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Catch-related attitudes of anglers and implications for fisheries management

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CATCH-RELATED ATTITUDES OF ANGLERS AND IMPLICATIONS FOR FISHERIES MANAGEMENT

By

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FOR FISHERIES MANAGEMENT

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A catch-related attitude measurement scale is used for discerning an angler's evaluation of catching fish in four constructs (*catching something, catching numbers, catching large fish,* and *retaining fish*) in two studies. The first study was of resident (in-state) and nonresident (out-of-state) anglers at Sardis and Grenada reservoirs and the second was of hand grabblers and rod and reel catfish anglers. In the first study at Sardis Reservoir, there were no differences in catch-related attitudes between groups. At Grenada Reservoir, there were differences between groups toward *catching large fish* and *retaining fish*. In the second study, hand grabblers had stronger attitudes toward *catching large fish* than rod and reel catfish anglers but rod and reel catfish anglers had stronger attitudes toward *catching numbers*. Knowledge of catch-related attitudes can lead to more palatable regulations that enhance angler satisfaction and ultimately retain and recruit new and lapsed anglers.

DEDICATION

My thesis is dedicated to my parents, Harold and Joyce Baker. Thank you for showing me that education is one of the best investments for future success and for your encouragement along the way. Without your guidance and support, I would not have gotten this far and I would not be the person I am. I love you both very much.

Knowledge is forever.

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INTRODUCTION

If the number of recreational anglers continues to decline, natural resource agencies will need to focus on recruiting new anglers, retaining current anglers, and attracting lapsed anglers to ensure sufficient license sales to fund resource management (Fedler & Ditton, 2001). Negative perceptions and conflicts between user groups are common. To understand the users of the resource, managers need to know their attitudes to make more palatable regulations which may improve satisfaction by minimizing conflict.

Tourist-prone locations are a source for negative perceptions and conflict to surface because these areas may receive significant resource use by nonresidents. Researchers have continually found residents may develop negative attitudes toward tourism because of potential harmful consequences such as crowding, noise, crime, pollution, and congestion (Andereck, Valentine, Knopf, & Vogt, 2005; Mason & Cheyne, 2000; Pizam, 1978). Recreational fishing can be a source of tourism (Ditton, Holland, & Anderson, 2002) and negative perceptions between resident and nonresident angler groups are common. Fishery-specific examples of contention between residents and nonresidents have occurred at Minnesota lake resorts (Radomski, 2003) and several popular Canadian salmon (*Salmonidae*) fishing destinations frequented by U.S. recreational anglers (Sinclair & Reid, 1974). At Sardis and Grenada reservoirs in

Mississippi, the prevalent negative perception among resident anglers was that nonresident anglers were catching and keeping too many crappie (*Pomoxis* spp.) (K. Meals, Mississippi Department of Wildlife, Fisheries and Parks, personal communication, January 14, 2008). Sardis and Grenada reservoirs were heavily fished in the spring (Hunt, Grado, Miranda, & Baker, 2008) when crappie were spawning in shallow water and were easier to catch (Allen & Miranda, 1996). This prompted my first study of catch-related attitudes in which I examined the link between catch-related attitudes and actual catch to investigate if known negative perceptions between resident and nonresident angler groups was plausible. I defined "residents" as those residing in Mississippi and "nonresidents" as those residing in states other than Mississippi.

Another negative perception existed toward hand grabblers which prompted my second study of catch-related attitudes. Hand grabbling is a non-traditional form of fishing where the grabbler puts their hand in an underwater natural or artificial cavity and attempts to get a catfish to bite their hand, after which the fish is pulled out. Hand grabbling has been viewed negatively because hand grabblers potentially remove spawning catfish (Morgan, 2004). However, previous studies found that hand grabbling was not negatively impacting catfish populations (Brown, in review; Winkelman, 2003; Jackson, 1999).

Catch-related attitudes are an angler's favorable or unfavorable evaluation of catching fish. The catch-related attitude scale, also known as the consumptive orientation scale, has been used to measure various aspects of catching fish (Anderson, Ditton, & Hunt, 2007). Since its development in 1980, researchers have modified scale items such that it reliably measures attitudes in four constructs, *catching something, catching*

numbers, *catching large fish*, and *retaining fish*. A common theoretical framework used to show a link between attitudes and behavior is the theory of reasoned action. The theory states that people process the available information they have when deciding whether or not to engage in a particular behavior (Ajzen & Fishbein, 1980). Understanding attitudes, specifically catch-related attitudes, can provide natural resource agencies with important information about their diverse angler groups and can facilitate informed decision-making processes.

Objectives

The first study was a comparison of resident and nonresident anglers at Sardis and Grenada reservoirs, Mississippi. The objective was to examine socio-demographics, participation patterns, and catch-related attitudes and test if these attitudes were different by residence. The second study was a comparison of hand grabblers and rod and reel catfish anglers in Mississippi. The objective was to document socio-demographics, general freshwater fishing characteristics, participation patterns, and catch-related attitudes and test if these attitudes were different by residence. Differences in catch-related attitudes were the primary focus of both studies.

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CHAPTER II

CATCH-RELATED ATTITUDES OF RESIDENT AND NONRESIDENT ANGLERS AT SARDIS AND GRENADA RESERVOIRS IN MISSISSIPPI

Introduction

Recreational anglers in the United States declined from 34.1 million to 30.0 million from 2001 to 2006 (USDI & USDC, 2001, 2006). This reduction created budgetary shortfalls for natural resource agencies that depend on license sales for funding fisheries management. In addition to recruiting new anglers, agencies often focus on attracting lapsed anglers and retaining existing anglers to ensure sufficient numbers of licenses are sold to meet management costs (Fedler & Ditton, 2001). These efforts include those designed at retaining existing resident anglers in a particular state and attracting nonresident anglers as well.

For this study, I defined "residents" as those who live in Mississippi and "nonresidents" as those who live in a state other than Mississippi. Nonresident anglers can help agencies reduce budget shortfalls because they pay greater priced license fees and contribute "new" monies to local and state economies (Grado, Jones, Earles, & Jones, 2003; Measells, Grado, Sun, & Belli, 2005). Additionally, Mississippi has a net gain of anglers, meaning it attracts more nonresident anglers than it loses as a result of residents seeking opportunities out-of-state (Ditton, Holland, & Anderson, 2002). Mississippi ranks thirteenth in terms of nonresident angler days. The opportunity exists

to attract more participants because quality fishing opportunities in Mississippi have been shown to attract nonresidents. Despite the benefits from attracting more nonresident anglers for economic development purposes, an influx of nonresident tourists can create unintended physical, environmental, economic, and social negative consequences for residents. Examples include increased traffic congestion, reduced access, inflated land prices, fluctuating employment, dependency on a single industry, crowding, presence of undesirable activities, and loss of cultural identity (Andereck, Valentine, Knopf, & Vogt, 2005; Mason & Cheyne, 2000; Pizam, 1978). Residents located closest to tourist destinations and who use them frequently were more likely to have negative attitudes towards nonresidents (Jurowski & Gursoy, 2004). State agencies "walk a thin line" because angler satisfaction is a large part of retaining anglers and resident anglers still comprise most of the state participants. The consequences of unsatisfied resident anglers include attrition, loss of agency and biologist credibility, regulation changes, anglers seeking public meetings to air their grievances, and political action to undermine agency authority (Boxrucker, 2002; Churchill, Bettoli, Peterson, Reeves, & Hodge, 2002; Matlock, Saul, & Bryan, 1988). Anglers also have been known to poach when they were in disagreement with specific regulations (Muth & Bowe, 1998).

Recreational fishing is a form of tourism (Ditton et al., 2002) and negative perceptions of nonresidents by residents are common. For example, Wisconsin recreational anglers who frequented resorts along Minnesota lakes were accused of catching yellow perch (*Perca flavescens*) and selling them commercially (Radomski, 2003). Similarly, Canadians believed U.S. recreational anglers were catching more than their legal limit and selling their catch commercially back in the United States (Sinclair &

Reid, 1974). These studies were inconclusive as to whether nonresident anglers were accounting for more fishing effort or harvest than resident anglers, but the perception among residents obviously existed.

At Sardis and Grenada Reservoirs in Mississippi, fisheries biologists also have heard from resident anglers that nonresident anglers were detrimental to the crappie (*Pomoxis* spp.) fishery (K. Meals, personal communication, January 14, 2008). Specifically, residents have accused nonresident anglers of catching too many crappie and selling them illegally in their home state. Resident angler contempt for nonresident anglers may be the result of Sardis and Grenada Reservoirs being marketed as tourist destinations; Grenada Reservoir has been referred to as one of the top trophy crappie lakes in the United States (Covington, 2007). Resident anglers at these reservoirs may consider crappie populations as personal stock and hold negative attitudes toward nonresident anglers. Quinn (1992) found that local anglers who have been situated in the community for many years adopt a "preservationist position" (p. 371) and consider fish stocks as private and resent harvest by nonresident anglers. A better understanding of catch-related attitudes of resident and nonresident anglers, and if they are indeed different, is needed to confirm or refute resident perceptions of nonresidents. In the absence of differences, fisheries agencies can better convince residents of the positive benefits tourism offers for local and state businesses and fisheries management.

Nevertheless, no research has been conducted comparing catch-related attitudes of resident and nonresident anglers. Previous fisheries research has examined resident angler catch-related attitudes (Anderson & Ditton, 2004; Anderson, Ditton, & Hunt, 2007), or catch-related attitudes of African-American and Anglo resident groups (Hunt,

Floyd, & Ditton, 2007). Other studies have examined attitudes relating to fishing motivations or regulations and surveyed resident angler attitudes only (Milon & Thunberg, 1993) or reported on overall attitudes by combining angler residence groups (Hunt, Poarch, & Riechers, 1996). Research on nonresident anglers has focused on expenditures (Bell, 1993; Calvert & Williams, 1999) and promoting fishing as tourism (Chen, Hunt, & Ditton, 2003). Therefore, my study objective was to compare socio-demographics, participation patterns, and catch-related attitudes between resident and nonresident angler groups.

The theory of reasoned action is helpful in understanding the relationship between attitudes and behavior and developing hypothesis statements (Ajzen & Fishbein, 1980). In general, the theory of reasoned action posits "that people use the information available to them in a reasonable manner to arrive at their decisions" (p. 244) and attitudes should be consistent with intentions and ultimately an individual's behavior. Using this theoretical framework in the context of natural resources, researchers have found that attitudes were consistent with intentions and that attitudes were the best predictor of an individual's intention to support hunting or facility development, (i.e., behaviors) (Bright, 2003; Campbell & Mackay, 2003). Therefore, if the theory of reasoned action holds true, there should be no differences in resident group attitudes towards four constructs related to catching and keeping fish. I did not test the theory but rather used it as a theoretical framework. I hypothesized there were no significant differences between resident and nonresident angler catch-related attitudes toward *catching something, catching numbers, catching large fish,* or *retaining fish*.

Methods

Prior to data collection, my study was approved by the Mississippi State University (MSU) Institutional Review Board (IRB) for the protection of human subjects (IRB Study #06-061). To develop a sampling frame for resident and nonresident anglers, I conducted access-point creel surveys at Sardis Reservoir from March 2006 to February 2007 and at Grenada Reservoir from March 2007 to February 2008.

