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ECONOMIC CHARACTERISTICS OF DEMAND IN NAMIBIA'S MARINE RECREATIONAL SHORE FISHERY

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A sample of 626 anglers was surveyed with a questionnaire to determine the expenditures, consumer surpluses, and elasticities of demand, associated with the Namibian recreational marine shore fishery in 1998. Two entirely different methods of valuation, the travel cost method and contingent valuation, were applied. Results for the two methods indicate convergent validation. On aggregate, anglers spent between N$23 million and N$31 million on angling trips in Namibia during 1998, and were willing to pay between N$24 million and N$27 million more than this for the experience. The fishery contributed between N$11 million and N$15 million to gross national income. Anglers in the fishery were found willing to pay some N$1 million annually toward conservation of the fish resource, as well as some N$340 000 annually for licences. Demand for angling experiences is generally price inelastic, suggesting that rents might be captured through donations and licence fees, without reducing angler numbers.

The Namibian coast, on the west coast of southern Africa, has a high reputation as an angling destination. The Benguela current, which flows along this coast, is characterised by cold but nutrient-rich upwellings. A system of relatively low species diversity but high production forms the basis for the recreational fishery. Anglers brave the somewhat inhospitable desert coast, characterised by cold winds and fog, to make notable catches. Most angling is from the shore, from the beach, in the surf, using bait. Some shore angling takes place off rocks, and some angling is done from skiboats offshore. Catches are made all year round but are higher in summer. The most frequently landed bonefish are kob (mostly silver kob, *Argyrosomus inodorus*, but also dusky kob, *A. coronus*), west coast steenbras (*Lithognathus aureti*), galjoen (*Dichistius capensis*) and blacktail (*Diplodus sargus*). To a much lesser extent, sharks, including the copper shark (*Carcharhinus brachyurus*), the spotted gulley shark (*Triakis megalopterus*) and the smoothhound (*Mustelus mustelus*) are targeted.

Access to shore angling on the Namibian coast is restricted to about one quarter of the coastline, some 260 km, stretching from Sandwich Harbour, south of Walvis Bay to the Ugab River in the North. Most of this is made up of the West Coast Recreation Area (WCRA), and more than 90% of angling takes place here. Additional smaller angling sites exist north of this, at Torra Bay and Terrace Bay in

the Skeleton Coast Park, and in the south near Lüderitz. Kirchner *et al.* (2000) described the fishery. They used a roving creel survey to determine that the angling population is made up tree distinct segments; coastal Namibian residents (15%), inland Namibian residents (38%), and South African visitors (46%).

The angling resource is shared with a commercial line fishery, which operates from Walvis Bay, in about ten vessels, up and down the coast, in inshore waters. These vessels target the same species off the bottom, but also seasonally seek the pelagic snoek (*Thysites atun*). There is a perception among anglers and commercial fishers that the resource is declining and apparent declines in catch per unit effort (*cpue*) have been reported by Kirchner (2000). There is an urgent need for economic data on the fishery, to enable sound policy development, planning and management.

Kirchner *et al.* (2000) undertook an expenditure survey where a stratified sample of 240 anglers was questioned for details on expenditures. It was determined that in the 1997/98 season, some 8 800 anglers spent about 173 000 days angling, and had direct expenditures of N$30 million within Namibia. The average angler thus spent some 20 days fishing and spent some N$3400 doing it. These findings were in broad agreement with those for South African anglers (McGrath *et al.*, 1997), except that effort per angler was higher in Namibia, perhaps a reflection of the relative remoteness of the Namibian coast. The gross value added attributable to the recreational shore fishery was estimated to be N$14 million, equivalent to some 3.6% of the value added in the whole Namibian fisheries sector. The *impact* of gross expenditures on the national income was also calculated, as N$27 million, using a crude national income multiplier.

In this paper, the results of a survey of 626 coastal recreational anglers, in Namibia in 1998, aimed at measuring further economic characteristics of demand in the fishery, is reported on. In particular, consumer surpluses[1] and value added for the different market segments, as well as elasticities of demand were sought. Two different approaches to valuation; the travel cost method (TCM), and the contingent valuation method (CVM), were employed to enable comparison of results, and possible convergent validation. The study is part of an on-going project to assess potential economic values of Namibian natural resources and wildlife.

METHODS

Economic values

Values (measured in Namibia dollars (N$)[2]) in this paper can be placed in the context of total economic value (TEV), as described by Pearce and Turner (1990). TEV consists of *use values* and *non-use values*. The *use values* consist of direct and indirect use values. Direct use values reflect direct consumption, such as fishing.

[1] Consumer surplus is the difference between the maximum amount a consumer is willing to pay for a product and what they actually pay for it – a component of economic value

[2] At the time of the study N$1.00 = ZAR1.00 = US$0.20

Indirect use values reflect indirect creation of such value, for example, a marine eco-system creates nutrient-rich water and hence increases the fish stock for direct use. *Non-use values* embrace option, bequest and existence values. Option value reflects the willingness to pay to ensure future use of the resource. Bequest value reflects willingness to pay to ensure the resource is available for future generations. Existence value reflects willingness to pay to ensure the mere existence of the resource. All measures of gross expenditure, net income, and consumer surplus, below, are measures of *direct use value*. Where anglers were asked for their willingness to pay for conservation of the fish resource, their responses could be reflecting non-use values.

