Fishing Activities and Economic Impacts of Charter Boat Businesses on the Mississippi Gulf Coast

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Abstract: We conducted a study of recreational fishing and economic activities of charter boat operators along Mississippi's Gulf Coast to determine their local and statewide economic impact in 2001. Mail questionnaires received ($N = 36$) from charter boat operators included information on sport fish species pursued, locations fished, number of trips and number of clientele entertained, gross revenues collected, expenditures incurred, and number of employees hired in 2001. Sport fish species or species groups that were most pursued in descending order of preference were sea trout (*Cynoscion* spp.), snapper (*Lutjanus* spp.), redfish *(Sciaenops ocellatus)* mackerel (*Scomberomorus* spp.), and sharks (*Carcharhinus* spp., *Sphyrna* spp., *Isrus* spp., *Rhizoprionodon* spp.). Captains reported open saltwater, offshore shipwrecks, oil rigs, sandbars off barrier islands, and inland shipwrecks as the top five locations fished during charter trips. Charter boat captains offered half-, full-, and multiple-day fishing trips with the latter yielding the greatest mean gross revenue annually (US$49,300), while more clients fished in the full-day arrangement ($\bar{x} = 280$ clients/year). The charter industry generated a total economic impact of $5.9 million to $6.7 million to the State of Mississippi and $5.3 million to $6.0 million to the three coastal counties of Hancock, Harrison, and Jackson. Information gained through studies of this type that identify economic benefits of fish and wildlife recreation and associated ecosystems that support species of interest, can be used by natural resource managers and policymakers to develop strategies for the pragmatic conservation of important coastal ecosystems.

Key words: Charter boats, economic impacts, Mississippi Gulf Coast, recreational fisheries

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Mississippi's coastline is characterized by a diversity of productive ecosystems that support an abundance of renewable natural resources. The three coastal counties of Hancock, Jackson, and Harrison contain approximately 18,860 ha of wetlands and associated water bodies (Burrage and Posadas 1998). The Mississippi Sound, a 293 km^2 estuary with 260 km^2 of watershed and 44 km^2 of tidal marsh, and the Gulf of Mexico lies to the south of the coastal counties. These coastal ecosystems support valuable commercial and recreational fisheries (Larson 1998). For example, the commercial fisheries harvest on the Mississippi Gulf Coast exceeds 198 million metric tons of finfish and shellfish, generates over US$500 million to the state's economy, and creates over 15,000 jobs. Coastal tourism and associated recreation attracted 32 million visitors, creating the state's second largest service sector employer in 1999. In 2000, tourism and related recreation generated a statewide income of $6.1 billion and over 91,000 jobs (Mississippi Division of Tourism Development 2001).

Fishing, boating, and wildlife-watching are primary recreational activities pursued by Gulf Coast tourists and residents (Burrage and Posadas 1998). Activities, such as fishing, hunting, and wildlife viewing, can contribute substantially to local and regional economies. In 2001, the United States Fish and Wildlife Service reported that recreationists spent $110 billion on fish and wildlife-related activities nationwide (USDI and USDC 2002). The most popular activity in 2001 was fishing with 43 million anglers spending more than $35.6 billion on trip-related equipment, licenses, and other support items. Freshwater fishing attracted 34 million anglers and saltwater fishing 9 million anglers. Average expenditures per angler for all types of fishing averaged $1,046 during 2001. In 2001, 106,000 saltwater anglers in Mississippi spent an estimated $26.3 million with 7.7% of this expenditure being derived from non-residents (USDI and USDC 2002). Burrage and Posadas (1998) projected a 19% increase in expenditures associated with recreational angling by 2025. In 1998, a study of charter boat operators estimated that Mississippi's charter boat businesses generated an economic output of $6.6 million, personal income of $2.1 million, and 211 jobs annually (Sutton et al. 1998).