I divided each reservoir into three sections with approximately four boat ramps per section because the reservoirs were too large to sample in one day. I used a Statistical Analysis Software (SAS), v. 9.1 randomization program to select 24 sampling days (12 week days and 12 weekend days) in each quarter (quarter one: March, April, May; quarter two: June, July, August; quarter three: September, October, November; quarter four: December, January, February). I also used the randomization program to determine which reservoir section and boat ramp to sample on those days. On each sampling day, I completed random instantaneous counts (morning or afternoon) of the total vehicle numbers at each boat ramp in the assigned section of the reservoir. Number of access points accessible by boat varied according to water-level or construction. Total daily effort for each reservoir section was estimated as the product of recorded trips and day length (hours).

Creel technicians, including myself, sampled 120 days at Sardis Reservoir from March 2006 through February 2007, with 96 days being creel survey days and 24 supplemental sampling days solely to collect names and addresses. Similarly, we sampled 130 days at Grenada Reservoir from March 2007 to February 2008, with 96 creel survey days and 34 supplemental sampling days. Creel technicians were stationed

at randomly selected boat ramps from 10:00 AM to 4:00 PM (CST) and approached anglers as they exited the boat ramp and explained the study's purpose. If anglers agreed to participate, creel technicians collected information regarding catch and effort, trip duration, party size, zip code, county, and state of residence. Then, the creel technician asked one participant from each fishing party to be a part of an "add-on" mail survey (Ditton & Hunt, 2001; Pollock, Jones, & Brown, 1994). Specifically, the creel technician explained to members of the fishing party that the Human Dimensions and Conservation Law Enforcement Laboratory (HDCLEL) at MSU was conducting an angler survey and needed cooperation from one randomly selected member. The party member with the most recent birthday was asked to participate in the "add-on" mail survey; this randomization technique was intended to reduce potential group representative and party leader bias (Holland, Fedler, & Ditton, 1985). After the angler was selected, he or she was asked to participate and then presented with an informational flier about the study. Once the angler agreed to participate, the creel technician recorded his or her name, address, and phone number. I entered names, addresses, and telephone numbers after each sampling day in a database maintained at the HDCLEL.

An 11-page, self-administered mail questionnaire was jointly developed by MSU and the Mississippi Department of Wildlife, Fisheries and Parks (MDWFP) to obtain information on angler socio-demographics, participation patterns, and catch-related attitudes. Questions regarding angler socio-demographics focused on their residence, ethnic group, gender, age, education level, and household income. First, based on address information, I determined residence group for each angler; those who lived in a state other than Mississippi were labeled "nonresidents" and Mississippians were labeled

"residents." Second, I asked anglers which ethnic background best described them: white or Anglo, black or African-American, Native American or Alaskan Native, Asian or Pacific Islander, Hispanic or Latino, or "other" with an open-ended response. Third, I asked their gender. Fourth, I asked "What is your age?" Fifth, I asked "What is your highest completed level of education?" by prompting them to circle one number from the following response format: "1" through "8" for elementary school, "9" through "12" for high school, "13" through "16" for college, and "17" through "22+" for graduate school. Last, I asked anglers to provide their approximate annual household income before taxes in $10,000 increments from "under $10,000" to "$100,000 and above." I reported percentage composition for ethnic background, gender, and household income and reported the median education level; because these variables represented nominal and ordinal data, I tested for differences using a Chi-square test. I reported the mean age and used a t-test for group differences because age represented a ratio scale and was normally distributed.

Questions regarding participation patterns focused on years of freshwater fishing experience, years of fishing experience at Sardis and Grenada Reservoirs, fishing ability compared to other anglers, total number of days fishing in the previous 12 months, number of days fishing at reservoirs in the previous 12 months, freshwater species fished for most often, and target species on the trip they were intercepted. First, I asked anglers "How many years have you been fishing in fresh water?" Second, I asked "How many years have you been fishing at Sardis/Grenada Reservoir?" Third, I asked "How do you compare your fishing ability to that of other freshwater anglers in general?" and provided them with three response choices: "less skilled," "equally skilled," and "more skilled."

Fourth, I asked "In the previous 12 months, how many days did you go fishing in the following environments?" and presented them with four environments to fill in the number of days, "ponds (less than 50 acres)," "lakes (greater than 50 acres)," "rivers and streams," and "saltwater." I totaled all their days from those categories to find their total number of days fishing in the previous 12 months and reported separately the number of days fished at reservoirs in the previous 12 months. Fifth, I asked "What species of freshwater fish do you fish for most often?" Sixth, I asked "What type of fish species did you target most on this trip?" I reported mean values for years of freshwater fishing experience and years of fishing experience at Sardis and Grenada reservoirs and performed a t-test for group differences because these variables were ratio level and normally distributed. I reported median values for total number of days fishing in the previous 12 months and number of days fishing at reservoirs in the previous 12 months and used a Wilcoxon-Mann-Whitney test for group differences because these variables were not normally distributed. I reported percentage composition for fishing ability, freshwater species fished for most often, and target species. I used a Chi-square test to test for homogeneity of nominal variables. If there were significant differences, I calculated standardized residuals from crosstabulations to determine which cells contributed most to the significant differences (Hinkle, Wiersma, & Jurs, 1994).

Questions pertaining to catch-related attitudes were conceptualized by 16 statements (Anderson et al., 2007) and operationalized in a five-point Likert measurement scale with response format 1 = "strongly disagree," 2 = "disagree," 3 = "neutral," 4 = "agree," and 5 = "strongly agree" (Table 2.1). The 16 attitudinal statements were separated into four constructs: *catching something, catching numbers,*

catching large fish, and *retaining fish* (Table 2.1). These constructs have previously been found to be reliable measures of catch-related attitudes (Anderson et al., 2007; Hunt et al., 2007). For a detailed background of the catch-related attitude scale, see Anderson et al. (2007). I used Statistical Package for the Social Sciences (SPSS), v. 15.0 to calculate Cronbach's alpha to determine scale reliability for each construct.

Prior to analysis of the catch-related attitude scale, I checked the data for missing values. I deleted from further analysis respondents who did not answer any of the 16 items. The greatest percentage of missing data was 3.3% for the *catching large fish* and *retaining fish* constructs. For those with item nonresponse on some scale items, I used the Markov chain Monte Carlo (MCMC) algorithm in PROC MI in SAS, v. 9.1 to replace missing values because this method repeatedly provides robust estimates when the percentage of missing values was low (Schafer, 1997).

To determine if resident and nonresident attitudes differed, I summed each participant's item scores for each construct and then calculated a mean construct score for residents and nonresidents (Table 2.2). I used PROC TTEST and the CLASS statement in SAS, v. 9.1 to conduct a t-test to determine if residents had different catch-related attitudes than nonresidents. The independent variable was residence (i.e., resident or nonresident) and the dependent variable was the mean construct score. I ran separate tests for each reservoir.

I followed the Tailored Design Method (Dillman, 2000) for survey implementation. Surveys for each reservoir were conducted in four waves at the end of each quarter to reduce recall bias (Ditton & Hunt, 2001). Therefore, each angler was contacted one to three months later. A pre-notification letter was sent on day one which

notified the participant he or she was about to receive a mail questionnaire. On day eight, I mailed the self-administered mail questionnaire along with a letter and a business reply envelope, termed a complete packet. I hand signed each letter accompanying the mail questionnaire and addressed each letter to the specific participant to provide a level of personalization and increase response rate. I sent a reminder/thank you postcard to all participants on day 15. I mailed the second complete packet on day 29 to any remaining nonrespondents and the third complete packet on day 48. Completed surveys were mailed to the HDCLEL where they were immediately processed. Any undeliverable surveys were investigated as to the cause and re-mailed, if possible, so each respondent had an equal opportunity to respond.

To examine angler catch behavior, I calculated total crappie fishing effort, total crappie harvest, total crappie caught, and average crappie weight from original creel survey data for both groups at each reservoir from March 2006 to February 2007 for Sardis Reservoir and March 2007 to February 2008 for Grenada Reservoir. I calculated total crappie fishing effort by multiplying hours spent fishing for crappie by number of people in the fishing party and summed those values. Total crappie harvest was the sum of all crappie kept and total crappie caught was the sum of all crappie kept or released. Average crappie weight was calculated by dividing crappie weight by the number of crappie kept. I used a Wilcoxon-Mann-Whitney test to determine if resident and nonresident total crappie fishing effort, total crappie harvest, and total crappie caught differed significantly (Siegel & Castellan, 1988). I used a t-test to determine if there were differences between resident and nonresident average crappie weight because

weights were distributed normally. I compared angler catch behavior to catch-related attitudes to help explain perceptions and reach my conclusions.

I investigated possible nonresponse bias using logistic regression to calculate response probabilities where the independent variables were residence, guided trip, number in the fishing party, and gender and the dependent variable was response status (1 = responded, 0 = did not respond) because survey results could be biased if response rates are not near 100% (Fisher, 1996). Throughout my study, I set my significance level at alpha = 0.05. Beta, the probability of a Type II error, was determined using average sample size per group and power tables provided by Cohen (1988). I found Beta to be < 0.01 for both studies.

Results

Sardis Reservoir Creel and Questionnaire

I encountered 512 fishing parties at Sardis Reservoir, with 415 (81.1%) creel interviews and 97 (18.9%) additional supplemental sampling days solely to collect names and addresses. In all, 436 (85.1%) participants provided their information for the "add-on" mail survey; of the remaining anglers, 70 (13.7%) were repeat encounters and six (1.2%) refused the mail survey. Of the 436 participants, 331 returned useable mail questionnaires, six were non-deliverable, and three anglers refused to complete the questionnaire providing an effective mailing response rate of 77.5% (Dillman, 2000). I found no differences in response rate relative to residence group ($\chi^2 = 1.113$, df = 1, $p = 0.291$), whether they were on a guided fishing trip ($\chi^2 = 0.001$, df = 1, $p = 0.997$), number in party ($\chi^2 = 1.343$, df = 3, $p = 0.719$), or gender ($\chi^2 = 0.032$, df = 1, $p = 0.858$).

Therefore, I do not believe nonresponse bias was an issue with the sample of Sardis Reservoir anglers. All variables except for catch-related attitudes were weighted to reflect the proportion of residents (51%) and nonresidents (49%) observed from the instantaneous counts.

Of the 331 participants who completed the questionnaire, 187 (56.5%) were Mississippi residents. Residents were predominantly "white or Anglo" (96.2%, $n = 177$) and male (97.3%, $n = 180$) and their average age was 52.9 years (SE = 1.0, $n = 184$). Most residents (53.6%, $n = 97$) had at least a high school diploma and their median annual household income was "$50,000 to $59,999."

Residents had an average of 39.9 years (SE = 1.1, $n = 181$) of freshwater fishing experience and averaged 25.7 years (SE = 1.1, $n = 186$) fishing experience at Sardis Reservoir. Most residents (71.0%, $n = 130$) indicated they were "equally skilled" compared to other anglers. In the previous 12 months, they reported fishing a median of 50.0 days ($n = 180$) and fished in reservoirs a median of 35.0 days ($n = 180$). Most residents (66.7%, $n = 122$) indicated they fished most often for crappie and 75.3% ($n = 140$) specifically targeted crappie on their fishing trip to Sardis Reservoir.

From my analysis of unextrapolated creel survey data, resident angler crappie effort was 1,676.7 hours and accounted for 49.7% ($n = 188$) of the total crappie effort but only accounted for 40.0% ($n = 188$) of the total Sardis Reservoir crappie harvest, or 1,685 crappie. In terms of total crappie caught, residents accounted for 45.5% ($n = 188$), or 2,736 crappie. Average weight of crappie caught by residents was 398.0 grams (SE = 7.6, $n = 123$).

