Lumber River Angler Creel Survey

Federal Aid in Sport Fish Restoration
Project F-108

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Abstract. A stratified non-uniform probability access–access creel survey was conducted along the Lumber River from January 2–December 30, 2022. Three hundred eighty-two creel sessions were conducted, resulting in interviews of 751 anglers in 399 angling parties. Overall, an estimated 39,556 (SE = 3,377) anglers expended 95,663 (12,606) hours of effort fishing the Lumber River in 2022. Anglers caught an estimated 51,020 (7,652) fish and harvested 26,425 (6,395) fish. Anglers spent an estimated USD $774,727 ($35,649) on direct fishing-related expenditures but were willing to spend $1,558,277 ($51,164) for a trip of equal satisfaction. Over 76% of anglers fished from the shoreline and most anglers (49%) were non-specified generalists targeting “anything that bites”. The angling demographic was largely comprised of local anglers as 63% were residents of Robeson County. The counties adjoining the Lumber River are home to the Lumbee Tribe of North Carolina—one of the largest Indigenous tribes in the United States—and 47% of anglers self-identified as Native American. Most anglers expressed satisfaction with the fishery and desired to “keep everything as is” (43%), though a large contingent (27%) also indicated a need to reduce trash at access sites. The Lumber River exhibits characteristics that are unique in North Carolina and conservation efforts should focus on collaborative management and community outreach.

The Lumber River flows approximately 214 km from the confluence of Drowning and Buffalo creeks near Wagram, NC to its confluence with the Little Pee Dee River near Nichols, SC. Over 130 km of the river is designated as a state-managed National Wild and Scenic River (National Park Service 1998). Additionally, the river is designated by the NC Department of Environmental Quality as High Quality Waters from its source downstream to Lumberton, NC (NCDENR 2007).

Previous surveys in the Lumber River have focused on biological characteristics of the fishery. Biological sampling indicates the river contains notable Redbreast Sunfish *Lepomis auritus* and Largemouth Bass *Micropterus salmoides* populations, in addition to several species of greatest conservation need (Rachels and Fisk 2021). Flathead Catfish *Pylodictis olivaris* were first detected in the Lumber River in 1998 (NCWRC unpublished data) and concomitant declines in native catfish species have been observed (Rachels and Ashley 2002; Rachels and Fisk 2021).

All four counties adjoining the Lumber River are categorized by the NC Department of Commerce as Tier 1 "most distressed", with Scotland and Robeson counties ranked as the first and second, respectively, most economically distressed counties in North Carolina (NCDC 2022). Additionally, Hoke, Robeson, and Scotland counties are among the 20 counties in North Carolina that are majority-minority (U.S. Census Bureau 2023). The area is home to the Lumbee Tribe of North Carolina, one of the largest Indigenous groups in the United States (U.S. Census Bureau 2023a). According to the 2020 U.S. Decennial Census, 44,871 Robeson County residents (38.5% of the county's population) identified as Native American (U.S. Census Bureau 2023b).

Angler creel surveys provide insight into angler behaviors and yield information on direct impacts to the biological resource through estimation of effort, catch, and harvest. Despite its unique biological and social dynamics, no previous angler survey has been conducted on the Lumber River. The purpose of this creel survey was to document the Lumber River's unique fishery by (1) characterizing angler demographics, catch, effort, and harvest, (2) estimating the economic impact, and (3) elucidating angler opinions about current fisheries management issues. Results from this survey will be used to manage fisheries in the Lumber River.

Methods

Access sites. Twenty-three angler access sites were identified along the Lumber River, with one additional site located on a major tributary in close proximity to the main stem (Table 1; Figure 1). Access sites were stratified into two zones: improved sites were identified as those that facilitate boating access (e.g., NCWRC Boating Access Areas, private landings, etc.), while unimproved sites were those with designated or opportunistic bank angling opportunities (e.g., NCWRC public fishing areas, bridge crossings, ad-hoc "landings" lacking a boat ramp).

Sampling. A non-uniform probability access point survey design (Pollock et al. 1994; Jones and Pollock 2012) was used from January 2, 2022 through December 30, 2022. The survey was stratified by zone (improved/unimproved), a primary sampling unit (weekday/weekend), and a secondary sampling unit (morning/afternoon; demarcation occurred at 1330 hours). Two random weekdays (Monday – Thursday) and two random weekend days (Friday – Sunday) were sampled each week for a goal of approximately 16 sampling days each month. Fridays were considered weekend days to allow flexibility in weekend scheduling. Holidays designated by the North Carolina Office of State Human Resources were considered weekend days but were not

sampled. During each randomly assigned sampling day, a creel technician conducted a 3-hour creel session at one randomly selected access site beginning 1–3 hours after sunrise. Following the completion of the 3-hour morning session, a 3-hour afternoon session was conducted at another randomly selected access site within the zone that was not sampled in the morning creel session. Sunrise and sunset times were based on data for Lumberton, NC. Given that each zone received one creel session each sampling day, the time-of-day probability was 0.25 for both morning and afternoon creel sessions. Initial access site probabilities were based on input from NCWRC Wildlife Enforcement Officers, Lumber River State Park staff, and a reconnaissance conducted November—December 2021. Site probabilities were greater for sites identified as receiving greater angling usage relative to low probability sites. Beginning in January 2022, daily boat trailer and vehicle counts were made at all access sites 1–3 times each month to assess relative angling pressure and, if needed, modify access site probabilities.

Interviews. During each creel session, the creel technician recorded session start and end times on a standardized creel session instrument (Appendix A). Each angler party was interviewed using a standardized survey instrument (Appendix B) when they completed their trip during a creel session. A trip was considered completed if anglers were observed ending their fishing trip and if the party provided the time they began their trip. Angling parties still fishing at the end of the creel session were considered incomplete trips but were also interviewed using the same survey instrument. The survey instrument collected information on angler effort, target species, catch, harvest, opinions regarding topical aspects of management interest, and angler demographics. Angling parties that declined to be interviewed or drove-off without being intercepted were noted. Following creel session completion, all session and survey instrument data were digitized and archived in QualtricsXM database management software (Qualtrics, Seattle, Washington).

Data analysis. All data analyses were conducted using R 4.3.1 (R Core Team 2023). Completed trips that lasted less than 15 minutes were censored. Angling effort for incomplete trips was incorporated by assigning to those trips the median of the angling hours observed from the 266 completed trips (3.2 hours). Catch and harvest of incomplete trips was incorporated by assuming the catch and harvest rates for each species observed at the time of the interview remained constant for the entire 3.2 angler hour trip. Estimates of angler effort (anglers; hours), catch (number of fish), and harvest (number of fish) for each sample day were calculated by standardizing the data to one quarter fishing day before expanding the interview data by the sample unit probability (product of the access site probability and the time-of-day probability). Daily estimates were averaged by month, zone, and primary sample unit. Averages were expanded to the total number of days in each month.

Economic impacts were investigated using direct fishing related expenditures and contingent valuation. Total direct expenditure was calculated as the product of the mean total expenditures per angling hour for completed trips and the estimate of angling hours. Contingent valuation was calculated by adding the angler-indicated “willingness-to-pay-more” for each trip to the total trip expenditures before proceeding as indicated for total direct expenditures. Individual responses were censored for nonsensical responses, and all data were included in the estimates.

Survey limitations. All angler interviews were conducted during daylight hours and estimates were standardized assuming a variable fishing day duration equal to the time elapsed

between sunrise and sunset (fishing day length ranged 9.8–14.5 hours). Therefore, overall estimates in this survey are negatively biased due to the exclusion of night angling. Additionally, the sum of the access site probabilities was 1; therefore, angling activity that occurred outside of the sampling frame of access sites would not be represented in this survey. Some questions, such as those dealing with harvest, were not applicable for every angler. Several known access sites were not sampled due to construction, maintenance or intermittent accessibility issues, and there are likely unknown access sites on privately-owned land.

Results

Sampling. A total of 382 creel sessions were conducted, resulting in 266 completed interviews, 130 incomplete interviews, and 3 interview refusals or drive-offs (Table 2).

Effort, catch, and harvest. An estimated 39,556 (SE = 3,377) anglers spent an estimated 95,663 (12,606) hours fishing the Lumber River during calendar year 2022 (Figures 2–3). Angling effort was greatest for "anything that bites" (Table 3). The estimated overall catch was 51,020 (7,652) fish. Bluegill *L. macrochirus* were the most frequently caught fish, followed by Largemouth Bass and Redear Sunfish (Table 4). The overall harvest was 26,425 (6,395) fish. Redear Sunfish *L. microlophus* were harvested in the greatest proportion to their catch (82%), followed by Flathead Catfish (78%) and Bluegill (63%).

Economic impact. Vehicle fuel was the greatest direct expenditure with a mean of $9.41 ($0.70) per trip, followed by food/beverage (mean = $5.72, SE = $0.47) and bait (mean = $5.61, SE = $0.51; Figure 4). The estimated total direct expenditure for fishing-related expenses in the Lumber River in 2022 was $774,727 ($35,649). The estimated contingent valuation for the fishery was $1,558,277 ($51,164).

Angler characteristics. Over 76% of anglers fished the Lumber River from the shoreline (Figure 5). Most anglers targeted "Anything that bites" (49%), followed by sunfish (19%) and Largemouth Bass (17%; Figure 6). Artificial bait was used by 60% of anglers (Figure 7). Most anglers were local, with 63% originating from Robeson County and 17% from Scotland County (Figure 8). Five anglers were from out-of-state and originated from Georgia, Ohio, South Carolina, and Washington, D.C. Most anglers were males age 16 or older (63%; Figure 9). Forty-seven percent of anglers self-identified as Native American, followed by 26% non-Hispanic white, 19% Black, and 4% Hispanic (Figure 10).

Angler opinions. When asked what could improve angling on the Lumber River, 401 responses were received (each interview could produce multiple responses). Forty-three percent of the responses indicated "keep everything as is" (Figure 11). For the remaining questions an education component to the questions could influence responses; therefore, anglers who indicated they had previously been interviewed during the Lumber River creel were omitted. Most (51%) of the 307 responses indicated anglers "support" the presence of Flathead Catfish in the Lumber River (Figure 12). The majority of responses (55%) indicated awareness of fish consumption advisories (Figure 13), and 74% of responses indicated fish consumption advisories are "important" (Figure 14). Seventy-one responses were received from anglers who caught and kept fish during the creel survey, with 41% indicating they planned to "clean and eat the caught fish with their family", 24% planned to "give the fish away", and 24% indicated they would "clean and eat the fish by themselves" (Figure 15). One

hundred responses were received from anglers who were observed with fish harvest and indicated generally how many meals per month they consumed of that species. Three percent of those responses (Figure 16) indicated they generally consume three or more meals each month of a species high in mercury (Black Crappie *Pomoxis nigromaculatus*, Bowfin *Amia calva*, Flathead Catfish, Largemouth Bass), while 35% indicated they generally consume one or fewer meals per month of sunfish, which are low in mercury (except Warmouth *L. gulosus*).

Discussion

As the first angler survey conducted on the Lumber River, this survey provides critical insight into the unique social and economic aspects of the fishery. The demographics of anglers fishing the Lumber River differ compared to most North Carolina anglers. Just 4% of freshwater anglers statewide identify as Native American (NCWRC 2023), yet they comprise over 47% of Lumber River anglers. Although the fishery is not a destination fishery drawing overnight and guided trips, direct fishing expenditures were greater than inflation-adjusted expenditures reported for the Tar River ($650,561; Homan et al. 2006) and Cape Fear River ($614,416; Ashley and Rachels 2005). These economic indicators suggest the value of the Lumber River fishery is especially impactful given the economic challenges and history of marginalization incurred by the communities who fish the river (McCulloch and Wilkins 1995; Maxwell 2017; Emanuel 2019).

Lumber River anglers are generalists primarily targeting “anything that bites”, compared to statewide anglers who primarily target catfish (55%), crappie (40%), and black bass (39%; NCWRC 2023). The large proportion of caught fish that are harvested in the Lumber River is similar to the 54% observed in the Chowan River (Dockendorf et al. 2004) and greater than the 40% in the Cape Fear and Neuse rivers (Rundle et al. 2004; Ashley & Rachels 2005) and 28% in the Roanoke and Tar rivers (Homan et al. 2006; McCargo et al. 2007). The greater proportion of fish retained for harvest suggests Lumber River anglers may rely on caught fish as a food source to a greater extent than most other coastal NC rivers.

Although fish consumption has a variety of health benefits (NCDHHS 2023), it is also a vector for methylmercury, which has known neurotoxicological and developmental impacts in children. Although current fish consumption advisories are limited to methylmercury, other pollutants with human health concerns have been discharged or detected in the Lumber River (e.g., PFAS; NPDES permit application NC0004618). Although only 3% of angler respondents indicated they consume 3 or more meals per month, 65% of respondents reported they share or give away their catch to others. Additionally, 45% of respondents were not aware of fish consumption advisories. Outreach efforts should be expanded to ensure individuals who consume fish from the Lumber River are able to make informed decisions regarding their fish consumption choices. Several anglers who knew about consumption advisories indicated their awareness was due to one particular sign located at a locally popular fishing lake at St. Andrews University (author’s notes). Additional signage should be placed at access areas that receive the greatest angling pressure (e.g., Riverton Rd; Wagram BAA; High Hill BAA, etc.). Messaging should be carefully tailored (e.g., Gray et al. 2020) given that subsistence fish consumption has been identified as an important cultural component to members of the Lumbee Tribe (Driscoll et al. 2012).

Substantial fishing effort was expended on the Lumber River in 2022. Comparisons to previous coastal river creel surveys are difficult as they primarily estimated effort expended by boat anglers. However, relatively little angling occurs along the shoreline of the Cape Fear River due to the difficulty of accessing the river from its deeply incised banks (KTR; personal observation). Boat angling effort in the Cape Fear River was estimated to be 134,976 hours of angling effort during the 12 months from July 2003 to June 2004 (Ashley and Rachels 2005). Similarly, boat anglers in the Tar River expended 104,140 hours of effort from July 2004 to June 2005 (Homan et al. 2006). Although estimates from the Cape Fear and Tar rivers are likely biased low due to the exclusion of anglers not fishing from a vessel, both rivers have substantial anadromous fisheries. Despite a lack of anadromous fisheries, the level of effort expended in the Lumber River in 2022 was comparable to the Cape Fear and Tar rivers (Ashley and Rachels 2005; Homan et al. 2006), though considerably less than the Chowan, Neuse, and Roanoke rivers (Dockendorf et al. 2003; Rundle et al. 2004; McCargo et al. 2007). These latter rivers have extensive freshwater, anadromous, and estuarine sport fisheries that attract fishing tournaments, overnight trips, and guided trips that inflate their value relative to more inland streams that exclusively contain warmwater sport fishes. Additionally, the estuarine habitats and hydrography in those rivers result in much greater surface area of fishable water than is available in the Lumber River.

Biological surveys indicate that the Redbreast Sunfish population is relatively strong in the upper Lumber River (Rachels and Fisk 2021). Yet, Redbreast Sunfish were caught and harvested at much lower levels than other Lepomids. Interviewed anglers reported catching 34 Redbreast Sunfish in 2022; 16 of those were from interviews at Wagram BAA and 7 were from nearby Riverton Road. The scarcity of Redbreast Sunfish at downstream access sites coincides with the increase in Flathead Catfish abundance observed in those areas during biological surveys (Rachels and Fisk 2021). Future biological studies should continue to investigate Flathead Catfish expansion in the Lumber River and attempt to elucidate effects on native fish populations. Lumber River anglers indicated general support for Flathead Catfish; however, the authors (C. Mata) observed that some anglers were confused by the question (e.g., terminology such as “invasive”), and others doubted the impacts Flathead Catfish have on native species. Clear communications should be utilized to educate anglers on the impacts Flathead Catfish have on native species in the Lumber River.

Most anglers indicated a desire for fisheries managers to “keep everything as is”, although a considerable number of anglers also wanted to see trash reduced at access sites. Most responses seeking trash reduction were from interviews conducted at Riverton Road (54%) and Matthews Bluff (13%). Of the 9 access sites with 20 or more conducted interviews, Riverton Road and Matthews Bluff had the smallest proportion of interviews with anglers who indicated “keep everything as is” (23% and 24%, respectively; Figure C.18), while Lumber River State Park had the greatest proportion of anglers who desired to “keep everything as” (70%). This suggests that access sites managed by NCWRC or NC State Parks provide greater angling satisfaction than popular unimproved or ad-hoc sites, possibly due to the amenities and routine trash collection provided at those sites. Increased stewardship of privately-owned access sites would require inclusive partnership with landowners and local communities as some access sites may have an inherent cultural significance. For example, Riverton Road had relatively low angler satisfaction (as measured by “keep everything as is”) and exhibited relatively poor sunfish catch

rates (Figure C.19), yet it is a location that has been used by the local community for water activities since before the mid-20th century (R. Rachels, personal communication). Land acquisition efforts by NCWRC and partners should prioritize culturally significant areas and work collaboratively with local communities to ensure continued access.

