

Angler Opinions Regarding Catfish Management in Tennessee

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Abstract: Emphasis on catfish management has increased in Tennessee, and in 2003 the Tennessee Wildlife Resources Agency adopted new regulations protecting trophy-sized catfish by restricting recreational harvest of catfish >864 mm to one fish per day and eliminating all commercial harvest of catfish >864 mm. A statewide survey on licensed catfish anglers was conducted in fall 2000, 2005 and 2006 to determine if angler responses changed following implementation of these regulations. Before the regulation change, catfish anglers generally supported protecting trophy-sized catfish but angler responses for managing catfish as a sportfish were equally divided between support and opposition. Catfish anglers surveyed in 2005 and 2006 had not diminished their support for the regulation, but support for managing catfish as a sportfish had increased by 75% over the previous survey. Tennessee catfish anglers were composed of harvest-oriented (73.5%) and trophy (12.5%) anglers and both groups supported management scenarios that restricted harvest of trophy-sized catfish, albeit at two different levels. Trophy anglers were 66% more likely to support the trophy-size regulation and 95% more likely to support managing catfish as a sportfish. Older (>45 years old) respondents were more likely to oppose management, and respondents having a higher level of education were more likely to support management. These results suggested that catfish anglers in general supported the trophy-size regulation but at disparate levels within harvest, age, and education groups.

Key words: human dimensions, angler survey, catfish, trophy-oriented, harvest-oriented, regulation

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Catfish (Ictaluridae) are an important sportfish in the United States, with many states supporting both recreational and commercial fisheries for catfish (Graham 1999). Angling for catfish is popular among anglers as catfish ranked third in popularity both nationally and in Tennessee in 2006 (USDI and USDC 2008). Catfish anglers have historically identified themselves as being harvest oriented; however, trophy catfish angling has become increasingly popular in the United States (Irwin et al. 1999, Arterburn et al. 2002). Many state agencies are now seeking to manage catfish as a trophy fishery, and these efforts have been assisted by development of methods to effectively monitor catfish populations, as well as the emergence of lobbying by anglers (Reitz and Travnichek 2007).

The Tennessee Wildlife Resources Agency (TWRA) has historically managed catfish only for commercial harvest (maximum sustained yield), which accounts for 77.4% of the annual catfish harvest in Tennessee (Stewart 2009). Due to mounting pressure from trophy catfish anglers and shifting angler opinions favoring a sport fish approach to catfish management (e.g., Arterburn et al. 2002), TWRA proposed a trophy catfish regulation to the Tennes-

see Wildlife Resources Commission (TWRC) for the Mississippi River. This proposal was amended by the TWRC to apply statewide and was adopted in March 2003. Recreational anglers and commercial fishers were limited to one catfish per day ≥ 864 mm with unlimited harvest of catfish <864 mm.

Previous surveys have shown that catfish anglers supported catfish management, but often opposed any regulation that would restrict harvest (Wilde and Riechers 1994, Schramm et al. 1999, Reitz and Travnichek 2007). When TWRA began evaluating trophy catfish management options, they contracted with the University of Tennessee to conduct an opinion survey of Tennessee catfish anglers. The objective of this survey was to determine: 1) the percentage of catfish anglers that would support catfish management (i.e., adoption of a restrictive regulation), 2) if opinions changed after the regulations took effect, and 3) if opinions of trophy anglers differed from those expressed by more traditional, harvest-oriented catfish anglers.

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Table 1. Questions and responses from a survey of Tennessee catfish anglers before (2000) and after (2005–06) implementation of a “trophy” size regulation. Likelihood Ratio Chi-Square (G^2) statistics are reported to detect differences in response pre- and post-implementation. Reported P -values are for the un-partitioned model.

