Analysis of sportfishing expenditures in the Pantanal

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Abstract:

Sport or recreational fishing is an important source of employment and revenue to the people of the Pantanal region. It has been reported that 72% of fish caught are captured by sport fishers. Yet, little is known about the characteristics and expenditures of sport fishers in the Pantanal. We provide an analysis of the principal correlates with sport fishing expenditures in the southern Pantanal region. We analyze the results of a formal oral survey of 493 sport fishing visitors during the high fishing season of 1994. Visitors were polled regarding costly aspects of their vacation decision, travel history in the region, reasons for choosing the Pantanal as a tourism destination, and aspects of their experience, in addition to demographic information. Three first order linear regression models are explored to reveal the principal features of Pantanal sport fishing expenditures. We find statistically significant relationships between visitor and trip characteristics and their total and daily expenditures for sport fishing in the Pantanal and for a proxy for fishing success. Statistically significant correlates with total and daily expenditures include respondent income, mode of transportation, fishing success, education level and motivations for visiting the Pantanal. In general, the higher the level of education, the greater the fishing success, the higher the income, the choice of traveling by air, and the greater the distance from the Pantanal the higher the predicted per trip and per day expenditures. Moreover, those who are principally motivated to visit the Pantanal to view wildlife and enjoy its unique natural environment spend significantly more money on sport fishing trips than those motivated primarily by either potential fishing success or relaxation. Fishing success is most highly correlated with the age of the respondent and his level of education. However, contrary to conventional wisdom, it is not correlated with expenditures, local experience, or a passion for fishing. Local policy implications of this study include working to attract more nature-oriented visitors and managing fish resources as parts of greater ecosystems rather than principally as a harvestable renewable resource.

Key words: Pantanal, sport fishing, tourism, natural resource management, expenditures

* Seidl's portion of this work financed through the PROMOAGRO program of the International Institute for Cooperation in Agriculture (IICA) and the Interamerican Development Bank.

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1. Introduction

The Brazilian Pantanal is an 138,000 km^2 tropical seasonal wetland located in the center of South America. The Pantanal provides the flood plain for the 360,000 km^2 Upper Paraguay River Basin (UPRB) which is comprised of land in Bolivia and Paraguay as well as Brazil. The Pantanal is known as a cradle of biological diversity and unique global resource. More than 650 bird species, 260 fish species, 80 mammal species, 50 species of reptiles and 2,000 floral species have been identified. Among the most recognized species found in the region are the giant anteater, jaguar, giant river otter, blue hyacinth macaw, caiman, maned wolf, jaburu stork, piranha, capybara and puma. The principal economic activities within the region are extensive cattle ranching, industrial and individual mining, recreational, subsistence, and commercial fishing, and, most recently, ecological or rural tourism.

Recreational or sport fishing in the region's many rivers provides an important source of employment and revenue to the people of the Pantanal. More than 46,000 recreational fishers visited the southern part of the Pantanal between May of 1994 and April of 1995 and 72% of fish landed were captured by sport fishers (Catella, et al. 1996). Little is known about the characteristics and expenditures of sport fishers in the Pantanal. In this work we model the principal correlates of sport fishing trip characteristics with expenditures in order to better understand sport fishing in the Pantanal.

2. Methodology

2.1 Survey effort

Orally administered written surveys were taken of Pantanal sport fishers over a 3 month period in 1994. These months, August, September and October, constitute the quarter of greatest sport fishing pressure and represent more than 60% of the total annual visits and catch by weight (Catella et al.,1996). Surveys were administered at the mandatory weigh stations near the towns of Miranda and Corumba in Mato Grosso do Sul, Brazil. Miranda and Corumba are the most popular sport fishing

destinations in the southern Pantanal. Catella et al. (1996) reported 47% of the fish taken from the southern Pantanal by sport fishers come from the Paraguay river (serviced by Corumba) and 27% come from the Miranda river (serviced by Miranda). Sampling was on a nonrandom "catch-as-catch can" basis. Visitors were polled regarding costly aspects of their vacation decision, their reasons for choosing the Pantanal as a tourism destination, and aspects of their experience, in addition to demographic information. Survey responses were analyzed and reported using traditional parametric and nonparametric statistical methods. In total, 493 useable questionnaires were derived from this effort.