Many economic impact studies of outdoor recreation in natural ecosystems have focused on revenue generated by the pursuit of specific game or nongame species, species group, or type of recreational activity (Schorr et al. 1995, Sutton et al. 1998, Burger et al. 1999, Grado et al. 2001). Businesses that feature fish and wildlife-related recreation generally depend on the integrity and productivity of ecosystems. Accelerated urban development and associated degradation of coastal ecosystems intensifies the need for comprehensive information on ecological, recreational, and economic values of coastal and marine habitats to support sound conservation planning (Sutton et al. 1998, Steinback 1999). With this type of information, natural resource managers and planners can better identify and compare direct and indirect impacts of ecosystem conservation versus ecosystem degradation and loss. Because there was a lack of current information on economic impacts of charter boat businesses in Mississippi, our primary objectives were to determine 1) fishing activity trends, including species pursued and habitats fished, of charter boat businesses in Gulf Coastal counties of Mississippi, and 2) economic impacts of charter boat businesses of Mississippi's Gulf Coast in coastal counties and statewide. Implicit in our

study objectives was the continuing desire of the funding agency, the Mississippi Department of Marine Resources (MDMR), to accumulate a number of different, but additive, studies on the economic impacts of marine-related activities on the Mississippi Gulf Coast to discern a more complete picture of the monetary benefits accrued from existing resources. These values could then be integrated into the policy process for MDMR.

Methods

Our study area included the coastal waters of three Mississippi coastal counties: Hancock, Harrison, and Jackson. The 3-county land base totaled 4,623 km^2 and supported a human population of approximately 275,300 in 2000 (USDC 2002). The coastal counties have a linear distance of 113 km along the Gulf Coast, with over 161 km of coastline. Major habitat types that support fisheries resources include rivers, coastal marshes, and marine ecosystems. Habitats that support recreational and commercial fisheries include over 18,000 ha of wetlands and approximately 337 km^2 of tidal marshes and estuaries (Burrage and Posadas 1998).

Our survey population was the Mississippi Charter Boat Captain Association (MCBCA), one of the largest organized user groups that depend on coastal habitats for their livelihood. Formed in the 1970s, the MCBCA maintains a current membership database and mailing list that was utilized in our study. Initial contact of businesses was made with owners and managers by site visits, organized meetings, and telephone to determine their willingness to participate. MCBCA officers assisted in updating mailing lists, pre-sampling surveys, and facilitating communication to its members.

We acquired data from charter boat operators through the use of a self-administered mail questionnaire co-developed by professionals in social science, economics, and natural resource management from Mississippi State University and MDMR. Questionnaires were pilot tested on three MCBCA officers and revisions made prior to distribution of surveys to study participants.

Our mailing procedure was a modification of Dillman's (1978) total design method. The mail questionnaire was distributed to charter boat captains listed in MCBCA's 2000–2001 membership database ($N = 115$). The survey period was initiated in November 2001. Questionnaires were accompanied by a postage-paid return envelope. A thank you/reminder postcard was sent to all potential respondents within four weeks following the initial mailing of questionnaires. A second mailing of the questionnaire occurred two months after the initial distribution. The self-administered mail questionnaires addressed the following: fish genera or species pursued and season of activity, locations fished (e.g., estuarine, offshore, near shore, barrier islands), number of trips per year, clientele numbers per year, craft size, related revenues and expenditures (e.g., client fees, equipment, supplies, fuel), and number and seasonality of employees. Clientele expenditure profiles were obtained from Gentner et al. (2001).

Survey bias types that potentially occurred in our study were recall, digit, and non-response bias (Hunt and Ditton 1996). Recall bias was minimized because par-

ticipants could refer to their business records. Digit bias was expected because participants were asked to average their responses to the nearest whole dollar. Unit non-response within surveys answered by the MCBCA was not corrected due to the requirement of participant anonymity. This aspect of the survey process made extrapolation of results to the Association, as a whole, less reliable since follow-up inquiries of non-respondents was not permissible.

The economic impacts of charter boat fishing were modeled using IMPLAN Professional, Version 2.0 software (Olson and Lindall 1999). Our data was based on a county-level analysis, and results were shown as total 3-county and state economic impacts categorized by total sales, employee income, value added, and jobs created (Grado et al. 2001). In our study, economic impacts refer to support generated in the economies of interest (i.e., state, 3-county) by the existence of charter boat operators and their clientele. These impacts are not economic impacts in the traditional sense, whereby dollars are imported into the economy solely from outside sources, because charter boat clientele included both resident and non-resident anglers. Economic impacts arising from non-resident clientele were considered a "true" economic impact for county and state level economies, due to the importation of out-of-state dollars by non-resident recreationists.