Management Recommendations

1. Maintain current regulations for Inland Game Fish.
2. Conduct targeted outreach at Riverton Road and Matthews Bluff to identify specific management actions that would improve the satisfaction of anglers using these sites. Additionally, develop capacity to improve public angling opportunities on private lands.
3. Collaborate with the Lumbee Tribe of North Carolina, Lumber River State Park, and local governments to improve access opportunities for both boat and bank anglers.
4. Partner with NCDHHS, the Lumbee Tribe of North Carolina, and local health departments to install fish consumption advisory signage at high-use access sites.
5. Investigate and communicate impacts of Flathead Catfish on native species in Lumber River.
6. Improve boat ramps at Fair Bluff BAA, McNeill's Bridge BAA, Lennon's Bridge BAA, and Red Banks to facilitate access at normal to low streamflow.
7. Partner with the Town of Fair Bluff and Lumber River State Park to encourage use of Fair Bluff BAA. The condition of boat ramp may be limiting use.
8. Increase IFD capacity for conducting creel surveys by allocating permanent creel positions.

Acknowledgments

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TABLE 1. Lumber River access sites. Sites are in descending order from upstream to downstream. Total probability of a site being sampled was the product of the site probability and the time-of-day probability (0.25).

Access Site	Zone	Site probability	
		January–June	July–December
Turnpike Road	Unimproved	0.10	0.10
Chalk Banks - State Park	Improved	0.05	0.05
Wagram BAA	Improved	0.15	0.15
Riverton Road	Unimproved	0.15	0.15
Campbell Soup (NC 71)	Unimproved	0.10	0.10
Old Maxton	Unimproved	0.10	0.10
Wire Pasture - State Park[a]	Unimproved	0	0
Red Banks	Improved	0.10	0.10
Harpers Ferry	Improved	0.05	0.05
Three Bridges	Unimproved	0.05	0.05
Chicken Road	Unimproved	0.10	0.10
Lowe Road	Unimproved	0.05	0.05
McNeills Bridge BAA	Improved	0.15	0.15
Stevens PFA	Unimproved	0.15	0.15
Lumberton - Water Street	Improved	0.05	0.05
High Hill BAA	Improved	0.10	0.15
Matthews Bluff	Unimproved	0.15	0.15
Buck Landing	Unimproved	0.05	0.05
Lennons Bridge	Improved	0.05	0.05
Boardman BAA	Improved	0.10	0.10
Anglers Welcome Property [b]	Improved	0.05	0
Lumber River Campground [c]	Improved	0	0
Lumber River State Park	Improved	0.10	0.10
Fair Bluff BAA	Improved	0.05	0.05

[a] Wire Pasture access was closed to public in 2022.

[b] Site was closed to public in July 2022 and site probability shifted to 0.

[C] Paid access only; progressive daily counts suggested little fishing effort.

TABLE 2. Interview characteristics by interview type.

Trip status	Trips	Anglers	Mean party size	Mean trip duration (h)	Mean angler-hours (h)	Median angler-hours (h)
Completed	266	504	1.9	2.4	5.2	3.2
Incomplete	130	242	1.9	1.3	2.6	1.5
Refused	1	1	1	-	-	-
Other	2	4	2	1.4	4.2	4.2

TABLE 3. Estimated effort (angler-hours) expended by target species. Effort sums to greater than the total effort (95,663) as anglers could target more than one species in a trip.

Target species	Effort (h)	SE
Anything	52,796	6,986
Sunfish	20,395	3,901
Largemouth Bass	17,449	3,145
Catfish	10,969	2,764
Other	10,430	4,175

TABLE 4. Estimated catch and harvest (number of fish).

Species	Catch	SE	Harvest	SE	Proportion harvested
Bluegill	29,712	7,137	18,716	6,219	0.63
Largemouth Bass	6,277	1,566	396	215	0.06
Redear Sunfish	3,281	976	2,699	1,034	0.82
Black Crappie	2,854	1,407	1,322	503	0.46
Bowfin	2,585	770	198	116	0.08
Redbreast Sunfish	1,706	561	757	313	0.44
Channel Catfish	1,682	668	1,204	540	0.72
Other [a]	1,255	597	298	196	0.24
Flathead Catfish	840	636	654	617	0.78
Yellow Perch	716	331	181	149	0.25
Chain Pickerel	113	113	0	0	0

[a] Includes Spotted Sunfish, Longnose Gar, “catfish”, “bullhead”, and “unknown”.

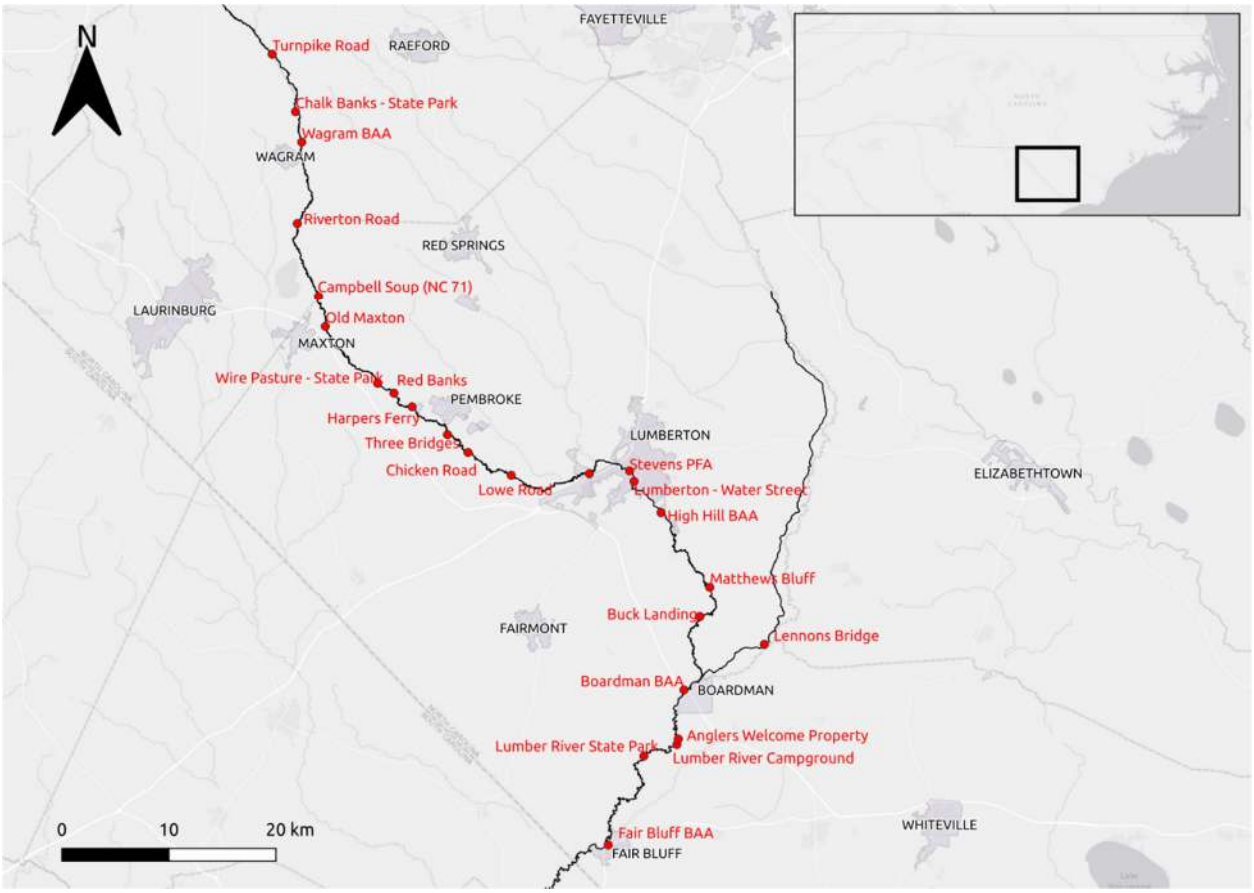

FIGURE 1. Lumber River access sites. Sites are denoted in red while nearby municipalities are denoted in black.

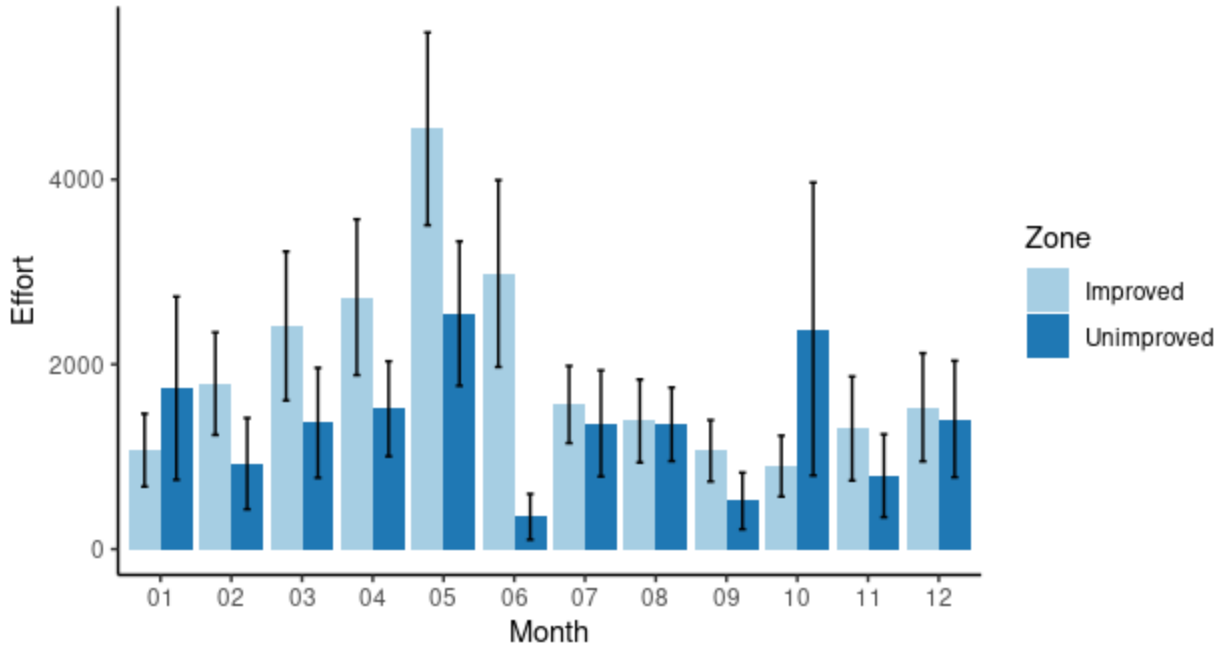

FIGURE 2. Number of anglers fishing the Lumber River. Error bars denote standard error.

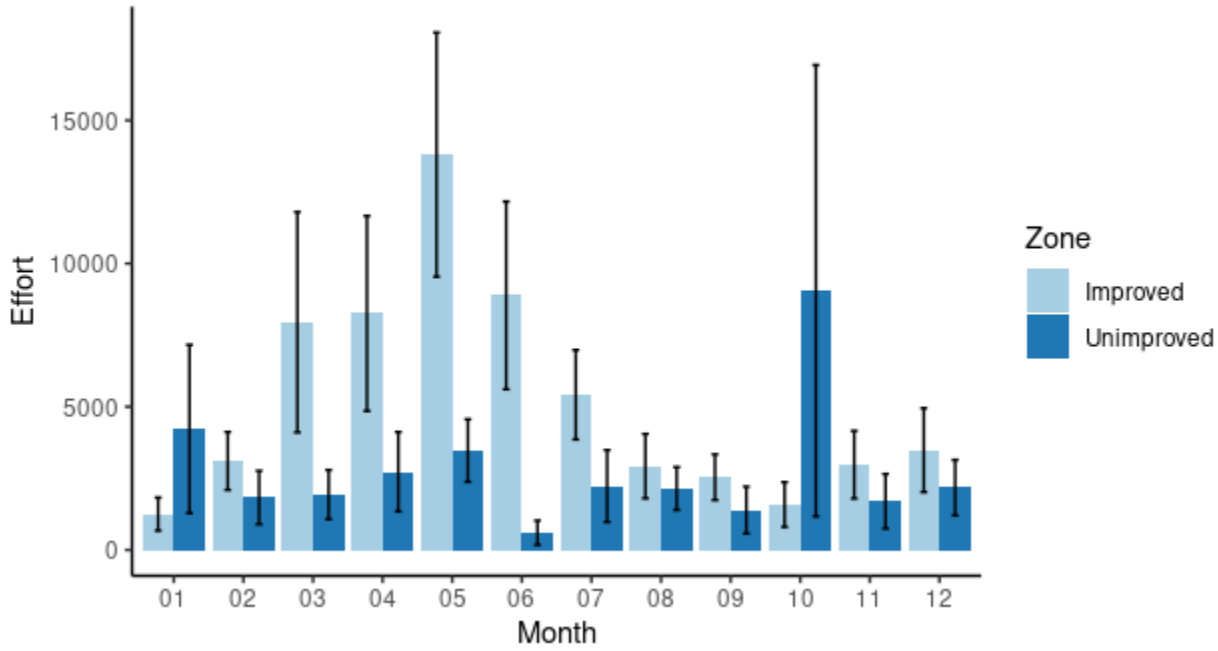

FIGURE 3. Total effort (angler-hours) expended by month and zone. Error bars denote standard error.

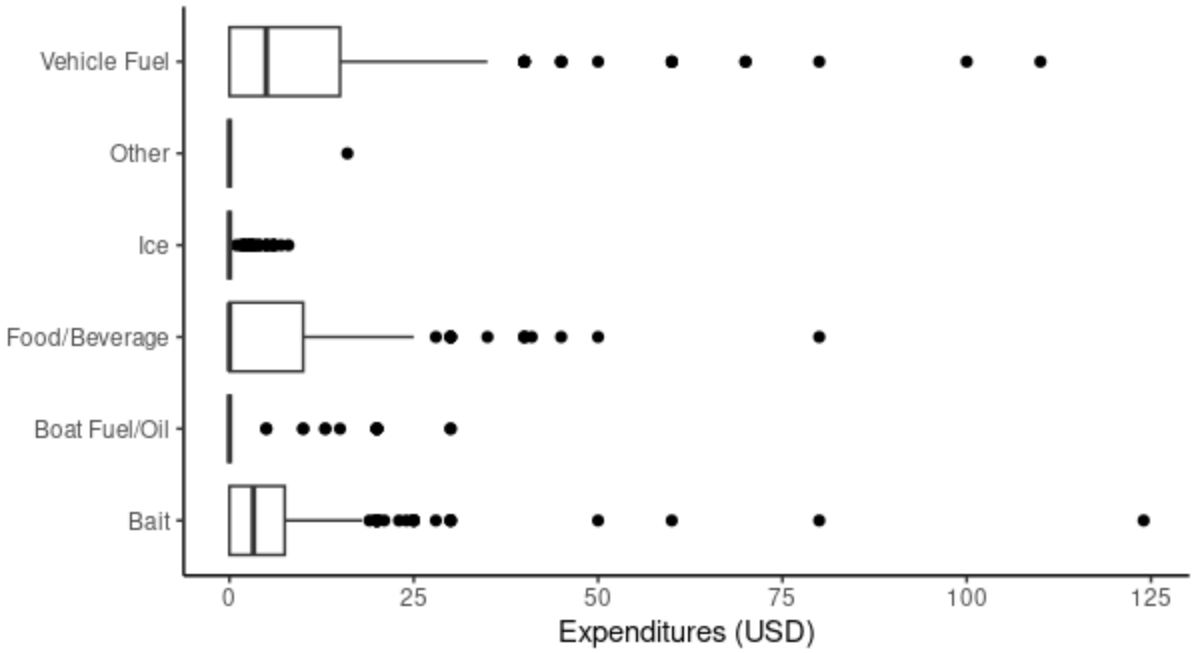

FIGURE 4. Direct expenditures by expenditure type reported by interviewed parties. The solid vertical line denotes the median, the box encloses the 25th and 75th percentiles, the whiskers denote 1.5x the interquartile range, and solid points denote outlying data.