Of the 331 participants who completed the questionnaire, 144 (43.5%) were nonresidents. Nonresidents were predominantly "white or Anglo" (92.1%, $n = 128$) and male (95.7%, $n = 134$) and their average age was 54.0 years (SE = 1.1, $n = 140$). A plurality of nonresidents (47.8%, $n = 66$) had at least a high school diploma and their median annual household income was "$70,000 to $79,999."

Nonresidents had an average of 41.0 years (SE = 1.1, $n = 136$) of freshwater fishing experience and averaged 21.2 years (SE = 1.2, $n = 136$) fishing experience at Sardis Reservoir. Most nonresidents (68.6%, $n = 94$) indicated they were "equally skilled" compared to other anglers. In the previous 12 months, they reported fishing a median of 40.0 days ($n = 133$) and fished in reservoirs a median of 28.0 days ($n = 133$). Most nonresidents (75.2%, $n = 103$) indicated they fished most often for crappie and 84.9% ($n = 112$) specifically targeted crappie on their fishing trip to Sardis Reservoir.

From the analysis of unextrapolated creel survey data, Sardis nonresident crappie effort was 1,698.0 hours and accounted for 50.3% ($n = 173$) of the total crappie effort and 60.0% ($n = 173$) of the total Sardis crappie harvest, or 2,529 crappie. Nonresidents caught 3,275 crappie, which was 54.5% ($n = 173$) of all crappie caught at Sardis Reservoir. Average weight of crappie caught by nonresidents was 430.8 grams (SE = 5.9, $n = 140$).

Of the results provided above for resident and nonresident Sardis Reservoir anglers, ethnic background ($\chi^2 = 3.360$, df = 4, $p = 0.499$), gender ($\chi^2 = 0.611$, df = 1, $p = 0.435$), average age ($t = -0.76$, $p = 0.448$), highest education level ($\chi^2 = 2.705$, df = 3, $p = 0.439$), fishing ability ($\chi^2 = 0.659$, df = 2, $p = 0.719$), average years of freshwater fishing experience ($t = -0.69$, $p = 0.489$), most targeted species on fishing trip ($\chi^2 = 3.967$, df = 4,

$p = 0.411$), most fished for freshwater species ($\chi^2 = 4.777$, df = 4, $p = 0.311$), and total crappie effort ($Z = 1.439$, $p = 0.150$) did not differ significantly between residents and nonresidents. Median annual household income ($\chi^2 = 19.148$, df = 10, $p = 0.038$), average years fishing experience at Sardis Reservoir ($t = 2.52$, $p = 0.012$), median days fishing in the previous 12 months ($Z = -2.882$, $p = 0.004$), median days fishing in reservoirs in the previous 12 months ($Z = -2.552$, $p = 0.011$), total harvested crappie ($Z = 3.761$, $p < 0.001$), total crappie caught ($Z = 2.592$, $p = 0.010$), and average crappie weight ($t = -3.41$, $p = 0.001$) differed significantly between residents and nonresidents.

Sardis Reservoir Catch-related Attitude Scale Reliability

Cronbach's alpha scores for scale items within constructs were reasonably reliable, with the least Cronbach's alpha score 0.69 and the greatest 0.79 (Table 2.1). Cronbach's alpha scores of 0.70 or greater were considered reliable (Nunnally, 1978). I did not drop any items in the catch-related attitude scale analysis because the items reliably measured their respective constructs.

Sardis Reservoir Catch-related Attitudes

The greatest mean construct score for residents was 13.96 (SE = 0.3, $n = 184$; Table 2.2) for *catching numbers*. The second greatest mean construct score was 13.71 (SE = 0.2, $n = 184$; Table 2.2) for *catching large fish*. *Catching something* was the third greatest mean construct score for residents, 12.31 (SE = 0.3, $n = 184$; Table 2.2). The least mean construct score was 11.81 (SE = 0.3, $n = 184$; Table 2.2) for *retaining fish*.

The greatest mean construct score for nonresidents was 13.91 (SE = 0.3, $n = 134$; Table 2.2) for *catching numbers*. The second greatest mean construct score was 13.18

(SE = 0.3, n = 134; Table 2.2) for *catching large fish*. *Catching something* was the third greatest mean construct score for nonresidents, 12.97 (SE = 0.3, n = 134; Table 2.2). The least mean construct score was 12.54 (SE = 0.3, n = 134; Table 2.2) for *retaining fish*.

There were no significant differences between resident and nonresident catch-related attitudes for any of the four constructs: *catching numbers* (t = 0.12, p = 0.901; Table 2.2), *catching large fish* (t = 1.55, p = 0.122; Table 2.2), *catching something* (t = -1.71, p = 0.089; Table 2.2), and *retaining fish* (t = -1.89, p = 0.061; Table 2.2). I accepted the hypotheses which stated there is no significant difference between resident and nonresident angler attitudes toward *catching something, catching numbers, catching large fish,* and *retaining fish*.

Grenada Reservoir Creel and Questionnaire

I encountered 614 fishing parties at Grenada Reservoir, with 399 (83.0%) being creel interviews and 215 (44.7%) additional supplemental sampling days solely to collect names and addresses. In all, 481 (78.3%) participants provided their information for the "add-on" mail survey; of the remaining anglers, 80 (13.0%) were repeat encounters and 53 (8.6%) refused the mail survey. Of the 481 participants, 345 returned useable mail questionnaires, 12 were non-deliverable, and three anglers refused to complete the questionnaire which resulted in a 74.0% effective mailing response rate (Dillman, 2000). I found no differences in response rate relative to number in party (χ^2 = 5.358, df = 3, p = 0.147) or gender (χ^2 = 1.307, df = 1, p = 0.253). No anglers were on guided fishing trips so that variable was not retained in the nonresponse check. However, I found residents more likely to respond than nonresidents (χ^2 = 21.738, df = 1, p < 0.001). To account for

this difference, all variables except for catch-related attitudes were weighted to reflect the proportion of residents (81%) and nonresidents (19%) observed from the instantaneous counts. Thus, nonresponse bias should be minimal for the sample of Grenada Reservoir anglers.

Of the 345 participants who completed the questionnaire, 282 (81.7%) were Mississippi residents. Residents were predominantly "white or Anglo" (96.7%, $n = 265$) and male (98.9%, $n = 270$) and their average age was 51.7 years (SE = 0.9, $n = 274$). Most residents (50.2%, $n = 134$) had at least a high school diploma and their median annual household income was "$50,000 to $59,999."

Residents had an average of 40.5 years (SE = 0.9, $n = 271$) of freshwater fishing experience and averaged 28.6 years (SE = 0.9, $n = 275$) fishing experience at Grenada Reservoir. Most residents (67.4%, $n = 186$) indicated they were "equally skilled" compared to other anglers. In the previous 12 months, they reported fishing a median of 40.0 days ($n = 270$) and fished in reservoirs a median of 30.0 days ($n = 270$). Most residents (78.3%, $n = 213$) indicated they fished most often for crappie and 85.5% ($n = 235$) specifically targeted crappie on their fishing trip to Grenada Reservoir.

From my analysis of unextrapolated creel survey data, Grenada resident crappie effort was 2,713.3 hours, which was 83.6% ($n = 326$) of the total crappie effort. Residents harvested 2,379 crappie, which accounted for 92.2% ($n = 326$) of the total Grenada Reservoir crappie harvest. In terms of total crappie caught, residents accounted for 91.8% ($n = 326$), or 3,495 crappie. Average weight of crappie caught by residents was 542.7 grams (SE = 7.9, $n = 245$).

Of the 345 participants who completed the questionnaire, 63 (18.3%) were nonresidents. All nonresidents were "white or Anglo" (100.0%, $n = 63$), most were male (98.4%, $n = 60$) and their average age was 54.0 years (SE = 1.5, $n = 62$). A plurality of nonresidents (43.6%, $n = 27$) had at least a high school diploma and their median annual household income was "$70,000 to $79,999."

Nonresidents had an average of 41.0 years (SE = 1.9, $n = 60$) of freshwater fishing experience and averaged 6.8 years (SE = 1.3, $n = 61$) fishing experience at Grenada Reservoir. Most nonresidents (59.0%, $n = 36$) indicated they were "equally skilled" compared to other anglers. In the previous 12 months, they reported fishing a median of 40.0 days ($n = 61$) and fished in reservoirs a median of 33.0 days ($n = 61$). Most nonresidents (76.7%, $n = 46$) indicated they fished most often for crappie and 95.2% ($n = 59$) specifically targeted crappie on their fishing trip to Grenada Reservoir.

From the analysis of unextrapolated creel survey data, Grenada nonresident crappie effort was 533.8 hours, which accounted for 16.4% ($n = 46$) of the total crappie effort and 7.8% ($n = 46$) of the total Grenada crappie harvest, 201 crappie. Nonresidents caught 313 crappie, which was 8.2% ($n = 46$) of all crappie caught. Average weight of crappie caught by nonresidents was 536.3 grams (SE = 27.7, $n = 35$).

Of the results provided above for resident and nonresident Grenada Reservoir anglers, ethnic background ($\chi^2 = 2.126$, df = 2, $p = 0.345$), gender ($\chi^2 = 0.123$, df = 1, $p = 0.726$), average age ($t = -0.63$, $p = 0.530$), average years of freshwater fishing experience ($t = -0.12$, $p = 0.908$), fishing ability ($\chi^2 = 0.369$, df = 2, $p = 0.831$), median days fishing in the previous 12 months ($Z = -0.127$, $p = 0.899$), median days fishing in reservoirs in the previous 12 months ($Z = 0.486$, $p = 0.627$), most fished for freshwater species ($\chi^2 =$

5.800, df = 4, $p = 0.215$), most targeted species on fishing trip ($\chi^2 = 1.194$, df = 2, $p = 0.550$), total crappie harvest ($Z = -1.807$, $p = 0.071$), and average crappie weight ($t = 0.28$, $p = 0.782$) differed significantly between residents and nonresidents. Highest education level ($\chi^2 = 11.566$, df = 3, $p = 0.009$), median annual household income ($\chi^2 = 22.041$, df = 10, $p = 0.015$), average years fishing experience at Grenada Reservoir ($t = 5.59$, $p < 0.001$), total crappie effort ($Z = 3.746$, $p < 0.001$), and total crappie caught ($Z = -2.018$, $p = 0.044$) were significantly different between residents and nonresidents.

Grenada Reservoir Catch-related Attitude Scale Reliability

Cronbach's alpha scores for scale items within constructs were reasonably reliable, with the least Cronbach's alpha score 0.68 and the greatest 0.81 (Table 2.1). Cronbach's alpha scores of 0.70 or greater were considered reliable (Nunnally, 1978). I did not drop any items in the catch-related attitude scale analysis because the items reliably measured their respective constructs.

Grenada Reservoir Catch-related Attitudes

The greatest mean construct score for residents was 14.01 (SE = 0.2, $n = 272$; Table 2.2) for *catching large fish*. The second greatest mean construct score was 13.68 (SE = 0.2, $n = 272$; Table 2.2) for *catching numbers*. *Catching something* was the third greatest mean construct score for residents, 13.26 (SE = 0.2, $n = 272$; Table 2.2). The least mean construct score was 13.18 (SE = 0.2, $n = 272$; Table 2.2) for *retaining fish*.

The greatest mean construct score for nonresidents was 15.61 (SE = 0.3, $n = 62$; Table 2.2) for *catching large fish*. The second greatest mean construct score was 13.27 (SE = 0.4, $n = 62$; Table 2.2) for *catching something*. *Catching numbers* was the third

greatest mean construct score for nonresidents, 12.95 (SE = 0.4, n = 62; Table 2.2). The least mean construct score was 11.65 (SE = 0.4, n = 62; Table 2.2) for *retaining fish*.