Question	Year	Number (percent)				G^2
		Support	Oppose	No opinion	Don't know	
Would you support or oppose TWRA managing catfish as a sportfish?	2000	149 (44.2%)	147 (43.6%)	15 (4.5%)	26 (7.7%)	$G^2 = 29.47, df = 3, P < 0.01$
Do you support or oppose managing catfish as a sportfish?	2005–06	469 (58.0%)	235 (29.1%)	62 (7.7%)	42 (5.2%)	
Would you support or oppose having specific waters designated as recreational (sportfishing only) allowing no commercial harvest of catfish?	2000	196 (58.9%)	102 (30.6%)	14 (4.2%)	21 (6.3%)	$G^2 = 26.79, df = 3, P < 0.01$
	2005–06	600 (74.3%)	157 (19.4%)	26 (3.2%)	25 (3.1%)	
Would you support or oppose managing for catch and release of trophy catfish, greater than 30 pounds, at one or two sites around the state?	2000	211 (62.6%)	98 (29.1%)	1 (0.3%)	27 (8.0%)	$G^2 = 41.25, df = 3, P < 0.01$
Do you support or oppose TWRA's regulation which limits sport anglers to one catfish over 34 inches per day?	2005–06	500 (62.0%)	255 (31.6%)	37 (4.6%)	15 (1.9%)	

Methods

Telephone Survey

The survey was part of a much larger general survey that randomly sampled Tennessee residents (16 years of age or older) to collect 1,000 completed interviews from the general population and 800 completed interviews from TWRA license holders (i.e., less here because license holders are commonly identified in the random population sample). Surveys were conducted by the University of Tennessee call center in the fall of 2000, 2005, and 2006. Sample sizes were selected to allow analysis of at least two strata within the sample. Interviewees were contacted by telephone using a computer-assisted telephone interview system that automated dialing processes and structured data input to prevent data entry errors. Ten attempts or calls were made to contact each respondent in the sample list. Anglers were identified in each survey by asking participants if they had ever fished. Catfish anglers were then identified by asking if they fished for catfish. License holders who identified themselves as non-anglers or anglers who did not fish for catfish were excluded from this study. We used standard American Association for Public Opinion Research (AAPOR) response rate calculations (AAPOR 2000). The AAPOR method defines which members of the sample fall into categories of eligible (e.g., completed intervals, refusals, and incomplete interviews) and non eligible (e.g., technical phone problems or always busy) members. Response rates were calculated as the proportion of eligible versus eligible and non eligible members (Cooperation rate, COOP2; AAPOR 2000).

Questions in the 2000 survey were generally posed to determine catfish angler support for future management strategies being considered by TWRA (Table 1). Anglers were asked if they would support TWRA increasing emphasis on catfish by managing them as a sportfish; if they would support restricting commercial harvest of catfish in some areas; and if they would support the release

Table 2. Identification of angler harvest composition from a survey of Tennessee catfish anglers in 2005 and 2006.

Which option best describes you:	Number (percent)		
	2005	2006	Total
I fish for catfish to eat	364 (74.9%)	229 (71.3%)	593 (73.5%)
I specifically target trophy catfish	57 (11.7%)	44 (13.7%)	101 (12.5%)
Both	8 (1.6%)	9 (2.8%)	17 (2.1%)
Don't know	2 (0.4%)	6 (1.9%)	8 (0.99%)
Other	55 (11.3%)	33 (10.3%)	88 (10.9%)
Just for fun/recreation	35	12	47
Catch and release	9	14	23
Neither meat or trophy	5	5	10
Various other reasons	6	2	8

of trophy-sized catfish, which were defined as fish ≥ 13.6 kg using standard weight equations for blue catfish and flathead catfish at Relative Stock Density trophy size (Gabelhouse 1984, Muoneke and Pope 1999, Bister et al. 2000).

Questions in the 2005 and 2006 surveys were posed to gauge level of angler support since the pre-regulation survey and additional questions were asked to determine angler support for the specific management actions that were implemented in 2003 (Table 1). The 2005 and 2006 surveys were conducted one year apart and were later pooled following inference testing. The post-regulation surveys also sought to describe differences in opinion between “harvest-oriented” and “trophy-oriented” catfish anglers (Tables 2). Angler type was identified by asking a series of response categories that best described them in terms of fishing preference. Respondents who replied “I fish for catfish to eat” were considered to be harvest-oriented anglers and trophy-oriented anglers were those who responded “I specifically target trophy catfish.” All respondents who replied “both” and “other” were not included in analysis (Table 3). Demographic data about catfish anglers were also collected and used to determine if levels of support for catfish

Table 3. Questions and responses from a survey of Tennessee catfish anglers in 2005 and 2006 (after implementation of a “trophy” size regulation). Likelihood Ratio Chi-Square (G^2) statistics are reported to detect differences in response between harvest- and trophy orientated anglers. Reported P -values are for the un-partitioned model.