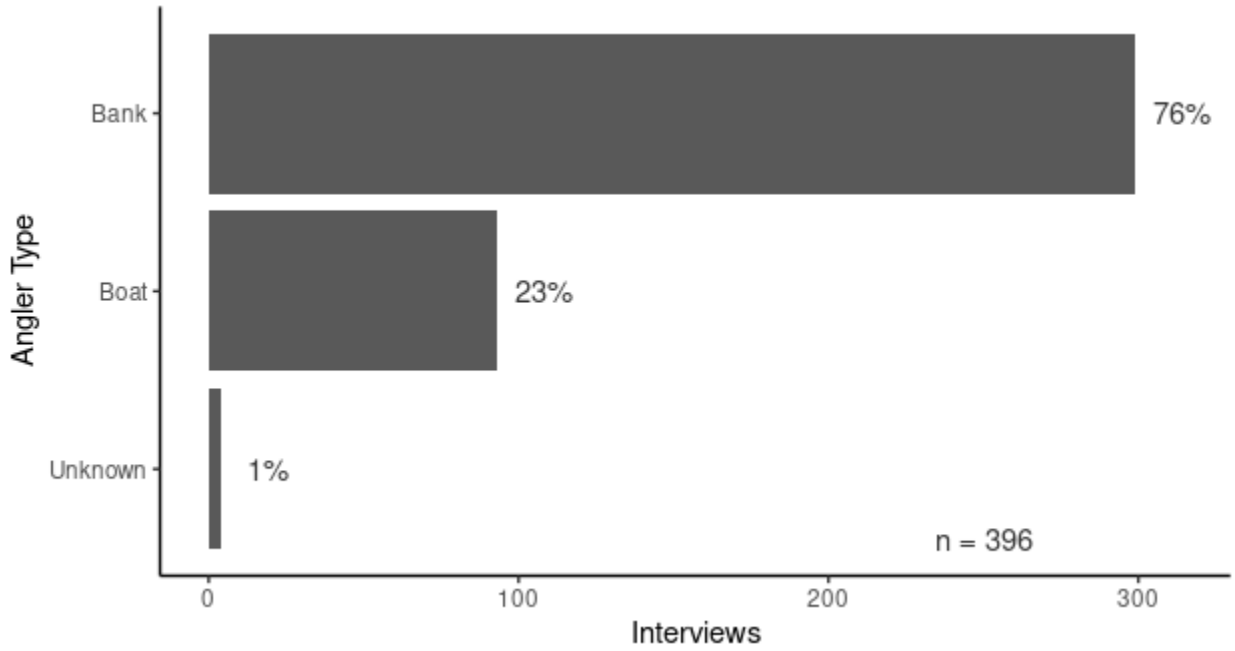

FIGURE 5. Interviewed parties by angler type. Boat includes any interview in which a motorized or non-motorized vessel was used.

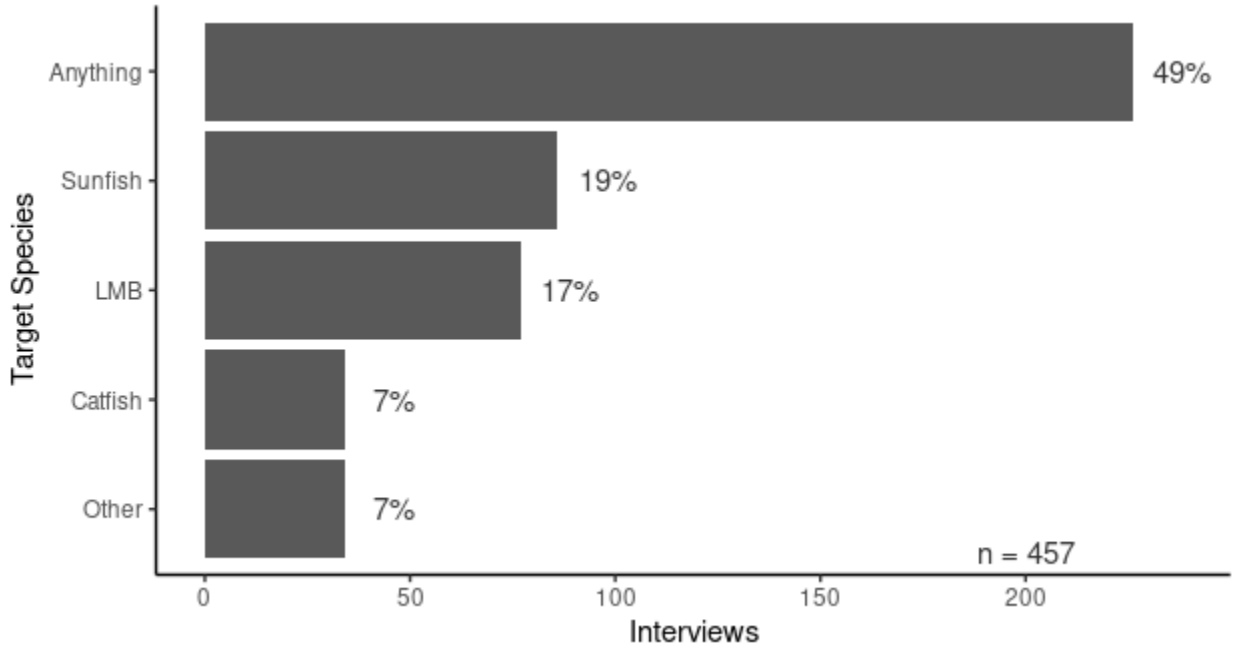

FIGURE 6. Count of interviews by angler-indicated target species. More than one species could be targeted in an interview. LMB = Largemouth Bass.

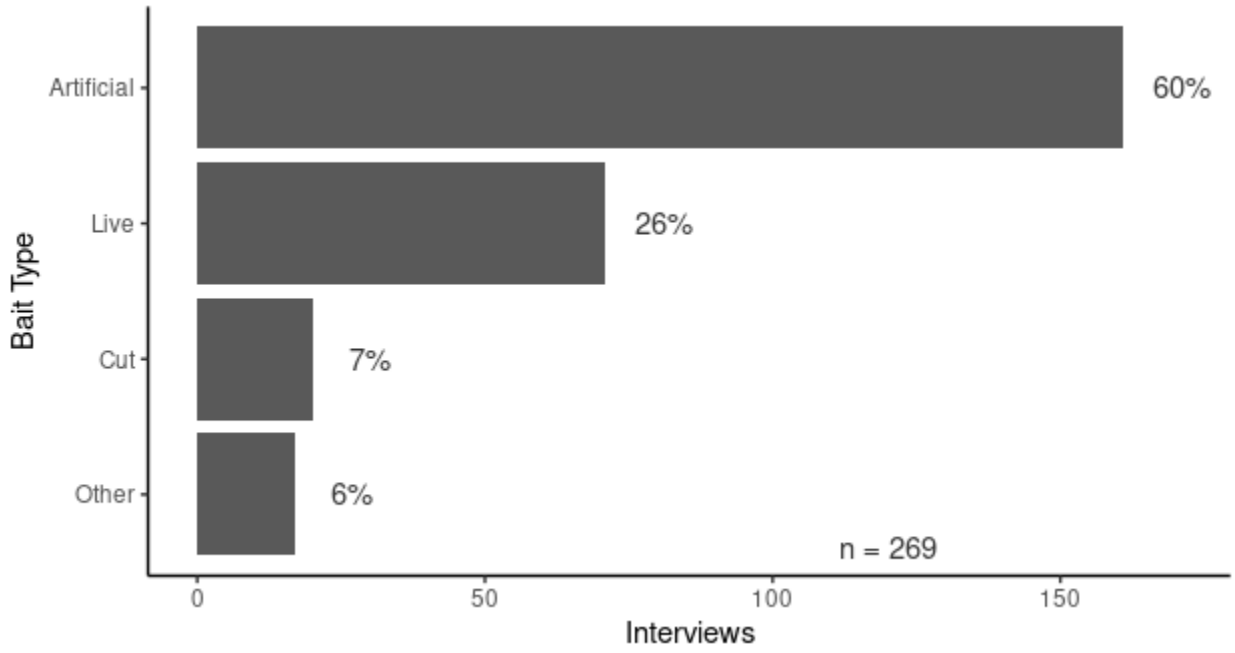

FIGURE 7. Count of interviews by angler-indicated type of bait.

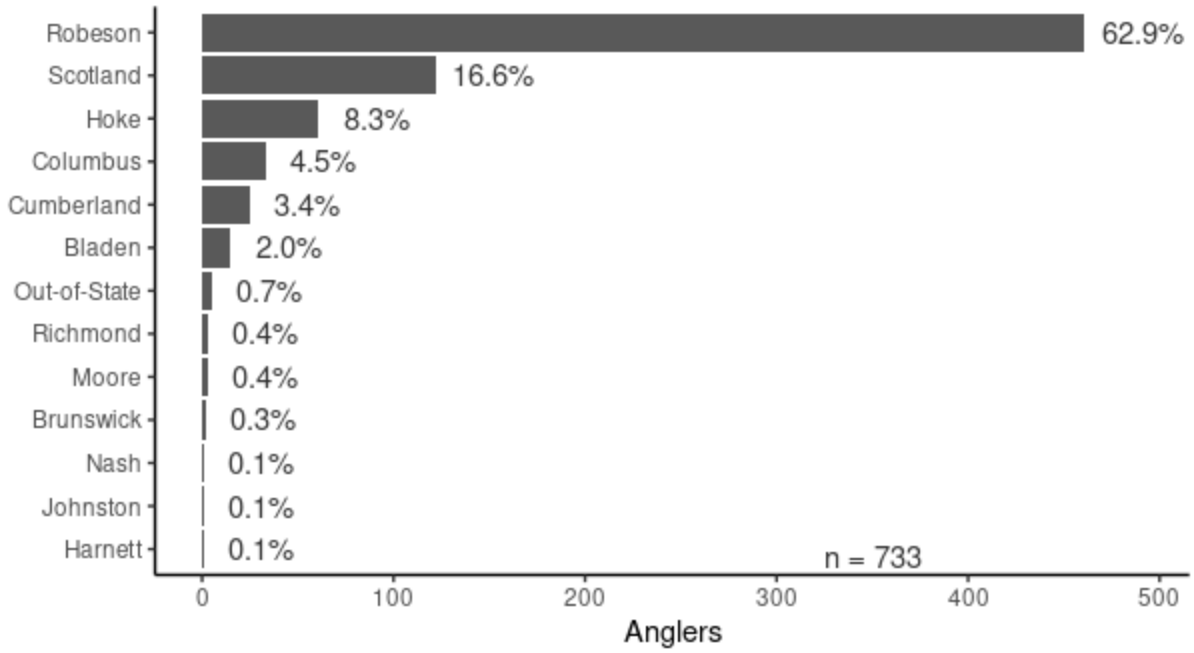

FIGURE 8. Number of anglers by county of residence.

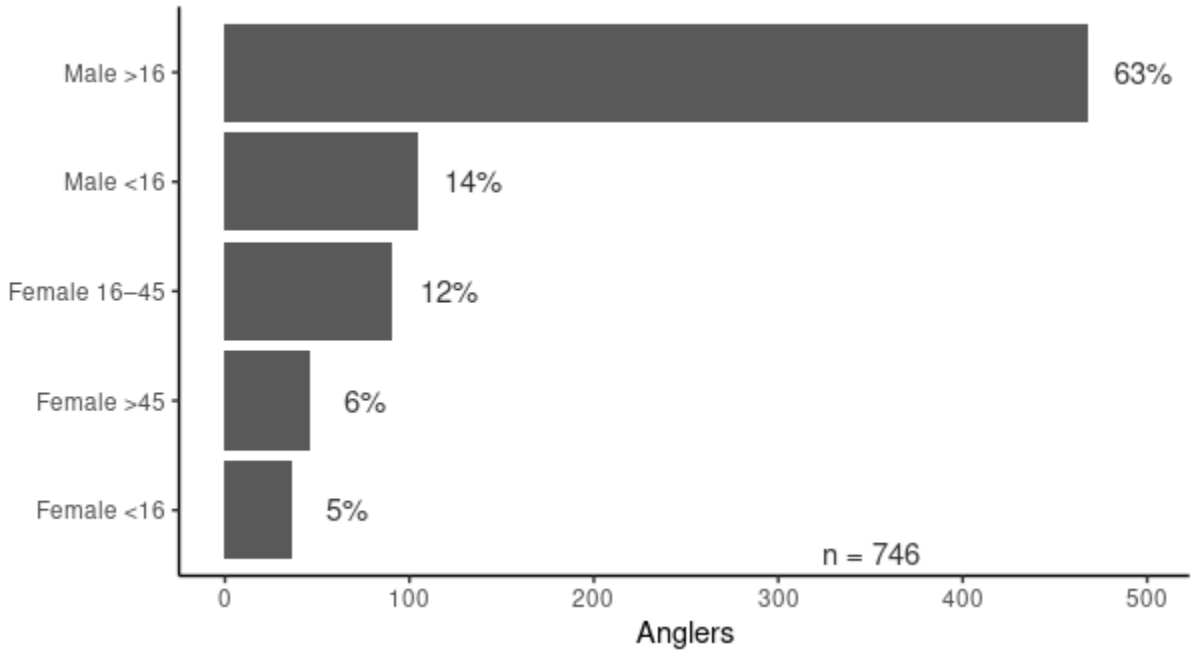

FIGURE 9. Count of anglers by sex and age.

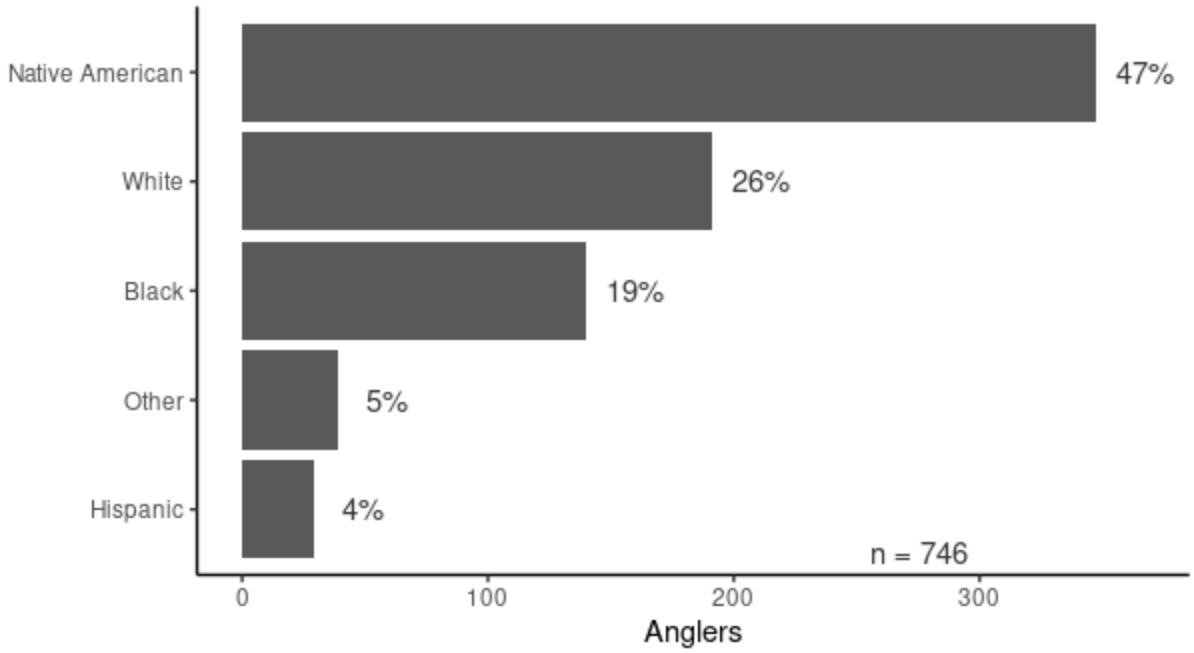

FIGURE 10. Angler self-identified race/ethnicity.

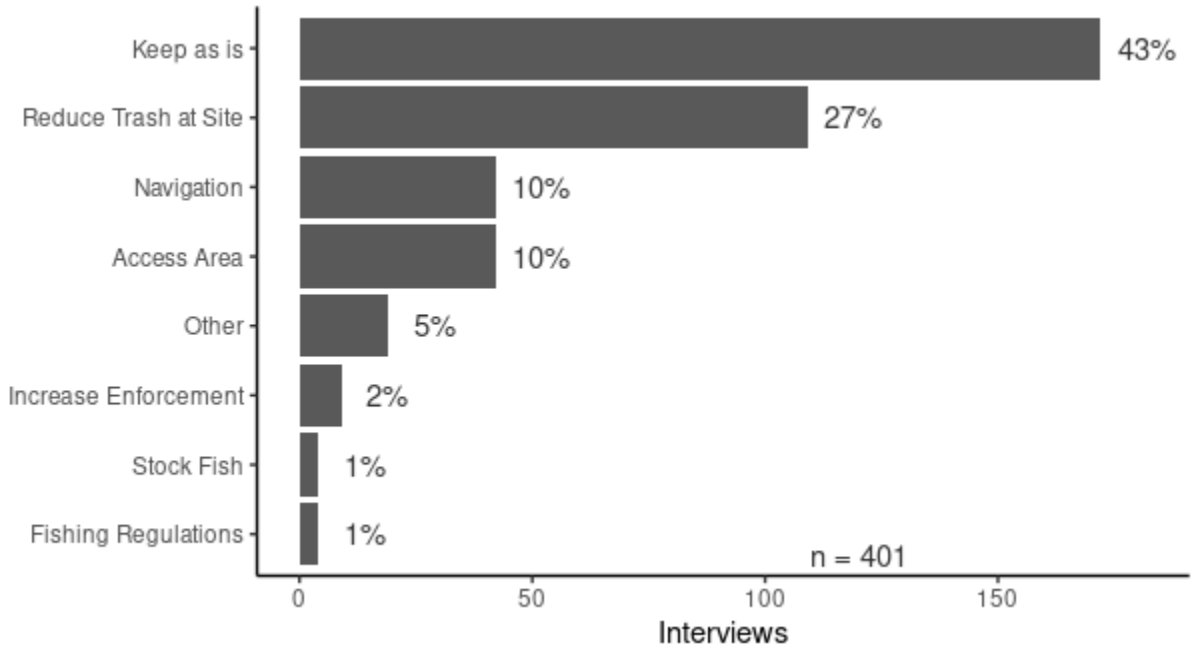

FIGURE 11. Angler response to “what would you change that could make your trip better”. Interviewed anglers could give more than one response.

