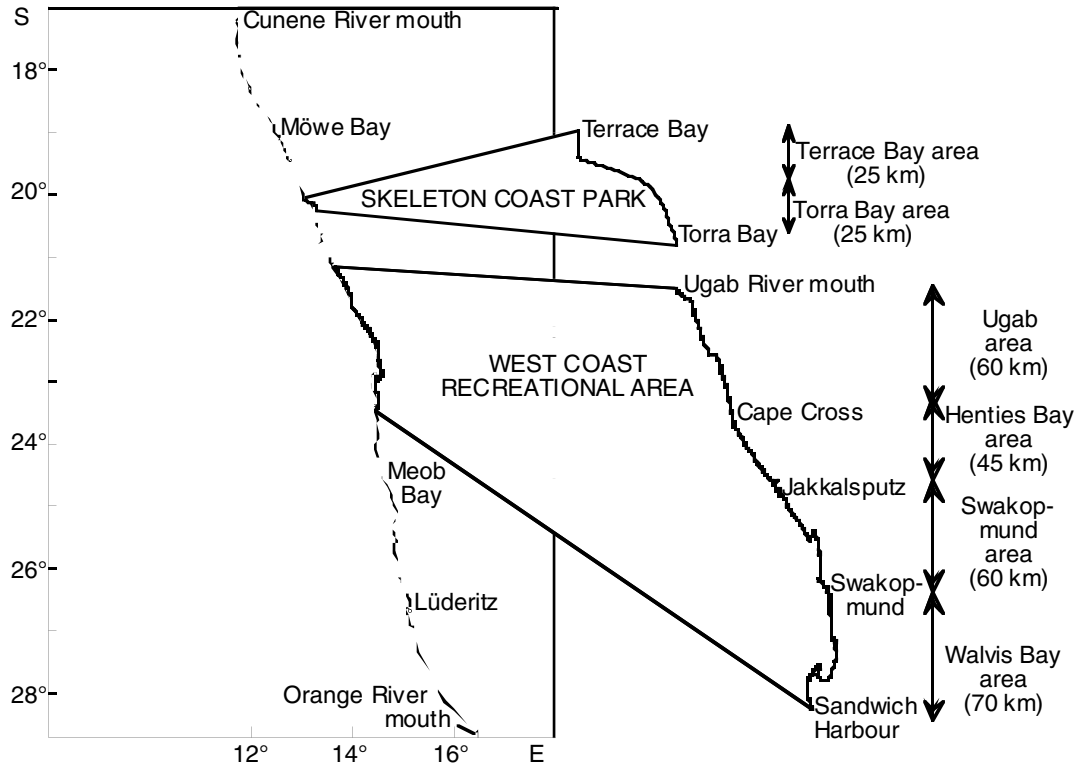

Fig. 1: Map of the Namibian coastline showing the study areas and localities mentioned in the text

Coast Recreational Area, Torra Bay and Terrace Bay (Fig. 1). There are shore-angling sites near the mouth of the Orange River and Lüderitz, but their contribution to the overall fishery is negligible.

West Coast Recreational Area

Four categories of anglers were identified in this area, subsistence anglers, anglers resident on the coast, anglers from inland Namibia, and anglers visiting Namibia from other countries (mostly South Africa). The mean number of anglers in each category fishing in the area each day and their mean catch per species was determined on the basis of roving creel beach surveys (Kirchner and Beyer 1999). The main species included in the creel survey were kob *Argyrosomus* spp., West Coast steenbras *Lithognathus aureti*, galjoen *Dichistius capensis* and blacktail *Diplodus sargus*.

Sampling was conducted from 1 October 1996 to 30 September 1997 (the 1996/97 angling season). In order to reduce variance of daily estimates of numbers of anglers and catches, the year was stratified into a 212-day "in-season" (1 October 1996–30 April 1997) and a 153-day "off-season" (1 May 1997–30 September 1997).