Question		Number (percent)				G^2
		Support	Oppose	No opinion	Don't know	
Do you support or oppose TWRA's regulation which limits sport anglers to one catfish over 34 inches per day?	Harvest	355 (59.9%)	202 (34.1%)	23 (3.9%)	13 (2.1%)	$G^2 = 8.34, df = 3, P = 0.04$
	Trophy	72 (71.3%)	27 (26.7%)	2 (2.0%)	0 (0.0%)	
Do you support or oppose TWRA's regulation which prohibits the commercial harvest of catfish greater than 34 inches?	Harvest	378 (63.8%)	137 (23.1%)	42 (7.1%)	36 (6.0%)	$G^2 = 6.65, df = 3, P = 0.08$
	Trophy	75 (74.3%)	20 (19.8%)	4 (4.0%)	2 (1.9%)	
Do you support or oppose managing catfish as a sportfish?	Harvest	332 (56.0%)	190 (32.0%)	38 (6.4%)	33 (5.6%)	$G^2 = 9.37, df = 3, P = 0.02$
	Trophy	72 (71.3%)	20 (19.8%)	6 (5.9%)	3 (3.0%)	
Do you support or oppose the commercial harvest of catfish less than 34 inches?	Harvest	301 (50.8%)	230 (38.8%)	36 (6.1%)	26 (4.3%)	$G^2 = 4.52, df = 3, P = 0.21$
	Trophy	51 (50.5%)	45 (44.6%)	2 (2.0%)	3 (2.9%)	
Would you support or oppose having specific waters designated as recreational (sportfishing only) allowing no commercial harvest of catfish?	Harvest	445 (75.0%)	119 (20.1%)	18 (3.0%)	11 (1.9%)	$G^2 = 5.57, df = 3, P = 0.13$
	Trophy	82 (80.4%)	12 (11.8%)	4 (3.9%)	4 (3.9%)	

Table 4. Demographic characteristics of Tennessee catfish anglers from the pre- (2000) and post- (2005–06) regulation surveys.

Demographics	Year	
	2000 (n = 337)	2005–06 (n = 808)
Age		
16–24 years	12.2	12.1
25–35 years	17.5	13.4
36–45 years	28.5	25.5
46–55 years	19.1	20.5
56–65 years	17.2	18.6
66 years and older	5.5	9.9
Gender		
Male	83.5	82.5
Female	16.5	17.5
Gross household income		
Less than \$10,000	5.1	1.8
\$10,000 to \$19,999	8.1	2.8
\$20,000 to \$24,999	12.9	4.5
\$25,000 to \$29,999	9.1	6
\$30,000 to \$39,999	14.6	6.2
\$40,000 to \$49,999	12.6	12.9
\$50,000 to \$74,999	9.7	18.9
\$75,000 to \$100,000	7.4	25
Greater than \$100,000	2.9	13.2
Don't know/ Other	17.6	8.7
Education completed		
Less than grade 8	5.5	3.2
Grade 9 to 11	17.8	9.8
Grade 12 (high school graduate/ GED)	45.3	46.4
Some college	18.8	18.1
Vocational/technical training	9.7	3.6
College graduate	2.6	14.9
Post-graduate	0	0
Other	0.3	4

Table 5. Model parameter estimates and 95% confidence intervals are shown for logistic regression models relating demographic characteristics to management regulations.

Parameter	Estimate (SE)	95% CI		
		Lower	Upper	
Do you support or oppose managing catfish as a sportfish?	Intercept	-0.22 (0.28)	-0.76	0.33
	Age	-0.15 (0.05)	-0.25	-0.05
	Year	0.71 (0.14)	0.44	0.98
Would you support or oppose having specific waters designated as recreational (sportfishing only) allowing no commercial harvest of catfish?	Intercept	-0.58 (0.31)	-1.19	0.03
	Education	0.20 (0.06)	0.08	0.32
	Year	0.60 (0.15)	0.31	0.89
Do you support or oppose TWRA's regulation which limits commercial fishers to one catfish over 34 inches per day?	Intercept	0.50 (0.20)	0.11	0.89
	Education	0.13 (0.05)	0.03	0.23

management differed between specific demographic groups (i.e., gender) and among subgroups (e.g., age group-1 [≥ 16 to ≤ 24]) (Table 4).