Weighted average charter boat operator expenditures based on activity days were used to generate economic impacts for genera reported in the number one ranked category, which consisted of 5 pursued fish species or species groups. These 5 fish species or species groups included sea trout (*Cynoscion* spp.), snapper (*Lutjanus* spp.), redfish *(Sciaenops ocellatus)*, mackerel (*Scomberomorus* spp.), and sharks (*Carcharhinus* spp., *Sphyrna* spp., *Isrus* spp., *Rhizoprionodon* spp.). Activity days were based on the average number of clientele reported annually over a 2-year period. A range of 75 to 100 charter boat operators was used in each IMPLAN model to derive activity levels. This range was deemed acceptable and used to capture the variability in the number of businesses operating commercially from year to year on Mississippi's Gulf Coast (D. Burrage, Mississippi State University Cooperative Extension Service, pers. comm.). Low and high activity levels were prorated for primary fish species pursued to derive separate activity levels for each grouping. An economic impact for charter clientele was generated at the 3-county region and state levels using weighted average expenditures and activity days by pursued fish species groupings and industry sectors according to methods described by Gentner and Steinback (2001) and Grado et al. (2001). Descriptive statistics were provided on fish groups pursued, habitats used, seasonal fishing activity, and general business activities of charter boat businesses.

Results

A total of 36 completed surveys were returned by MCBCA members for a response rate of 33%. Of 115 surveys, six were undeliverable or recipients indicated that they no longer conducted charter services. This lowered the target population to 109 possible respondents. Unit and item non-response bias as described by Hunt and Ditton (1996) were experienced due to questionable expenditure/income estimates

Table 1. Charter boat captains indicating ranking of listed fish according to importance and/or frequency of pursuit during charter fishing trips in 2001 as reported in the 2002 Mississippi Gulf Coast Charter Boat Captain Survey.

	Rank									
	1[a]	2	3	4	5	6	7	8	9	10[b]
Fish pursued	*N* respondents reporting pursued fish by rank									
Redfish *Sciaenops ocellatus*	16	11	2	1	2	0	0	0	1	1
Snapper *Lutjanus* spp.	10	3	1	6	3	1	1	0	0	0
Sea trout *Cynoscion* spp.	7	2	3	3	3	1	0	3	2	2
King and Spanish mackerel *Scomberomorus* spp.	1	13	11	6	2	2	1	0	0	0
Cobia *Rachycentron canadum*	0	2	4	1	4	2	1	0	1	1
Sharks *Carcharhinus* spp., *Sphyrna* spp., *Isurus* spp., *Rhizoprionodon* spp.	1	1	2	7	7	3	1	2	0	2
Flounder *Paralichthys* spp.	0	0	4	1	0	0	0	0	0	0
Jack crevalle *Caranx* hippos	0	0	0	0	1	2	3	2	1	0
Amberjack/jack *Seriola* spp.	0	1	1	1	1	2	0	0	2	0
Grouper *Epinephellus, Mycteroperca* spp.	0	0	1	2	1	0	3	1	0	2
Bonita *Sarda* spp.	0	0	1	0	0	1	4	1	1	1
Tuna *Thunnus* spp.	0	1	1	0	0	0	0	2	1	0
Wahoo *Acanthocybium solandri*	0	0	1	0	1	0	0	0	1	0
Sheepshead *Archosargus probatocephalus*	0	0	0	1	0	0	0	2	0	0
Triggerfish *Balistes* spp.	0	1	0	0	0	0	0	0	0	0
Dolphin *Coryphaena hippurus*	0	0	0	2	0	0	1	0	0	1
Little tunny *Euthynnus alleteratus*	0	0	0	0	0	1	1	0	0	0
Billfishes *Xiphias, Tetrapturus, Makaira, Istiophorus* spp.	0	0	0	0	0	0	0	0	0	1
Tarpon *Megalops atlanticus*	0	0	0	0	0	1	0	0	0	0
Kingfish *Menticirrhus* spp.	0	0	1	0	0	1	0	0	2	0
Vermillion snapper *Rhomboplites aurorubens*	0	0	0	0	0	1	0	0	0	0

a. Most sought.

b. Least sought.

and unanswered questions on several surveys. Since respondents were anonymous there was no opportunity to further inquire about specific survey question responses thus limiting accuracy.