There were no differences between resident and nonresident catch-related attitudes for two constructs, *catching something* (t = -0.03, p = 0.972; Table 2.2) and *catching numbers* (t = 1.60, p = 0.114; Table 2.2). Resident and nonresident catch-related attitudes toward *catching large fish* (t = -3.62, $p < 0.001$; Table 2.2) and *retaining fish* (t = 3.39, p = 0.001; Table 2.2) differed significantly. I accepted the hypotheses which stated there is no significant difference between resident and nonresident angler attitudes toward *catching something* and *catching numbers.* I rejected the hypothesis that there was no significant difference between resident and nonresident angler attitudes toward *catching large fish* and *retaining fish*.

Discussion

There were no significant differences in Sardis Reservoir resident and nonresident angler catch-related attitudes. Residents harvested and caught significantly fewer crappie than nonresidents even when crappie fishing effort was nearly equal. Also, nonresidents average crappie weight was greater than residents. I expected no differences in catch behavior between Sardis residents and nonresidents because their attitudes should be consistent with behavior as articulated in the theory of reasoned action. Not only would the theory of reasoned action not be applicable in this case, but resident perceptions of nonresidents catching and keeping more crappie likely had some merit.

Grenada Reservoir nonresident anglers had stronger attitudes toward *catching large fish* than residents. Conversely, Grenada residents had stronger attitudes toward

retaining fish than nonresidents. In terms of catch behavior, Grenada residents and nonresidents did not harvest a disproportionate share of crappie and average crappie weights were similar. However, residents accounted for more effort and caught more crappie than nonresidents. From the theory of reasoned action, I expected nonresident crappie average weight to be greater than that of residents because nonresidents catch-related attitudes toward *catching large fish* were stronger. I also would have expected residents to harvest significantly more crappie because their attitudes toward *retaining fish* were stronger than nonresidents but this was not the case. Grenada resident angler perceptions of nonresidents keeping more fish probably did not have merit according to my study and resident's attitudes reflected their own strong disposition towards keeping fish.

My objective was not to test the theory of reasoned action but instead use it as a theoretical framework to examine the relationship between attitude and behavior. Nevertheless, I found conflicting results when comparing attitudes to behavior at both reservoirs. I did not measure subjective norms or intentions which may be necessary to fully understand the link between catch-related attitudes and actual catch. Researchers (McCleery, Ditton, Sell, & Lopez, 2006) have argued that human dimensions research should measure behaviors and attitudes which provide more information than simply assuming there was a connection.

Scale reliability was comparable to other studies (Anderson et al., 2007; Hunt et al., 2007). Anderson et al. (2007) focused on studying catch-related attitudes of Anglo male anglers in Texas, Hunt et al. (2007) focused on African-American and Anglo males, and this study focused on predominantly Anglo males targeting crappie. Overall, my

study should provide more evidence of the catch-related attitude scale's reliable use among predominantly Anglo male angling groups.

Angler specialization may help explain differences in catch behavior at Sardis Reservoir and differences in catch-related attitudes between residents and nonresidents at Grenada Reservoir. Bryan (1977) developed a conceptual framework of recreational specialization among recreational fishermen that segmented anglers on a continuum ranging from general to specialized anglers based on skill level, equipment used, and preferred setting. In their study of specialization among crappie anglers, Allen and Miranda (1996) found four distinct groups of crappie anglers (occasional anglers, generalists, springtime anglers, and crappie specialists) and anglers were segmented into groups because they differed in "fishing frequency and seasonality, fishing techniques, attitudes concerning harvest, and motivations" (p. 145). Although crappie harvest was significant in all groups, occasional anglers were fishing for no specific species and usually harvested their catch. Generalists placed more importance on catching many fish and springtime anglers indicated they preferred crappie greater than 10 inches to harvest for consumption and competed with their peers to catch a bag limit. Specialists indicated crappie harvest was not as important compared to the challenge of finding and catching large crappie. Others have recognized nonresidents as more specialized anglers because of their time and monetary commitment to seek fishing opportunities out-of-state (Ditton et al., 2002; Romberg, 1999). Sardis nonresidents may be considered more specialized because they had a couple more years of freshwater fishing experience, traveled out-of-state to seek other fishing opportunities, and were more skilled at catching crappie because they put in less effort while still harvesting more crappie than residents.

However, if Sardis nonresidents were specialized anglers, I would have expected their harvest to be less than those of residents as suggested by Allen and Miranda's (1996) study. Sardis residents had the "home field" advantage; they had significantly more years fishing experience at Sardis Reservoir and reported fishing more days in the previous 12 months than nonresidents but still were out-fished by nonresidents. This may show nonresident superior fishing skills, although most residents and nonresidents indicated their fishing ability as "equally skilled" compared to other freshwater fishing anglers. Sardis nonresidents cannot be firmly labeled as specialized anglers but it would help explain differences in catch behavior.

Differences in catch-related attitudes at Grenada also could be attributed to nonresidents being more specialized anglers than residents. Grenada nonresidents did not have greater freshwater fishing experience than residents but they likely traveled to Grenada because of its trophy crappie status and their catch-related attitudes towards *catching large fish* were stronger than residents. Grenada nonresident's highly positive attitude toward *catching large fish* was expressed in open-ended comments: "I caught the biggest crappie I ever caught, 3 lb 4 oz., I am very happy! I am looking forward to next spring (Grenada Reservoir nonresident angler)." Grenada nonresidents did not harvest more than residents and if they were considered to fall under Allen and Miranda's (1996) definition of crappie specialists, this is because harvest is less important. Grenada residents may place more importance on harvest because of their stronger attitudes toward *retaining fish* than nonresidents, thus providing more evidence of resident's lesser degree of specialization. Grenada nonresidents cannot be firmly labeled as specialized anglers but it would help explain differences in catch-related attitudes.

Negative perceptions were the original problem which led to the study of catch-related attitudes and catch behavior; residents at both reservoirs had negative perceptions of nonresidents harvesting too many crappie. This perception likely had merit at Sardis Reservoir but not as much at Grenada Reservoir. However, I believe there were other causes that gave rise to negative perceptions. Other explanations for resident negative perceptions included low water levels and crowded boat ramps which concentrated fishing effort and led to perceived crowding. Water levels were below normal due to drought in 2007 and both angler groups were frustrated with low water levels because fewer boat ramps were accessible. During summer 2007, only three boat ramps out of 15 were useable at Grenada Reservoir due to extremely low water levels. Most open-ended comments in the mail questionnaire included remarks about low water levels: "The water level was very low and made fishing very hard (Grenada Reservoir resident)," and "Worst fishing trip, no water in the lake (Grenada Reservoir nonresident)." Anglers had a greater chance of encountering one another because of fewer locations to launch their boat.

Residents also could have negative attitudes toward tourism and resented the presence of nonresidents. Recreational fishing as a form of tourism can attract nonresident anglers that otherwise would not travel to the area (Ditton et al., 2002). The city of Grenada formed a tourism commission to promote tourism and perhaps some in the community were unaware of the possible benefits and negative aspects of tourism. Some residents did not want Grenada Reservoir promoted as a tourist destination and resented extra attention paid to the resource "in their backyard" and they voiced their frustration in open-ended comments: "The problem lies with the local politicians and

Grenada tourism committee. They only want outside money from out of state fishermen. They don't think about the money local fishermen spend (Grenada Reservoir resident angler)." This is a "people problem" and resident anglers could be educated about possible benefits of tourism (Davis, Allen, & Cosenza, 1988). I should also note not all resident anglers shared this point of view and realized the potential of nonresident dollars that can be used to improve the reservoir and surrounding infrastructure and stated this in open-ended comments: "Grenada Lake is truly one of the best lakes for crappie in my opinion. If the current status of the lake, e.g., number of anglers, conditions of boat ramps and roads and lack of water stay the same, my time spent here will be limited. We need to capitalize on out of state money coming into the state to improve the lake (Grenada Reservoir resident angler)."

My angler group segments may be viewed as a study limitation because I placed anglers into broad groups (i.e., resident and nonresident) based on residence location. However, I segmented anglers broadly because state natural resource agencies sell fishing licenses based on residency. Others have segmented anglers into groups such as local, non-local, border state, or other nonresident (Hunt & Ditton, 1996). I realize some nonresident anglers may have traveled a shorter distance than some resident anglers. However, I analyzed catch-related attitudes of residents and nonresidents for its potential application at viewing recreational fishing as a form of tourism and also how state natural resource agencies may better understand its nonresident clientele.

Temporal differences in reservoir sampling periods regarding the measurement of catch-related attitudes may be viewed as a study limitation. Although each reservoir was sampled in a different year, I assumed angler catch-related attitudes were consistent and

remained unchanged throughout my study period because, according to Erwin (2001), attitudes are "relatively consistent and enduring" (p. 6). Attitudes are easier to change compared to a person's values and beliefs, but not as easily changed compared to behavior or behavioral intentions. Attitudes, especially strongly held attitudes, can be difficult to change unless anglers were provided with information or persuaded to change their attitudes (Decker, Brown, & Siemer, 2001).

My study results may be atypical due to the 2007 drought. Accessible boat ramps were limited due to low water levels and there were few ramps for anglers to launch their boats. Therefore, angler effort was more than likely concentrated in certain areas of the reservoirs. Furthermore, I observed some anglers using all terrain vehicles (ATVs) to haul jon boats to access remote shorelines of the reservoirs. I was unable to sample those anglers because they launched boats from remote locations and their catch-related attitudes may not be reflected in this study. My results may underestimate fishing effort, harvest, and catch compared to a typical year with adequate rainfall because angler effort was suppressed due to low water levels. Several anglers commented they would not return if water levels did not increase.

Understanding angler attitudes is critical to learning how people use the resource so fisheries managers can effectively manage it (Fisher, 1997; Knuth & McMullin, 1996; Wilde, Ditton, Grimes, & Riechers, 1996). I was not expecting to observe differences between resident and nonresident angler catch-related attitudes; however, this was the first study to describe differences while examining catch behavior. Crappie harvests can be variable and populations can be irregular, thereby having a potential effect on angler satisfaction (Miranda & Allen, 2000). Because of crappie population fluctuations,

anglers may return to their favorite reservoir only to find the crappie fishing not as good as they remember. This may affect their satisfaction, change their catch-related attitudes, or even alter where they go crappie fishing. Mississippi's recreational fishing has the potential to attract even more anglers because it attracts more anglers than it loses (Ditton et al., 2002). Tension over finite resources such as crappie fisheries will only become more of an issue for fisheries managers to tackle, especially if they are effective at attracting new and lapsed anglers and retaining existing ones.

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Table 2.1. Scale items used to measure constructs and scale reliability related to the catch-related aspects of fishing for resident and nonresident anglers at Sardis and Grenada reservoirs for creel surveys conducted at each reservoir from 2006 to 2007 and 2007 to 2008, respectively.

Catch-related attitude scale items [a]	Cronbach's Alpha	
	Sardis	Grenada
Catching something	0.74	0.72
A trip can be successful even if no fish are caught. [b]		
When I go fishing, I'm just as happy if I don't catch fish. [b]		
If I thought I wouldn't catch any fish, I wouldn't go fishing.		
When I go fishing, I'm not satisfied unless I catch at least something.		
Catching numbers	0.79	0.81
The more fish I catch, the happier I am.		
A successful fishing trip is one in which many fish are caught.		
A full stringer is the best indicator of a good fishing trip.		
I'm happiest with a trip if I at least catch the daily bag limit.		
Catching large fish	0.69	0.75
I would rather catch one or two big fish than ten smaller fish.		
The bigger the fish I catch, the better the fishing trip.		
I'm happiest with the fishing trip if I catch a challenging game fish.		
I like to fish where I know I have a chance to catch a "trophy" fish.		
Retaining fish	0.77	0.68
I usually eat the fish I catch.		
I'm just as happy if I don't keep the fish I catch. [b]		
I want to keep all the fish I catch.		
I'm just as happy if I release the fish I catch. [b]		

[a] Respondents were asked whether they agreed or disagreed with each of the 16 items on a 5-point Likert scale with response format: 1 = "strongly disagree," 2 = "disagree," 3 = "neutral," 4 = "agree," 5 = "strongly agree."