In the macroeconomic context of Namibia, a primary measure of economic value is the gross national income (GNI). This measure can either be estimated as the total value of consumption of all final products in the economy, or as the total value added by all productive activities in the economy. Value added in an enterprise is defined as the returns to internal factors of production (labour and capital), and is the gross output, less intermediate expenditures. Net national income (NNI) is gross national income less depreciation. Using expenditure data and empirical data on intermediate inputs from the broader tourism sector, we attempt to estimate these contributions to national income. The measure that we end up with is the recreational marine shore fishery's share of the total value added by all productive activities within the fishery sector in Namibia. We subtract intermediate inputs for the angling activities from the total expenditures made by the recreational anglers in Namibia. The intermediate inputs are simply the expenditures made for inputs from outside the angling sector, and can be interpreted as leakage from the tourism sector. No figure is available for the angling tourism specifically, but Ashley (1995), in an empirical analysis of the economic structures of tourism activities in Namibia, found the gross value added to be 48% of gross output, and net value added to be 41% of gross output. Accordingly, we have applied these proportions to gross expenditures, to calculate the contributions of the fishery to gross and net national income. It is noteworthy that our measures are of the "*value*" of the fishery, involving first-round expenditures only. We did not attempt to measure the "*impact*" of the fishery on the economy, using multiplier analysis.

Both valuation approaches used, the travel cost method (TCM), and the contingent valuation method (CVM), provide estimates of consumer surpluses associated with angler expenditures. Use of two, completely different and independent, methods should increase the theoretical and practical validity of the study. Both methods have been widely used and, in the right circumstances, have been accepted as giving reliable economic values for recreational activities (Mitchell and Carson, 1989).

Field survey

The field survey was carried out among coastal anglers between January and April 1998. This enabled the collection of mostly high season responses, but also some from the low season, in April. 626 anglers were interviewed at angling sites along

the coast stretching from Walvis Bay in the South to Terrace Bay in the North. Sampling took place while anglers were on the beach, or at government campsites/resorts along the coast. Some piles of questionnaires were left at campsite offices for distribution by staff, and later return by mail. Sampling was not systematic or random, but non-selective at sites, with the aim of getting the highest possible number of responses. Stratification of sampling between sites was undertaken aimed at achieving a suitably representative spatial coverage.

More than half of our sample (52%) consisted of foreign visitors. The other 48% were Namibians, of which 64% travelled from inland Namibia and 34% from coastal areas. These proportions differ from those actually measured by Kirchner *et al.* (2000). They determined that, in 1997/98, foreign visitors made up 46%, coastal Namibian residents made up 15% and inland Namibian residents made up 38% of the angling population. To correct for our sample bias with respect to angler origin, we divided the sample into these three segments and weighted them according to the measured ratios. It was not possible to correct the sample for bias in other characteristics such as gender, income, etc. However, our primary interest was in the three segments above, and it is reasonable to assume that the sample was sufficiently representative.

A questionnaire, similar to that used by Barnes *et al.* (1999), and Barnes (1996) to survey broader tourism populations, and wildlife viewing tourists was developed. The questionnaire was designed to elicit as much information as possible so that data could be analysed using the travel cost and contingent valuation approaches. In addition to general tourist characteristics and reasons for the visit, respondents were asked to state their travel costs, total costs, specific angling costs such as bait, tackle, rods and reels and the replacement cost of their vehicle/skiboat (if any). Further, the anglers were asked if they were willing to pay for an angling licence and willing to contribute to a coastal conservation trust fund.

A team of five enumerators distributed questionnaires, assisted respondents when needed, and collected completed questionnaires. The questionnaire was in most cases handed out and the respondents filled them out themselves, but some regular interviews were held. Most anglers approached were willing to fill in the questionnaire, and the refusal rate was very low. Children were excluded from the interviewing process since we considered that adults were more capable of estimating expenditures within their budget constraints. Of the 626 returned questionnaires, 372 were finally selected for use after cleaning. All expenditure estimates were converted to Namibia dollars (N$) at the prevailing exchange rates.

Travel cost method (TCM)

The travel cost method uses the anglers' costs of consuming the services of the environmental asset are used as a proxy for price. These consumption costs include travel costs, entry fees, on-site expenditures, and the annualised costs of outlay on capital equipment needed for consumption. The basic premise is that the user

population is homogeneous in its willingness to pay, and that differences in the costs of consumption (due, for example, to different travel costs) result in different rates of visitation. The visitation rate is used as the quantity measure of the angling experience. As such, the travel cost method is an *indirect* method of valuation. By varying the travel costs and visitation rates, it is possible to derive a demand curve that expresses the demand for trips to the recreational area, in this case recreational angling on the Namibian coast (Hanley and Spash, 1993).

TCM has not been used much in the context of southern African tourism activities, because it depends for success on certain assumptions, which are commonly not applicable. It requires that the population of users be homogeneous regarding willingness to pay, that the destination be a sole one (not part of a multi-destination trip), and that the substitutability of the destination to be low. In this particular case (recreational angling on the Namibian coast) the angling population is fairly homogeneous (nearly all middle class and southern African), visits are made very specifically for angling, substitute sites are remote and somewhat different, and the price elasticity of demand is likely to be low (McGrath *et al.*, 1997). We consider this angling population to be suitable for analysis, using the conventional travel cost approach (Kerr, 1986; Hanley and Spash, 1993).