2.2 Modeling effort

It is in the interests of the industry and of local and regional governments to know what features of their clientele and of their vacation habits correlate most strongly with expenditures. In addition, conventional wisdom tells us that the better the fishing the more sport fishers should be willing to pay to fish. Three base or "unrestricted" models or relationships are estimated in order to improve our understanding of sport fishing visits to the Pantanal: total trip expenditures (TE), expenditures per trip-day (E/D), and kilograms of fish caught per trip (KG). First order linear expressions were used to model the relationships between these three dependent variables and as many as 16 independent variables describing features of sport fishing visitors or of their visits. Therefore, independent variables in the estimated relationships included: respondent's monthly income (INC), age (AGE), the total reported number of visits to the Pantanal region for sport fishing (VIS), the average number of days per visit (DAY), the distance traveled to and from the region from the respondent's home (DST), the total number of fish caught (TFC), the total weight of the catch (KG), the total number of hours spent traveling to and from the region (HR), whether he traveled by roadway (CAR) or by plane (PLN), whether he purchased a package to cover all or part of his expenses (PCK), his principal reason for visiting the region (R1-3, R4-5&8, R6-7), and his education level (ED3-4, ED5, ED6-7) (Table 1).

"Nested" or "restricted" estimated relationships sought to improve the statistical description and prediction of each of the proposed unrestricted relationships. The strength of the unrestricted

models was assessed based upon the F-test. The appropriateness of included variables was based upon the T-test and the value of the restricted models relative to the unrestricted models was based upon the Chow-test (Chow, 1960; Fisher, 1970; Johnson, 1970).

3. Results

3.1 Overview of the Pantanal sport fisher and his trip

3.1.1 Demographics

Of the 493 useable responses, 99% were completed by Brazilian men who live outside of the Pantanal region. The mean respondent was a 43 yr old man with 2 children and a monthly salary of about US$4,400. More than ½ of respondents held university degrees, while more than 85% had completed secondary school. Sport fishers traveled to the Pantanal in groups averaging about 7 adults.

3.1.2 Motivations

It would be logical that the primary reasons for sport fishers to visit the Pantanal region would be directly related to fishing. While direct aspects of sport fishing (catching many, large or varied fish) were the most important reasons for about 1/3 of respondents, 2/3 of survey responses cited reasons associated with outdoor tourism of a more general nature. More than ½ of respondents indicated that their principal reason for visiting the Pantanal was due to the quality of the natural environment and 7% cited the possibility of seeing exotic wildlife as their primary motivation (Table 2).

3.1.3 Trips

The respondents to the sport fishing questionnaire had traveled to the Pantanal a total of 1,943 times for a cumulative total of more than 13,000 days visiting the region. On average, respondents had visited 3.9 times and had stayed 26.5 days in the Pantanal. Sport fishing visitors report staying an avaerage of 6.3 days in the Pantanal per trip. Catella et al. (1996) report a stay of 4-6 days per sport fishing visit (median of 5).

3.1.4 Expenditures

Respondents to this survey reported spending a total of US$471,191, or US$970 per person, on

their fishing visit to the Pantanal. Average expenditures per day in the Pantanal were US$163. Fewer than 1/4 of respondents reported purchasing some sort of travel package totaling US$92,088 or 20% of total expenditures. The average package price was about US$800. Those purchasing packages spent, on average, US$1,046 on their visit or about US$174 per day in the Pantanal. Total expenditures by visitors purchasing packages accounted for about 26% of total expenditures overall. Greater than 3/4 of respondents did not purchase a vacation package. Their visits to the Pantanal cost about US$946 on average, or US$160 per day.

While its remoteness is considered among the region's positive characteristics, traveling to the Pantanal poses a substantial investment in time or money or both. At approximately 300 to 400 km from the nearest population center and more than 1,500 km from the most populous regions of Brazil, traveling to Pantanal can be an adventure in itself. On average, visitors traveled a total of about 2,800 km or 468 km per day spent in the Pantanal. About 3/4 of all respondents traveled from the state of Sao Paulo, 12% from Parana, 3% from Minas Gerais, and 2% each from Santa Catarina, Mato Grosso do Sul and Rio de Janeiro. About 1% or fewer visitors traveled from the states of Rio Grande do Sul, Espirito Santo, Ceara, Bahia, Goias and the Capitol District. Catella et al.(1996) reported that 72% of visitors came from Sao Paulo, 11% from Parana, and 6% from Minas Gerais.