[b] Item reverse coded for analysis purposes.

Table 2.2. Respondent's mean construct scores on catch-related attitude items for Sardis and Grenada Reservoir resident and nonresident anglers for creel surveys conducted at each reservoir from 2006 to 2007 and 2007 to 2008, respectively.

Construct by Reservoir	Residents [a] Mean Construct Scores (SE)	Nonresidents [b] Mean Construct Scores (SE)	Test Statistic	*p*-value
Catching something				
Sardis	12.31 (0.3)	12.97 (0.3)	-1.71	0.089
Grenada	13.26 (0.2)	13.27 (0.4)	-0.03	0.972
Catching numbers				
Sardis	13.96 (0.3)	13.91 (0.3)	0.12	0.901
Grenada	13.68 (0.2)	12.95 (0.4)	1.60	0.114
Catching large fish				
Sardis	13.71 (0.2)	13.18 (0.3)	1.55	0.122
Grenada	14.01 (0.2)	15.61 (0.3)	-3.62	< 0.001
Retaining fish				
Sardis	11.81 (0.3)	12.54 (0.3)	-1.89	0.061
Grenada	13.18 (0.2)	11.65 (0.4)	3.39	0.001

[a] Sardis Reservoir resident anglers, $n = 184$; Grenada Reservoir resident anglers, $n = 272$
[b] Sardis Reservoir nonresident anglers, $n = 134$; Grenada Reservoir nonresident anglers, $n = 62$

CHAPTER III

CHARACTERISTICS AND CATCH-RELATED ATTITUDES OF MISSISSIPPI HAND GRABBLERS AND ROD AND REEL CATFISH ANGLERS

Introduction

Hand grabbling is a non-traditional form of fishing where the grabbler puts their hand in an underwater natural or artificial cavity and attempts to get a catfish to bite it so that the fish can be pulled out. In the southeastern United States, hand grabbling has been described as embedded in a grabbler's heritage and folk tradition (Morgan, 2006; Salazar, 2002); others have described it as a "lost art" and as being "passed down through generations" (Beesley, 2001). Fisheries biologists have voiced their concerns about the possible negative impacts of hand grabbling on catfish populations because hand grabbling season in Mississippi specifically coincides with catfish spawning in the summer (Jackson, Francis, & Ye, 1997). Also, some do not consider it a fair form of fishing because catfish were targeted while spawning (Morgan, 2004).

Nevertheless, research has indicated hand grabbling has not negatively impacted catfish populations in Mississippi (Brown, in review; Jackson et al., 1997) or in Oklahoma (Winkelman, 2003). In a study comparing hand grabbling catch rates to hoop net catch rates in the Tallahatchie River, Jackson et al. (1997) found hoop nets to be more efficient at capturing blue catfish (*Ictalurus furcatus*) than hand grabbling. However,

hand grabbling was found to be selective at catching large blue catfish (mean length = 77.3 cm) compared to hoop nets (mean length = 48.3 cm). Hand grabbling was unlikely to negatively impact catfish populations in the Tallahatchie River because riverine conditions (e.g., rapid currents, muddy water, siltation) limit successful hand grabs (Jackson et al., 1997). A separate study of hand grabblers at Ross Barnett Reservoir, Mississippi, concluded hand grabbling did not negatively impact flathead catfish (*Pylodictis olivaris*) populations and evidence from electrofishing showed Ross Barnett Reservoir maintains a healthy population with a range of size classes (Brown, in review). A study of "noodlers" (the term commonly used for hand grabblers in Oklahoma and Missouri) in Lake Carl Blackwell, Oklahoma, showed noodlers were not having a significant negative impact on flathead catfish populations, mostly due to few participants (Winkelman, 2003).

Despite the lack of evidence of detrimental impacts due to hand grabbling, Mississippi hand grabbling has been regulated to control harvest of large fish and prevent impacting catfish stocks adversely (Jackson, 1999). Prior to 2005, sport anglers and hand grabblers were limited to five flathead catfish per day of which two could be less than 61 cm (Jackson, 1999). However, while the regulation was removed in 2005 (Brown, in review) hand grabblers continued to be regulated by a hand grabbling season which lasted from May 1 to July 15 (MDWFP, 2007). Hand grabbling regulations in Mississippi are still liberal compared to other states as the Mississippi Department of Wildlife, Fisheries and Parks (MDWFP) does not require a special hand grabbling license. The Kansas Department of Wildlife and Parks (KDWP) required hand grabblers to purchase a hand fishing license for $27.15 in addition to purchasing a regular fishing

license (KDWP, 2008). The Oklahoma Department of Wildlife Conservation (ODWC) maintained a year-round hand grabbling season with a modification to the normal daily limit of flathead catfish. The statewide limit for flathead catfish was normally 10 per day, 50 cm or longer but was restricted to 3 per day, 50 cm or greater from May 1 to August 31 to restrict harvest of potentially spawning flatheads (ODWC, 2008).

Hand grabbling has recently attracted more attention in the scientific community although few studies have been conducted. In his comparison of noodlers and trout anglers in Missouri, Morgan (2006) found the two groups exhibited similar activity involvement but differed on activity-specific lifestyles (also known as centrality), values, and beliefs. Centrality was more important for noodlers than trout anglers, meaning their lives were more centered on noodling than trout fishing was for the trout anglers. Morgan (2004) found 89% of Missouri noodlers preferred to catch flathead catfish, 8% blue catfish, and 3% channel catfish (*Ictalurus punctatus*). A creel survey of Ross Barnett Reservoir hand grabblers in Mississippi indicated 73% targeted flathead catfish, and this species accounted for 72.7% of their harvest (Brown, in review). Wilde and Ditton (1999) found rod and reel anglers who fish for flathead and blue catfish were more concerned with catching trophy-sized catfish in comparison to catfish anglers in general who were more catch and harvest oriented (Schramm, Forbes, Gill, & Hubbard, 1999).

Hand grabbling in Mississippi has likely been regulated for non-biological reasons (e.g., the perception that this form of fishing is detrimental to spawning fish). Hand grabbler catch-related attitudes have not been studied before and this study is the first attempt to measure catch-related attitudes of hand grabblers and traditional rod and reel catfish anglers. This information will be helpful in understanding negative

perceptions and will help decision makers with future discussions of catfish regulations. The study objective was to document socio-demographics, general freshwater fishing characteristics, participation patterns, and catch-related attitudes of hand grabblers and test if they differed from a sample of licensed rod and reel catfish anglers in Mississippi. Research hypotheses relating catch-related attitudes were non-directional because there was no existing literature indicating directionality of attitudes between these two groups. I hypothesized there were no significant differences between hand grabbler and rod and reel recreational catfish angler attitudes toward *catching something, catching numbers, catching large fish,* or *retaining fish.*

Methods

Prior to data collection, my study was approved by the Mississippi State University (MSU) Institutional Review Board (IRB) for the protection of human subjects (IRB study #08-169). A valid sport fishing license was required to participate in hand grabbling in Mississippi. A sampling frame of Mississippi hand grabblers did not exist because there was no specific hand grabbling license. According to a previous study, only 9% of resident anglers in Missouri had participated in noodling (Reitz & Travnicheck, 2005) and I expected a similar percentage in Mississippi. Thus, developing a sampling frame of Mississippi hand grabblers from the Mississippi resident fishing license holders was deemed inefficient and cost prohibitive because the number of surveys needed to be sent to a random sample of license holders was too large. Therefore, I used snowball sampling to develop a sampling frame of hand grabblers. This sampling methodology was found useful for studying social events that were not

common, readily visible, or for which there was no defined target population (Biernacki & Waldorf, 1981) and was used successfully in a study of Missouri noodlers (Morgan, 2006). Advantages of snowball sampling included the ease of sampling design, cost effectiveness, and limited time requirements. A disadvantage of snowball sampling was that it resulted in a nonprobability sample, thus affecting generalizability (Biernacki & Waldorf, 1981). Therefore, results were not generalizable to all hand grabblers. However, this study provided a baseline comparison of hand grabblers and rod and reel catfish anglers for further research and theoretical development.

Two snowball sampling efforts and one random sampling effort were used for this study. The first snowball sampling effort used hand grabblers as informants who were encountered at Grenada Reservoir during the 2007 Mississippi hand grabbling season. I called informants to ask them to participate in the study and provide contact information for additional hand grabblers they knew who may be willing to participate. Informants were encouraged to contact their friends even if they were not sure if they wanted to participate. The second snowball sampling effort was through a statewide press release prompting hand grabblers to contact the Human Dimensions and Conservation Law Enforcement Laboratory (HDCLEL) at Mississippi State University (MSU) to participate in a study examining the social aspects of hand grabblers. Hand grabblers were eligible for the study if they participated in this activity at least once. Hand grabblers contacted the HDCLEL by telephone, e-mail, or Internet sign-up over the HDCLEL Web site and provided their name, address, telephone number, and e-mail address. Similar to the first sampling effort, those responding to the press release also were asked to serve as

informants for additional hand grabblers who would be interested in participating in the study. I called those participants and followed all leads until the list was exhausted.

To compare hand grabblers to rod and reel catfish anglers, a statewide random sample of 1,000 licensed Mississippi resident anglers was drawn from the MDWFP freshwater fishing license files. I felt this method would obtain sufficient numbers of rod and reel catfish anglers for comparison purposes because 55% of Mississippi anglers fished for catfish (USDI & USDC, 2001). This random sample also resulted in the identification of additional hand grabblers not recruited through snowball sampling and in the analysis they were combined with the hand grabblers from the snowball sampling.

I developed two similar, self-administered mail questionnaires. The first questionnaire was sent to the nonprobability sample of hand grabblers and the second was sent to the 1,000 licensed Mississippi anglers. Both mail questionnaires had questions to obtain information on hand grabbler and rod and reel catfish angler socio-demographics, general freshwater fishing characteristics, participation patterns, and catch-related attitudes. Questions regarding socio-demographics and general freshwater fishing experience were worded exactly the same on both questionnaires. Questions regarding participation patterns and catch-related attitudes were reworded to reflect the fishing method but other wording was unchanged to facilitate group comparisons (i.e., the words "hand grabbling" were replaced with "fishing for catfish using rod and reel" in the respective surveys). Catch-related attitude scale items were only slightly modified. One scale item in the construct *catching numbers* was changed from "I'm happiest with a trip if I at least catch the daily bag limit" to "I'm happiest with a fishing trip if I catch a lot of fish" because there was no bag limit on catfish in Mississippi. Also, I removed the

word “game” from the scale item “I’m happiest with a fishing trip if I catch a challenging game fish” because catfish were not considered game fish in Mississippi.