Depending on the degree of homogeneity of the sample population regarding travelling distance and social characteristics, an *individual* or *zonal* travel cost model can be used. The *individual* model uses each individual's travel costs and visitation rate, but requires a relatively homogenous data set, i.e., the observations may not differ too much (Hanley and Spash, 1993; Navrud and Mungatana, 1994; Randall 1994). Our sample consists of anglers travelling from 10km to 3000km, with highly variable costs data, and variable frequencies of visitation. The *zonal* model is better suited to deal with this variability, as all visitors are divided into zones of origin. Population figures are derived for zones and figures on visits per capita can thus be calculated. A typical zonal visitation rate model is:

$$(VPC)_{zj} = f(TC_{zj}, S_z)$$

where $(VPC)_{zj}$ is visits per capita from zone z to site j, TC_{zj} is trip (including travel) costs from zone z to site j; and S_z is a vector for the social characteristics of the zone z. It is assumed that the visitors travelling from different zones have the same willingness to pay and the same social characteristics. The zonal model is somewhat sensitive to the selection of the zones used. This can affect the resulting consumer surplus estimates (Sterner, 1994; Hanley and Spash, 1993).

Thirteen geographical zones were identified for the model. These were made up of South Africa's nine provinces, three Namibian coastal zones, and one Namibian inland zone. The populations and mean incomes for the South African zones were derived from data from the South African Centre for Statistical Services (CSS). The populations for zones in Namibia were derived by adding the populations for each city or town in the zone represented in the zone samples. No official estimates of

local Namibian incomes were available. The zones, their numbers of visits, populations, visitation rates, and trip costs are shown in Table I.

The travel costs included the fuel cost of a return trip to the Namibian coast and the on-site expenditure. We believed that the fuel costs only, rather than full cost of the vehicle (including depreciation of the car, tyres etc), was closest to the typical respondent's perception of vehicle costs. A difficult issue regarding travel cost models relates to the inclusion and estimation of costs for travel time. Current economic thinking tends to favour the notion that time costs ought to be included in travel cost models. One could argue that travelling time is the opportunity cost of the foregone income. An angler could have worked, and hence been making money instead of travelling. Hanley and Spash (1993) suggest that the questionnaire should include a question about the enjoyment during the time travelling. They argue that if the visitor enjoyed the time travelling, it is not reasonable to impute the time cost of travelling to that specific visitor. Of all respondents in this study, 95% stated that they enjoyed the time travelling. Accordingly, time costs for these respondents were not imputed. Nevertheless, in order to show what effect time costs have on the final outcome we present models and consumer surpluses calculated with 0, 30, 60 and 100 percent time costs included in addition to the above.

The cost of time for the South African zones was determined by deriving hourly income from mean zonal incomes, as acquired from the statistical service. For Namibian zones, mean incomes from questionnaire responses were used. The travel cost was determined by multiplying the distance travelled to and from the coast with the Automobile Association of South Africa's (AARSA, 1998) estimation of cost per km for two-wheel and four-wheel drive vehicles[3]. Added to this was the time cost, which was calculated by assuming an average speed of 70 km/hour.

The inclusion of on site and other non-travel costs such as accommodation, entry fees, is also contentious. Whether these should be included depends on whether they can be deemed to affect rates of participation and, as with travel time, the degree of enjoyment derived from the consumption. We consider that, along with the cost of travel, these expenditures overwhelmingly *do* affect visitation rates, and therefore should be included in the analysis.

Many travel cost models (e.g. Navrud and Mungatana, 1994) include social characteristics such as gender, income, and other relevant variables to obtain better specification for the model. In this case, it was difficult to acquire such information for all zones, and attempts to develop models with the information acquired, resulted in problems with multicollinearity. Different functional forms were tested. The model that had the "best" fit was chosen for the following stages of the analysis, i.e., developing a second stage demand function (Kerr, 1986; Hanley and Spash, 1993), and calculating the consumer surplus.

[3] The costs were N$2.39 per km for a two wheel drive, and N$3.46 per km for a four wheel drive vehicle

Contingent valuation method (CVM)

We used a variation of the contingent valuation method. Unlike travel cost, which is based on revealed preferences, contingent valuation is a direct method and is based on stated preferences. In it, the respondent's willingness to pay (WTP) for an increased amount of a specific good, or her/his willingness-to-accept (WTA) to avoid a decrease of a good, are elicited through surveys. It is generally agreed that willingness to pay is preferable to willingness to accept (NOAA, 1993; Mitchell and Carson, 1989).

Barnes *et al.* (1999) describes the contingent valuation approach used here in some detail. Among general questions regarding their personal characteristics, origin, trip and trip preferences, respondents were asked how much their *travel* to and from their angling destination (by any mode) was costing, what their *total angling* trip was costing, how much of this they were personally spending within Namibia, and what their annual income was. In the introduction to a section on expenditures they were informed that their answers were to assist with planning and could not affect actual prices. A payment card was used to ask the respondents what they would be willing to pay for a *similar return* angling trip. They were first asked whether their current trip was value for money and then whether they would be willing to return on a similar trip. If they said "yes", (nearly all did) they were asked to identify the cost level (in relation to their present or actual cost) which would *prevent* them from returning. If they said "no" they were asked to identify the cost level (also in relation to their actual cost) that would *induce* them to return. These cost levels were taken as the maximum willingness to pay for a return trip. For each respondent, a positive difference between willingness to pay for return trips and actual trip cost was taken as an estimate of that individual's consumer surplus for the whole trip. For foreign anglers, the consumer surplus for the Namibian part of the trip was calculated proportionally, based on the ratio between expenditures for the *whole trip* and the *Namibian component of the whole trip*. Thus, the not unreasonable assumption was made that consumer surplus for the Namibian part of the trip was proportionally the same as that for the whole trip.