Because the West Coast Recreational Area is too large to be surveyed in a single day, it was subdivided into four zones (Fig. 1). Three of these (Ugab, Henties and Swakop) were sampled on consecutive days but were treated as having been sampled on the same day, the underlying assumption being that there were no changes in angler numbers or catches during the three days. These three areas were sampled 14 times in the in-season and nine times in the off-season. The fourth area (Walvis) was treated separately, because it is visited by anglers mainly during the in-season. This area was sampled 12 times in the in-season and only three times in the off-season.

For all days sampled, the mean number of anglers fishing and the size of their catch was estimated for the combined area (Ugab-Henties-Swakop) and the Walvis area. Values from the two areas were summed to obtain the daily mean number of anglers and the mean catch.

This was done for all four angler categories in both the in- and the off-season. The total number of angler-days per year per category was determined by multiplying the daily mean number of anglers by the number of days for each season.

In all, 80 recreational anglers from three categories (Namibians living near the coast, i.e. coastal Namibians, those living inland, i.e. inland Namibians, and foreign visitors) were interviewed while they were fishing, in order to determine their daily expenditures. Subsistence anglers were only encountered near two major coastal towns, and were few in number. They walked to the beach, made use of natural bait and unsophisticated equipment, and their expenses were therefore considered negligible. For that reason, they were not interviewed. Foreign visitors were asked to estimate costs of fuel, accommodation, bait, tackle, groceries, refreshments and entertainment, in addition to costs of any fishing equipment purchased in the last calendar year within Namibia. Anglers from inland Namibia were asked to estimate the same costs, excluding those for groceries. For coastal residents, the costs of fuel, bait, tackle and equipment purchased within the last calendar year were included in the analysis. All expenditures were estimated in Namibian dollars (N$). At the time of the study, N$1.00 = ZAR1.00 = US$0.19.

Mean daily expenditures were estimated for the three categories of recreational angler. Seasonal expenditures for each category were obtained by multiplying the mean number of anglers fishing per day by their mean daily expenditure, and multiplying this amount by the number of days in the season. Estimated annual expenditures for each angler category were obtained by the addition of the in- and off-season expenditure. Total estimated annual expenditures for recreational shore-angling in the West Coast Recreational Area was the sum of expenditures by all categories of anglers in both seasons of the year. The expenditure per fish caught was calculated for each angler category by dividing total expenditure by total catch.

A separate survey of 600 Namibian shore-anglers carried out in 1997 indicated that the mean number of days fished per year by anglers in the three recreational categories were: 41.4 for coastal Namibians, 18.9 for inland Namibians, and 18.5 for foreign visitors (F. Zeybrandt, Ministry of Environment and Tourism, Namibia, pers. comm.). Annual numbers of anglers in the three categories were estimated by dividing the number of angler-days by the mean number of days fished per angler.

Terrace Bay and Torra Bay

Three and two roving creel surveys of four days were undertaken at Terrace Bay and Torra Bay respectively. The daily mean number of anglers fishing was estimated, but because of the limited sampling, visitors to the localities were not stratified into angler categories. In Terrace Bay, many fishers were staff members of a local fishing company (or members of their families). These people were excluded from the analysis, because they were considered to be non-paying anglers. The mean daily catch was obtained from logbooks used by fishers and sometimes by staff members to report their catch. Because fishers in the two areas generally did not complete the questionnaires on expenditure, the daily mean expenditure per angler was estimated using data from the West Coast Recreational Area for inland Namibian and visiting foreign anglers. Adjustments were made where appropriate. For example, visitors to Terrace Bay make use of accommodation and meals provided there at a set price. In the analysis, the cost of board and lodging at Terrace Bay was set at N$235 per person per day. An additional cost of N$500 was added to the fuel category for travel to and from Terrace Bay. Fishers visiting Torra Bay pay N$30 per person per day for accommodation, but no meals are provided. Therefore, the calculation of their expenditures included costs of groceries, accommodation at N$30 per person per night, and an additional N$500 for travel fuel. Expenditures were expressed in N$ per fishing day per fisher. Account was taken of the closed season at Torra Bay (1 February–30 November). When the total number of anglers in Namibia was calculated, the assumption was made that the ratios between angler categories in the West Coast Recreational Area also applied at Terrace Bay and Torra Bay.