3.1.5 Mode of transportation

Visitors have the option of flying, taking a bus, chartering a bus or plane, or driving their own vehicles. Due to data restrictions and potential errors in interpretation, responses were divided between those who arrived by air (31%) and those who arrived by roadway (69%) for their most recent trip to the region. Those visitors arriving by roadway traveled 2,718 km on average, while those arriving by air traveled 2,991 km round trip to visit the Pantanal. Via roadway, the trip took an average of 34 hr (6 hr per day) at a cost of US$65 (US$0.03 per km, US$11 per day) versus 4 hr (<1 hr per day) and US$764 (US$0.26 per km, US$132 per day) by air. A substantial tradeoff between time and money exists in the selection of mode of travel for a visit to the Pantanal.

3.1.6 Fishing success

Although sport fishing visits to the Pantanal are not principally motivated by expectations of

the fish catch, catching fish (number, weight or variety) remains among the motivations for sport fishers to travel to the region. Respondents provided information about their success in capturing 8 popular fish species. Clearly, not all fishers attempted to catch or caught all species. However, our data did not allow us to distinguish fishing effort from success.

Respondents reported catching more than 41 thousand fish (mean=12 per visitor-visit, 2 per visitor-day) weighing more than 89 thousand kg (mean=25 kg per visitor-visit, 4 kg per visitor-day) on this trip. Catella et al. (1996) reported a median of 20 to 27 kg per visitor-trip and 3.7 to 6.2 kg per visitor-day. The Catella study used reported an annual median of 22.5 kg per visitor-trip, 4.6 kg per day, and 5 days per visit. We use a mean observed visit of 6.3 days in our calculations.

The great majority of fishers captured Pacu, Pintado/Cachara, Piranha, and Barbado species (92%, 84%, 84%, and 73%, respectively). The four species caught by the most visitors accounted for about 95% of fishing success both in terms of number and weight of fish captured. Pacu accounted for 42% of the fish caught and 56% of the total weight. Piranha comprised 39% of the fish caught, but only 13% of the total weight. Pintado were only 7% of the fish caught, but 17% of the total weight. Barbado made up 8% of both the number of fish and the total weight captured. Catella et al. (1996) reported that Pacu represented 44% of the weight of fish landed by sport fishers, Pintado/Cachara 22%, Piranha 6% and Barbado 5%, or a total of 77% of the catch.

Finally, based on survey information, respondents spent US$69.87 (s.d. 165.01) per kilo or US$148.91 (s.d. 331.10) per fish captured. Clearly, for the majority of visitors, there is more to the sport fishing experience than providing an additional source of protein for his family.

3.2 Model 1: Total expenditures

3.2.1 Model choice

Our first model sought to reveal the descriptors and predictors of expenditures on sport fishing visits to the Pantanal. The results of the unrestricted model and two restricted models are reported here (Table 3).

The unrestricted model regressed income, age, number of visits, number of days visiting,

number of fish caught, weight of fish caught, distance traveled, time traveling, mode of transportation, package purchase, reason for visiting, and education level against total trip expenditures. The estimated relationship was statistically significant by conventional standards ($F=38.48$, $p<0.05$). The intercept term, incorporating information for respondents motivated to visit the Pantanal for either leisure or due to its proximity to their homes, income, days visiting, total fish, total weight, distance traveled, roadway travel, motivation by fishing, motivation by natural environment, and relatively low education level were found to be statistically significant variables (t-test, $p<0.10$) in the unrestricted model (Table 3).

The first restricted model regressed these statistically significant variables from the unrestricted model against total expenditures. The resultant estimated relationship was statistically significant ($F=66.48$, $p<0.05$) and all of the included variables were found to be statistically significant predictors (t-test, $p<0.10$) of total sport fishing expenditures except for the total number of fish caught (Table 3).

The second restricted model included all of the variables from the first restricted model less the total number of fish caught. The resultant estimated relationship was statistically significant ($F=74.30$, $p<0.05$) and all of the included variables were found to be statistically significant predictors (t-test, $p<0.10$) of total sport fishing expenditures (Table 3).