The cost of travel and the cost of the overall trip were common to all, and most respondents seemed able to make a good estimate of these themselves. They were first asked for these two costs in that order, before being asked to value any other specific components of the trip such as accommodation. The order of questions was selected with care after the pilot survey, and was thought to reduce the potential for both *budget constraint*[4] bias (as described by Mitchell and Carson 1989), and also *embedding* or *part-whole*[5] bias (as described by Navrud and Mungatana, 1994, and Kahneman and Knetsch, 1992). Focus on the *overall* trip cost for the willingness to pay question was also thought to reduce the possibility of these biases. Other

[4] Where the respondent answers within a budget constraint which differs from that which the researcher intends to invoke

[5] Where a respondent values a larger or smaller entity than the researcher's intended good

workers doing willingness to pay surveys (Moran, 1994; Navrud and Mungatana, 1994) have also deemed it best to focus on the overall trip cost.

Getting anglers to focus on *return* trips in their consideration of willingness to pay was thought to reduce confusion between actual and maximum estimates, which might arise if they were to focus on the *actual* trip. In as much as desire for return trips is likely to be less than that for *first time* trips the estimates of actual demand and consumer surplus are likely to be conservative. We consider this of value in reducing any effects of *avidity*[6] bias, as described by Thomson (1991), which might be expected. The way the question was worded (using the words "prevent" and "induce") was thought to reduce the possibility of *strategic*[7] bias as described by Mitchell and Carson (1989). Using the actual angling experience as the reference point for the valuation of a return trip was considered to minimise the risk of various forms of *miss-specification*[8] bias and reduce the risk of other possible sources of bias defined by Mitchell and Carson, such as *compliance*[9] bias, *starting point*[10] bias, *range*[11] bias, *relational*[12] bias and *positional*[13] bias.

Care was taken with the order of questions, to minimise the possibility of embedding or part-whole bias. Generally, respondents are asked to state several expenditure estimates. Depending on in which order these questions are asked, the valuation might become different. For instance, if the valuation question is asked late in a sequence, the consumer surplus tend to be higher than if the same question is asked first earlier. (Kahneman and Knetsch, 1992). It is therefore vital that the sequencing of the questions is constructed with stringency. In the pilot study, we first asked for the total cost figure and then about the specific parts of it. We believed that this would reduce the risk of embedding bias. However, the results from the pilot survey showed that the questions were mixed and misunderstood. Therefore we first asked about the respondent's *travel* cost, then the *total* cost and thereafter the parts of the total cost other than travel cost such as the specific *angling* cost.

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[6] Where the survey attracts respondents who are more avid or enthusiastic than the average

[7] Where a respondent gives an answer that differs from his/her true amount in an attempt to influence the provision of the good and/or the respondent's level of payment for the good

[8] Biases of this type occur when a respondent does not respond to the correct contingent scenario

[9] Where a respondent gives an answer that differs from his or her true one in an attempt to comply with the presumed expectations of the sponsor/researcher, or to please, or to gain status in the eyes of the researcher/interviewer

[10] Where the elicitation method or payment vehicle directly or indirectly introduces a potential answer that influences the answer given by the respondent

[11] Where the elicitation method presents a range of potential answers that influences the respondent's answer

[12] Where the description of the good presents information about it's relationship to other public or private commodities that influences a respondent's answer

[13] Where the position of, or order in which, different valuation questions for different goods, or levels of a good, suggest to the respondent how those levels should be valued

In addition to and following the payment card, we used an open-ended question, where we asked the respondent to state his/her maximum willingness to pay for the return trip. This use of two different elicitation techniques was aimed at getting closer to the true willingness to pay. Studies have shown (Kealy and Turner, 1993) that open-ended questions tend to give lower consumer surplus estimates than close-ended ones. Later in the questionnaire, respondents were asked to state if they were willing to pay for an annual angling licence, and, if so, how much they would pay. Similarly, they were also asked if they would be willing to pay into a *coastal resources conservation fund*, to be administered by an agency of their choice, aimed at ensuring conservation of the fish resource. If they said yes, they were also asked how much they would pay.

By informing respondents, before they completed the questionnaire, that the Ministry of Environment and Tourism was carrying out an environmental evaluation of recreational angling, we aimed to avoid possible sponsor bias. In general, the interviewers felt that the respondents answered the questions correctly and honestly.

Price elasticities

We attempted to derive measures of price elasticity from the data and the demand functions developed using the TCM and CVM methods. First multiple and then simple regressions were run on the raw variables to try to determine price, income, success and other elasticities. Then the second stage demand functions developed in the travel cost analysis were used to try and determine mainly price elasticities. Then the variable for willingness to pay, obtained in the contingent valuation study, was manipulated to develop a derived demand function. Here, the range of willingness to pay was divided into 20 equal segments, and a frequency histogram depicting the distribution of responses along the range was drawn. Simple regression on the histogram data was carried out to obtain the *price* (willingness to pay) to *quantity* (number of respondents per price category) relationship. Double log, lin-log, log-lin, linear and reciprocal functional forms were tested for both multiple and simple regression models. In multiple regressions, different combinations of explanatory variables were tested in an attempt to minimise multicollinearity effects. Only models displaying significance, overall and with respect to the coefficients, were retained. Elasticities were calculated from the model data. Point elasticities at mean and median price values were calculated for all other than double log functions.

RESULTS

Angler profile

General characteristics of the angling population are presented in Table II. The average angling visitor to the Namibian coast was 45 years old, was male, spent 10 days at the coast (of which he spent 8,2 days fishing), travelled with 3 people, travelled by own vehicle, used private accommodation, and had an annual income of

N$116 000. The latter figure is an approximate one, since data on income from the questionnaires was inadequate, due to low response, and statistical data on this was lacking for Namibia. An attempt to estimate more complete income data using regression and the Heckman two-stage approach was unsuccessful.