Charter boat captains listed a total of 29 different fish species pursued during charter boat trips (Table 1). Fish types were reported by common name, genus, and species. In several cases, fish species pursued contained several genera that included more than one species; these fish were reported at the genus level only. Sharks were grouped as a general category that included multiple genera. Respondents were asked to rank fish pursued from 1 (most sought) to 10 (least sought) (Table 1). Trout, snapper, redfish, mackerel, and sharks were the 5 most frequently reported species pursued during charter fishing trips in summer, spring, and fall. Redfish was the most pursued fish with the highest number of respondents ($N = 30$) reporting pursuit during summer months. Species that were pursued during all seasons included sea trout and grouper (*Centropristis, Epinephellus, Mycteroperca* spp.). Although most charter boat operators reported less fishing activity during winter months, 6 and 5 respondents reported high fishing activity during winter to pursue sea trout and redfish.

Table 2. Business activity characteristics of charter boat operators offering three excursion types along the Mississippi Gulf Coast during 2001 as reported in the 2002 Mississippi Gulf Coast Charter Boat Captain Survey.

Business activity characteristic	Charter boat trip type								
	Half-day			Full-day			Multi-day		
	N^a	$\bar{x}$	SE	N	$\bar{x}$	SE	N	$\bar{x}$	SE
Trips/year	27	28.2	4.1	25	41.5	6.3	11	16.5	5.9
Group size/trip	27	5.1	0.4	26	5.6	0.5	11	7.2	1.0
Revenue/trip	28	$439	19.2	27	$644	41.8	10	$3,020	720
Clientele/year	25	152	30	24	280	73	11	172	75

a. Indicates the number of respondents answering the specific question.

Charter boat operators reported that open saltwater, offshore shipwrecks, oil rigs, sandbars off barrier islands, and inland shipwrecks were the top 5 locations used during charter fishing trips. Respondents ($N = 32$) reported pursuit of redfish, mackerel, and shark around barrier islands, cobia *(Rachycentron canadum)* near oil rigs, snapper around offshore shipwrecks, and trout near inland shipwrecks. Twenty-one respondents pursued redfish near rigs and offshore shipwrecks. Other locations and habitats that were fished by charter boat operators included saltwater and brackish water marshes, mainland sandbars, and oyster beds.

The majority (81%) of survey participants offered half-day (4–8 hrs) and/or full-day (>8–24 hrs) charter fishing trips. Eleven respondents offered multiple-day fishing trips that ranged from 2 to 4 days (Table 2). Using the average number of trips per year and mean charge per trip to estimate gross revenue per year, multiple-day trips yielded the greatest mean gross revenue of $49,830 annually. Full-day trips generated $26,726 in gross revenue annually and half-day trips averaged $12,380 (Table 2). Although our questionnaire was designed to discern clientele numbers, trips, and revenue per year for each of the three excursion types, it is important to note that most (78%) of the charter boat operators in our study offered more than one type of excursion. Of the 36 operators, 61% offered both half-day and full-day fishing trips; whereas, 18% offered all 3 types of trips. Four operators (12%) offered only multiple-day fishing trips, 2 operators (6%) offered half-day trips only, and 1 operator (3%) offered full-day trips only.

Respondents were asked to report business-related expenditures for 2001. Although craft purchases made prior to 2001 were not used in the economic impact analysis, respondents were asked to report craft purchases along with year and location of purchase. Thirty-five respondents reported an average expenditure of $133,000 for purchases of primary craft, which made this category the highest average expenditure. Craft operational expenditures reported for 2001 were the second highest annual expenditures in the economic analysis exceeding an average of $17,000 per year. Within this category, maintenance had average annual expenditures exceeding $10,000 (Table 3). Thirty charter boat operators reported payment of wages or salaries to part-time, seasonal or full-time employees. Part-time employees were defined as employees who worked intermittently and <40 hours per week. Sea-

Table 3. Business expenditures of charter boat operators along the Mississippi Gulf Coast during 2001 as reported in the 2002 Mississippi Gulf Coast Charter Boat Captain Survey.