A Chow test was used to compare the results of the unrestricted model with the two restricted models and the restricted models against one another in order to determine which of the estimated relationships should be adopted. The Chow test revealed that neither of the restricted models were statistically distinct from the unrestricted estimated relationship ($p<0.10$). In addition, the two restricted models were found to be statistically indistinct from one another ($F=2.16$, $p<0.14$). As a result, we adopted the second restricted model as the simplest and statistically equivalent estimation of the relationship between sport fishing trip expenditures in the Pantanal and features of the sport fishing trips and the sport fishers themselves.

3.2.2 Interpretation of Model 1

Our results indicate that income has a small but positive impact on total expenditures. The estimated model predicts that an income US$1000 per month higher should be reflected in an increase in total sport fishing visit expenditures of US$40. Similarly, an increase in fish catch by 1 kg should

result in an increase in expenditures of US$3.40 and traveling an additional 100 km should result in an increase of US$10 in total trip expenditures. Those who arrived via roadway are shown to spend, on average, US$662 less than those who arrived via plane. Those whose primary motivation for traveling to the Pantanal to sport fish was fishing-oriented spend, on average, US$136 more than those who came primarily for leisure or convenience, but US$79 less than those who came because of the natural environment. Finally, those with primary education or less spend, on average, US$152 less than those with more extensive educational experiences on their sport fishing visits to the Pantanal.

Strangely, our results indicate that the number of days spent in the Pantanal has a negative influence on total expenditures; for each additional day spent in the region the average visitor spends about US$22 less. We offer two potential explanations for this result. First, shorter visits may be highly correlated with air travel and air travel is very costly. As a result, those who stay longer and arrive via roadway spend less than visitors for shorter periods of time. Second, longer visits may be highly correlated with individuals who chose not to purchase a package covering some or all of their costs. As shown above, those purchasing packages tend to spend somewhat more than those who do not. As a result, longer stays without packages may be cheaper than shorter stays with packages.

By means of illustration we can derive predicted expenditure levels for hypothetical travelers using mean values for the continuous variables. Recall that the overall mean expenditure for a sport fishing visit to the Pantanal was calculated as US$970. A typical sport fisher possessing a university degree, earning US$4,400 per month, staying 6.3 days, catching 25 kg of fish, traveling 2,800 km by plane in order to see exotic Pantanal wildlife is be predicted to spend US$1,470.29 on his trip. On the other hand, a typical sport fisher with primary school education or less, earning US$4,400, staying 6.3 days, catching 25 kg, traveling 2,800 km by car in order to relax is predicted to spend US$461.75 on his trip.

3.3 Model 2: Expenditures per day

3.3.1 Model choice

Our second model sought to reveal the descriptors and predictors of per day expenditures on

sport fishing visits to the Pantanal. These may differ substantially from total expenditures due to distances traveled, mode of transportation chosen and number of days stayed in the region, for example. The results of the unrestricted model and two restricted models are reported here (Table 4).

The unrestricted model regressed income, age, number of visits, total fish caught per trip-day, kilograms of fish caught per trip-day, distance traveled per trip-day, mode of transportation, package purchases, principal motivation for visitation variables and educational variables against expenditures per trip-day sport fishing in the Pantanal. The relationship estimated in unrestricted model was found to be statistically significant ($F=49.21$, $p<0.05$). The intercept term, incorporating trip motivation information for relaxation or proximity, income, kilograms of fish captured per day, distance traveled per day visiting, roadway arrival, visitation motivated by the natural environment of the region, and low education level were found to be statistically significant (t-test, $p<0.05$) predictors of expenditures per trip-day (Table 4).

The first restricted estimated relationship included these statistically significant variables from the unrestricted model plus the total fish caught per day since it was very close to statistically significant at conventional levels in the unrestricted estimation. The resultant estimated relationship was statistically significant ($F=95.12$) and all included variables except for total fish caught per day were statistically significant predictors (t-test, $p<0.05$) of expenditures per trip-day (Table 4).

The second restricted estimated relationship included all significant variables from the first restricted model. The resultant relationship was statistically significant ($F=110.18$) and all of the included variables were found to be statistically significant predictors (t-test, $p<0.05$) of expenditures per trip-day (Table 4).