From the anglers' responses it was determined that the mean weight of the daily catch was 6,06 kilograms, and the mean number of fish caught per day was 3,98. The average angler had 21 years of angling experience and spent 26 days per year angling. Only 12% of the angling population were members of an angling club.

Travel cost model

Five visitation rate models were tested with different functional forms. Of all the models forms tested, the lin-log function had the best explanatory power for each of the five models. This is also consistent with earlier research where the semi-log function has been widely used (Ziemer *et al.*, 1980; Strong, 1983). Table III shows the five models. All independent variables were, as expected, negative (i.e., the lower the travel costs, the more frequently anglers visit the coast). Further, they were all significant at the 99% level of significance ($p < 0,01$). The modelling was thus successful and consistent with theory. As stated above, attempts to include other variables, such as income were unsuccessful. We encountered very low levels of significance and multicollinearity problems. It is possible that income has little effect on the demand for angling trips.

The model with the *mixed* time cost, as defined by Hanley and Spash (1993) was chosen for further analysis. We believe that this cost level is closest to what the respondents perceived when the interviewing was carried out. A majority of 95% *did* enjoy their travelling time. The demand for recreational angling can thus be described by the following function:

$$VPC = 0,004232 - 0,00055 \ln P$$

where VPC is the number of visits per capita and P is the trip cost.

Table IV shows the trip expenditures and consumer surpluses determined using the the travel cost method. It was considered useful to split the angling population into the three main segments based on origin. Accordingly, the results are presented for the coastal Namibians (from Henties Bay, Swakopmund and Walvis Bay), inland Namibians (mostly from Windhoek), and foreigners (from South Africa).

As can be seen in Table IV, the estimates differ markedly between segments. The mean consumer surplus per trip for foreign anglers was more than three times larger than that for the Namibians. There was also a notable difference within Namibia. Inland Namibians enjoyed a more than two times larger consumer surplus than did the coastal Namibians. However, seen as percentage of trip costs, the coastal

Namibian anglers enjoyed the largest consumer surplus, while the foreign anglers had the smallest.

The inclusion or not of on site and other non-travel costs (accommodation, food, entry fees, costs of capital items) in the model was tested in sensitivity analysis. The consumer surplus estimates were found to be sensitive to their inclusion. This finding points to the need for care in determining which costs to include in travel cost analysis. The results in Table IV show consumer surpluses derived with full inclusion of these costs. The fact that these consumer surplus values conform closely with those we derived using contingent valuation (see below) seems to suggest that our approach to inclusion of on site costs is valid.

According to the sample, coastal Namibians spend 41,4 days angling per year, while inland Namibians spend 18,9 days per year, and foreigners spend 18,5 days per year, angling. As calculated by Kirchner (1999), the numbers of anglers per year were 1 279 for coastal Namibians, 3 156 for inland Namibians, 3 836 for foreigners. Given the consumer surplus per day for these categories (N$149, N$122 and N$165, respectively), the aggregate annual consumer surplus for the angling population is thus estimated at some N$26,9 million.

Contingent valuation

The contingent valuation study used the stated preferences rather than derived ones, for the consumer surplus estimations. As such, it is a direct valuation technique. Table V presents results from the contingent valuation study. As with travel cost, the population was split into three different segments of origin.

The consumer surplus, in absolute nominal terms, was greatest for foreigners. It was double the inland Namibians and more than triple the coastal Namibians. Expressed as percentage of expenditure, though, the coastal Namibians enjoyed a surplus of 121% compared with the foreigners' 48%. The aggregated consumer surplus was estimated to some N$23,7 million per annum. This is more or less the same amount as the travel cost method result. The results from the two widely disparate methods show a remarkable convergence. Comparison of the results for the different segments in Tables IV and V, also show a remarkable consistency of pattern, although the absolute values are slightly divergent.

We carried out some multiple regression analysis using the questionnaire data, in an attempt to get at *determinants* of willingness to pay, as estimated through contingent valuation. We thus regressed monetary as well as non-monetary variables against the respondents' willingness to pay. Several models were developed most of which suffered from problems with multicollinearity. Table VI shows the results for the best one, a log-linear model with and adjusted R^2 value of 0.32. It excludes other variables, rejected because of non-significance. The results give some *indication* on how the variables affect anglers willingness to pay. If an angler is foreign, her/his willingness to pay is increased. Female anglers have lower willingness to pay than

men. If an angler is from inland Namibia, her/his mean willingness to pay is reduced by N$1 172. The more frequently an angler visits the coast, and the larger the angling group have a small effect on angler willingness to pay. If an angler is not a member of an angling club, her/his willingness to pay is decreased. The number of fish caught, a measure of angling success, had a very small influence on the willingness to pay, but the coefficient here was not significant.

From the questions eliciting willingness to pay for conservation, we found that 74% of anglers were willing to contribute to a coastal resources conservation trust fund. On average, excluding zero responses, anglers were willing to pay N$175 annually to this fund. With zero responses included, the mean willingness to pay fell to N$126 per annum. Namibians appeared willing to pay more than foreigners, but the difference was not statistically significant. Kirchner *et al.* (2000) calculated the number of anglers at the coast during the year before our survey to be 8 271. Thus, at N$126 per angler, a conservation fund could capture some N$1 million annually.

A considerable majority of anglers (also 74%) was, in addition, willing to pay for a fishing licence. If a licence system were established, revenue amounting to some N$340 000 per annum (N$41 per angler) could be generated.