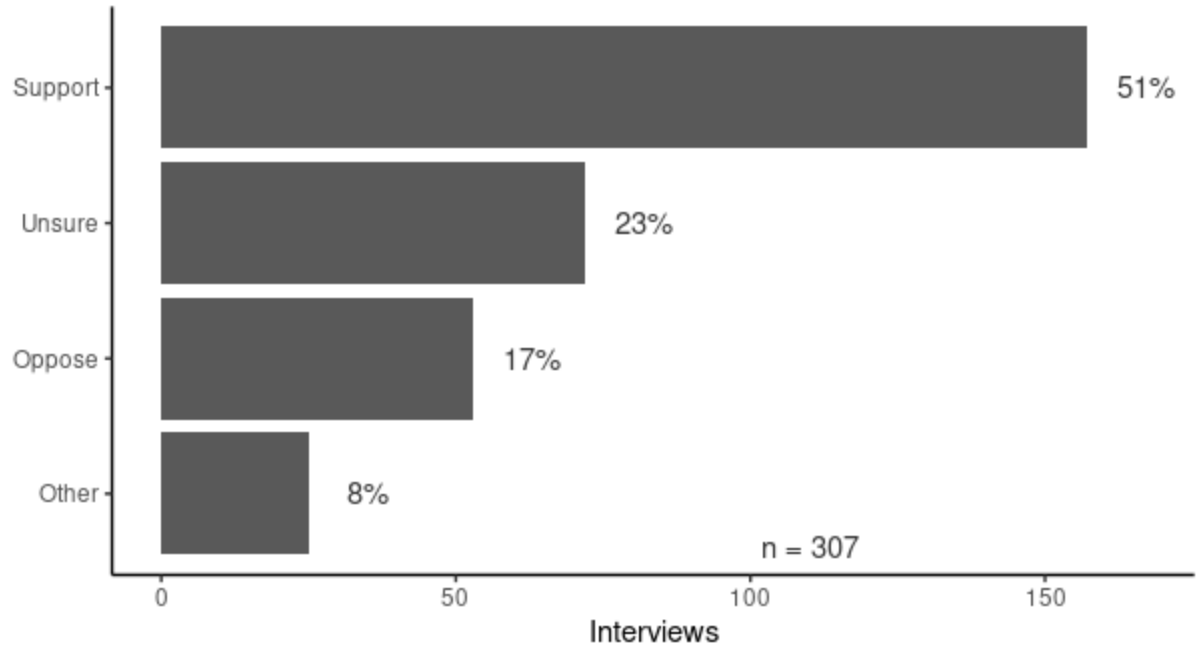

FIGURE 12. Angler response to “do you support Flathead Catfish in the Lumber River”.

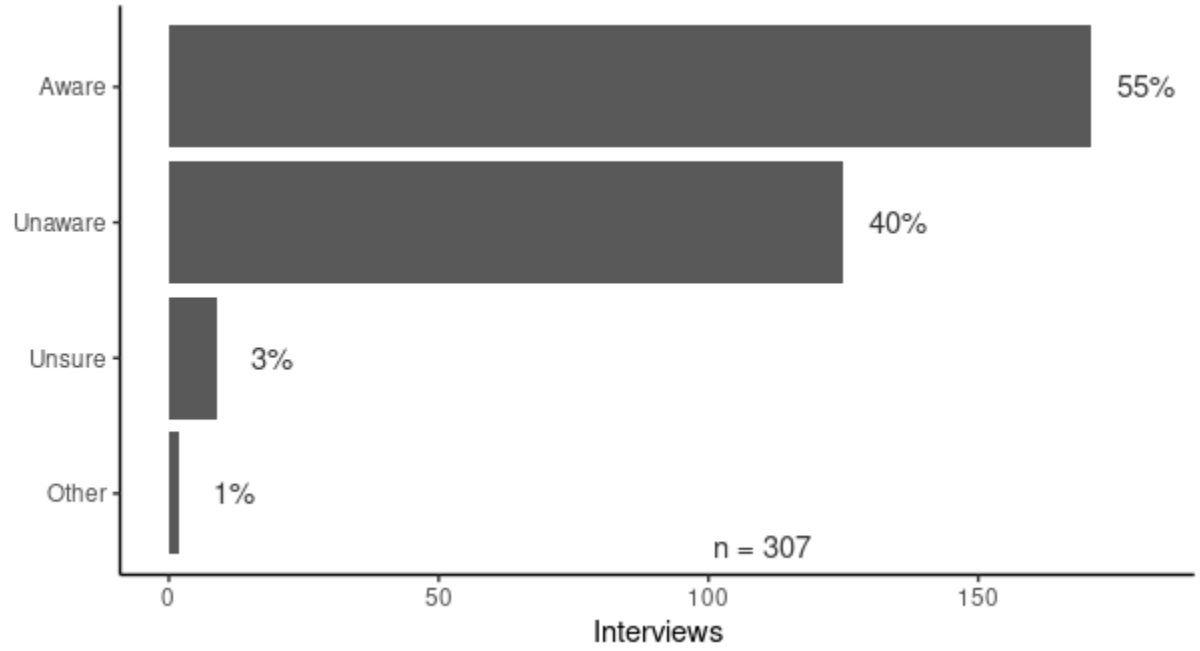

FIGURE 13. Angler awareness of fish consumption advisories.

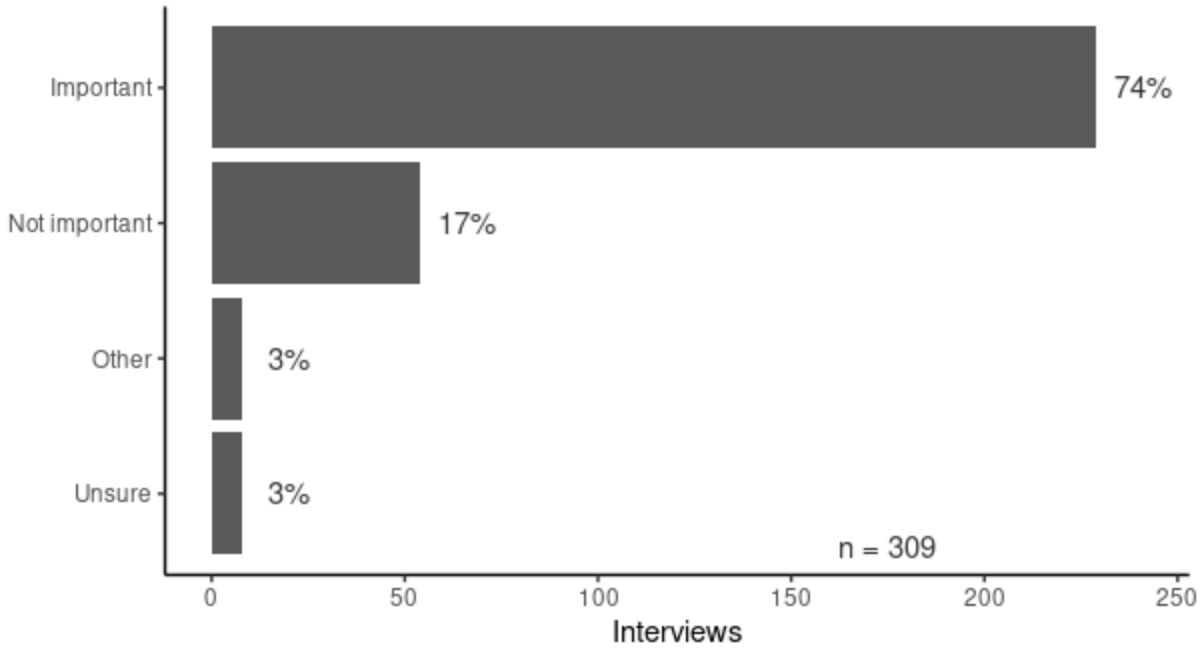

FIGURE 14. Importance of fish consumption advisories.

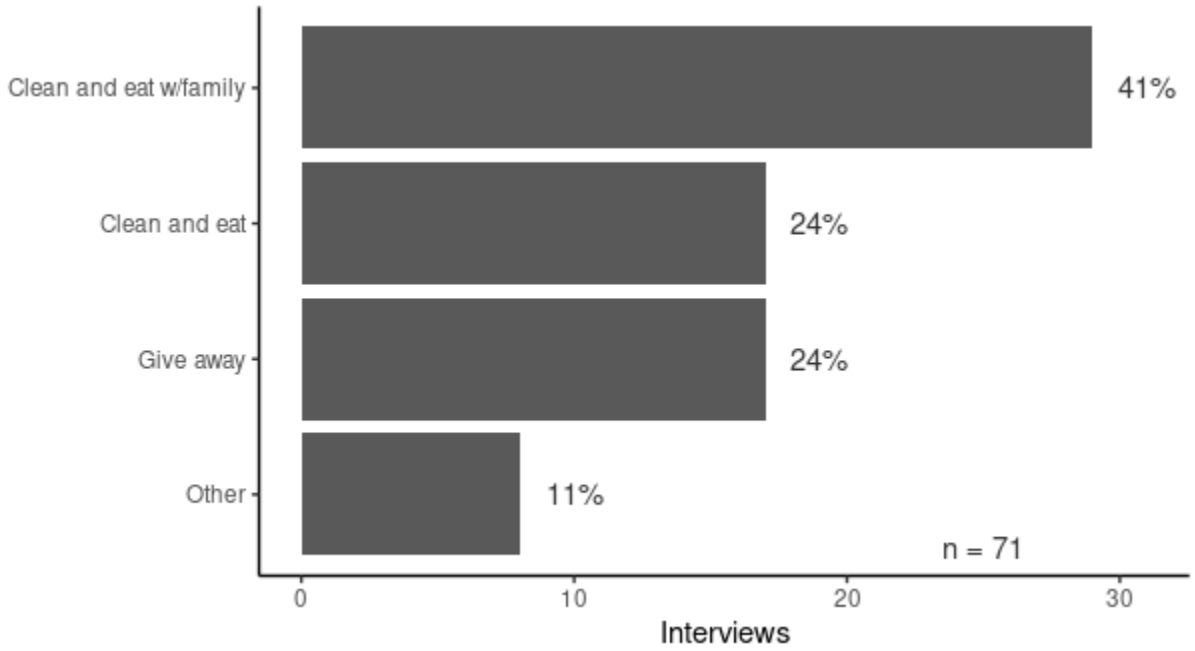

FIGURE 15. Intended use for harvested fish.

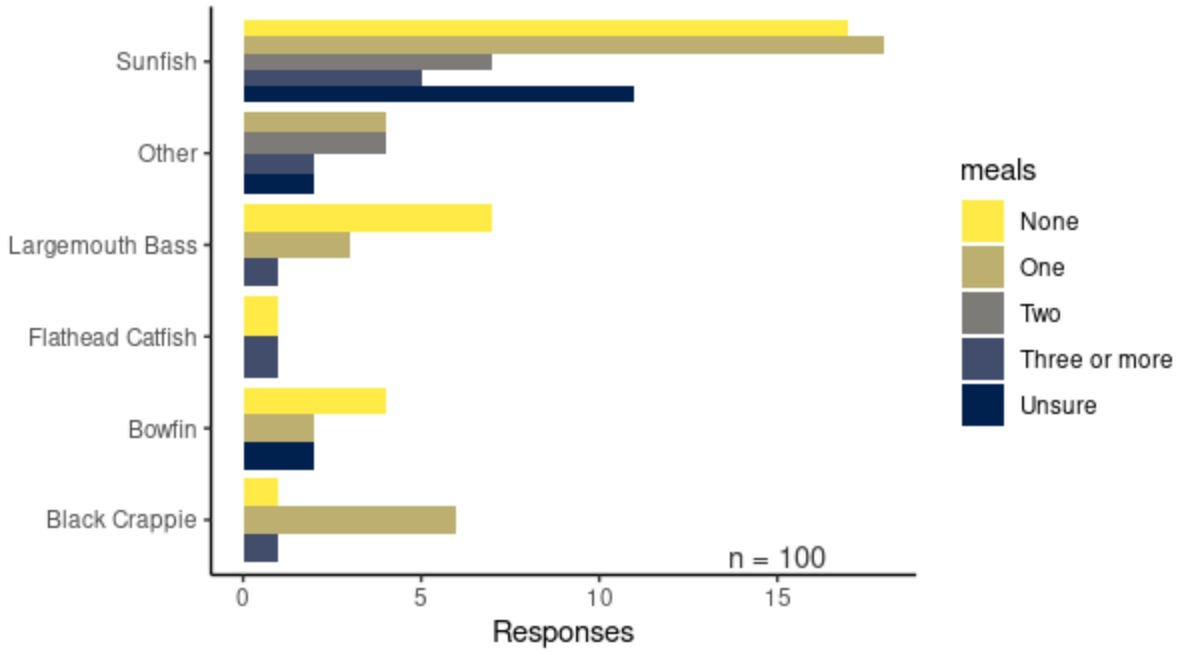

FIGURE 16. Number of meals per month of harvested fish.

Appendix A. Session Instrument

Period:____ Sample:____ (*Admin only*)

LUMBER RIVER CREEL SURVEY
Cover Sheet

DATE: _____

ACCESS LOCATION_____ SESSION (circle): AM PM

Counts For:	Start Time_____	Midway Time_____	End Time_____
Boat Trailers	_____	_____	_____
Single Vehicles	_____	_____	_____
Anglers on Site	_____	_____	_____
Other_____	_____	_____	_____
Water Data	**Time of Day _____**		
Water Temperature	_____°C		
Water Level	Circle general observation – Low Normal Flood		

Number of Drive-offs, angling parties that leave and ignore the survey: _____

Number of Angling Parties Not Able to be Interviewed, including Refusals: _____

Number of Non-Angling Parties Described on Back of Sheet: _____

Total Angling Interview Sheets: _____

Weather Observations:

_____
_____

Access Area Notes:

_____
_____

Other Session Notes:

_____
_____

Appendix B. Survey Instrument

Lumber River Creel Survey Interview Form **Angler Interview Sheet #:**_____

Interview Date __ __/__ __/2022 (Month Day Year)

Completed Trip Expected, Else Circle/Specify Below
Incomplete Trip Refused Other _____

Effort: **As you approach the party, Record Time of Interview:** __ __ __ __

What TIME did you start fishing today? Record Angler Time Started: __ __ __ __

How many anglers fishing in your party today? Record the Number of Anglers in Party: __ __

Fishing Access Type and Methods Used: (Circle all that apply - write in for Other)

Did you fish from Boat Kayak Fishing Pier Bank Wading Other _____

What bait or method used? Artificial Live Worms Live Bait _____ Cut Bait Other _____

Reason Incomplete? Weather Plan to Fish All Day Just Arrived Fish at Night Other _____

Species Targeted - What type of fish were you fishing for today? (Circle any mentioned)

Largemouth Bass Sunfish Pickerel Catfish Other (specify) _____ Anything

Catch Any? Keep Any? Total weight of kept				***Species*** _____		***Species*** _____		***Species*** _____	
Species	Number Caught	Number Kept	Weight (kg)	TL (mm)	Wt (g)	TL (mm)	Wt (g)	TL (mm)	Wt (g)
Largemouth Bass				1		1		1	
Redbreast Sunfish				2		2		2	
Bluegill				3		3		3	
Redear Sunfish				4		4		4	
Chain Pickerel				5		5		5	
Redfin Pickerel				6		6		6	
Flathead Catfish				7		7		7	
Bowfin				8		8		8	
_____				9		9		9	
				10		10		10	

Released Fish Reasoning? **Length Limit** **Bag Limit** **C&R Angler** **Unsafe to Eat** **Other** _____

For your fishing trip today here and back home, how much money do you expect to spend on:

Food/Beverage $____ Ice $____ Bait $____ Boat Fuel/Oil $_____ Vehicle Fuel $_____

Any other expenses for today's fishing trip? Lodging per night? $_____/_____ Guided Trip? $_____

How much more would you be willing to spend to have a similar trip as today? $_____

Flathead Catfish presence in river		***Aware of fish consumption advisories?***	***Importance of fish consumption advisory TO YOU?***	***Eat any you keep today?***	***How many meals of these fish eaten per month?***
☐ Oppose		☐ Aware	☐ Important	☐ Give away	☐ None
☐ Unsure		☐ Unsure	☐ Unsure	☐ Eat myself	☐ One
☐ Support		☐ Not aware	☐ Not important	☐ Eat w/family	☐ Two
☐ Other_____		☐ Other_____	☐ Other_____	☐ Other_____	☐ Three or more
					☐ Unsure

Would you change anything to improve a future trip? No Yes

If yes, related to Navigation_____ Access Area_____ Fishing Regulations_____ Trash at Site_____

Space for more details _____

Have we interviewed you before today?	***What NC county do you live? If not NC, what state do you live?*** *(Enter # anglers; e.g. 3 Robeson , 2 SC)*	***May I ask your Gender/Age?***	***May I Ask your Race?***
☐ No	___ Robeson ___ Scotland	___ Female < 16	___ Asian
☐ Yes	___ Hoke ___ Columbus	___ Female 16-45	___ Black
☐ Other_____	___ Cumberland ___ Bladen	___ Female > 45	___ Hispanic
Notes on back?	___ NC County _____	___ Male < 16	___ Native American
☐ No	___ NC County _____	___ Male 16+	___ White
☐ Yes	___ Out of State _____	___ Other_____	___ Other_____

Appendix C. Additional Tables and Figures

TABLE C.1. Access site information. Sites in descending order from upstream to downstream.