The Chow test was employed to distinguish between the unrestricted and the two restricted estimated relationships as well as between the restricted models. Here, the Chow-test revealed statistically distinct results between the unrestricted and the two restricted models ($p<0.10$), but insufficient statistical evidence was found to distinguish between the two restricted models ($F=2.44$, $p<0.12$). As a result, we describe the implications of the unrestricted model and the second restricted model as two distinct estimations of the relationship between trip and fisher characteristics and his daily

expenditures for sport fishing in the Pantanal.

3.3.2 Interpretation of Model 2

The unrestricted model of the relationship between expenditures per day and trip and visitor characteristics shows that an increase in income, age, kilograms caught per day and distance traveled per day increase the predicted daily expenditure of the visitor. The number of times a person had visited the Pantanal is shown to have a negative influence on daily expenditures. Arrival by plane is shown to increase expenditures by about US$105 per day relative to arrival via the roadway. Those who came to the Pantanal primarily for the fishing tend to spend US$11.52 per day more than those who came for relaxation, but about US$19 less than those who came primarily because of the unique natural environment and the wildlife. Those with the lowest level of education tend to spend about US$12 per day less than those with secondary school education, who tend to spend about US$18 per day less than the most educated respondents (Table 4).

The coefficients on two variables (neither statistically significant) appear to be contrary to what has been observed. Both the number of fish caught per day and the purchase of a package are shown to have a negative influence on daily expenditure levels. We offer the following potential explanations for these results. First, although we observe that those purchasing packages actually spend more per day and in total than those who do not, it may be that package purchasers overwhelmingly arrive via the roadway. Perhaps, this covariation has influenced the parameter values of our estimation. Secondly, generally speaking, large fish are trophy fish and are the most desirable to catch. Also generally speaking, one catches relatively few large fish and relatively many smaller fish. It is likely that what we observe here is that expenditures are correlated with fishing quality (measured in kilograms) more strongly than fishing quantity (measured in numbers of fish) and that the negative correlation between quantity and expenditures is related to the desire to catch large trophy fish.

Using mean values for the continuous variables provides a means to illustrate the predictions this model would make. Recall that the overall mean daily expenditure for a sport fishing visit to the Pantanal was calculated as about US$163. A 43 yr old sport fishing visitor with a university education, earning US$4,400 per month, having visited the region 3.9 times, traveling 468 km per day on average

by air, catching 2 fish and 4 kg of fish per day, who didn't purchase a package and has come to view the unique wildlife and scenery of the Pantanal is predicted to spend about US$249 per day. On the other hand, another fellow with similar characteristics except that he has very little education, has come to relax, and has prepurchased a package for some of his needs is predicted to spend about US$77 per day. These predictions are broadly in line with the per trip expenditures estimated in the first model.

The restricted form of the second model shows the same direction but somewhat different magnitude effects of the included variables relative to the unrestricted model. In the restricted model our more highly education and nature loving sport fishing visitor is predicted to spend about US$245 per day. Our less educated and leisure motivated traveler is predicted to spend about US$95 per day. As expected, the restricted model of expenditures per day is quite similar to the reduced total expenditures model adjusted to reflect daily rather than per trip purchases. Only the absence of visitation motivated by fishing success in the relationship describing daily expenditures distinguishes the predictive variables between the two models.

3.4 Model 3: Fishing success by weight

3.4.1 Model choice

Since fishing success is one of the principal motivating factors for sport fishing visits to the Pantanal, it would be useful to better understand the features of sport fishing trips and sport fishers that lead to fishing success. The results of an unrestricted and two restricted models estimating this relationship are reviewed here. Fishing success is defined as kilograms per trip (Table 5).

The unrestricted model regressed total expenditures, income, age, number of visits, days visiting, distance traveled, mode of transportation, package purchases, principal motivation for visitation variables and educational variables against fishing success. Although, the relationship estimated in the unrestricted model was found to be statistically significant ($F=2.30$, $p<0.05$), only one variable, the highest level of education, was found to be a statistically significant correlate (t-test, $p<0.10$) with fishing success (Table 5).