Price elasticity of demand

Multiple regression models constructed from the unaltered data, with number of days fishing per annum as the dependent variable, and including willingness to pay, angling success, angler age, angler experience, club membership, annual income, among others in various combinations as explanatory variables, had extremely poor fit. They were also affected by multicollinearity and were thus abandoned. Elasticities were obtained, as explained above, from second stage demand functions developed in the travel cost analysis, and derived price-quantity demand functions developed from the contingent valuation willingness to pay data. The lin-log form consistently provided good fit and significance. The second stage lin-log travel cost demand function used is described as

$$Q = 18052.43 - 25.48 \ln P - 1186.61 \ln I - 837.02 \ln C$$

where Q is the quantity of angling trips, P is trip cost, I is angler annual income, and C is angler consumer surplus. This model shows a negative response to rising price, as expected, but (not as expected) negative signs to the income and consumer surplus variables. The derived lin-log demand function constructed from the contingent valuation (willingness to pay) data is described as

$$Q = 266.09 - 29.43 \ln Pw$$

where Pw is the willingness to pay for angling trips.

The results, shown in Table VII, suggest that, on average, demand of shore angling on the Namibian coast is price inelastic. They also show variation in results, depending on the model used to estimate elasticities, which highlights the need for sensitivity analysis in such exercises. The simple regression models are mis-specified to the extent that other, possibly explanatory variables are omitted. Our sensitivity analyses indicated that price elasticities derived from simple regressions were consistently higher than those from multiple regressions. True price elasticity is thus probably lower than indicated in Table VII

Aggregate values

Calculations, made from our data and those of Kirchner *et al.* (2000), indicated that 8 800 anglers spent 173 000 days angling on the Namibian coast during 1997/98 season. These aggregate angling numbers were used to calculate aggregate economic values for the recreational shore fishery, which are presented in Table VIII. There are two different sets of values because of the two valuation methods used. As can be seen, there is a minor difference between the aggregated consumer surpluses (N$23,7 to N$26,9 million). The fact that two completely different methods give quite similar results indicates validity in these methodologies. There is reason to believe that we have found estimates that are close to the "true" values.

The direct economic use – which is made up of the aggregated consumer surplus and expenditure – was estimated to N$49,9–N$54,9 million per annum. Only the consumer surpluses of Namibians accrue within Namibian society, while those of foreigners' are lost to it. This means that the estimated economic use value attributable to Namibia was some N$38,1 – N$48,2 million per annum. The value added to the Namibian GNI was estimated to be N$11 – N$15 million, or 48% of expenditure.

DISCUSSION

Seen in an historical context, the Namibian recreational angling sub-sector has never been considered as an important or a substantial part of the total fishery sector. However, two studies, this one and that of Kirchner *et al.* (2000), suggest that it *does* indeed provide significant economic value and income within Namibia. According to the Central Bureau of Statistics (1998) in Namibia, the whole fisheries sector in Namibia contributed some N$391 million in value added to the gross national income in 1996. The gross value added of the recreational fishery in 1998 (Table VIII) was most likely between N$11 million and N$15 million per annum, which would represent a share of between 2,8% and 3,8% of the value added in the Namibian fishery sector, in 1996. The *impact* of the sector expenditures on gross national income, as described by Kirchner *et al.* (2000), is of course quite a lot higher as a result of multiplier effects within the economy, but we have not considered this here.

Only the Namibians' consumer surplus is beneficial for the Namibian economy. Those of foreign visitors are lost to the country and it behoves Namibia to try and capture this value. Ways in which this might be achieved might include implementing a fishing licence system, imposing other indirect taxes on anglers, or soliciting donations from anglers towards a conservation trust fund. Our findings suggest that demand in the recreational shore fishery is price inelastic, which means that imposition of new costs on anglers is unlikely to deter them from the activity. The finding is supported by that of McGrath *et al.* (1997) who found the price elasticity of demand in the South African recreational marine shore fishery to also be very low. Further support comes from the broader tourism sector. Several studies on wildlife tourism in Africa and elsewhere have found low price elasticities (Barnes, 1996; Navrud and Mungatana, 1994).

Kirchner *et al.* (2000) did not actually measure consumer surplus for the recreational fishery, but used empirical data from elsewhere in the Namibian tourism sector (Barnes *et al.*, 1997) to estimate it. They got estimates for consumer surplus that were considerably lower than ours (N$8,6 million, compared with around N$25 million per annum). Our study incorporated methods identical to those of Barnes *et al.* (1999) and, with corroborating evidence from Botswana (Barnes, 1996), it seems possible to conclude that consumer surpluses in the recreational fishery are significantly larger, *relative* to trip costs, than they are among the broader nature-based tourism sector.

Although we used two completely different methods, with different cost figures, we ended up with almost exactly the same aggregated consumer surplus, which is a key economic value for policy analysis. This of course provides convergent validation and adds to the weight of the findings. Given that there are few other comparable studies this is important. Further, our measures of aggregate angler expenditures, are close to that measured by Kirchner *et al.* (2000) in an entirely different survey carried out just before ours. Our estimates, of N$23 million and N$31million, more or less conform with theirs of N$30 million.

The total willingness to pay of the recreational angling sub-sector, i.e., total expenditure plus total consumer surplus, consists entirely of direct use values. The contingent valuation part of the questionnaire was not specifically designed to collect information on non-use values. However, an indication of the non-use values of the fishery can be found in the willingness to pay toward a coastal conservation trust fund. As stated, the anglers were found to be willing to contribute some N$1 million per annum in aggregate for this. Anglers may be willing to pay for conservation of the resource so they can use it in future (option value), or simply be willing to contribute toward its continued existence without intending to return and use it (existence value).