Economic value

There are a number of ways in which the value of a linefishery can be expressed, and these have various components. It is important to define these and to examine the estimates of expenditure in this perspective.

From a microeconomic perspective, the value of linefishing to individual anglers can be measured as the "value in use", which is the total amount that the angler is willing to pay for the activity. Value in use consists not only of the angler's actual expenditures, but also the "consumer surplus", which is the difference between what the angler is willing to pay and what is actually paid. The annual expenditures of anglers in the shore-angling fishery was measured, but not their consumer surplus, which was measured indirectly. In a survey of nature tourists in Namibia, Barnes *et al*. (1997) used contingent valuation to determine that South African and Namibian tourists benefitted from consumer

surpluses amounting to 28 and 30% of their trip expenditures respectively. It is assumed in the present study that the consumer surplus of anglers is 29% of their expenditures.

From a macroeconomic perspective, a common measure of economic value in national accounting in Namibia is gross national income (GNI, Central Bureau of Statistics 1998). This is income earned, whether domestically or abroad, by the factors of production owned by residents. GNI is estimated either as the sum of the total annual expenditure on the "consumption of final products" in the economy, or as the sum of the "values added by all productive activities" in the economy per year. In the economy as a whole, these two approaches in estimating GNI will give the same value, but owing to boundary differences, they will differ when one specific activity or sector is examined. Value added is the concept in national accounts where the returns to internal factors of production such as labour and capital are measured. Therefore, the value added for a recreational fishery is the gross expenditure on fishing, minus intermediate inputs, which are those imported to the activity from other sectors and from outside the country (such as fuel and food).

The present measure of the annual expenditure of recreational anglers in the shore-angling fishery of Namibia represents the consumption of final products in that fishery, and therefore represents the gross output, or the "share of gross national income by final demand" for the fishery. This is a measure of "impact", as discussed below. An estimate of the "value added by all productive activities" within the fishery can be derived by subtracting intermediate inputs (inputs from outside the fishery, including imports) from the anglers' total expenditures. Because no measure of intermediate inputs for angling activities was available, those from the tourism sector as a whole were used. Empirical analysis of the financial and economic structure of formal tourism activities in Namibia (Ashley and Garland 1994, Barnes *et al*. 1997, Ministry of Environment and Tourism, unpublished data) has shown consistently that gross value added is around 48% of gross output. Consequently, value added for the fishery is assumed here to be 48% of the total anglers' expenditures.

Regarding the concept of opportunity costs, refined measures of economic value take into account the value of alternative uses for the resources involved. In the context of the rock- and surf-fishery, an alternative use for the fish resource would be commercial linefishing. In addition, the expenditure of the anglers could be spent on other forms of tourism. No attempt is made in this study to estimate the value of the commercial fishery and therefore the opportunity cost of their use of recreational fish. This is a subject of further study, where the marginal values of both uses can be compared. Regarding the possible diversion of anglers to other tourism sectors, it is assumed that this would be unlikely, i.e. that angling is specific and the opportunity cost is zero.

Economic impact

Instead of simply determining the "value" of the fishery, its "impact" on the economy can be measured. As stated earlier, a measure of total annual expenditure on final products within Namibia is the share of gross national income by final demand and, as such, is a primary measure of impact. The ultimate impact on the economy incorporates the multiplier effect. Here, all expenditures resulting from the activity are taken into account, including not only the first-round spending on final products, but also second- and further-round spending on backward and forward linkages and household needs. Several different multipliers measure these effects on, for example, output, employment and income.

There are no estimates of multipliers for either tourism or the whole Namibian economy. Also, there are no social accounting matrices or input-output models, from which multipliers are normally derived. A very crude estimate of the national income multiplier can be derived from a simple macroeconomic model, if a number of simplifying assumptions are made (Irish Tourist Board 1979). This is based on the national accounting identity, which sets GNI by origin equal to expenditure on GNI, and it measures the relation between an initial exogenous stimulus ($G + I + E$) and the resulting national income or GNI. The multiplier is given by:

$$K = Y/(G + I + E) \quad ,$$

where K is the GNI multiplier, G is government net current expenditure, I is gross physical capital formation, E is exports of goods and services and Y is the GNI at market prices. Using national accounts data for Namibia from 1996 and 1997 (Central Bureau of Statistics 1998), a GNI multiplier value of 0.9 is derived. This gross national income multiplier for Namibia is an (albeit crude) Keynesian multiplier, or response coefficient (Stynes 1998). The product of the GNI multiplier and the direct expenditures of anglers provides an estimate of the resultant value added, or GNI, ultimately generated by the expenditures.