Access Site	Latitude	Longitude	Ownership	Notes
Turnpike Road	34.9739	-79.3784	NCWRC	Sandhills Gamelands.
Chalk Banks - State Park	34.9263	-79.3548	Lumber River State Park	Canoe launch.
Wagram BAA	34.9011	-79.3484	NCWRC	Bank fishing popular along old NC401 bridge.
Riverton Road	34.8336	-79.3529	Private	Maxton Airbase swimming hole. Canoe accessible.
Campbell Soup (NC 71)	34.7729	-79.3314	Private/Public ROW	Canoe accessible, but mostly bank angling.
Old Maxton	34.7469	-79.3245	Private/Public ROW	Canoe accessible, but mostly bank angling.
Wire Pasture - State Park	34.6995	-79.2714	Lumber River State Park	Closed 2020–2023
Red Banks	34.6913	-79.2548	Lumber River State Park	Limited river access during low streamflow.
Harpers Ferry	34.6799	-79.2364	Private	Small boat ramp.
Three Bridges	34.6567	-79.2005	Private/Public ROW	Canoe accessible.
Chicken Road	34.6418	-79.1796	Private	Popular swimming hole.
Lowe Road	34.6228	-79.1358	Private/Public ROW	
McNeills Bridge BAA	34.6241	-79.0565	NCWRC	Limited river access during low streamflow.
Stevens PFA	34.6265	-79.0157	NCWRC/City of Lumberton	Canoe launch and fishing pier.
Lumberton - Water Street	34.6177	-79.0111	City of Lumberton	Small boat ramp.
High Hill BAA	34.5916	-78.9837	NCWRC	
Matthews Bluff	34.5293	-78.9343	Public ROW	Anglers fish from bridge and along road up to 0.5km away.
Buck Landing	34.5037	-78.9443	Lumber River State Park	Canoe accessible.
Lennons Bridge	34.4806	-78.8789	NCWRC	Limited river access during low streamflow.
Boardman BAA	34.4428	-78.9605	NCWRC	
Anglers Welcome Property	34.4022	-78.9662	Private	Closed to public fishing in June 2022.
Lumber River Campground	34.3976	-78.9676	Private	Open to fishing for customers.
Lumber River State Park	34.3880	-79.0011	Lumber River State Park	
Fair Bluff BAA	34.3142	-79.0373	NCWRC/Town of Fair Bluff	Limited river access during low streamflow.

TABLE C.2. Fishes reported during Lumber River Creel.

Scientific Name	Common name	Local names
Amia calva	Bowfin	blackfish; mud fish
Ameiurus natalis [a]	Yellow Bullhead	bullhead; mud cat
Esox niger	Chain Pickerel	jack
Ictalurus punctatus	Channel Catfish	catfish; blue catfish
Lepisosteus osseus	Longnose Gar	gar; alligator gar
Lepomis auritus	Redbreast Sunfish	robin; bream/brim
Lepomis gulosus	Warmouth	bream/brim; goggle-eye
Lepomis macrochirus	Bluegill	bream/brim
Lepomis microlophus	Redear Sunfish	shellcracker; bream/brim
Lepomis punctatus	Spotted Sunfish	bream/brim; hardhead
Micropterus salmoides	Largemouth Bass	bass
Perca flavescens	Yellow Perch	raccoon perch; sand trout
Pomoxis nigromaculatus	Black Crappie	crappie
Pylodictus olivaris	Flathead Catfish	mud cat

[a] Although reported caught, no bullheads were observed in creel. Other species in Lumber River include *A. brunneus*, *A. catus*, *A. nebulosus*, and *A. platycephalus*.

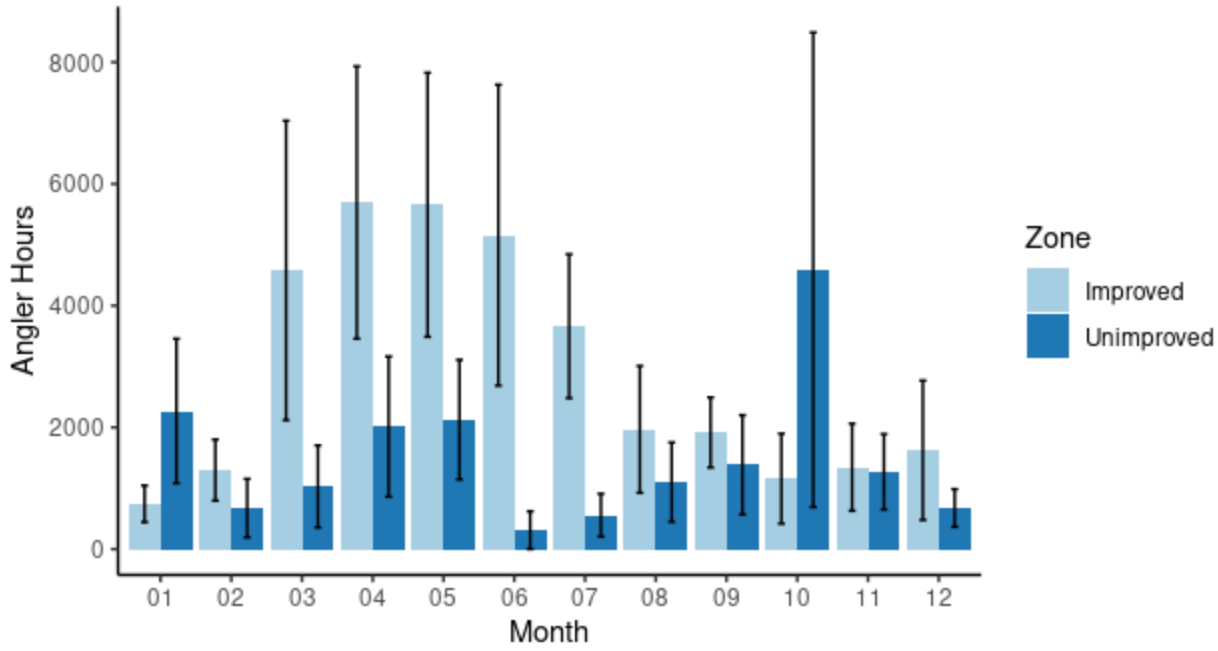

FIGURE C.1. Effort (angler-hours) spent fishing for “anything that bites”. Error bars denote standard error.

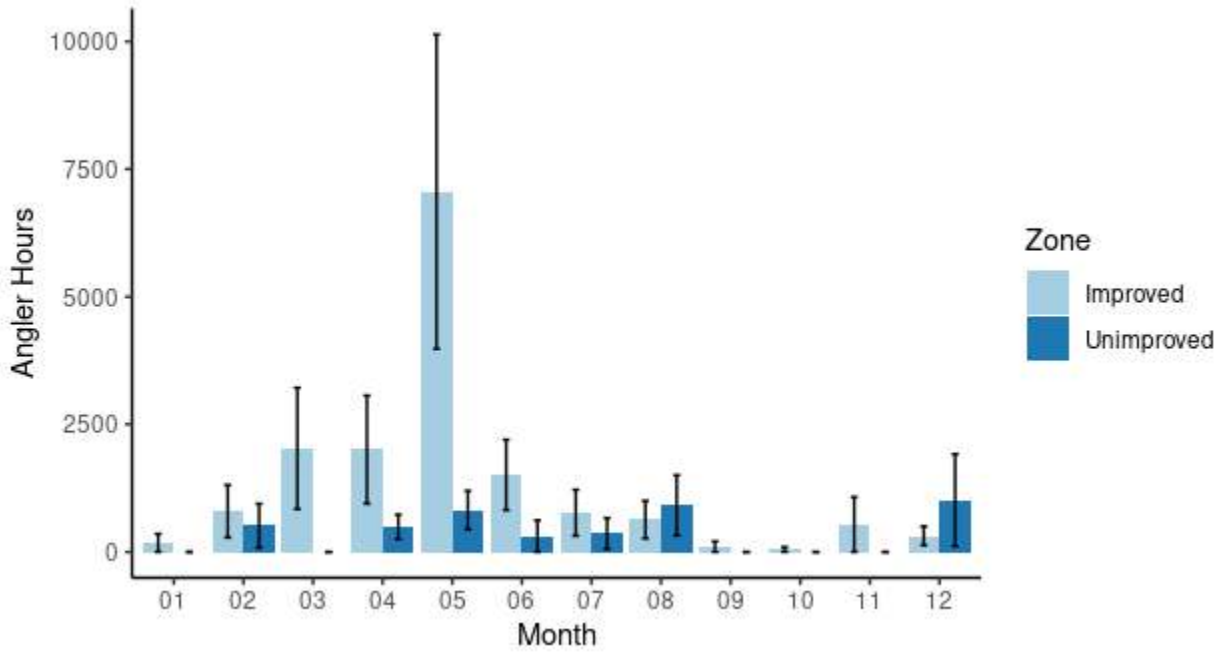

FIGURE C.2. Effort (angler-hours) spent fishing for sunfish. Error bars denote standard error.

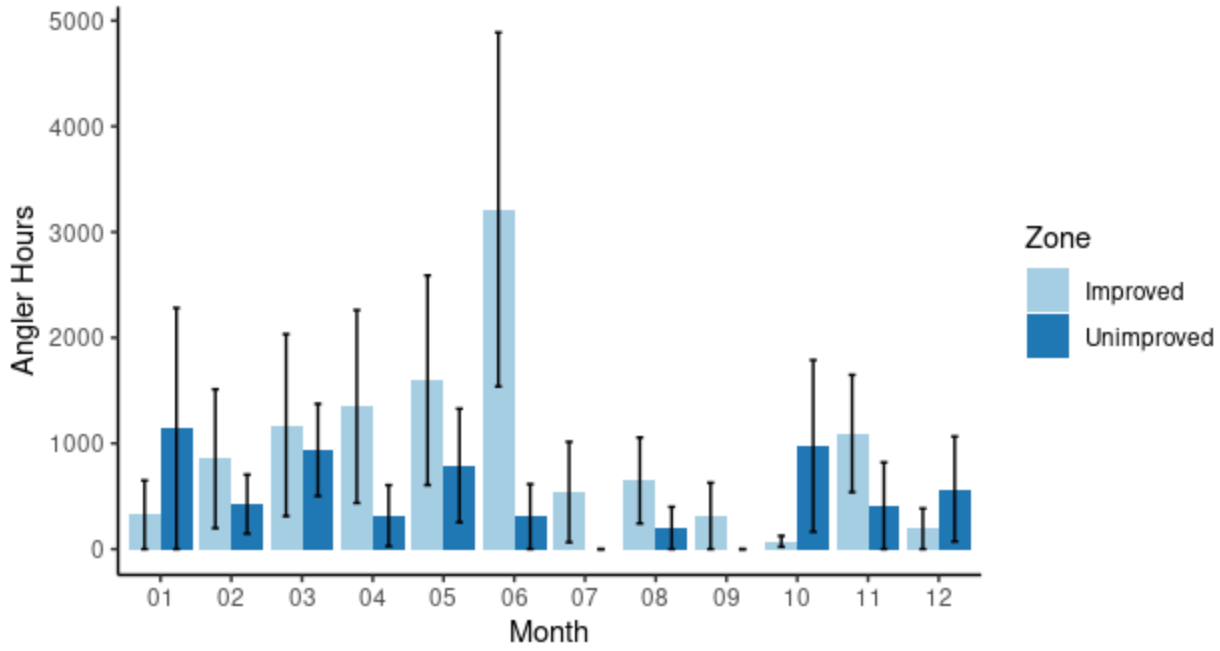

FIGURE C.3. Effort (angler-hours) spent fishing for Largemouth Bass. Error bars denote standard error.

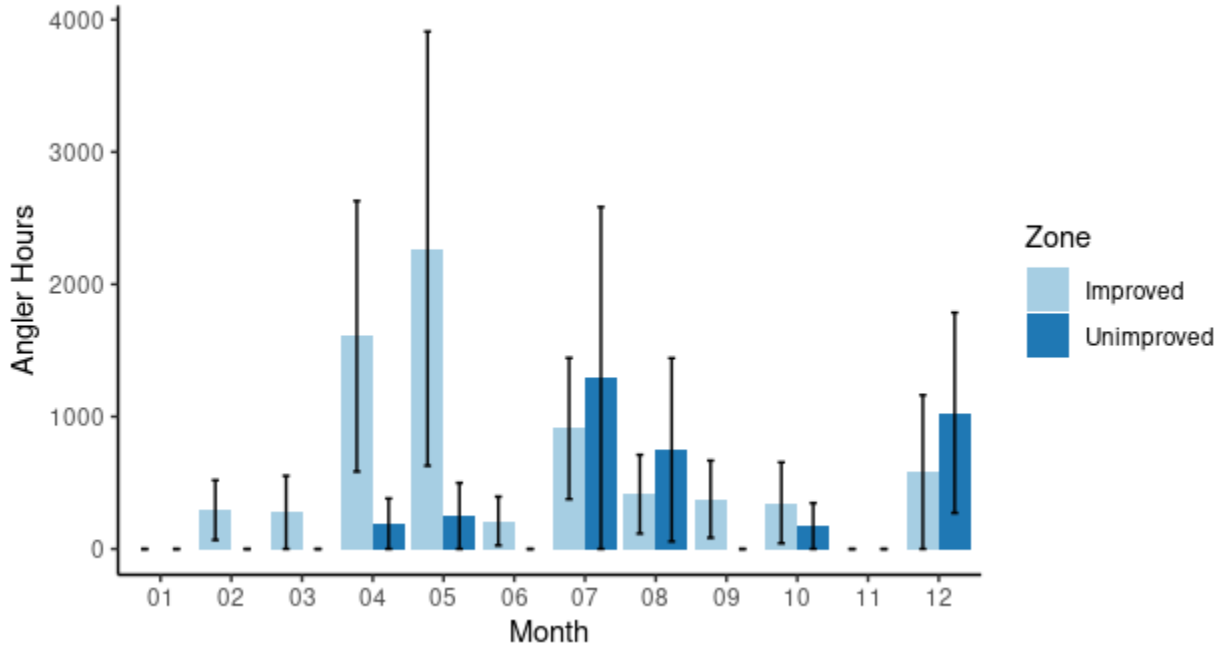

FIGURE C.4. Effort (angler-hours) spent fishing for catfish. Error bars denote standard error.

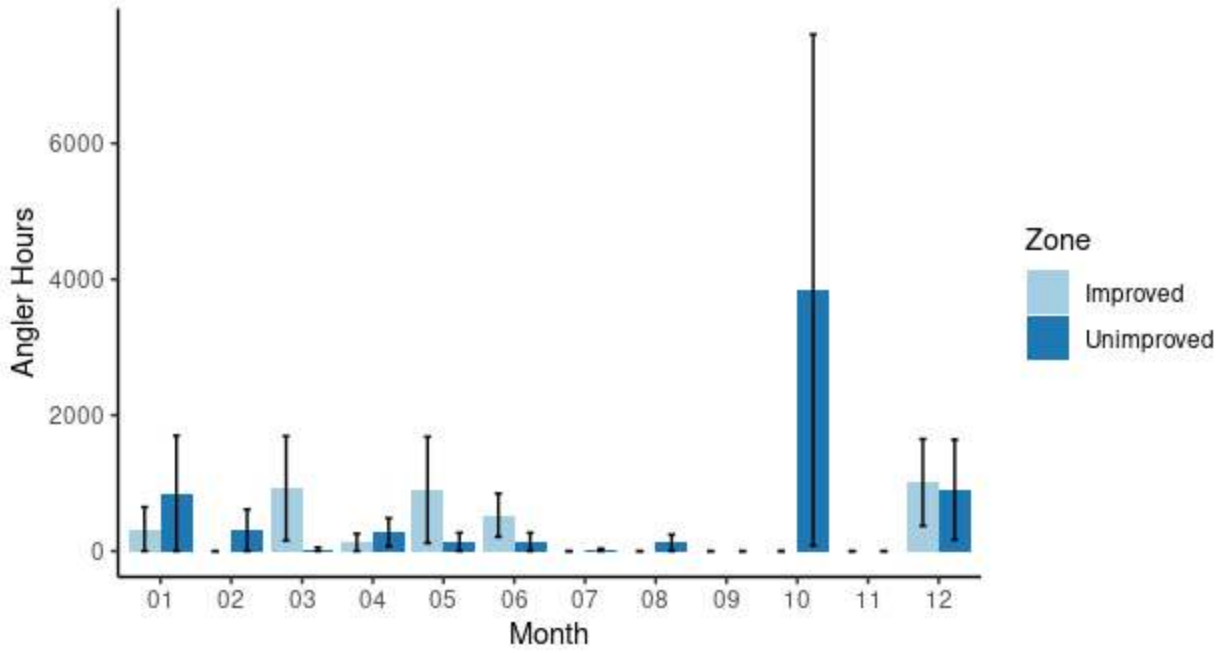

FIGURE C.5. Effort (angler-hours) spent fishing for other species. Error bars denote standard error.