Holtzhausen and Kirchner (1998) provide evidence to show that, with kob, angling catch per unit of effort is significantly higher in areas which are closed to recreational angling (but open to line-fish boats). This suggests that the anglers do

indeed affect the stock levels in a negative way. In detailed studies on the kob population, Kirchner (1998) also provided evidence for a decline in stocks. As stated by Kirchner *et al.* (2000), current daily bag limits for anglers are liberal. Our evidence concerning the determinants for willingness to pay and price elasticities corroborates theirs. Thus, sharp reductions in bag limits are likely to be feasible and may not reduce the numbers of anglers.

POLICY IMPLICATIONS

This study has shown that marine recreational angling in Namibia has significant value as a component of the total fisheries sector in Namibia. The value added of by all productive activities within the recreational angling sub-sector amounts to between 3% and 4% of the fisheries sector. Catch rates are high relative to those elsewhere, the experience is rated highly by both local and foreign anglers, and there is potential for expansion if sound policies are adopted.

It is recommended that a marine conservation trust fund be established, in order to enable capture of some of the foreign consumer surplus. This economic value is currently lost to the Namibian economy, and could be used to develop the resource and recreational angling further. In addition, a fishing licence system should be established, because of the income it would generate, but also to facilitate management and collection of statistics. It would enable more systematic monitoring and control of the number of anglers, how much they catch, and hence enable management of off-takes.

This is a preliminary study and more, more detailed, more specific research is indicated for the angling sector. As examples, it would be useful to determine more values specific to the different market segments, and what effect quality variation would have on the demand for angling trips. In this study, we found that angling success did not determine the number of trips, but more specialised studies would examine this more thoroughly. For methodological reasons, it would be interesting to run a conjoint travel cost and contingent valuation analysis, as described by Cameron (1992). We have shown that the two methods presented similar results regarding consumer surpluses for this particular study, and it would be of great interest to corroborate this through further work.

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LITERATURE CITED

ASHLEY, C. 1995 - Tourism, communities, and the potential impacts on local communities and conservation. Research discussion paper No. 10, Directorate of Environmental Affairs, Ministry of Environment and Tourism, Windhoek, Namibia.

AARSA. 1998 - Vehicle ownership cost schedule. Automobile Association of South Africa, Johannesburg, South Africa.

BARNES, J. I. 1996 - Economic characteristics of the demand for wildlife viewing tourism in Botswana. *Development Southern Africa* 13: 377-397.

BARNES, J. I., SCHIER, C. and VAN ROOY, G. 1999 - Tourists' willingness to pay for wildlife viewing and wildlife conservation in Namibia. *South African Journal of Wildlife Research* 29: 101-111.

CAMERON, T. A. 1992 - Combining contingent valuation and travel cost data for the valuation of non-market goods. *Land Economics* 68: 302-317.

HANLEY, N. and SPASH, C. L. 1993 - Cost-benefit analysis and the environment. Edward Elgar Publishing Limited, Aldershot, UK.

HOLTZHAUSEN, J. A. and KIRCHNER, C. H. 1998 - Kob fishery in Namibia. *Namibia Brief* (Namibia Foundation, Windhoek, Namibia) 20:130-133.

KAHNEMAN, D. and KNETSCH, J. L. 1992 - Valuing public goods: the purchase of moral satisfaction. *Journal of Environmental Economics and Management* 22: 90-94.

KEALY, M. J. and TURNER, R. W. 1993 - A test of the equality of close-ended and open-ended contingent valuations. *American Journal of Agricultural Economics* 75: 321-331.

KERR, G. N. 1986 – *Introduction to non-market valuation: theory and methods*. Centre for Resource Management, Lincoln College, Christchurch, Canterbury, New Zealand. 60pp.

KIRCHNER, C. H. 1998 - Population dynamics and stock assessment of the exploited silver kob (*Argyrosomus inodorus*) stock in Namibian waters. PhD Thesis, Faculty of Science, University of Port Elizabeth, Port Elizabeth, South Africa.

KIRCHNER, C. H., SAKKO A.L. and BARNES, J. I. 2000 - An economic valuation of the Namibian recreational shore-angling fishery. *South African Journal of Marine Science* 22: 17-25.

MCGRATH, M. D., HORNER, C, C, M., BROUWER, S. L., LAMBERTH, S. J., MANN, B. Q., SAUER, W. H. H. and ERASMUS, C. 1997 - An economic valuation of the South African linefishery. *South African Journal of Marine Science* 18: 165-177.

MITCHELL, R. and CARSON, R. 1989 - *Using surveys to value public goods, the contingent valuation method*. Resources for the Future, Washington, DC, USA.

MORAN, D. 1994. - Contingent valuation and biodiversity: measuring the user surplus of Kenyan protected areas. *Biodiversity and Conservation* 3: 663-684.

NAVRUD, S. and MUNGATANA, E. D. 1994 - Environmental valuation in developing countries: the recreational value of wildlife viewing. *Ecological Economics* 11: 135-151.

NOAA Panel (1993) - Natural Resource Damage Assessments Under the Oil Pollution Act of 1990," U.S. Dept. of Commerce, National Oceanic and Atmospheric Admin., *Federal Register,* vol. 58: no. 10 (Jan. 15, 1993): 4601-4614.

PEARCE, D. W. and TURNER, R. K. 1990 - Economics of natural resources and the environment. Harvester Wheatsleaf, London, UK.