Questions regarding socio-demographics focused on their residence, ethnic group, gender, age, education level, and household income. First, anglers were asked which ethnic background best describes them: white or Anglo, black or African-American, Native American or Alaskan Native, Asian or Pacific Islander, Hispanic or Latino, or “other” with an open-ended response. Second, I asked anglers their gender. Third, I asked “What is your age?” Fourth, I asked “What is your highest completed level of education?” by prompting them to circle one number from the following response format: “1” through “8” for elementary school, “9” through “12” for high school, “13” through “16” for college, and “17” through “22+” for graduate school. Last, I asked anglers to provide their approximate annual household income before taxes in $10,000 increments from “under $10,000” to “$100,000 and above.” I reported percentage composition for ethnic background and gender and reported the median for education level and household income. I tested for differences using a Chi-square test because these variables were nominal and ordinal data. I reported mean age and used a t-test to determine angler group differences because age is a ratio level variable and was normally distributed.

I asked hand grabblers and rod and reel catfish anglers seven questions regarding general freshwater fishing characteristics. First, I asked “How many years have you been fishing in freshwater?” Second, I asked “In the previous 12 months, how many days did you fish for any species by any means?” Third, I asked both groups “How do you compare your fishing ability to that of other freshwater anglers in general?” and provided them with three response choices: “less skilled,” “equally skilled,” and “more skilled.”

Fourth, I asked "Are you a member of a fishing club or organization?" Fifth, I asked "Do you participate in fishing tournaments?" Sixth, I asked "What type of group do you fish with most often?" and provided seven social unit category responses: fish alone, family, friends, family and friends together, club, business associates, or other with an open-ended response. Last, I asked both groups "What species of freshwater fish do you fish for most often?" and provided them with an open-ended response format. I reported average values for years of freshwater fishing experience and median days fished for any species by any method in the previous 12 months and used the appropriate statistical tests to examine group differences (i.e., t-test and Wilcoxon-Mann-Whitney, respectively). I reported percentage composition for fishing ability, members of fishing clubs or organizations, fishing tournament participation, group fished with most often, and freshwater fish fished for most often. I used a Chi-square test to test for homogeneity for nominal variables. If there were significant differences on Chi-square tests, I calculated standardized residuals from crosstabulations to determine which cells contributed most to the significant differences (Hinkle, Wiersma, & Jurs, 1994).

The first mail questionnaire had questions pertaining to hand grabbling participation patterns that were not asked on the second mail questionnaire and I presented those results in a **Hand Grabbling Participation Patterns** section. No group comparisons could be made for these questions. I asked hand grabblers "What percent of your hand grabbling trips do you take a boat to get to your hand grabbling location(s)?" and reported the mean percentage. I also asked "Do you set out your own hand grabbling boxes, either in this season or previous seasons?" and reported the percentage who indicated they set out boxes and the mean number of boxes. I asked "Which of the

following equipment do you use while hand grabbling?" and provided them with several choices: ropes, gloves, surface air pumped through a hose, SCUBA gear/air tank, none – bare hands only, and "other" with an open-ended response. I reported the percentage composition of each piece of equipment used. Last, I asked "Which of these structures do you prefer to grabble?" and prompted them to choose from "natural cavities (e.g., rocks, logs, undercut banks)" or "artificial structures (e.g., concrete slabs, hand-made boxes)." I reported percentage composition for each choice.

Questions regarding hand grabbler and rod and reel angler participation patterns focused on participation in the previous 12 months, preferred fishing environment, preferred species, trophy catfish lengths, and number of people that participated. First, I asked respective groups "In the previous 12 months, how many days did you fish for catfish by hand grabbling?" or "In the previous 12 months, how many days did you fish for catfish using a rod and reel?" Second, I asked respective groups "Which of the following fishing environments do you prefer to go hand grabbling in?" or "Which of the following environments do you prefer when fishing for catfish using a rod and reel?" and asked them to circle one from the following choices: "large lakes (greater than 50 acres)," "small lakes/ponds (less than 50 acres)," "big rivers," or "small rivers/streams." Third, I asked respective groups "Which species of catfish do you prefer to catch when hand grabbling?" or "Which species of catfish do you prefer to catch when fishing using a rod and reel?" and they selected from flathead, blue, or channel catfish. Fourth, I asked respective groups "When hand grabbling, what do you consider to be a trophy catfish?" or "When fishing for catfish using a rod and reel, what do you consider to be a trophy catfish?" and they were provided an open-ended response format to respond in pounds

for three catfish species, flathead, blue, and channel. Last, I asked each group "How many people do you go hand grabbling with?" or "How many people do you go with when fishing for catfish using a rod and reel?" I reported median values for days of participation, trophy catfish lengths, and number of people each group participated with and used a Wilcoxon-Mann-Whitney test to test for significant differences. I reported percentage composition for preferred fishing environment and preferred species and used a Chi-square test to examine group differences.

Questions pertaining to catch-related attitudes were conceptualized by 16 statements (Anderson, Ditton, & Hunt, 2007) and operationalized in a five-point Likert measurement scale with response format 1 = "strongly disagree," 2 = "disagree," 3 = "neutral," 4 = "agree," and 5 = "strongly agree" (Table 3.1). The 16 attitudinal statements were separated into four constructs: *catching something, catching numbers, catching large fish,* and *retaining fish* (Table 3.1). These constructs have previously been found to be reliable measures of catch-related attitudes (Anderson et al., 2007; Hunt et al., 2007). For a detailed background of the catch-related attitude scale, see Anderson et al. (2007). I used Statistical Package for the Social Sciences (SPSS), v. 15.0 to calculate Cronbach's alpha to determine scale reliability for each construct.

Prior to analysis of the catch-related attitude scale, I checked for missing data values. I deleted from further analysis respondents who did not answer any of the 16 items. The highest percentage of missing data was 6.7% for hand grabbler attitudes in the *catching numbers* construct. For those with item nonresponse on some scale items, I used the Markov chain Monte Carlo (MCMC) algorithm in PROC MI in SAS, v. 9.1 to

replace missing values because this method provided robust estimates when the percentage of missing values was low (Schafer, 1997).

To determine if hand grabbler and rod and reel catfish angler attitudes differed, I summed each participant's item scores for each construct and then calculated a mean construct score for hand grabblers and rod and reel catfish anglers (Table 3.2). I used PROC TTEST and the CLASS statement in SAS, v. 9.1 to conduct a t-test to determine angler group differences. Independent variables were the method of fishing (i.e., hand grabbling or rod and reel catfish angling) and the dependent variable was the mean construct score.

I followed the Tailored Design Method (Dillman, 2000) for survey implementation for both mail questionnaires. Survey implementation began in October 2008 and ended in December 2008. I mailed the pre-notification letter on day one which notified the participant he or she was about to receive a mail questionnaire. On day eight, I mailed the self-administered mail questionnaire along with a letter and a business reply envelope, termed a complete packet. I hand signed each letter accompanying the mail questionnaire and addressed each letter to the specific participant to provide a level of personalization and to increase the response rate. I sent a reminder/thank you postcard to all participants on day 15. I mailed the second complete packet on day 29 to any remaining non-respondents and the third complete packet on day 48. Completed surveys were mailed to the HDCLEL where they were processed immediately. Any undeliverable surveys were investigated as to the cause and re-mailed, if possible, so each respondent had an equal opportunity to respond.

For the statewide questionnaire, I adjusted for nonresponse bias using logistic regression to calculate response probabilities where the independent variables were race, age, and gender and the dependent variable was response status (1 = responded, 0 = did not respond) because survey results should be assumed to be biased except for studies with high response rates (Fisher, 1996). All variables except catch-related attitudes were weighted to adjust for nonresponse bias. Fisher (1996) found catch-related attitudes did not depend on response probabilities nor were related to race, age, or gender. Throughout my study, I set my significance level at alpha = 0.05. Beta, the probability of a Type II error, was determined using average sample size per group and power tables provided by Cohen (1988). I found Beta to be < 0.02.

Results

Mail Questionnaire

I recruited 116 hand grabblers to participate in the hand grabbler mail questionnaire. Ninety-six (82.8%) returned useable questionnaires and one person (0.9%) misunderstood the study eligibility and admitted she did not hand grabble. This gave an effective response rate of 83.5% (Dillman, 2000). I made no attempt to do a nonresponse survey because the effective mailing response rate was high (Sedlack & Stanley, 1992) and this was a nonprobability sample.

Of the 1000 randomly sampled anglers for the rod and reel catfish angler questionnaire, 228 (22.8%) returned useable questionnaires, 179 (17.9%) were non-deliverable, 59 (5.9%) "did not fish for catfish," and three (0.3%) refused to complete the questionnaire, providing an effective response rate of 30.0% (Dillman, 2000). When

investigating nonresponse bias, I found three variables to be significant: race (χ^2 = 10.337, df = 1, p = 0.001), age (χ^2 = 69.204, df = 1, p < 0.001), and gender (χ^2 = 6.494, df = 1, p = 0.011). White or Anglo respondents (73.1%, n = 204) were more likely to respond than all other racial groups combined (26.9%, n = 75; χ^2 = 5.261, df = 1, p = 0.022). Respondent's mean age (47.6 years, SE = 0.7, n = 286) was significantly greater than nonrespondent's mean age (39.7 years, SE = 0.5, n = 714; t = -9.09, p < 0.001, Figure 3.1). Overall, I found older white women were most likely to respond and young black men least likely to respond.

Demographics

Hand grabblers were predominantly "white or Anglo" (97.4%, n = 98) and male (87.0%, n = 95) and their average age was 40.5 years (SE = 1.3, n = 99). Most rod and reel catfish anglers also were "white or Anglo" (73.0%, n = 117) and male (72.6%, n = 99) and their average age was 40.2 years (SE = 1.0, n = 149). The median education level for hand grabblers was two years of college (n = 95) and their median household income before taxes was "$80,000 to $89,999" ($n$ = 93). Rod and reel catfish angler's median education level was one year of college (n = 150) and their median household income before taxes was "$40,000 to $49,999" ($n$ = 140). I found significant differences between groups on gender (χ^2 = 10.321, df = 1, p = 0.001), ethnic background (χ^2 = 30.934, df = 3, p < 0.001), education level (χ^2 = 51.577, df = 14, p < 0.001), and household income (χ^2 = 80.403, df = 10, p < 0.001). Age did not differ significantly between groups (t = -0.17, p = 0.862).

General Freshwater Fishing Characteristics

Hand grabblers had significantly more freshwater fishing experience than rod and reel catfish anglers ($t = -2.59$, $p = 0.010$). On average, hand grabblers had 32.2 years (SE = 1.2, $n = 103$) of freshwater fishing experience compared to rod and reel catfish angler's 26.7 years (SE = 1.0, $n = 156$). Hand grabblers fished significantly more days for any species by any method than rod and reel catfish anglers ($Z = -5.684$, $p < 0.001$), a median of 30.0 ($n = 99$) and 20.0 days ($n = 153$), respectively. Hand grabblers and rod and reel catfish anglers were not homogenous regarding skill level ($\chi^2 = 58.918$, df = 2, $p < 0.001$). There were fewer hand grabblers (2.6%, $n = 3$) and more rod and reel catfish anglers (29.7%, $n = 52$) than expected who indicated they were "less skilled." Conversely, more hand grabblers (28.6%, $n = 31$) and fewer rod and reel catfish anglers (9.5%, $n = 17$) than expected indicated they were "more skilled." Percentages of hand grabblers and rod and reel catfish anglers who indicated they were "equally skilled" were similar, 68.9% ($n = 68$) and 60.7% ($n = 87$), respectively.