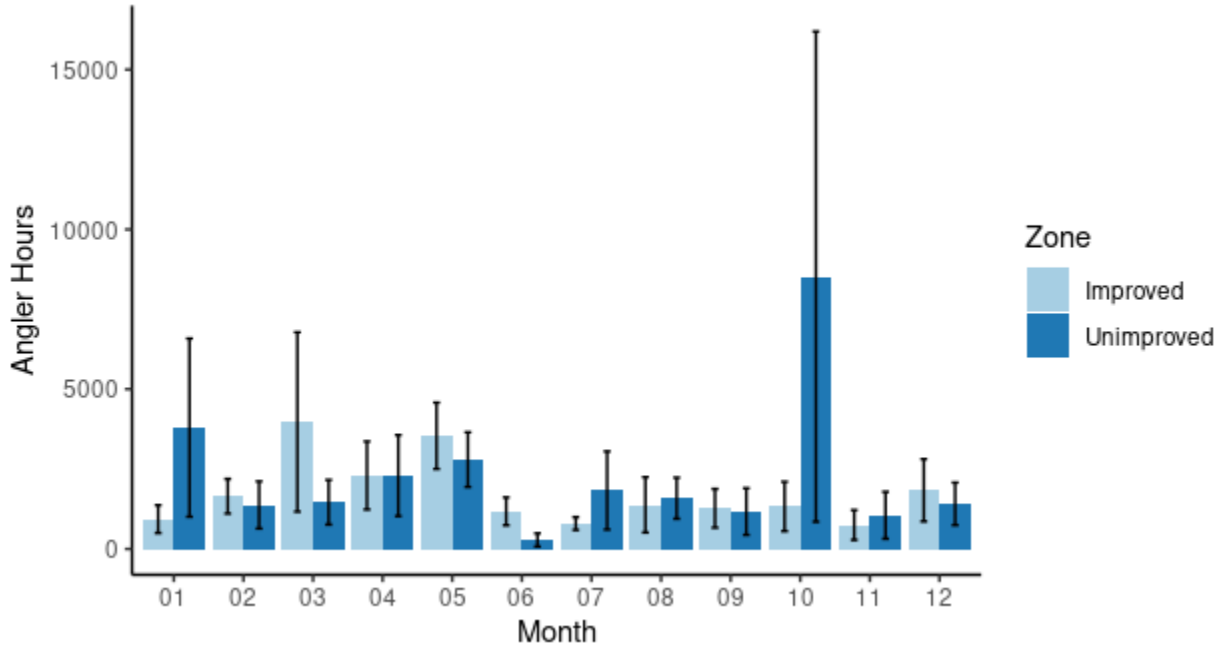

FIGURE C.6. Effort (angler-hours) expended by anglers fishing from the shoreline. Error bars denote standard error.

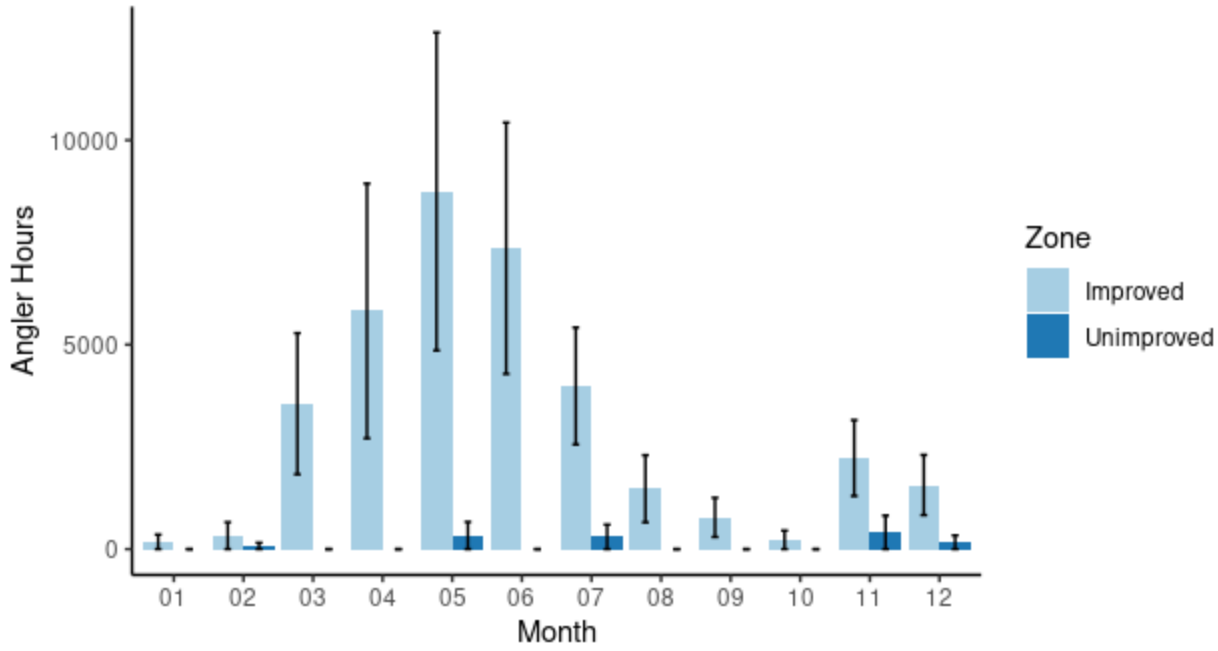

FIGURE C.7. Effort (angler-hours) expended by anglers fishing from a boat. Error bars denote standard error.

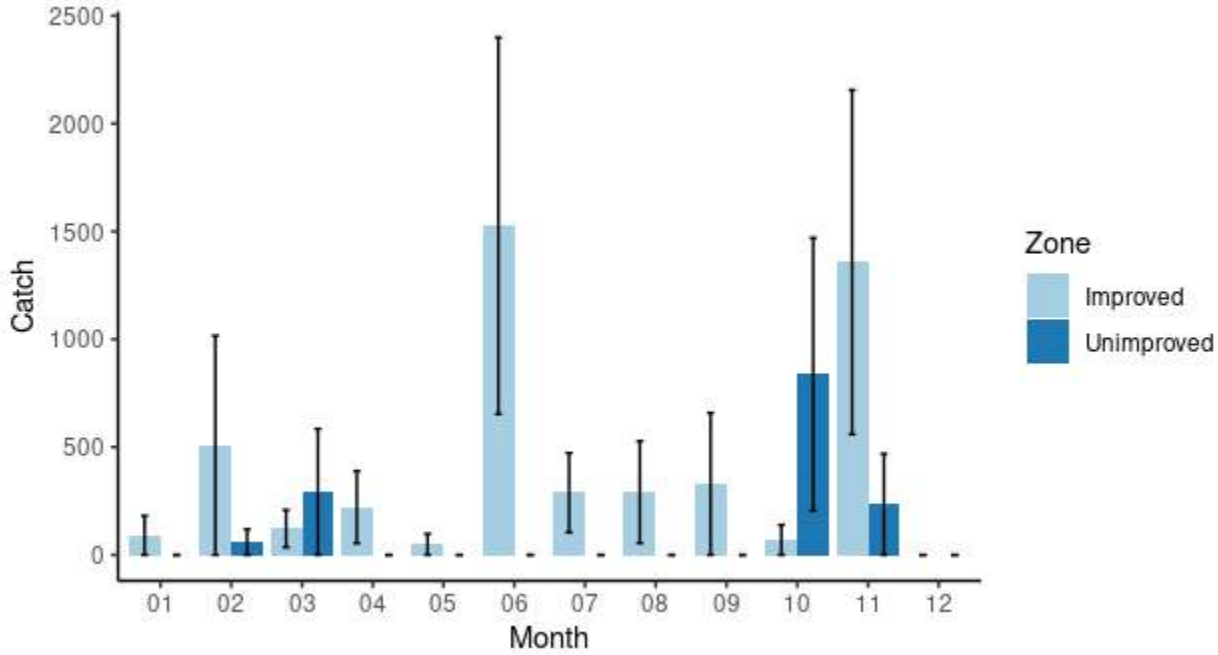

FIGURE C.8. Largemouth Bass catch (number of fish). Error bars denote standard error.

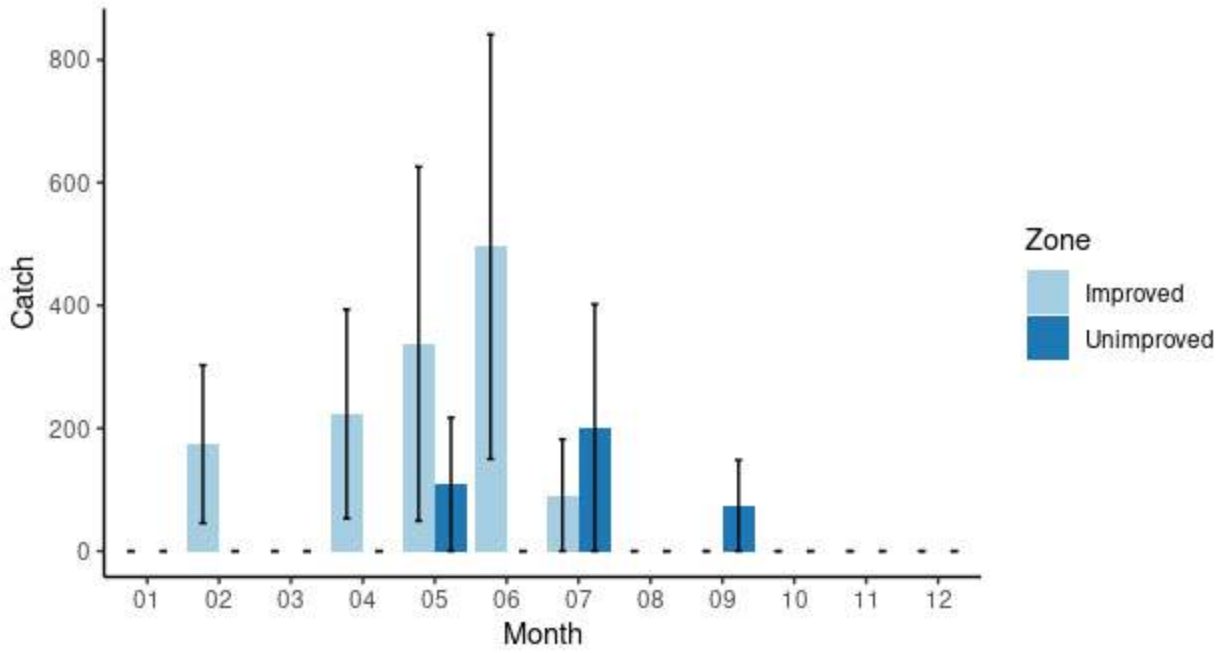

FIGURE C.9. Redbreast Sunfish catch (number of fish). Error bars denote standard error.

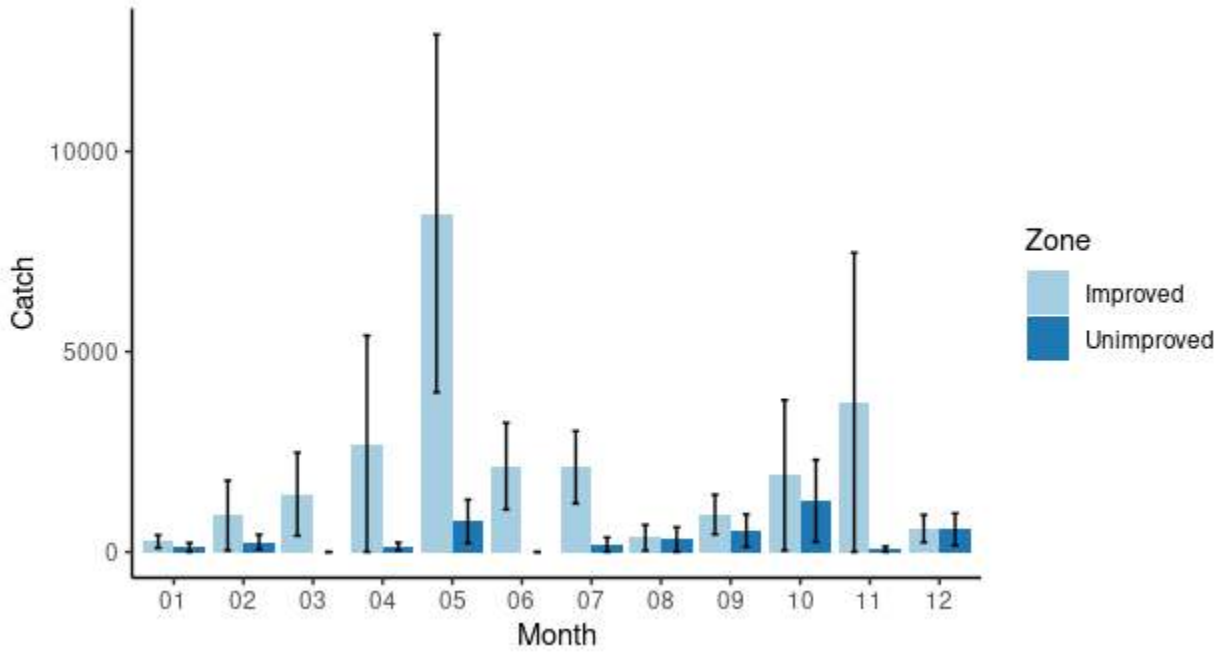

FIGURE C.10. Bluegill catch (number of fish). Error bars denote standard error.

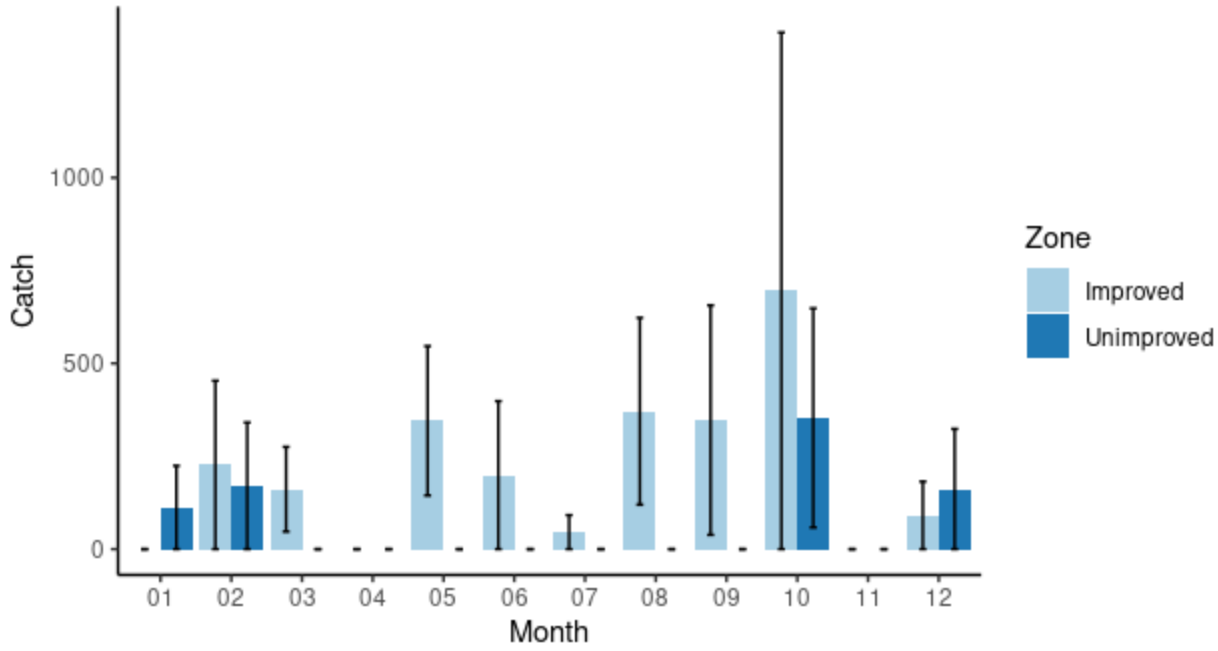

FIGURE C.11. Redear Sunfish catch (number of fish). Error bars denote standard error.