In the first restricted model we selected variables that were relatively close to statistical

significance by conventional standards. Total expenditures, age, distance traveled, roadway arrival, motivation for visitation by natural environment, and high education level were regressed against fishing success expressed in kilograms caught per trip. The estimated relationship was revealed as a statistically significant predictor of fishing success ($F=4.17$, $p<0.05$). However, only age of respondent and high education level were found to be statistically significant variables in the estimated relationship (t-test, $p<0.05$).

The second restricted model omitted motivation for visitation and roadway arrival from the first restricted model in attempting to predict fishing success. The estimated relationship was statistically significant ($F=5.95$, $p<0.05$) and age, high education and the intercept term were found to be significant individual variable predictors of fishing success (t-test, $p<0.10$). The intercept term included the impact of educational lower than university level on fishing success.

The Chow tests undertaken indicated that neither of the restricted models was statistically distinguishable from the unrestricted model ($p<0.61$ and $p<0.67$, respectively) and that the restricted models were not distinguishable from one another ($F=0.64$; $p<0.53$). As a result, we interpreted the estimated relationship described by the second restricted model as the simplest and statistically equivalent model predicting fishing success (Table 5).

3.4.2 Interpreting Model 3

The second restricted model of the relationship between fishing success and trip and visitor characteristics shows that an increase in visitor age and education increases the predicted catch by weight of the visitor. It is interesting to note that neither the primary motivation for visiting the Pantanal nor the amount spent on the trip is a statistically significant predictor of fishing success; more passionate fishers are not necessarily better fishers and money can't buy fishing success.

Inserting mean values where possible we can illustrate the influence of age and education on predicted fishing success. A visitor of age 43 and no university education can be predicted to catch 11.26 kg of fish per visit, while one with some university training is predicted to catch about 14 kg per visit. A 55 yr old visitor with a university education can be predicted to catch 14.7 kg per visit. Without university training he can be predicted to catch about 12 kg during his visit (Table 5). Since the mean

observed catch per visit approached 25 kg in this survey, it is apparent that we were not particularly successful in describing a relationship between visitors, their sport fishing trips, and their fishing success. The observation that fishing success is not of particular importance to the majority of sport fishing visitors may provide a justification for the relatively poor predictive performance of this model.

4. Discussion

Sport fishing is an important source of employment and income to the people of the Pantanal. Sport fishing is likely to compete closely with commercial and subsistence fishing as an employment option for local people. Understanding the sport fishing industry will help the people of the Pantanal to manage the industry and their resources in such a way as to glean the maximum benefit from sport fishing while balancing the needs of commercial and subsistence fishers for fish. This study reveals that the individuals who are paying the most and are arriving in the greatest numbers to sport fish aren't primarily concerned with catching fish. This revelation suggests a substantial change in the types of services the sport fishing industry might offer, local perspectives on fisheries management, and the degree of competition versus complementarity the sport fishing industry creates with commercial and subsistence fishing.

For example, the sport fishing industry currently closes down for three months of "piracema" or spawning each year when fishing is prohibited in the Pantanal. This period happens to closely coincide with the most popular travel period in the country (Christmas-Carnaval). If the industry were to be reoriented toward providing services to nature-oriented tourists, even if only for the "piracema," substantial financial rewards might be expected for little additional investment. Moreover, the market niche described by nature-oriented or ecological tourism is the fastest growing sector in the tourism industry. Those currently possessing substantial investments in recreation fishing infrastructure would do well to recognize this complementary or substitute market niche.

If sport fishers aren't principally motivated by catching fish, but rather by seeing wildlife and experiencing the unique natural environment of the Pantanal, then the principal objective of fisheries management should not be to produce game fish. Fisheries management should, then, be integrated into

wildlife and public and private lands management at the ecosystem or catchment level in order to provide the types of services people are interested in purchasing. Moreover, if sport fishers are not principally motivated by catching fish, then providing alternative and preferred tourism experiences should not only increase the number of visitors and the willingness of each visitor to pay more for their visit, but also take pressure off of current fish stocks leaving more for the commercial and subsistence fishers.