Workers such as Storey and Allen (1993), discussed by McGrath *et al*. (1997), have argued that the macroeconomic impact of a recreational fishery on a region or country should be measured by excluding the ex-

Table I: Mean daily numbers and expenditures of anglers, and mean daily catches (numbers) by species in the West Coast Recreational Area in-season (212 days) and off-season (153 days), 1996/97. Standard errors are indicated in parenthesis

Parameter	Coastal Namibians	Inland Namibians	Foreigners	Subsistence fishers
		In-season		
Number of anglers	171 (25)	152 (55)	282 (41)	21 (5)
Silver kob	380 (84)	240 (112)	430 (107)	37 (13)
West Coast steenbras	41 (9)	25 (10)	82 (30)	7 (4)
Galjoen	55 (14)	23 (11)	72 (15)	10 (5)
Blacktail	20 (11)	9 (4)	9 (2)	1 (0.3)
Total fish	496 (86)	297 (113)	593 (112)	54 (14)
		Off-season		
Number of anglers	109 (11)	35 (10)	73 (22)	22 (2)
Silver kob	200 (106)	63 (23)	117 (61)	4 (3)
West Coasr steenbras	62 (30)	3 (1)	19 (11)	2 (1)
Galjoen	64 (13)	11 (5)	36 (17)	8 (4)
Blacktail	13 (10)	1 (0.4)	6 (4)	0
Total	339 (158)	78 (23)	178 (64)	14 (5)
Total expenditure (N$)	95 (9)	188 (12)	208 (11)	Negligible

penditures of residents of the region/country. This is because of the assumption that residents would nevertheless spend on substitute activities if the fishery did not exist. If this is true, then the above measurements for the impact of the fishery on Namibia's economy should be restricted to that of foreign anglers. An alternative estimate of the impact on the economy, resulting only from foreign anglers' expenditures, was calculated in the present study.

To measure the effect of angler expenditures on employment, indirect methods drawn from two sources were used. McGrath *et al*. (1997) gave an estimate of the number of people employed in the South African shore-angling fishery, which amounted to one job for every ZAR16 667 of gross geographical product. The Namibian Tourism Policy, Planning and Management Information Unit (R. Hanson, Ministry of Environment and Tourism, Namibia, pers. comm.) estimated that, in Namibia during1998, there was one formal employment opportunity for every N$75 180 of tourist expenditure. It was also estimated that every formal job in tourism was associated with one casual employment opportunity. These ratios of expenditures/income to jobs created were used in the present analysis.

RESULTS

During the in-season, the beaches were used mostly by visiting foreign anglers, averaging 282 individuals per day in the West Coast Recreational Area (Table I). Although these anglers removed approximately the same number of fish over one year as did coastal Namibian anglers, the visitors spent more than twice as much money in pursuit of their sport (Table I). In addi-

Table II: Estimated annual catches (thousands) by species for three regions of Namibia 1996/97. Standard errors (thousands) are indicated in parenthesis

Species	West Coast Recreational Area				Terrace Bay	Torra Bay	% of total
	Coastal Namibians	Inland Namibians	Foreigners	Subsistence fishers			
Silver kob	111 (24)	61 (24)	109 (25)	8 (3)	10 (1)	15 (2)	68
West Coast steenbras	18 (5)	6 (2)	20 (7)	2 (1)	9 (2)	2 (1)	12
Galjoen	22 (4)	7 (2)	21 (4)	4 (1)	3 (1)	7 (1)	14
Blacktail	6 (3)	2 (1)	3 (1)	1 (1)	11 (1)	7 (1)	6
Total	157 (25)	76 (24)	153 (26)	15 (3)	33 (2)	31 (2)	100.0