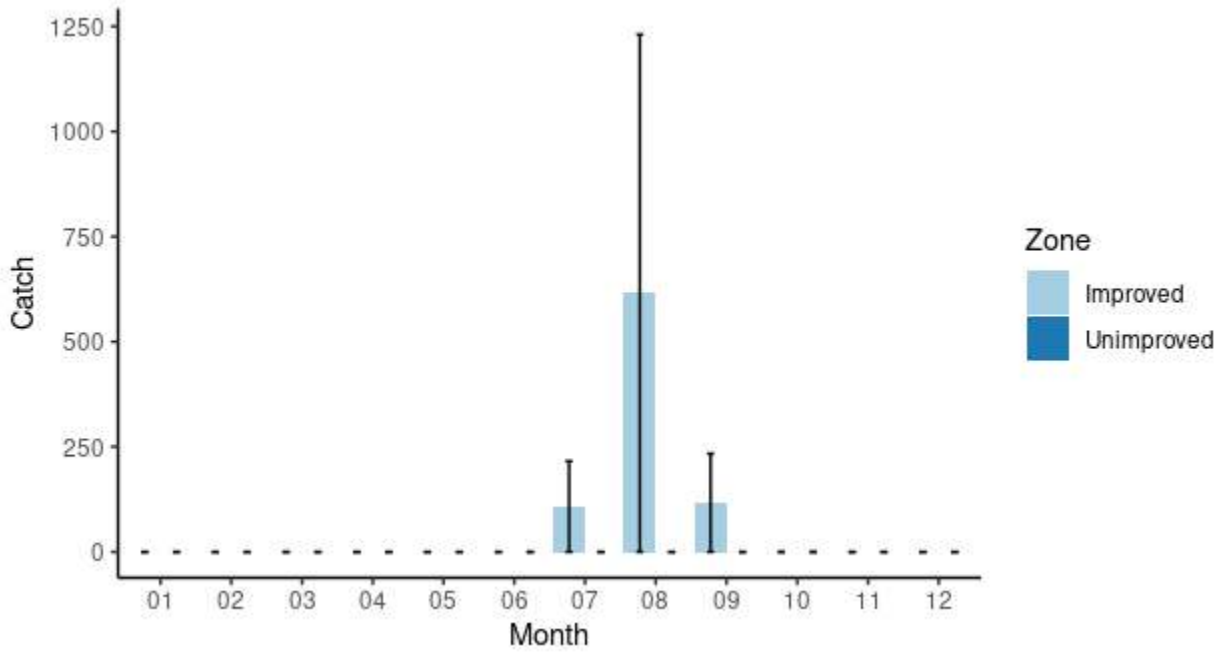

FIGURE C.12. Flathead Catfish catch (number of fish). Error bars denote standard error.

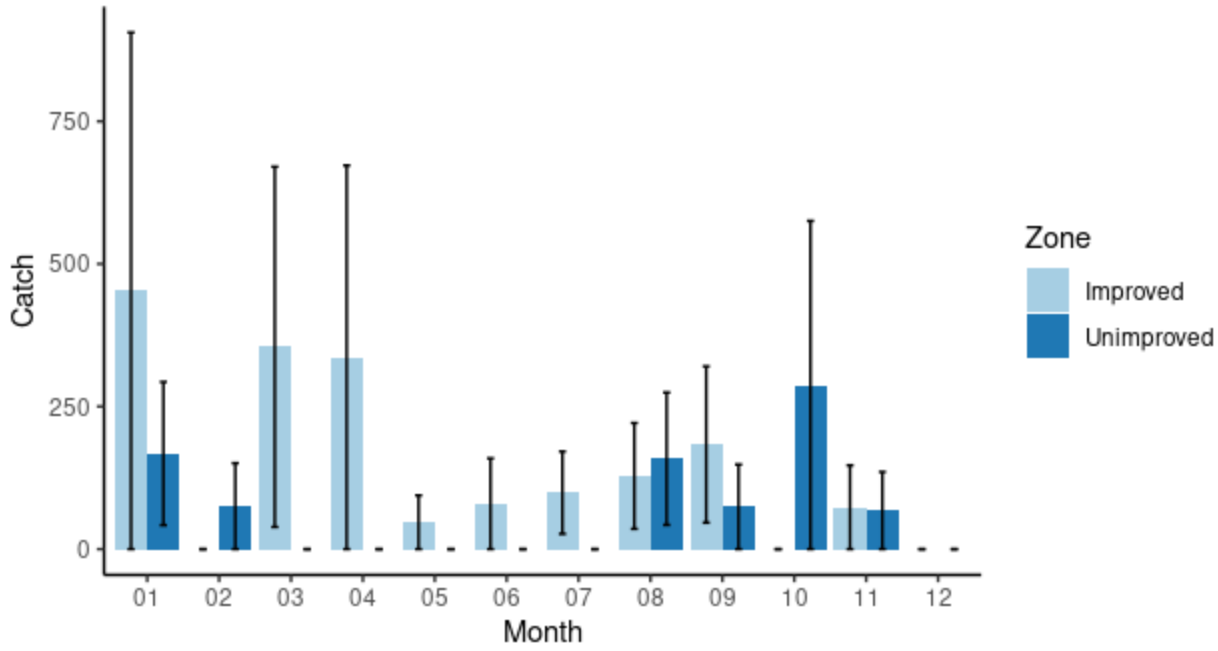

FIGURE C.13. Bowfin catch (number of fish). Error bars denote standard error.

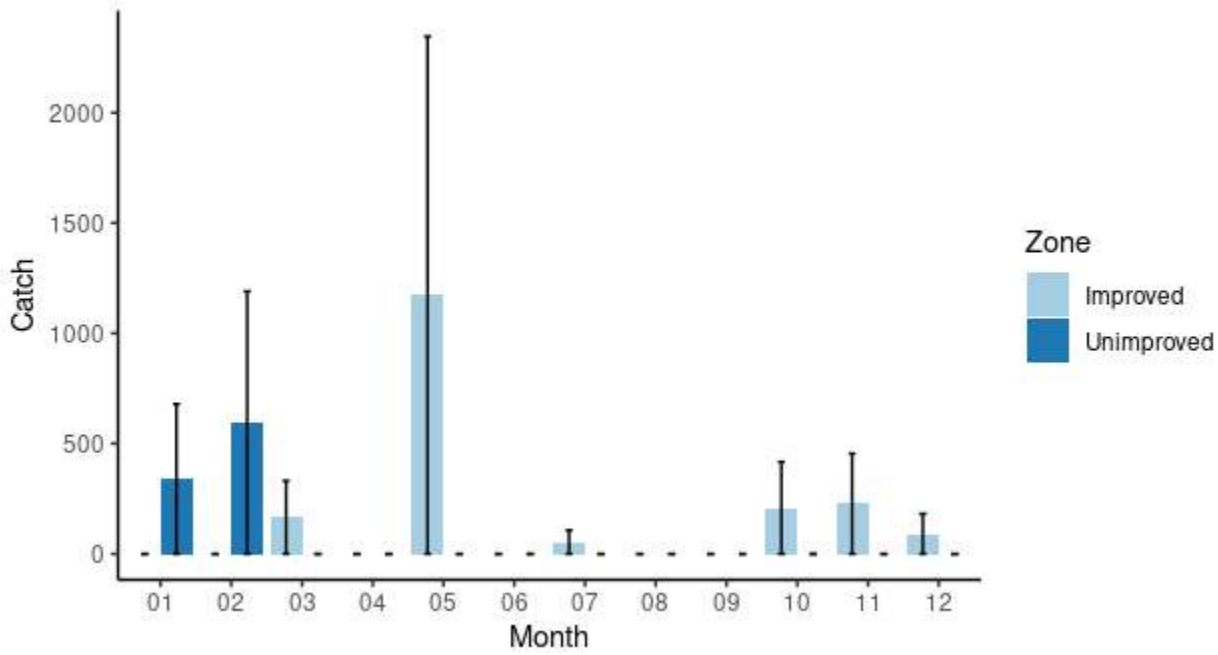

FIGURE C.14. Black Crappie catch (number of fish). Error bars denote standard error.

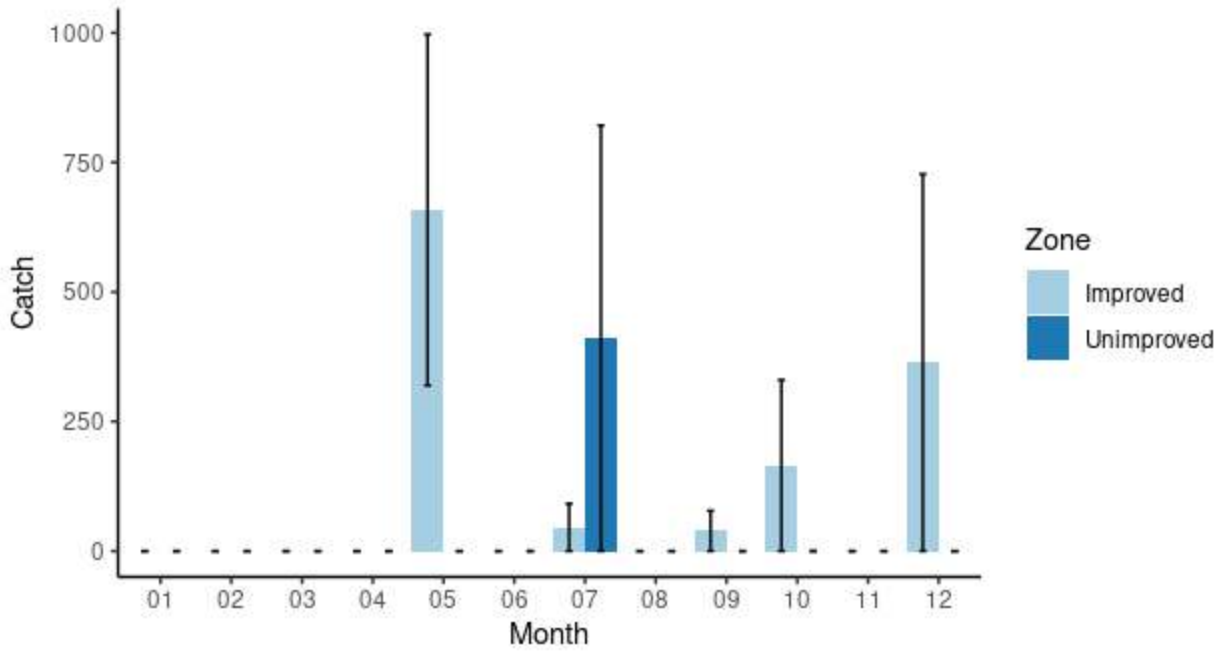

FIGURE C.15. Channel Catfish catch (number of fish). Error bars denote standard error.

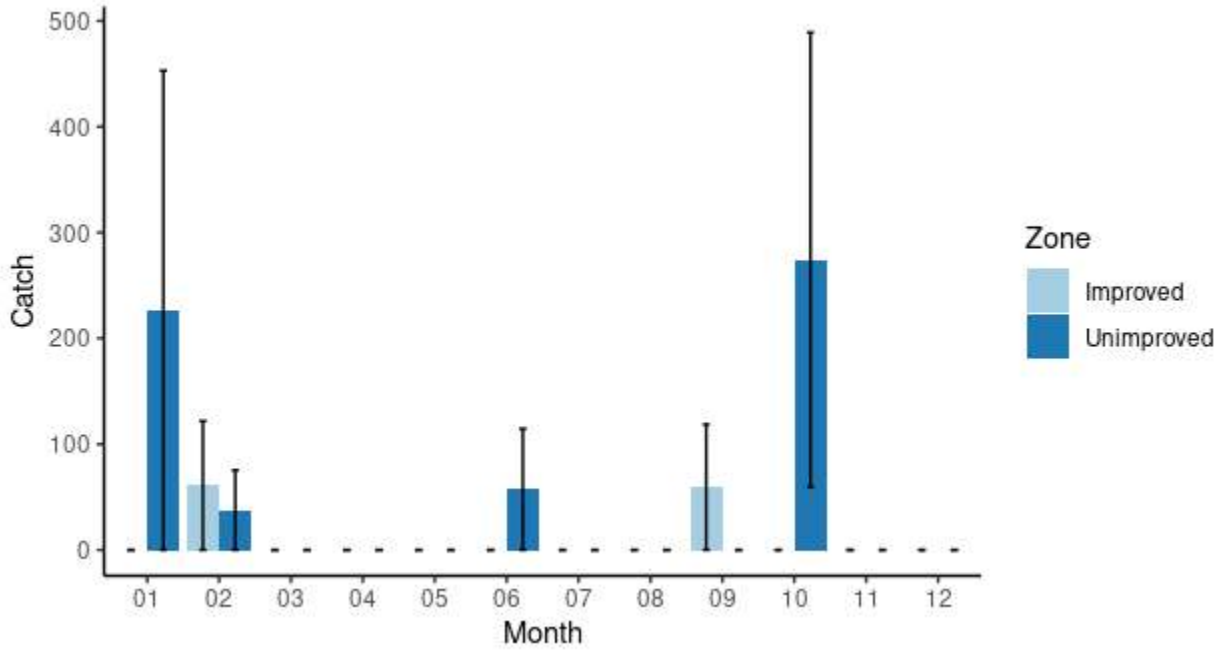

FIGURE C.16. Yellow Perch catch (number of fish). Error bars denote standard error.

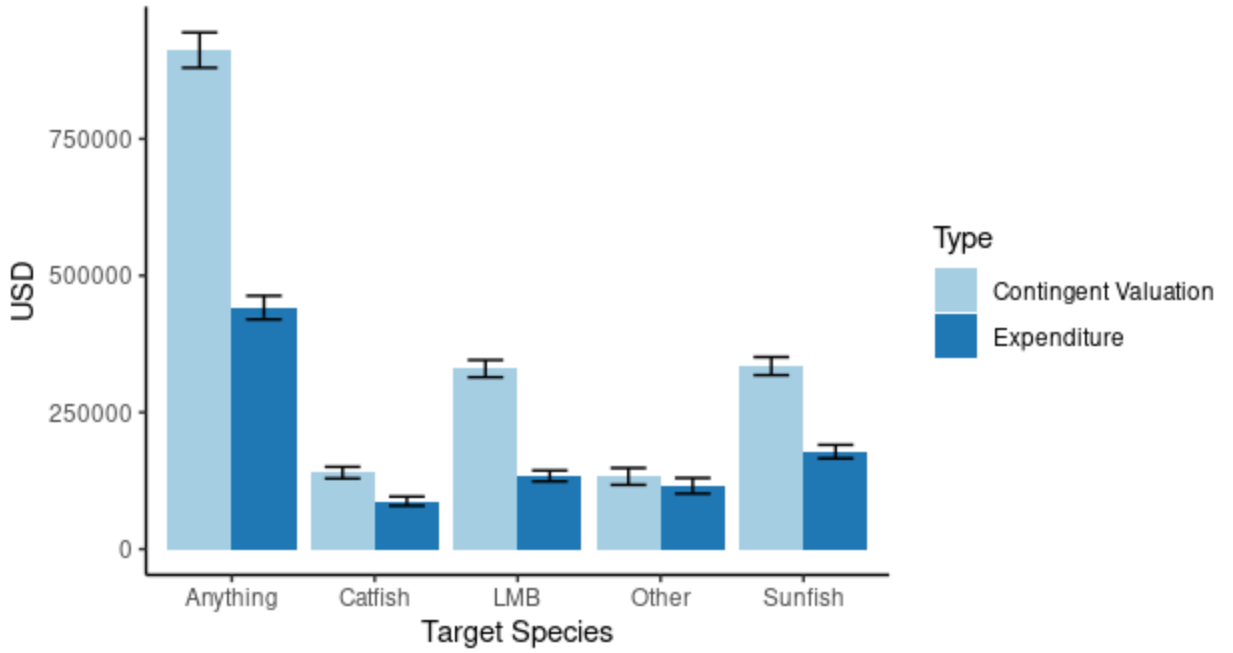

FIGURE C.17. Direct expenditures and contingent valuation by target species. Error bars denote standard error.

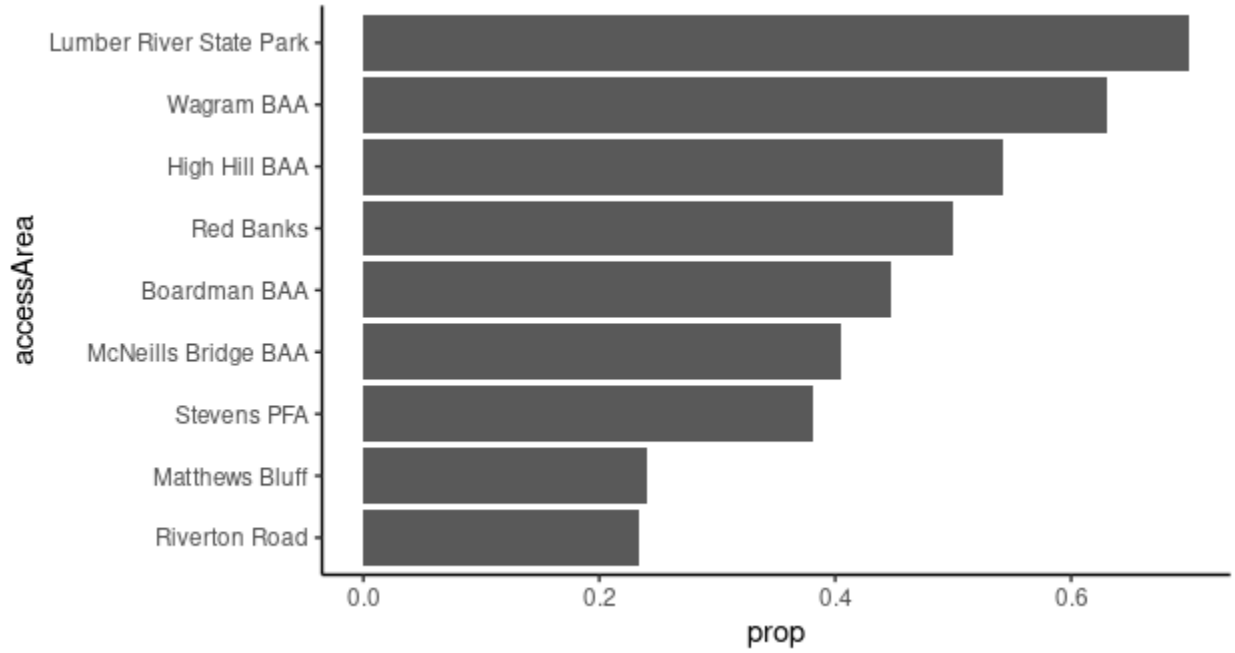

FIGURE C.18. Proportion of total interviews at each access area that indicated “keep everything as is”. Only sites with 20 or more interviews are displayed.