Most hand grabblers (94.1%, $n = 96$) and rod and reel catfish anglers (98.0%, $n = 156$) were not members of fishing clubs or organizations but significantly more hand grabblers were members of fishing clubs and organizations ($\chi^2 = 5.649$, df = 1, $p = 0.018$). Most hand grabblers (85.7%, $n = 86$) and rod and reel catfish anglers (94.6%, $n = 150$) did not participate in fishing tournaments but significantly more hand grabblers participated in fishing tournaments ($\chi^2 = 12.405$, df = 1, $p < 0.001$). Hand grabblers and rod and reel catfish anglers were not homogenous regarding type of group fished with most often ($\chi^2 = 50.104$, df = 5, $p < 0.001$). Standardized residuals computed from crosstabulations showed less hand grabblers (1.7%, $n = 2$) than expected fished "alone."

Fewer hand grabblers (13.8%, $n = 12$) than expected fished with "family." Also, more hand grabblers (60.1%, $n = 59$) than expected fished with "family and friends together."

Chi-square tests indicated hand grabblers and rod and reel catfish anglers were not homogenous regarding type of freshwater fish they fished for most often ($\chi^2 = 13.277$, df = 6, $p = 0.039$). Standardized residuals showed fewer hand grabblers (6.5%, $n = 5$) than expected fished for sunfish (*Centrarchidae*) most often when compared to 16.5% ($n = 22$) of rod and reel catfish anglers. Hand grabblers and rod and reel catfish anglers responded catfish were the freshwater species they fished for most often, 47.0% ($n = 47$) and 36.3% ($n = 56$), respectively.

Hand Grabbling Participation Patterns

Hand grabblers averaged 81.5% (SE = 3.3, $n = 102$) of hand grabbling trips using a boat. Most hand grabblers set out their own hand grabbling boxes (87.2%, $n = 82$) and, on average, they set out 37.5 boxes (SE = 3.3, $n = 79$) per hand grabbling season. The most used piece of equipment was gloves (81.2%, $n = 87$), followed by ropes (29.5%, n =32), bare hands (22.1%, $n = 20$), surface air pumped through a hose (13.2%, $n = 16$), SCUBA gear/air tank (7.4%, $n = 9$), and other types of equipment (7.4%, $n = 9$). Most hand grabblers (75.4%, $n = 83$) preferred to hand grabble in artificial structures compared to natural structures (24.6%, $n = 17$).

Comparison of Hand Grabbling and Catfish Angling Participation Patterns

Hand grabblers grabbled a median of 5.0 days ($n = 94$) in the previous 12 months and rod and reel catfish anglers fished for catfish a median of 10.0 days ($n = 152$) in the previous 12 months. This difference was significant ($Z = -8.440$, $p < 0.001$). Hand

grabblers and rod and reel catfish anglers were not homogenous regarding preferred fishing environment ($\chi^2 = 43.220$, df = 3, $p < 0.001$). More hand grabblers (50.5%, n = 58) and less rod and reel catfish anglers (24.2%, n = 45) than expected preferred large lakes. Also, fewer hand grabblers (13.6%, n = 6) than expected preferred small lakes.

Hand grabblers and rod and reel catfish anglers were not homogeneous regarding species preference ($\chi^2 = 243.490$, df = 2, $p < 0.001$). Analysis of standardized residuals indicated more hand grabblers (81.7%, n = 87) and fewer rod and reel catfish anglers (13.2%, n = 23) than expected preferred to catch flathead catfish. Fewer hand grabblers (7.5%, n = 9) than expected preferred to catch blue catfish. Fewer hand grabblers (10.7%, n = 7) and more rod and reel catfish anglers (55.1%, n = 86) than expected preferred to catch channel catfish. Hand grabblers indicated a trophy flathead catfish was a median of 914 mm (n = 32), a trophy blue catfish was a median of 838 mm (n = 26), and a trophy channel catfish was a median of 635 mm (n = 25). Rod and reel catfish anglers indicated a trophy flathead catfish was a median of 673 mm (n = 52), a trophy blue catfish was a median of 622 mm (n = 56), and a trophy channel catfish was a median of 610 mm (n = 71). There were significant differences between hand grabbler and rod and reel catfish angler trophy flathead catfish length ($Z = -5.312$, $p < 0.001$), trophy blue catfish length ($Z = -5.327$, $p < 0.001$), and trophy channel catfish length ($Z = -5.828$, $p < 0.001$). Hand grabbling was more of a social activity; hand grabblers participated with significantly more people than rod and reel catfish anglers ($Z = -7.272$, $p < 0.001$), a median of 4.0 people (n = 103) and 2.0 people (n = 158), respectively.

Catch-related Attitude Scale Reliability

Cronbach's alpha scores for scale items within three constructs for hand grabblers and rod and reel catfish anglers were reliable, with values 0.72 and greater (Table 3.1). Cronbach's alpha scores of 0.70 or greater were considered reliable (Nunnally, 1978). However, items in the construct *catching large fish* only had a Cronbach's alpha score of 0.55 and 0.60 for hand grabblers and rod and reel catfish anglers, respectively.

Catch-related Attitudes

The greatest mean construct score for hand grabblers was 16.43 (SE = 0.2, n = 105; Table 3.2) for *catching large fish.* The second greatest mean construct score was 13.41 (SE = 0.3, n = 105; Table 3.2) for *catching numbers. Catching something* was the third greatest mean construct score for hand grabblers, 11.23 (SE = 0.4, n = 105; Table 3.2). The least mean construct score was 11.18 (SE = 0.4, n = 105; Table 3.2) for *retaining fish.*

The greatest mean construct score for rod and reel catfish anglers was 14.31 (SE = 0.3, n = 162; Table 3.2) for *catching numbers.* The second greatest mean construct score was 13.47 (SE = 0.2, n = 162; Table 3.2) for *catching large fish. Retaining fish* was the third greatest mean construct score for rod and reel catfish anglers, 12.02 (SE = 0.3, n = 162; Table 3.2). The least mean construct score was 10.37 (SE = 0.3, n = 162; Table 3.2) for *catching something.*

There were no differences between hand grabbler and rod and reel catfish angler catch-related attitudes for two constructs, *catching something* (t = -1.84, p = 0.067; Table 3.2) and *retaining fish* (t = 1.88, p = 0.061; Table 3.2). Hand grabbler and rod and reel

catfish angler catch-related attitudes toward *catching large fish* ($t = -8.99$, $p < 0.001$; Table 3.2) and *catching numbers* differed significantly ($t = 2.17$, $p = 0.031$; Table 3.2). I accepted the hypotheses which stated there were no significant differences between hand grabbler and rod and reel catfish angler attitudes toward *catching something* and *retaining fish.* I rejected the hypotheses that there were no significant differences between hand grabbler and rod and reel catfish angler attitudes toward *catching large fish* and *catching numbers*.

Discussion

Hand grabbler and rod and reel catfish angler catch-related attitudes toward *catching large fish* and *catching numbers* may be different because hand grabblers appeared to be more specialized anglers. Bryan (1977) developed a conceptual framework of recreational specialization among recreational fishermen that segmented anglers on a continuum ranging from general to specialized anglers based on skill level, equipment used, and preferred setting. Jackson et al. (1997) described hand grabbling as a "specialized fishery" (p. 1019) and Wilde and Ditton (1999) found flathead and blue catfish angler groups contained more specialized anglers than the channel catfish angler group. My study results were comparable because hand grabblers preferred flathead catfish whereas rod and reel catfish anglers preferred channel catfish. Furthermore, Wilde and Ditton (1999) found flathead and blue catfish anglers rated catching a "trophy fish" as the most important fishing motive. Although I did not measure motivations, hand grabbler catch-related attitudes were consistent with *catching large fish* and a hand grabbler's idea of a trophy fish for all three species was significantly larger than those of

a rod and reel catfish angler. Quinn (1993) found flathead catfish anglers chose a particular setting, bait, and gear to target flathead catfish because of its potential to reach large sizes, its quality table fare, and the challenge of the catch.

Another component of angler specialization was equipment. Hand grabblers reported taking most trips with a boat, with further possible evidence of their high level of specialization the reported use by some of air tanks and SCUBA gear. Most hand grabblers preferred to hand grabble in artificial structures and constructed their own hand grabbling boxes. Skill level was another component of angler specialization. Although the majority of both groups thought they were "equally skilled" in their general fishing ability compared to other anglers, hand grabblers were more likely to indicate they were "more skilled." Hand grabblers had more overall freshwater fishing experience and fished more in the previous 12 months for any species by any means than rod and reel catfish anglers. Bryan (1977) noted specialized angler groups were likely to remain faithful to their favorite activity but were not restricted from participating outside their specialty, as evidenced by hand grabbler's higher level of general fishing participation. I expected hand grabblers to participate in more days hand grabbling than rod and reel anglers fished for catfish but this was not the case. An explanation may be the limited length of the hand grabbling season whereas rod and reel anglers had opportunities to fish year round and I suspect hand grabblers would grabble more often if the season was lengthened.

Hand grabblers had more formal education and greater household incomes than rod and reel catfish anglers. I did not expect to find significant differences in most socio-demographic variables between the two groups because catfish anglers from previous

studies tended to have lower levels of formal education and lower household incomes (Schramm et al., 1999). I expected hand grabblers to have similar education and income levels to rod and reel anglers; however, this could be explained by the nonrandom sample of hand grabblers who signed up to participate over the Internet and results could be biased toward more affluent hand grabblers who had Internet access.

When comparing my hand grabbling study results to Morgan's noodling study (2004; 2008), I found similarities and differences. Hand grabblers and noodlers were both an average of 40 years old but my sample of hand grabblers had more females than Morgan's sample of noodlers, 13.0% and 5.8%, respectively. Also, hand grabblers seemed to have more formal education and have greater household incomes than noodlers. Morgan (2008) did not ask if noodlers used boats or set out their own "noodling" boxes but I suspected this was because noodling is illegal in Missouri and noodlers tried to be as secretive as possible to avoid getting caught. Noodlers also preferred to noodle in small rivers and streams so a boat may not be needed. However, hand grabblers preferred to grabble in large reservoirs, which may explain why most used a boat and set out their own grabbling boxes. Most noodlers preferred natural cavities but hand grabblers preferred artificial structures. There were differences in equipment; most noodlers used their bare hands and most hand grabblers used gloves.

Noodlers indicated a trophy flathead and blue catfish was longer than what hand grabblers indicated. Noodlers and hand grabblers indicated similar lengths for trophy channel catfish. Both hand grabblers and noodlers participated with more than three people in their group. Although Morgan (2008) did not specifically ask catch-related attitudes, he found most noodlers would rather catch "fewer, but larger fish" and the

minority would rather catch “more, but smaller fish” (Morgan, 2008; p. 169) and this may indicate noodlers would have similar catch-related attitudes as hand grabblers.

There is recent evidence of an increased interest in catfish fishing (Brown, 2007; Schramm et al., 1999), although some agencies reported catfish management as a low priority and cite constraints to catfish management as lack of angler interest, insufficient habitat, or lack of knowledge about catfish populations due to inadequate sampling methods (Michaletz & Dillard, 1999). Agencies taking a proactive role in catfish management should consider conducting specific creel surveys targeting catfish anglers and their attitudes. To better understand the link between catch-related attitudes and actual catch, future creel surveys should be conducted on recreational catfish anglers using any method of harvesting catfish such as jugs, trotlines, banklines, and hand grabbling. Creel surveys that fail to account for these nontraditional forms of recreational catfish angling may underestimate catfish harvest (Quinn, 1993). In Oklahoma, recreational catfish anglers using jugs and trotlines were found to harvest more catfish than hand grabblers (Winkelman, 2003). Also, future creel surveys targeting catfish anglers should include nighttime creels because researchers found significant catfish fishing effort occurs at night in Ohio reservoirs (Parrett, Marshall, & Bright, 1999). Catfish anglers can be difficult to creel because they fished at night, did not use public access areas, and fished from shore (Michaletz & Dillard, 1999; Winkelman, 2003).