Table III: Mean daily number of anglers, catches (numbers) by species and expenditures, estimated over the entire fishing seasons at Terrace Bay (365 days) and Torra Bay (60 days). Standard errors are indicated in parenthesis

Parameter	Terrace Bay	Torra Bay
Number of anglers	14 (1)	109 (2)
Silver kob	27 (3)	246 (33)
West Coast steenbras	25 (4)	29 (4)
Galjoen	31 (4)	120 (13)
Blacktail	8 (1)	121 (12)
Total fish	91 (7)	516 (38)
Number of fish per angler per day	6.5 (0.5)	4.7 (0.6)
Expenditure (N$)	295 (11)	210 (8)

tion, the visiting anglers generated foreign currency for Namibia, the equivalent of approximately N$15 million for the year under study.

A total of some 401 000 fish was removed by shore-anglers from the West Coast Recreational Area during the study period, whereas catches of approximately 33 000 and 31 000 fish were taken from Terrace Bay (open all year round) and Torra Bay (open season December 1996 and January 1997 – Tables II and III).

Visiting foreign anglers in the West Coast Recreational Area (averaging 282 individuals per day) caught an average of 593 fish per day during the in-season (Table I), whereas coastal Namibian anglers (averaging 171 individuals per day) caught a daily average of 496 fish. This indicates a higher catch per angler-day for local anglers. The same trend was apparent during the off-season, when daily catches by coastal Namibians were higher than for any of the other angler categories (Table II). However, anglers who visited Terrace Bay and Torra Bay were rewarded with high average catches of 4.7–6.5 fish per angler per day (Table III).

The number of anglers fishing per day decreased during the off-season, especially for visiting foreigners (Table I). Coastal Namibians removed on average 339 fish per day during the off-season in the West Coast Recreational Area, more than any of the other angler categories during that period.

Silver kob *Argyrosomus inodorus* were the most targeted and probably abundant linefish (Table II). They made up 68% by number of the estimated total annual catch, followed by galjoen (14%) West Coast steenbras (12%) and blacktail (6%).

Daily expenditures of coastal Namibian, inland Namibian and visiting foreign anglers in the West Coast Recreational Area were N$95, N$188 and N$208 respectively (Table I). Total annual expenditures by those anglers were N$5.0, N$7.1, and N$14.7 million respectively, or N$26.8 million for the whole area (Table IV). Total annual expenditures for anglers in Terrace Bay and Torra Bay were N$1.5 and N$1.4 million respectively (Table IV).

Annual effort was around 161 000 angler-days (from 8 271 anglers) in the West Coast Recreational Area and 11 650 angler-days (from 527 anglers) for Terrace Bay and Torra Bay combined (Table IV). In all, about 8 800 shore-anglers spent around 173 000 days angling at a total expenditure of N$29.7 million in pursuit of their recreation during the season of 12 months under study.

Foreign anglers and inland Namibians had similar expenditures of N$96 and N$94 respectively per fish caught. Costs for anglers resident on the Namibian coast were less at N$32 per fish. Visitors to Terrace Bay and Torra Bay had the highest expenditures of any angling group but, because their catches were greater, the expenditure per fish caught was about N$45 (Table IV).

Estimates of the value of the shore-angling fishery to the Namibian economy are shown in Table V. The aver-

Table IV: Estimated angler-effort, number of anglers, overall expenditure, expenditure per fish caught and per angler in the shore-angling fishery of Namibia, 1996/97

Parameter	Number of anglers	Angler-days fished	Expenditure (N$ million)	Expenditure per fish (N$)	Expenditure per angler (N$)
Recreational Area					
Coastal Namibians	1 279	52 929	5.0	32	3 909
Inland Namibians	3 156	37 579	7.1	94	2 250
Foreigners	3 836	70 953	14.7	96	3 832
Terrace Bay	231	5 110	1.5	46	6 494
Torra Bay	296	6 540	1.4	44	4 730
Total	8 798	173 111	29.7		
Mean				64	3 376