In order to manage the sport fishing industry to provide maximum benefit to local communities it is important to understand the flow of money in the industry. All inclusive resorts, prepurchased packages and absentee owners generally provide little or no local benefit in terms of increasing cash flow or local employment opportunities (e.g. Jamaica). Rather, they tend to impose additional costs on financially strapped communities including demands for greater policing, sewage and trash cleanup, local price inflation, increases in prostitution and drug trafficking associated with tourism etc. None of these issues is revealed in our or most other statistical modeling efforts.

For example, fishing vacations in the Pantanal commonly can be prepurchased as packages from major cities in Brazil. These packages vary substantially in cost and in content. Although package expenditures were not statistically significant predictors of total expenditures, expenditures per day or fishing success, tracking package expenditures is important because they are less likely to find their way into the local economy than those purchases actually made within the region. Without an understanding of package purchases, estimates of the economic impact of sport fishing on the region are likely to be overstated.

5. Summary and Conclusions

Sport fishing is an important source of employment and income to the Pantanal region. More than 46 thousand sport fishing visits were recorded in the southern Pantanal in 1994-95, spending more than an estimated US$36 million, or just under US$1,000 per visitor. Pantanal sport fishing is a group activity that is decidedly more male, more educated, older, wealthier, and with a smaller family than is typical of Brazil as a whole. The majority of sport fishing visitors to the Pantanal are not principally

motivated by the potential for fishing success. Rather, sport fishing visitors to the Pantanal are attracted to the region for the possibility to see exotic wildlife species and to experience the unique natural environment of the region.

We found statistically significant relationships between visitor and trip characteristics and their total and daily expenditures for sport fishing in the Pantanal and for a proxy for fishing success. Statistically significant correlates with total and daily expenditures include respondent income, mode of transportation, fishing success, education level and motivations for visiting the Pantanal.

In general, the higher the level of education, the greater the fishing success, the higher the income, the choice of traveling by air, and the greater the distance from the Pantanal the higher the predicted per trip and per day expenditures. Moreover, those who are principally motivated to visit the Pantanal to view wildlife and enjoy its unique natural environment spend significantly more money on sport fishing trips than those motivated primarily by either potential fishing success or relaxation.

Fishing success is most highly correlated with the age of the respondent and his level of education. However, contrary to conventional wisdom, it is not correlated with expenditures, local experience, or a passion for fishing. Local policy implications of this study include working to attract more nature-oriented visitors and managing fish resources as parts of greater ecosystems rather than principally as a harvestable renewable resource.

6. References

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7. Tables

Table 1: Variables used to model the descriptors and predictors of Pantanal sport fishing visits

Variable	Description	Units
TE	Total expenditures on current sport fishing visit	US$
E/D	Expenditures per day on current sport fishing visit	US$
KG	Total kilograms of fish caught on current sport fishing visit	Kg
INC	Monthly salary of respondent	US$
AGE	Age of respondent	Yr
VIS	Total number of sport fishing visits to Pantanal region in lifetime	Visits
DAY	Number of days staying in Pantanal on current sport fishing visit	Days
DST	Round trip distance traveled to Pantanal for sport fishing	Km
TFC	Total number of fish caught by respondent	Fish
HR	Total number of hours traveled to and from Pantanal for sport fishing	Hr
CAR	Traveled to Pantanal using the roadway (e.g. car, bus)=1; otherwise=0	#
PLN	Traveled to Pantanal by airplane=1; otherwise=0	#
PCK	Purchased a travel package including some or all anticipated purchases of current sport fishing visit=1; otherwise=0	#
R1-3	Principal reason for traveling to the Pantanal was to catch a lot of fish, catch many different kinds of fish or catch large fish=1; otherwise=0	#
R4-5&8	Principal reason for traveling to Pantanal was proximity or accessibility to home or to other fishing regions or for relaxation=1; otherwise=0	#
R6-7	Principal reason for traveling to Pantanal was the possibility to see animals or the uniqueness and quality of the natural environment=1; otherwise=0	#
ED3-4	Primary school or less is highest level of education obtained=1; otherwise=0	#
ED5	Secondary school is the highest level of education obtained=1;otherwise=0	#
ED6-7	At least some training beyond secondary school obtained=1;otherwise=0	#

Table 2: Principal reason for sport fishers to travel to the Pantanal (n=483) (% of total)