Expenditure category/Item	N^a	$\bar{x}$ ($)	Range ($)
Craft purchase			
Primary	35	133,000	7,000–750,000
Secondary	9	35,555	5,000–125,000
Craft operational			
Maintenance	31	10,406	500–60,000
Fuel	32	6,135	300–30,000
Equipment	29	965	25–4,153
Service-related			
Fishing equipment	31	1,574	150–8,000
Bait	27	688	50–2,000
Food and beverages	19	3,935	125–22,500
Miscellaneous supplies	20	1,408	100–5,000
Licenses, permits, fees			
Consultant	24	748	100–2,700
Docking	28	1,937	40–4,000
Licenses and permits	33	874	143–4,000
Miscellaneous overhead			
Advertising	27	1,514	143–5,149
Utilities	24	1,884	100–2,200
Insurance	21	2,930	143–8,500
Employees	30	23,528	1,000–100,000
Part-time, full-time, seasonal			

a. Number of respondents who answered specific question.

sonal employees worked at least 40 hours per week on a seasonal basis. Full-time employees worked at least 40 hours per week throughout the year. Full-time, part-time, and seasonal employment ranged from 1 to 6 employees with an average of 2 full-time employees, 3 part-time employees, and 2 seasonal employees working in 2001.

The IMPLAN analyses led to the combined total economic impacts for the 5 pursued fish species in the number one ranking. There was a state level economic impact of $2.5 and $3.3 million for the low and high activity levels, respectively (Table 4). Combined total economic impacts for the charter industry, at the 3-county regional level, were $2.1 million to $2.8 million. Total employee income was $768,557 to $1.0 million and $571,378 to $755,714 for the state and 3-county region, respectively. There were 29 to 38 and 25 to 33 full- and part-time jobs supported in the state and 3-county region, respectively. In both analyses, wholesale and retail trade; transportation, communication, and utilities; and manufacturing were the aggregated industrial sectors creating the greatest impacts.

The industry as a whole includes the charter boat service and clientele, collectively. Resident charter boat clientele produced total sales impacts for the state of $1.6 million, with non-residents generating total sales of $1.7 million and 29 to 31 full- and part-time jobs, respectively (Table 4). Resident charter boat clientele, for the 3-county level, produced total sales of $1.5 million with non-residents generating $1.7 million in total sales and 28 to 29 full- and part-time jobs, respectively. Assess-

Table 4. Economic impacts of charter boat operators and clientele in Mississippi's coastal counties and the state of Mississippi based on weighted averages of 2001 expenditures and activity days by pursued fish genera and industry sectors as reported in the 2002 Mississippi Charter Boat Captain Survey.

Impact category	Direct sales ($)	Indirect sales ($)	Induced sales ($)	Total sales ($)	Employee income ($)	Jobs
			Harrison, Hancock, and Jackson Counties			
Charter boat operators						
Low activity[a]	1,380,424	149,201	574,057	2,103,682	571,378	25
High activity[b]	1,826,744	197,540	760,115	2,784,399	755,714	33
Charter boat clientele (resident)	879,054	114,836	517,654	1,511,544	643,865	28
Charter boat clientele (non-resident)	966,465	163,331	546,704	1,676,500	667,855	29
Overall 3-county total						
Low activity	3,225,943	427,368	1,638,415	5,291,726	1,883,128	82
High activity	3,672,263	475,707	1,824,473	5,972,443	2,067,464	90
			State of Mississippi			
Charter boat operators						
Low activity	1,481,593	291,289	743,410	2,516,292	768,557	29
High activity	1,952,359	383,923	980,167	3,316,449	1,013,377	38
Charter boat clientele (resident)	868,684	173,130	566,490	1,608,304	653,728	29
Charter boat clientele (non-resident)	936,376	223,640	584,292	1,744,308	664,087	31
Overall state total						
Low activity	3,286,653	688,059	1,894,192	5,868,904	2,086,372	89
High activity	3,757,419	780,693	2,130,949	6,669,061	2,331,192	98

a. Low activity-based on 75 charter boat operators.

b. High activity—based on 100 charter boat operators.

ment of the overall economic impact was accomplished through summation of the total service impacts and total clientele impacts. Therefore, the total economic impact for the industry ranged from $5.9 to $6.7 million generated for the state and $5.3 to $6.0 million at the 3-county level. A total of 89 to 98 full- and part-time jobs were created for the state and 82 to 90 full- and part-time jobs for the 3 coastal counties (Table 4).