Table V: Summary of estimated annual economic values and impacts for the shore-angling fishery of Namibia, 1996/97

Parameter	Value per angler	Aggregate value
Values		
Direct angler expenditures (N$)[1]	3 376	N$29.7 million
Consumer surplus (N$)[2]	979	N$8.6 million
Value in use or willingness to pay (N$)[3]	4 355	N$38.3 million
Shore-angling fishery value added to GNI (N$)[4]		N$14 million
Impacts		
Direct expenditures (consumption of final products) (N$)[1]		N$29.7 million
Impact of total direct expenditure on GNI (N$)[5]		N$27 million
Impact of foreign direct expenditure on GNI (N$)[5]		N$15 million
Employment resulting from expenditure (numbers)[6]		790 – 1 620

[1] Direct expenditure on final products within Namibia in the recreational fishery
[2] Calculated using estimates for the broader tourism population in Namibia (direct expenditures × 0.29)
[3] Sum of angler expenditure and consumer surplus
[4] Calculated using estimates for the broader tourism sector (direct expenditure × 0.48)
[5] Crude measure of ultimate effect of direct expenditures on GNI, incorporating an income multiplier effect (direct expenditures × 0.9 rounded to the nearest N$ million), measured using either all expenditures or only foreign expenditures
[6] Rough estimates of employment effects of total direct expenditure, based on data from McGrath *et al*. (1997) and R. Hanson (Ministry of Environment and Tourism, Namibia, pers. comm.)

age angler spent N$3 376 per year, and would have had a consumer surplus amounting to 29% of this, equivalent to a further N$979. The aggregate willingness to pay or "value in use" for the activity was N$38.3 million. The value added to GNI within the shore-angling fishery was estimated at N$14 million, or 48% of expenditure (Table V).

Measures of the impact of the fishery on the economy are also shown in Table V. The annual expenditure of anglers in the fishery (N$29.7 million) represents the primary impact of the fishery on the economy. The full impact of the fishery on the economy incorporates the effect of the income multiplier. This is the value added to GNI that ultimately results from the expenditures, and is estimated to be N$27 million. If the impact of the fishery on Namibia's economy is restricted to that of foreign anglers, it is reduced to N$15 million (Table V). Estimates of the numbers of jobs likely to be created in the fishery varied widely, depending on the source used for the estimate. If the data used by McGrath *et al*. (1997) for South Africa were to be applied to the present study, a total of 1 619 jobs could be anticipated. However, a lower number of 790 jobs is predicted when data of the Namibian Tourism Policy, Planning and Management Information Unit for the whole tourism sector are used.

An indication of sensitivity to changing assumptions is needed for the estimates made in the study. The percentages used to calculate consumer surplus, and value added to GNI, are based on results from other studies in the region. Based on these data, the consumer surplus may vary between 20 and 40% of gross expenditure, and value added to GNI could vary between 40 and 55% of gross output. Therefore, the consumer surplus could range between N$6.0 and N$11.9 million, and the value added to GNI could range between N$11.9 million and N$16.3 million (Table V). The crude income multiplier value of 0.9 used here to measure economic impact could range between 0.7 and 1.1. This would mean that the impact of total direct expenditure on GNI could vary between N$21 and N$33 million. It is important to bear in mind these possible variations when considering the present findings and their implications.

DISCUSSION

In the 1996 national accounts for Namibia (Central Bureau of Statistics 1998), the fisheries sector (fishery products, excluding fish processing) was reported to contribute N$391 million in value added to the gross national income. This amounted to 2.9% of total gross national income. The equivalent estimate for shore-angling is the gross value added within the fishery, which was N$14 million that year, i.e. 3.6% of the contribution of the fishery sector as a whole.

The aggregate consumer surplus for the shore-angling fishery could amount to N$8.6 million (29% of N$29.7 million). The consumer surplus is an economic benefit to Namibia only if it accrues to Namibians. That attributable to South Africans and other foreigners is of no value to the country unless it can be captured through, for example, angling licence fees, taxes or donations. It is of interest that, in South Africa, McGrath *et al*. (1997) found price elasticities of demand for recreational shore-angling to be low.