Data Analysis

Data were analyzed using contingency tables and Likelihood Ratio Chi-Square (G^2) statistics to draw inferences among year and angler harvest type (SAS 2009). When significant associations were found, 2×4 tables were partitioned into additive parts (e.g., combined “don't know” and “no opinion” responses vs “oppose” responses) that formulate a nested hierarchy of models to assess conditional independence of response categories (Agresti 2002). Partitioning of 2×4 tables was conducted to illustrate associations between responses (“don't know” vs. “no opinion”) or groups (“no opinion,” “don't know,” and “oppose vs. support”) and to detect which response categories changed over time (2000 vs. 2005–06) or between angler groups (harvest vs. trophy). All P -values report-

ed herein represent statistics from the un-partitioned G^2 models, except where indicated. Logistic regression models (PROC GENMOD; SAS 2009) were used to describe associations in proportion of support among demographics of catfish angler groups and subgroups (Agresti 2002). Odds ratios (odds) were used to quantify magnitude of differences between groups. All analyses were considered significant at $P \leq 0.05$.

Results

In total, 1,145 catfish anglers completed one of the three telephone surveys (337 in 2000, 487 in 2005, and 321 in 2006) with a response rate in 2005 and 2006 of 58.3% and 45.4%, respectively. Response rates could not be calculated for the 2000 survey due to corrupt data files. Responses during the 2005 and 2006 surveys for questions related to the new regulation were determined to be similar across all questions ($P > 0.05$), so data from those years were pooled for all analyses.

Support and opposition for managing catfish as a sportfish was nearly identical (approximately 44% each) during the 2000 survey (Table 1); however during the 2005 and 2006 surveys (after catfish were officially designated as a sport fish) support (58%) was higher than opposition (29%). In 2000, 59% of respondents supported and 31% opposed having specific waters designated as recreational fishing only (i.e., no commercial harvest), while support (74%) was again higher in 2005–06 than opposition (19%). Similarly, in 2000, 63% of respondents supported and 29% opposed implementing a catch and release trophy catfish management strategy. However, after the statewide trophy catfish maximum size limit was implemented, support and opposition for the new regulation was relatively unchanged (Table 1).

Responses from the 2000 and 2005–06 surveys were compared to infer how opinions of catfish anglers may have changed before and after a major shift in management emphasis (Table 1). Based on partitioning response categories, we found that odds of angler support for managing catfish as a sportfish (i.e., having at least some harvest restrictions and protection of the sport fishery) increased since the 2000 survey by 75% (odds = 1.75; $P < 0.01$). Support for restricting commercial harvest in some areas was twice as high since the original survey, with the greatest change being a shift from oppose to support (odds = 2.00; $P < 0.01$). Although no-opinion responses increased over time ($P < 0.01$), angler support for managing trophy size catfish was similar between pre- and post-regulation surveys ($P = 0.52$).

The proportion of harvest-oriented anglers were similar between the 2005 and 2006 surveys ($P = 0.17$; Table 2) as 73.5% described themselves as harvest-oriented, whereas only 12.5% identified themselves as trophy anglers. However, these two groups

responded dissimilarly to two of five survey questions (Table 3). Trophy anglers were 66% more likely to favor regulations which restrict harvest of trophy catfish by recreational anglers (odds = 1.66; $P = 0.04$) and were 95% more likely to support managing catfish as a sportfish (odds = 1.95; $P = 0.002$). Response categories were similar between angling groups; both supported prohibiting commercial harvest of trophy catfish and designating waters for recreational use only, but neither supported or opposed commercial harvest of catfish <864 mm.

Overall, respondents were mostly male (~83%), ranged between ages 35 and 55 years old, and most (45%–46%) had a high school degree or GED (Table 5). Logistic regression models indicated few significant associations. Managing catfish as a sportfish was associated with an 86% decrease in odds of support from young (≥ 16 to ≤ 25) to older (≥ 65) age groups (odds = 0.86; 95% CI, 0.77–0.95) and a 103% increase in odds of support since the pre-regulation survey (odds = 2.03; 95% CI, 1.55–2.66). Support for restricting commercial harvest in some areas generally increased (odds = 1.22; 95% CI, 1.08–1.38) as an anglers level of education moved from grade eight to post-graduate; also, support of all anglers increased 82% from pre- to post-regulation survey (odds = 1.82; 95% CI, 1.36–2.44). Anglers with a higher level of education tended to support restricting commercial harvest of trophy catfish more than anglers with less than a high school education (odds = 1.14; 95% CI, 1.03–1.26). We observed no relationships with support for regulations between angler gender and level of income.