Discussion and Conclusions

The response rate for this study is typical for those inquiries requesting sensitive economic data about business activities from individuals that own or manage the enterprises. Henderson et al. (2003) reported a 28% response rate in a study of hunting guides and outfitters in Mississippi. Although the response rate in our study was typical of mail survey response rates for similar studies, the lack of response and non-response bias aspects had the effect of reducing the reliability of our results. Future

studies planned for investigation of revenue production of charter boat operators could be designed to use a combination of survey methods to increase respondent participation. We recommend a combination of survey approaches including a mail questionnaire and follow-up interviews as conducted by Sutton et al. (1998).

Our findings on economic impacts of recreational anglers were similar to those reported by Story and Allen (1993), Schorr et al. (1995), and Steinback (1999). Steinback (1999) reported economic impacts of marine party and charter boats in Maine of $1.3 million and 49 full- and part-time jobs in 1996. Bohnsack et al. (2002) found that the economic impact of the recreational pursuit of one fish species, the bluefin tuna *(T. thynnus)* generated $ 4.6 million in economic output and produced 126 jobs associated with recreational angling. Sutton et al. (1998) reported that Mississippi charter boat operators generated $ 6.6 million in economic impact in 1997. Our study found similar economic contributions in 2001, although the studies differed in terms of time period and experimental design. Sutton et al. (1998) utilized interview surveys and sampled 16 charter boat operators in Mississippi in 1997; whereas, our survey utilized a self-administered mail survey and sampled a total of 36 charter boat operators in 2001. Business activity and related economic impacts derived from charter boat businesses could be expected to fluctuate depending on the economy and weather patterns. Although our study was conducted during 2001 when U.S. economic conditions were declining and tourist-related travel was expected to decrease (J. Twiggs, MCBCA, pers. commun.), economic impacts of charter boat fishing approximated those found in the Sutton et al. (1998) study when the U.S. economy was strong and growing.

We feel that the information provided in our study is useful in assessing viability and potential economic impacts of development projects and recreational use trends that may degrade coastal ecosystems (USEPA 2000). This was in line with the intent of the MDMR. It is recognized that charter boat fishing is but one of the many businesses and user groups that depends on the fisheries of coastal ecosystems. Therefore, to gain a comprehensive assessment of the monetary value of goods and services provided by coastal ecosystems, natural resource managers need compatible information on economic impacts of other user groups that depend on wildlife and fisheries resources, such as commercial finfish and shellfisheries, subsistence fishers, fishing tournaments, and non-consumptive use outdoor recreation (e.g., festivals). Not to be excluded, are the activities generated by the Public Trust Tidelands Program, which are funds allocated to marine-related activities and research on the Mississippi Gulf Coast. Our findings indicated that charter boat operators ($N = 100$) generated $6.7 million to the state's economy and $6.0 million to the economies of the three coastal counties. Summation of our derived charter boat economic impacts with those reported by Grado et al. (2002) yielded a more comprehensive evaluation of economic impacts generated by coastal fisheries along Mississippi's Gulf Coast. Economic impacts generated by charter boat activities as reported, summed with the economic impacts of pier fishing, fishing tournaments, marine-related festivals, and natural history museums reported by Loden et al. (2002), yielded a total economic impact of $42.5 million for the state and $37.7 million for Mississippi's three coastal counties in 2001. Total state and regional economic impacts from expensed Tide-

lands Grants for Public Access Projects and Tidal Management Projects for fiscal years 1995–1996 through 1999–2000 (partial data) generated statewide total sales impacts at a minimum of $3.25 million dollars annually (2000 dollars) (Grado 2001). Three county total sales impacts were at a minimum of $3.24 million dollars annually (2000 dollars). According to Balmford et al. (2002), this type of overall analysis is needed for a comprehensive evaluation of ecosystem goods and services that quantify the links between economics and natural capital (i.e., goods and services) produced by natural ecosystems (Tschirhart and Crocker 1987, Plantinga et al. 1999). We concede that our study does not measure the intrinsic values associated with human attitude, aesthetic quality, or life quality, because our study focused on economic information on charter boat businesses and associated recreational angling. Therefore, the total value of coastal ecosystems can not be assessed using our methods alone. Information on economic impacts of fisheries recreation should be used in conjunction with other inquiries, such as biological, ecological, aesthetic quality, and social and attitudinal evaluations to assess intrinsic and measurable values of coastal ecosystems (Cooper et al. 2002).