This suggests that capture of the consumer surplus of South African visitors, through taxes or licence fees, would be possible, and would not affect the size or growth of the fishery.

The estimate of N$29.7 million for annual expenditure of recreational anglers in the shore-angling fishery of Namibia represents first-round expenditures on final products, and backward linkages (there are no forward ones). It is a primary measure of impact, but the full impact of anglers' expenditures on the GNI is N$27 million. In as much as the tourism multiplier is generally considered higher than that for the economy as a whole (Irish Tourist Board 1979), this estimate may be conservative. N$27 million amounts to only 1.6% of the equivalent estimate for recreational shore-anglers in South Africa (McGrath *et al*. 1997). However, it is consistent in that the number of anglers in Namibia is some 2% of that of South Africa (McGrath *et al*. 1997). Angler effort in Namibia is 5% of that in South Africa (Brouwer *et a*l. 1997), and the size of the Namibian economy is 2% of that of South Africa (Development Bank of Southern Africa, unpublished data). The impact on GNI per angler of N$3 069 estimated here for Namibia is comparable to the gross geographic product per angler of N$4 012 estimated for South Africa in 1995 (McGrath *et a*l. 1997).

The measure of impact on the economy that excludes the expenditures of residents of the country is only valid if residents would nevertheless spend on substitute activities if the fishery did not exist. McGrath *et al*. (1997) found low elasticities of demand for shore-angling in South Africa, indicating that substitute activities might be difficult to find in that country. Given the proximity of the two countries and the general similarity of lifestyles in each, it is reasonable to expect similar circumstances in Namibia. Impact on income may therefore be better measured using all expenditure. The wide range in the estimates of employment resulting from the fishery (Table V) suggests that pertinent empirical data are needed.

The most important species in the Namibian linefishery is silver kob, which constituted 68% by number of the total linefish caught in this study. The Namibian stock of silver kob has a biomass of approximately 13 000 tons (Kirchner 1998), small compared to stocks of the commercially exploited pelagic and demersal fish off Namibia. Kirchner (1998) showed that the Namibian silver kob is overexploited, having been depleted to between 29 and 49% of its pristine level. Kirchner and Beyer (1999) found that shore-anglers catch approximately the same number of kob annually as do commercial fishers, so the recreational fishery has the potential to deplete kob stocks in Namibian waters. The same may well apply to other species targeted by the fishery. This raises the question of whether the economic values estimated here are sustainable.

The primary value associated with a recreational angling fishery is in the "experience" of the angler and not in the size of the catch, as it is with commercial fisheries. Even if success is important to value, the possibility of "catch and release" means that high rates of angling success need not be directly correlated with high fish mortality. McGrath *et al*. (1997) found evidence for low success elasticities of demand relating to the South African recreational linefishery. It is reasonable to expect that the Namibian fishery has similar characteristics. This suggests that imposition of smaller bag limits would not have a negative effect on the amount of, or growth in, angling activity in Namibia.

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, p. 42). It is therefore appropriate to consider specific policy approaches for shore-anglers to ensure sustainability and efficiency. Currently, anglers have a daily bag limit of 30 fish, or 30 kg of filleted fish, of any one or more of silver kob, steenbras, blacktail and galjoen, provided that not more than eight galjoen are caught and retained per day (Ministry of Fisheries and Marine Resources 1993). With recorded daily mean catches ranging from 1.9 (inland Namibians in the in-season) to 6.5 fish (at Terrace Bay), such a bag limit is unlikely to limit fish mortality at all.

In the Western Cape, South Africa, daily bag limits for similar linefish species are much lower at 5–10 fish per day. Attwood and Bennett (1995) noted that these bag limits had a negligible effect on fish mortality and that reductions in bag limits to 2–4 fish per day were necessary to reduce mortality by between 5 and 20%. There is scope to reduce bag limits in Namibia, so appropriate policies could be considered to help sustain the size and growth of the recreational shore-angling fishery. Such action could help reduce fish mortalities and may ultimately help to control the problem of increase in fishing effort. Further, consideration could be given to the possibilities of introducing angling licences in the fishery, improving control and data collection and allowing the fishers to contribute to effective management of the species they benefit from catching.