Discussion

Angler participation was generally good in 2005 and 2006 but response rates could not be calculated for the fall 2000 survey due to corrupted files. Because the catfish questions were embedded in a larger, general hunting and fishing survey, participants would not have opted in or out of the survey based on their interest in catfish angling, therefore we would not expect a self-selection response bias related to participation in the catfish questions. Because of that, we feel that our survey adequately reflects a broad range of opinions from catfish anglers in Tennessee and would not necessarily reflect opinions from a group of anglers with a vested interest.

The surveys were conducted five years apart and responses may not reflect the opinions of the original survey frame. However, catfish anglers in the 2005–06 survey were typically middle aged (35–55 years), and it is likely that opinions from those age groups are reflective of the original participants within our survey frame. Older age groups and respondents with a lower level of education were less likely to support the proposed management scenarios. Reitz and Travnichek (2005) also found older respondents were

the least favorable to regulations. Older age groups seem to be less supportive of catfish management regardless of limitations imposed on harvest. It is possible that regulations may not be understood, too complex, or perceived as an infringement on an angler that fishes more often.

Previous studies have documented that catfish anglers would support more restrictive regulations but these surveys were based on hypothetical management scenarios (e.g., Reitz and Travnichek 2005), and none have examined catfish angler opinions following a regulation change. In 2000, anglers were evenly divided in their support and opposition of managing catfish as a sportfish, but anglers supported specific management scenarios that restricted harvest of trophy-sized fish and regulations on commercial fishers. Three years later catfish regulations were amended, including a measure that would limit recreational and commercial harvest of trophy-sized fish statewide. This was one of the first instances of a state implementing regulations to protect trophy-sized catfish and many states have since followed suit (e.g., Kuklinski and Patterson 2011). The regulations were apparently well received by anglers in Tennessee, as support for catfish management was twice as high in 2005–06 compared to 2000. The high level of support shown by anglers prompted the TWRC to officially reclassify catfish as both a sport and commercial species in 2007. That change reflected a first-time commitment from TWRA to manage catfish populations using regulations geared at optimizing the sport fishery.

Harvest-oriented catfish anglers were less supportive than trophy anglers of the regulations. Dissimilarities in opinions often exist between harvest groups because of species-specific preferences between trophy anglers, who primarily target flathead catfish (*Pylodictis olivaris*) and blue catfish (*Ictalurus punctatus*), and harvest-oriented anglers, who primarily target channel catfish (*I. punctatus*) (Gill 1980, Reitz and Travnichek 2007). Although the majority of Tennessee catfish anglers were harvest oriented, they generally supported TWRA's sportfish management focus on catfish, which has not been observed in other, similar studies. Harvest-oriented catfish anglers in Missouri (Reitz and Travnichek 2007) were generally opposed to minimum length limits because the hypothesized regulation, which restricted numbers of fish caught but increased chances of catching trophy-sized catfish, failed to appeal to both angler subgroups even though they indicated support for trophy catfish management. Other studies have also shown that increasing angler specialization is associated with preserving that resource and accentuating catch and release motivations (Bryan 1977, Hutt and Bettoli 2007). Typically an angler that values catching a fish as a primary motivation tends to support regulations that may increase that opportunity (Hicks et al. 1983, Spencer 1993, Edison et al. 2006).

Obtaining support for management regulations can be difficult when motivations and specializations vary within angling subgroups (Hutt and Bettoli 2007). However, these findings suggest that the high level of support for Tennessee's trophy catfish regulation might be due because the regulation appeals to both harvest sub-groups. Harvest-oriented anglers were still permitted to harvest an unrestricted number of catfish <864 mm and trophy-angler interests were protected with the size limit. Although many trophy anglers had expressed support for more restrictive regulations on catfish, harvest-oriented recreational anglers were not likely to support the regulations, based on comments received after the regulation was passed. Results of this survey suggested that this opposition was not representative of the opinions of Tennessee catfish anglers across both subgroups. Nevertheless, survey results demonstrated that trophy anglers were still very much a minority of catfish anglers. These results further justify the need for angler survey data when making management decisions and should serve as a reminder to fisheries managers that the most vocal angling groups are not always representative of all anglers.

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