Determination of the economic value associated with fisheries resources and human use trends of coastal habitats and fish species is important to effective conservation planning (Propst and Gavrilis 1987). Proactive conservation along the Mississippi Gulf Coast is especially important under today's developmental and human population levels which are predicted to increase by 30% by 2015 (Burrage and Posadas 1998). As human population growth increases, development associated with industrialization and urbanization generally results in habitat loss, ecosystem degradation, and declines in native biodiversity (Friesen 1998, Janus 1998, Perry 1998, Mitsch and Gosselink 2000).

Since charter boat operators utilize and depend on the fisheries and coastal resources for their livelihood, it can be assumed that they support, either directly or indirectly, the viability of the ecosystem. Information gained through investigation of economic benefits of fish and wildlife recreation, to be used in conjunction with the economic worth of natural capital, can help natural resource managers assess the economic importance of coastal ecosystems. This information can elucidate the importance of fisheries resources to human stakeholders and local and regional economies. In turn, this information can be provided to policymakers for development of pragmatic conservation planning and low impact tourism (Janus 1998, Morris 1998).

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Literature Cited

Balmford, A., A. Bruner, P. Cooper, R. Costanza, S. Farber, R. E. Green, M. Jenkins, P. Jefferiss, V. Jeassamy, J. Madden, K. Munro, N. Myers, S. Naeem, J. Paavola, M. Rayment, S. Rosendo, J. Roughgarden, K. Trumper, R. K. Turner. 2002. Economic reasons for conserving wild nature. Science 297:951–953.

Bohnsack, B. L., R. B. Ditton, J. R. Stoll, R. J. Chen, R. Novak, and L. S. Smutko. 2002. The economic impacts of the recreational bluefin tuna fishery in Hatteras, North Carolina. North American Journal of Fisheries Management 22:165–176.

Burger, L. W., D. A. Miller, and R. I. Southwick. 1999. Economic impact of northern bobwhite hunting in the southeastern United States. Wildlife Society Bulletin 27(4):1010–1018.

Burrage, D. and B. Posadas. 1998. Economics of marine resources. Volume 3. Pages 69–80 *in* Klein, L. A., M. Landry, and J. E. Edward, editors. Marine Resources and History of the Mississippi Gulf Coast. Mississippi Department of Marine Resources, Biloxi, Mississippi.

Cooper, A. B., F. Stewart, J. W. Unsworth, L. Kuck, T. J. McArthur, and J. S. Rachael. 2002. Incorporating economic impacts into wildlife management decisions. Wildlife Society Bulletin 30(2):565–574.

Dillman, D. A. 1978. Mail and telephone surveys: The total design method. New York, New York: John Wiley and Sons, Inc.

Friesen, L. 1998. Impacts of urbanization on plant and bird communities in forest ecosystems. The Forestry Chronicle 74(6):855–860.

Gentner, B., M. Price, and S. Steinback. 2001. Marine angler expenditures in the Southeast Region, 1999. NOAA Technical Memorandum NMFS-F/SPO-48. National Marine Fisheries Service, Washington, D.C.

Grado, S.C. 2001. Economic Impacts of Tidelands Grants from Gaming Revenues in Mississippi. Report to the Mississippi Department of Marine Resources, Biloxi, Mississippi. 37 pp.

_____, J. C. Jones, and E. K. Loden. 2002. Economic impacts of onshore fishing, fishing tournaments, and marine-related museums, festivals, and educational centers on the Mississippi Gulf Coast. Final report to Department of Marine Resources, Forest and Wildlife Research Center, Mississippi State University.

_____, R. M. Kaminski, I. A. Munn, and T. A. Tullos. 2001. Economic impacts of waterfowl hunting on public lands and at private lodges in the Mississippi Delta. Wildlife Society Bulletin 29(3):846–855.

Henderson, J. E., S. C. Grado, and I. A. Munn. 2003. Economic impact of commercial hunting outfitters and clientele. Proceedings of the 2003 Southern Forest Economics Workshop, New Orleans, Louisiana.