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LITERATURE CITED

ASHLEY, C. and E. GARLAND 1994 — Promoting community-based tourism development: why, what and how? Research Discussion Paper 4, Directorate of Environmental Affairs, Ministry of Environment and Tourism, Windhoek, Namibia: 54 pp.

ATTWOOD, C. G. and B. A. BENNETT 1995 — A procedure for setting daily bag limits on the recreational shore-fishery of the South-Western Cape, South Africa. *S. Afr. J. mar. Sci*. **15**: 241–251.

BARNES, J. I., SCHIER, C. and G. VAN ROOY 1997 — Tourists' willingness to pay for wildlife viewing and wildlife conservation in Namibia. Research Discussion Paper 15, Directorate of Environmental Affairs, Ministry of Environment and Tourism, Windhoek, Namibia: 24 pp.

BROUWER, S. L., MANN, B. Q., LAMBERTH, S. J., SAUER, W. H. H. and C. ERASMUS 1997 — A survey of the South African shore-angling fishery. *S. Afr. J. mar. Sci*. **18**: 165–177.

CENTRAL BUREAU OF STATISITICS 1998 — Republic of Namibia: National Accounts 1982–1997. National Planning Commission, Windhoek, Namibia: 54 pp.

DUPONT, D. P. 1990 — Rent dissipation in restricted access fisheries. *J. environ. Econ. Mgmt* **19**: 26–44.

IRISH TOURIST BOARD 1979 — Republic of Botswana: tourism development plan. Gaborone, Botswana; EEC and Ministry of Commerce and Industry: 390 pp.

KIRCHNER, C. H. 1998 — Population dynamics and stock assessment of the exploited silver kob (*Argyrosomus indorus*) stock in Namibian waters. Ph.D. thesis, University of Port Elizabeth, South Africa: 276 pp.

KIRCHNER, C. H. and J. BEYER 1999 — Estimation of total catch of silver kob *Argyrosomus inodorus* by recreational shore-anglers in Namibia, using a roving-roving creel survey. *S. Afr. J. mar. Sci*. **21**: 191–199.

KIRCHNER, C. H. and S. F. VOGES 1999 — Growth of the Namibian silver kob *Argyrosomus inodorus* based on otoliths and mark-recapture data. *S. Afr. J. mar. Sci*. **21**: 201–209.

LENSSEN, J., TARR, P. and H. BERRY 1991 — An assessment of visitor statistics and linefishing along the Sandwich shoreline, Namib-Naukluft Park, Namibia. *Madoqua* **18**(1): 33–36.

McGRATH, M. D., HORNER, C. C. M., BROUWER, S. L., LAMBERTH, S. J., MANN, B. Q., SAUER, W. H. H. and C. ERASMUS 1997 — An economic valuation of the South African linefishery. *S. Afr. J. mar. Sci*. **18**: 203–211.

MINISTRY OF FISHERIES AND MARINE RESOURCES 1991 — National Fisheries Policy for the Republic of Namibia. White Paper, Ministry of Fisheries and Marine Resources, Windhoek, Namibia: 55 pp.

MINISTRY OF FISHERIES AND MARINE RESOURCES 1993 — Sea Fisheries Regulations. *Government Gazette of the Republic of Namibia* Act 29 of 1992 (Section 32): 55 pp.

SAKKO, A. 1998 — Biodiversity of marine habitats. In *Biological Diversity in Namibia: a Country Study*. Barnard, P. (Ed.). Windhoek, Namibia; Namibian Biodiversity Task Force: 189–226.

STOREY, D. A. and P. G. ALLEN 1993 — Economic impact of marine recreational fishing in Massachusetts. *N. Am. J. Fish. Mgmt* **13**: 698–708.

STYNES, D. J. 1998 — Approaches to estimating the economic impacts of tourism: some examples. Unpublished Report, Department of Park, Recreation and Tourism Resources, Michigan State University, East Lansing, USA: 16 pp.