In my study, scale reliability was comparable to other studies (Anderson et al., 2007; Hunt et al., 2007) except for the *catching large fish* construct, which had lesser reliability scores. Anderson et al. (2007) reported a reliability score of 0.69 for *catching large fish* and Hunt et al. (2007) had reliability scores across four years of survey data

which ranged from 0.79 to 0.80. However, Anderson et al. (2007) dropped one scale item ("The bigger the fish I catch, the better the fishing trip") to improve reliability and Hunt et al. (2007) did not have the item "I'm happiest with the fishing trip if I catch a challenging game fish" in all four years of survey data. I removed the word "game" from that same scale item but it is unlikely that removing a word would greatly impact construct reliability. I investigated if dropping any scale items would have increased reliability but this was not the case. It is interesting that the construct for which hand grabblers had the strongest attitudes also had the least reliability. I believe more research is needed on catch-related attitudes of catfish anglers because the scale consistently has been reliable when used to measure catch-related attitudes of other angler groups.

My results were not generalizable to the hand grabbler general population because my sample of hand grabblers was not random. Comparisons between hand grabblers and rod and reel catfish anglers did not meet assumptions for statistical analysis but were useful for examining differences in socio-demographics, general freshwater fishing characteristics, participation patterns, and catch-related attitudes. I hoped to find enough hand grabblers in the statewide survey to make group comparisons but I only identified nine hand grabblers from this random sample. Therefore, I used the nonrandom sample of hand grabblers to make group comparisons. Thus my study was conducted following Bryan (1977) who argued that studies using nonprobability samples were useful to help develop conceptual frameworks with the understanding that generalizations cannot be made to the greater population.

I recommend establishing a hand grabbling license, whether free of charge or with a small fee, for several reasons. First, establishing a hand grabbling license would create

a sampling frame so future studies targeting hand grabblers would have a random sample, thereby allowing for more robust statistical analysis. Also, less time would be spent locating study participants. The most time intensive aspect of my study was locating hand grabblers to participate in this research. I received contact information for other possible hand grabblers from those that already signed up and I called each person and asked them to participate and took all their information over the telephone. Implementing a hand grabbling license would eliminate time and labor intensive procedures and would be more cost effective than trying to sample hand grabblers from the general angling population. Second, in cases of rare events, such as consumption advisories warning against consuming catfishes, hand grabblers could be notified more readily since they are known to target large catfishes. Third, hand grabblers possess significant "local knowledge" of the habitat and resource and could help biologists locate large catfish for tagging studies or to use as brood stock in hatcheries. This could create beneficial relationships between hand grabblers and agencies, with hand grabblers knowing they had a direct impact on fisheries management.

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Table 3.1. Scale items used to measure constructs and scale reliability related to the catch-related aspects of fishing for catfish by hand grabbling and fishing for catfish using a rod and reel for the mail survey conducted from October to December 2008.

Catch-related attitude scale items [a]	Cronbach's Alpha	
	Hand Grabbler	Rod and Reel Catfish Angler
Catching something	0.78	0.78
A trip can be successful even if no fish are caught. [b]		
When I go fishing, I'm just as happy if I don't catch fish. [b]		
If I thought I wouldn't catch any fish, I wouldn't go fishing.		
When I go fishing, I'm not satisfied unless I catch at least something.		
Catching numbers	0.76	0.73
The more fish I catch, the happier I am.		
A successful fishing trip is one in which many fish are caught.		
A full stringer is the best indicator of a good fishing trip.		
I'm happiest with a fishing trip if I catch a lot of fish.		
Catching large fish	0.55	0.60
I would rather catch one or two big fish than ten smaller fish.		
The bigger the fish I catch, the better the fishing trip.		
I'm happiest with the fishing trip if I catch a challenging fish.		
I like to fish where I know I have a chance to catch a "trophy" fish.		
Retaining fish	0.79	0.72
I usually eat the fish I catch.		
I'm just as happy if I don't keep the fish I catch. [b]		
I want to keep all the fish I catch.		
I'm just as happy if I release the fish I catch. [b]		

[a] Respondents were asked whether they agreed or disagreed with each of the 16 items on a 5-point Likert scale with response format: 1 = "strongly disagree," 2 = "disagree," 3 = "neutral," 4 = "agree," 5 = "strongly agree."

[b] Item reverse coded for analysis purposes.

Table 3.2. Respondent's mean construct scores on catch-related attitude items for hand grabblers and rod and reel catfish anglers for the mail survey conducted from October to December 2008.

Construct by Reservoir	Hand Grabbler [a] Mean Construct Scores (SE)	Rod and Reel Catfish Angler [b] Mean Construct Scores (SE)	Test Statistic	*p*-value
Catching something	11.23 (0.4)	10.37 (0.3)	-1.84	0.067
Catching numbers	13.41 (0.3)	14.31 (0.3)	2.17	0.031
Catching large fish	16.43 (0.2)	13.47 (0.2)	-8.99	< 0.001
Retaining fish	11.18 (0.4)	12.02 (0.3)	1.88	0.061

[a] Hand grabblers, $n = 105$
[b] Rod and reel catfish anglers, $n = 162$

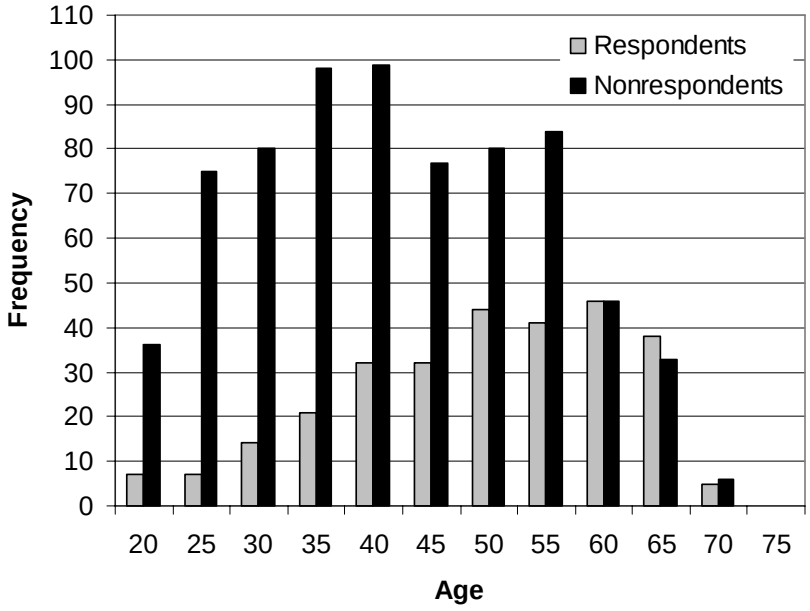

Figure 3.1. Frequency distribution of the mean age of respondents and nonrespondents for the statewide catfish mail survey conducted from October to December 2008.

CHAPTER IV

SYNTHESIS

Negative perceptions among recreational angling groups are not uncommon and have the potential to spark conflict (Radomski, 2003; Sinclair & Reid, 1974). I measured different angler group catch-related attitudes in two separate studies to understand how differences or lack of differences in catch-related attitudes can illuminate some causes for negative perceptions. The catch-related attitude scale reliably measures angler attitudes in four constructs: *catching something, catching numbers, catching large fish,* and *retaining fish* (Anderson, Ditton, & Hunt, 2007). Additionally, I reported if catch-related attitudes were consistent with actual catch behavior from creel surveys in the first study and if these were consistent with what I would expect from the theory of reasoned action.

In the first study, resident anglers at Sardis and Grenada reservoirs in Mississippi developed negative perceptions toward nonresident anglers because residents believed nonresidents were harvesting too many crappie and were negatively impacting the crappie fishery. I compared resident and nonresident angler catch-related attitudes at Sardis and Grenada reservoirs and examined creel data to determine if these negative perceptions had merit. At Sardis Reservoir, catch-related attitudes between resident and nonresident anglers did not differ significantly for any of the four constructs. After analyzing the unextrapolated creel data, I found Sardis nonresidents caught and harvested

significantly more crappie than residents and nonresident's average crappie weight was significantly more than residents. However, residents and nonresidents had similar crappie fishing effort. Sardis resident angler perceptions of nonresidents harvesting more crappie than residents were warranted. Differences in catch behavior and lack of differences between resident and nonresident catch-related attitudes at Sardis Reservoir showed the inconsistency of the theory of reasoned action in which posited attitudes should be consistent with behavior.

At Grenada Reservoir, nonresident anglers had stronger attitudes toward *catching large fish* than resident anglers but residents had stronger attitudes toward *retaining fish* than nonresidents. After analyzing the unextrapolated creel data, Grenada residents caught more crappie and had more crappie fishing effort than nonresidents but crappie harvest and average crappie weight did not differ significantly. Grenada resident angler perceptions of nonresident anglers harvesting more crappie were not confirmed. Differences in catch behavior and differences between resident and nonresident catch-related attitudes at Grenada Reservoir showed the inconsistency of the theory of reasoned action in which posited attitudes should be consistent with behavior.

I concluded differences in catch-related attitudes could be due to nonresidents being more specialized anglers than residents because the catch-related attitude scale was not consistent in predicting angler catch behavior at either Sardis or Grenada Reservoirs. There was evidence to suggest nonresidents were more specialized anglers but neither Sardis nor Grenada nonresidents could be firmly labeled as specialized anglers. Also, some differences in catch-related attitudes could be explained by concentrated fishing effort, disproportionate fishing effort, low water levels, crowded boat ramps, a limited

number of useable access points, and negative tourism attitudes which could have caused negative perceptions.

In the second study, I investigated negative perceptions toward hand grabblers who were viewed as negatively impacting catfish populations because of their potential to remove large, spawning catfish from the population. I compared hand grabbler and rod and reel catfish angler catch-related attitudes to better understand negative perceptions. Hand grabblers had stronger attitudes toward *catching large fish* than rod and reel catfish anglers. Rod and reel catfish anglers had stronger attitudes toward *catching numbers*. Unlike the first study, I did not have creel data to compliment the measurement of catch-related attitudes. Although I found differences in catch-related attitudes, previous studies concluded hand grabbling was not adversely impacting catfish populations and there was no biological evidence for negative perceptions. I explained how differences in catch-related attitudes between hand grabblers and rod and reel catfish anglers could be due to hand grabblers being more specialized anglers.

Future studies need to focus on measuring all parts of the theory of reasoned action (i.e., attitudes, subjective norms, behavioral intentions, and behavior) to truly understand possible mechanisms between attitudes and behavior. In the first study, I measured catch-related attitudes and catch behavior but in the second study, I only measured catch-related attitudes. Measuring all parts of the theory of reasoned action may show how important subjective norms and behavioral intentions are to a person's evaluation of whether he or she engages in a behavior rather than simply the person's favorable or unfavorable attitude toward the behavior alone.

The number of recreational anglers is declining and agencies need to recruit new anglers, retain existing ones, and attract lapsed anglers to reduce budget shortfalls. Even if this daunting task is accomplished, regulations will need to be modified, or new ones created, such that angler satisfaction is not impacted negatively from increased consumption and use of resources. Currently, if there is no scientific basis for hand grabbling negatively affecting catfish populations, should we be limiting hand grabbling, especially when recruiting and retaining anglers is a major obstacle? Hand grabbling is a rare event fishery and regulations would be modified accordingly if future studies showed the need for regulation changes. Although there will always be dissent between angler groups trying to use the same resources, it is important to continue to investigate negative perceptions and potential sources of conflict between angling groups to facilitate palatable management decisions.

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