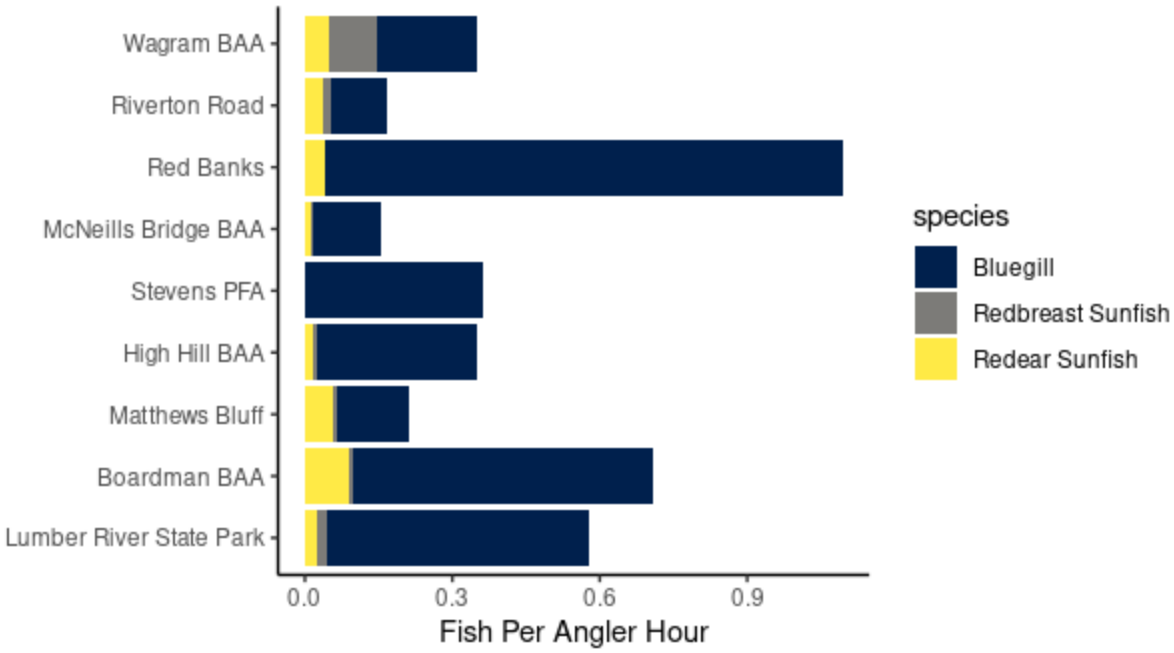

FIGURE C.19. Total sunfish catch per angler-hour by species. Only those sites with 20 or more interviews are displayed.

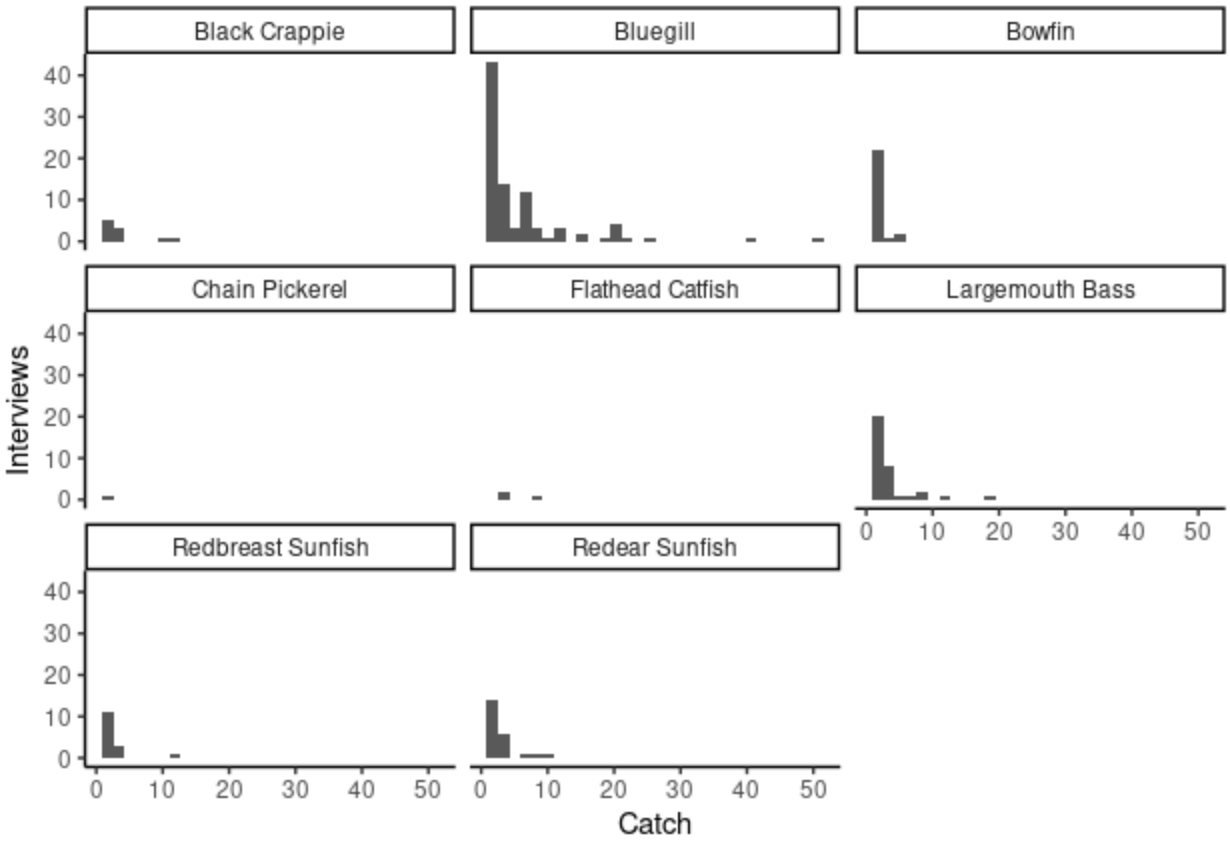

FIGURE C.20. Histogram of number of fish reported caught per interview by species.

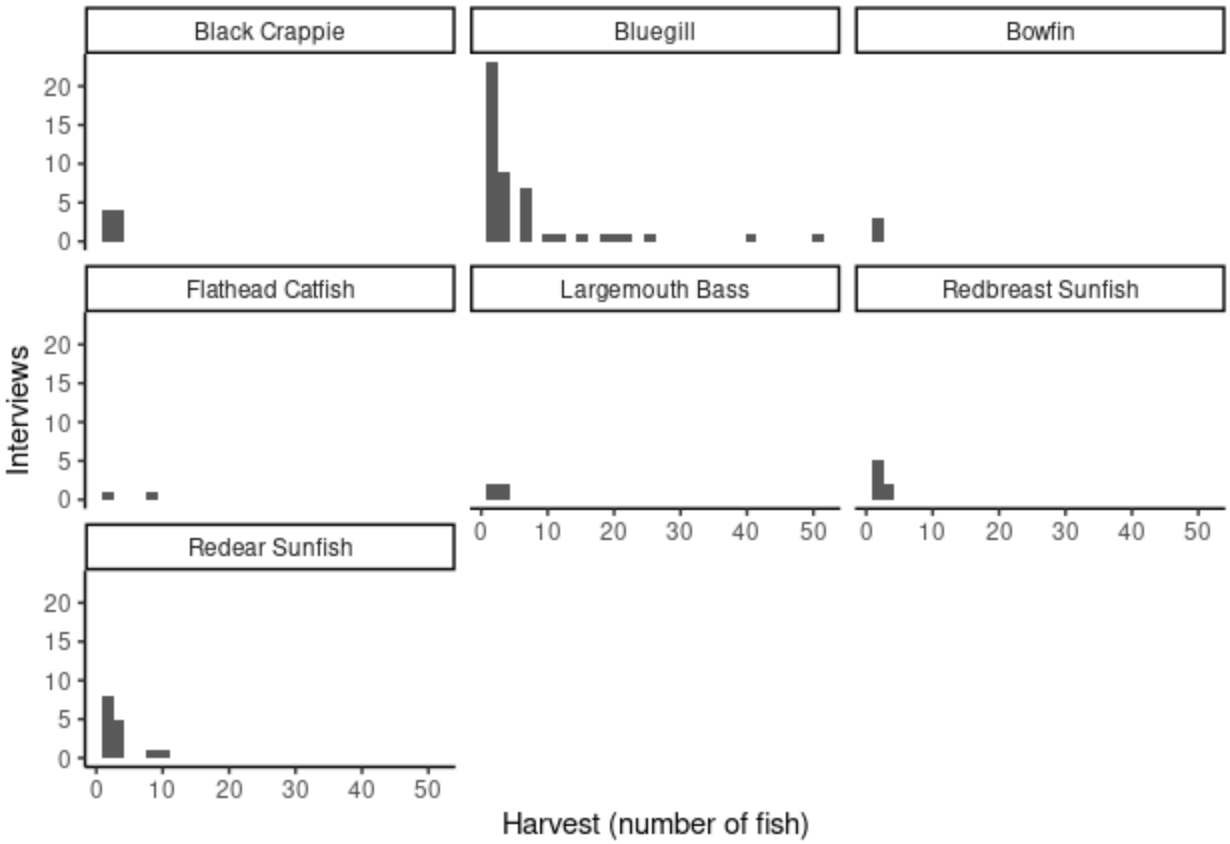

FIGURE C.21. Histogram of number of fish harvested per interview (i.e., creel) by species.

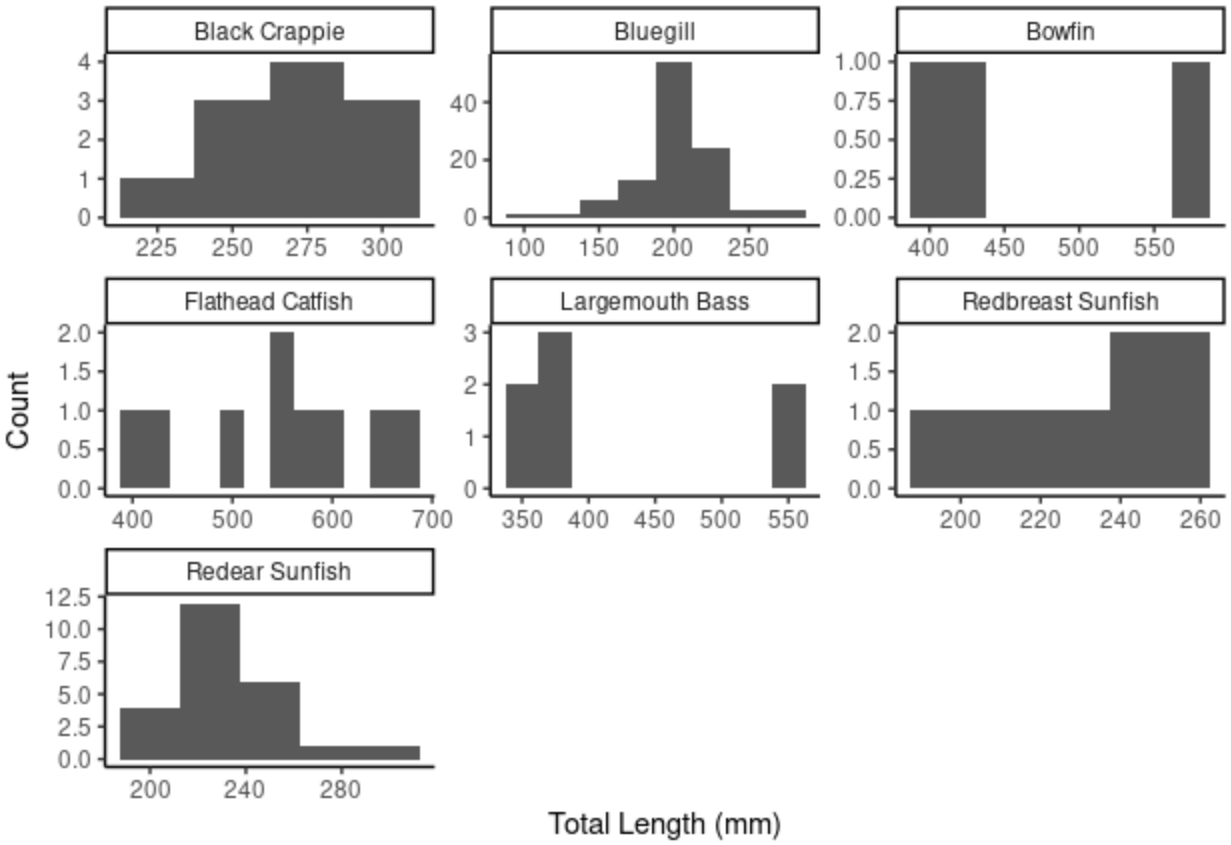

FIGURE C.22. Length distributions of harvested fish.

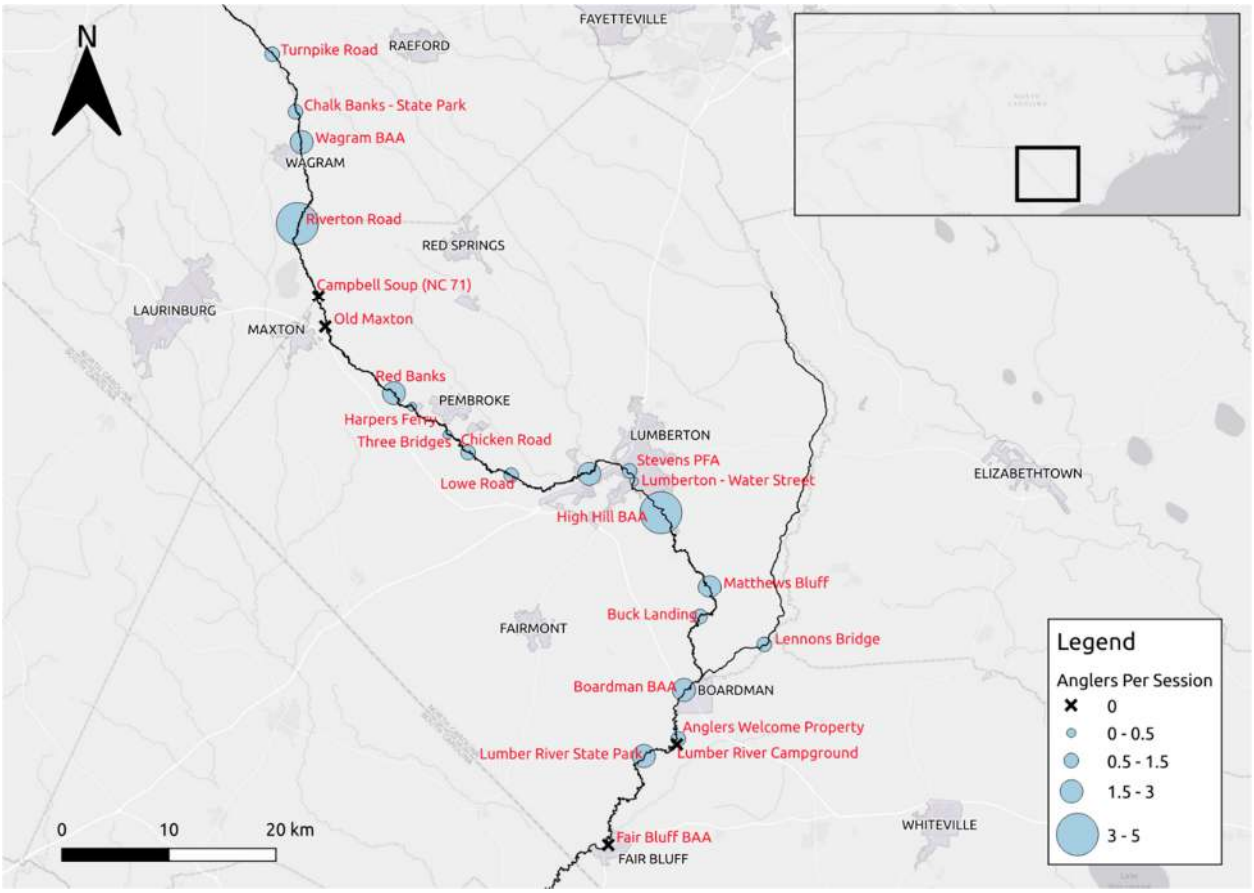

FIGURE C.23. Total number of anglers interviewed divided by number of creel sessions at each access site.