Quality of the environment (natural beauty, lack of pollution)	57%
Possibility of catching large fish	14%
Possibility of catching many different species of fish	8%
Possibility of seeing wild or exotic animals	7%
Possibility of catching many fish of whatever size	5%
Proximity to other regions for fishing	3%
Relaxation	2%
Get to know the Pantanal region	1%
Proximity and accessibility to where you live	<1%

Table 3: Model 1-- Total expenditures on sport fishing in the Pantanal versus fisher and trip characteristics

n=396	Unrestricted Model		Restricted Model #1		Restricted Model #2	
Variable	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
INT	947.68**	371.74	873.71**	123.61	872.56**	123.79
INC	0.03**	0.01	0.04**	0.01	0.04**	0.01
AGE	1.88	2.15				
VIS	-3.90	2.96				
DAY	-20.04*	11.70	-22.24**	11.34	-21.89*	11.35
TFC	-7.04*	4.20	-6.12	4.17		
KG	6.12**	2.07	5.97**	2.06	3.40**	1.08
DST	0.07**	0.03	0.10**	0.03	0.10**	0.03
HR	2.85	2.80				
CAR	-760.85**	343.19	-658.70**	37.31	-661.72**	37.31
PLN	-18.03	336.71				
PCK	-25.85	40.60				
R1-3	135.07**	61.78	136.71**	61.03	136.06**	61.12
R6-7	213.20**	57.17	213.41**	55.66	214.64**	55.74
ED3-4	-203.61*	116.39	-148.62**	54.32	-152.18**	54.35
ED5	-102.55	107.57				
ED6-7	-12.74	104.33				
F-test (df1,df2)	38.48** (16, 379)		66.48** (8, 386)		74.30** (7, 387)	
Chow-test (df1, df2)			1.23 (9, 378)		1.65 (8, 378)	

Table 4: Model 2--Total expenditures per day on sport fishing in the Pantanal versus fisher and trip characteristics

n=429	Unrestricted Model		Restricted Model 1		Restricted Model 2	
Variable	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
INT	161.52**	65.12	95.51**	12.53	95.72**	12.56
INC	0.006**	0.001	0.007**	0.001	0.007**	0.001
AGE	0.24	0.35				
VIS	-0.37	0.49				
TFC/D	-7.12	4.33	-6.76	4.32		
KG/D	7.15**	2.10	7.26**	2.10	4.44**	1.08
DST/D	0.17**	0.02	0.18**	0.02	0.17**	0.02
CAR	-173.42**	59.88	-105.75**	6.42	-106.36**	6.42
PLN	-68.62	59.83				
PCK	-7.17	6.84				
R1-3	11.52	10.27				
R6-7	30.28**	9.50	21.23**	5.97	21.33**	5.98
ED3-4	-33.22*	19.83	-22.10**	9.28	-22.70**	9.29
ED5	-21.28	18.40				
ED6-7	-3.69	17.79				
F-test	49.21**		95.12**		110.18**	
(df1,df2)	(14, 414)		(7, 421)		(6, 422)	
Chow-test			1.88*		1.96**	
(df1, df2)			(7, 413)		(8, 413)	

Table 5: Model 3-- Fishing success expressed in kilograms per visitor-sportfishing trip to the Pantanal versus fisher and trip characteristics

n=431	Unrestricted Model		Restricted Model #1		Restricted Model #2	
Variable	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
INT	-8.33	8.36	2.63	2.80	4.05*	2.36
TE	0.002	0.001	0.002	0.001	0.001	0.001
INC	0.0001	0.0002				
AGE	0.07	0.04	0.08*	0.04	0.08*	0.04
VIS	0.05	0.06				
DAY	-0.21	0.25				
DST	0.001	0.001	0.001	0.001	0.001	0.001
CAR	11.96	7.64	1.18	1.08		
PLN	10.53	7.60				
PCK	0.97	0.86				
R1-3	-1.60	1.32				
R6-7	-1.66	1.23	-0.27	0.76		
ED3-4	2.02	2.54				
ED5	1.98	2.32				
ED6-7	4.30*	2.24	2.43**	0.74	2.49**	0.74
F-test	2.30**		4.17**		5.95**	
(df1,df2)	(14, 416)		(6, 424)		(4, 426)	
Chow-test			0.81		0.77	
(df1, df2)			(9, 415)		(11, 415)	