Hunt, K. M. and R. B. Ditton. 1996. Using survey research in support of fisheries management: The 1994 Texas Statewide Angler Survey. American Fisheries Society Symposium. 16:234–244.

Janus, M. W. 1998. Selected laws affecting Mississippi and the Gulf of Mexico marine resources. Volume 3. Pages 81–93 *in* L. A. Klein, M. Landry, and J. E. Edwards, editors. Marine resources and history of the Mississippi Gulf Coast. Mississippi Department of Marine Resources, Biloxi.

Larson, R. 1998. Mississippi's wetlands. Volume 3. Pages 81–93 *in* L. A. Klein, M. Landry,

and J. E. Edward editors. Marine resources and history of the Mississippi Gulf Coast. Mississippi Department of Marine Resources, Biloxi.

Loden, E. K., S. C. Grado, J. C. Jones, and D. L. Evans. 2002. Economic impacts of on-shore fishing, fishing tournaments, and marine-related museums and activities on the Mississippi Gulf Coast. Proceedings of International Symposium on Society and Resource Management. "Global Challenges of Parks and Protected Area Management." University of Sassari and Colorado State University. La Maddalena, Sardinia, Italy.

Mississippi Division of Tourism Development. 2001. Fiscal Year 2000 Economic impact for tourism and recreation in Mississippi. Mississippi Development Authority, Jackson.

Mitsch, W. J. and J. G. Gosselink. 2000. Wetlands. Third Edition. John Wiley and Sons, Inc., New York, New York.

Morris, A. P. 1998. Tidelands trust fund. Volume 2. Pages 95–101 *in* L. A. Klein, M. Landry, and J. E. Edward, editors. Marine resources and history of the Mississippi Gulf Coast. Mississippi Department of Marine Resources, Biloxi.

Olson, D. and S. Lindall. 1999. IMPLAN Professional. Second Edition. MIG, Inc. Stillwater, Minnesota.

Perry, H. M. 1998. The estuarine ecosystem. Volume 2. Pages 75–86 *in* L. A. Klein, M. Landry, and J. E. Edward, editors. Marine resources and history of the Mississippi Gulf Coast. Mississippi Department of Marine Resources, Biloxi.

Plantinga, A. J., T. Mauldin, and D. J. Miller. 1999. An econometric analysis of the costs of sequestering carbon in forests. American Journal of Agricultural Economics 81:812–824.

Propst, D. B. and D. G. Gavrilis. 1987. Role of economic impact assessment procedures in recreational fisheries management. Transactions of the American Fisheries Society 116:450–460.

Schorr, S. S., J. Sah, D. F. Schriener, M. R. Meador, and L. G. Hill. 1995. Regional economic impact of the Lake Texoma (Oklahoma-Texas) striped bass fishery. Fisheries 20(5):14–18.

Steinback, S. R. 1999. Regional economic impact assessments of recreational fisheries: An application of the IMPLAN modeling system to marine party and charter boat fishing in Maine. North American Journal of Fisheries Management 19:724–736.

Story D. A. and P. G. Allen. 1993. Economic impact of marine recreational fishing in Massachusetts. North American Journal of Fisheries Management 13:698–708.

Sutton, S.G., R. B. Ditton, J. R. Stoll, and J. W. Milon. 1998. A cross-sectional study and longitudinal perspective on the social and economic characteristics of the charter and party boat fishing industry of Alabama, Mississippi, Louisiana, and Texas. Human Dimensions of Recreational Fisheries Research Laboratory HD-612. Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station.

Tschirhart, J. and T. D. Crocker. 1987. Economic valuation of ecosystems. Transactions of the American Fisheries Society 116:469–478.

U.S. Department of Commerce (USDC). 2002. Mississippi: Census 2000 Profile. C2KPROF/00-MS. Economics and Statistics Administration, U. S. Census Bureau, Washington, D.C.

U. S. Department of Interior (USDI) and U. S. Department of Commerce (USDC). 2002. Fish and Wildlife Service and Bureau of Census. National survey of fishing, hunting, and wildlife-associated recreation. U. S. Government Printing Office, Washington, D.C.

U. S. Environmental Protection Agency (USEPA). 2000. A method for quantifying environmental indicators of selected leisure activities in the United States. Office of Policy, Economics, and Innovation, US EPA, Washington, D.C.