RANDALL, A. 1994 - A difficulty with the travel cost method. *Land Economics* 70: 88-96.

STERNER, T. 1994 - *Environmental economics*. Göteborg University, Göteborg, Sweden.

STRONG, E. 1983 - A note on the functional form of travel cost models with unequal zonal populations. *Land Economics* 59: 342-349.

THOMSON, C. J. 1991 - Effects of the avidity bias on survey estimates of fishing effort and economic values. *American Fisheries Society Symposium* 12: 356-366.

ZIEMER, R., MUSSER, W. and HILL, C. 1980 – Recreation demand equations: functional form and constructions. *American Journal of Agricultural Economics* 62: 136-141.

Table I: Zones used in the travel cost model

Zone	Number of visits	Population (thousands)	Visits per 10 000 inhabitants	Mean zone trip cost (N$)
Kwazulu-Natal	15	7 672	0,020	3 273
Gauteng	89	7 171	0,124	2 041
Eastern Cape	5	5 865	0,009	2 873
Northern Province	11	4 128	0,027	3 258
Western Cape	86	4 118	0,209	2 008
North West	34	3 043	0,112	1 902
Mpumalanga	17	2 646	0,064	1 669
Free State	9	2 470	0,036	1 766
Northern Cape	30	746	0,402	1 489
Inland Namibia	199	275	7,236	638
Henties Bay	24	10	9,000	122
Swakopmund	47	25	18,80	88
Walvis Bay	45	50	24,00	87

Table II: General characteristics of the marine shore-angling population (Namibia, 1998)

Item	Value
Foreigners	46%
Coastal Namibians	15%
Inland Namibians	38%
Mean age	45 years
Male gender	94%
Mean duration of stay	10 days
Mean size of angling party	4,3 people
Mean days spent angling	8,2 days
Type of travel to coast – own two-wheel drive car	42%
Type of travel to coast – own four-wheel drive car	45%
Use of private accommodation	46%
Use of state-owned accommodation	24%
Mean annual net income	N$115 681
Membership of angling club	12%
Mean number of years of angling experience	21
Mean number of days fishing per annum	26
Rated the angling as good or excellent	66%
Mean number of fish caught per day	4,0
Mean weight (kg) of fish caught per day	6,1

Table III: Details for five preliminary demand functions for recreational shore-angling derived with the travel cost method (Namibia, 1998)

Model	Variable	Value	R^2
Model 1 (100% time cost)	Constant	0,003331	0,91
	Ln price	-0,0004	
Model 2 (60% time cost)	Constant	0,0032	0,91
	Ln price	-0,00041	
Model 3 (30% time cost)	Constant	0,003138	0,93
	Ln price	-0,00043	
Model 4 (0% time cost)	Constant	0,002848	0,94
	Ln price	-0,00043	
Model 5 (Mixed time cost)	Constant	0,004232	0,85
	Ln price	-0,00055	

Table IV: Estimates of mean angling trip costs and consumer surpluses for recreational shore-anglers, made using the travel cost method (N$, Namibia, 1998)

Segment	Trip cost	Consumer surplus per day	Consumer surplus per trip	Consumer surplus as % of trip cost
Coastal Namibians	101	149	239	237%
Inland Namibians	638	122	639	100%
All Namibians	440	n.a.*	491	112%
Foreigners	2 051	165	1 947	95%

* not available

Table V: Estimates of mean angling trip costs and consumer surpluses for recreational shore-anglers, made using contingent valuation (N$, Namibia, 1998)

Item	Coastal Namibians	Inland Namibians	Foreigners
Angling trip cost	267	744	2 325
Consumer surplus	322	562	1 116
Consumer surplus per day	188	116	95
Consumer surplus as % of trip cost	121%	76%	48%

Table VI: Some determinants of willingness to pay, as determined using contingent valuation, for angling trips among recreational shore-anglers (Namibia, 1998)

Variable	Coefficient	p-value
Intercept	6,58	<0,01
Gender (1=female)	-0,53	<0,01
Foreign (1=yes)	0,92	<0,01
Visits per year	-0,01	<0,01
Size of group	-0,02	<0,05
Member of an angling club (yes=0)	-0,15	0,25
Replacement cost of fishing equipment (N$)	0,00005	<0,05
Success (fish caught)	-0,006	0,31

Table VII: Estimates of price elasticity of demand for angling trips among recreational shore-anglers (Namibia, 1998)

	R^2	Point elasticity at: Mean price	Median price
Travel cost models			
Second-stage demand function			
Lin-log model[1]	1.00	-0.16	-0.15
Contingent valuation models			
Derived demand function			
Linear model[2]	0.73	-0.32	-0.21
Lin-log model[2]	0.93	-0.71	-0.58
Reciprocal model[2]	0.84	-1.03	-1.02

[1] multiple regression
[2] simple regression

Table VIII: Aggregate economic values for the recreational shore fishery as determined using the travel cost and contingent valuation methods (N$'000, Namibia, 1998)

Value		Travel cost method	Contingent valuation
Aggregated expenditure		22 978	31 303
Aggregated consumer surplus		26 897	23 611
Consumer surplus accruing to Namibians		15 152	16 869
Direct economic use value	(Expenditure + consumer surplus)	49 875	54 914
Gross direct economic use Value attributable to Namibia	(Expenditure + Namibian consumer surplus)	38 130	48 172
Value added to gross national income	(Expenditure – 52%)	11 029	15 025
Value added to net national income	(Expenditure – 59%)	9 421	12 834