Managing Missouri's Catfish

A Statewide Catfish Management Plan

A report of the Quality Catfish Committee

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Introduction

Catfish represent one of the most important recreational and commercial fish groups in Missouri. In one survey, catfish were the third most popular group of fish among Missouri anglers comprising 16% of total angler effort (Weithman 1991). In another survey of Missouri anglers, catfish ranked second only to black bass in both the number of anglers and days spent fishing (United States Department of Interior 1997). Total pounds of commercially harvested catfish (channel catfish, blue catfish, flathead catfish) from the Mississippi River has been higher than any other fish group every year since 1987 (Missouri Department of Conservation [MDC], unpublished data). Carp and buffalo closely follow catfish in terms of pounds harvested; however, the market value of catfish is 2 to 3 times higher, further elevating the importance of catfish to Missouri's commercial fishing industry.

Historically, large catfish have been taken by anglers in Missouri. The current pole and line record for blue catfish is 103 pounds taken from the Missouri River in 1991. The current pole and line record for flathead catfish is 77 pounds 8 ounces taken from the Missouri River in 1997. This record was equaled in the spring of 2003 at Montrose Lake. The current pole and line record for channel catfish is 34 pounds 10 ounces taken from Lake Jacomo in 1976. Records for fish taken with other methods such as trot line, bank line and jug line are slightly higher for blue catfish (117 pounds from the Osage River in 1964) and flathead catfish (94 pounds from the St. Francis River in 1971) and slightly smaller for channel catfish (29 pounds 14 ounces from a farm pond in Pattonsburg in 1974).

The legacy of large catfish in Missouri goes all the way back to the1800's. Heckman (1950) reports "Of interest to fishermen is the fact that the largest known fish ever caught in the Missouri River was taken just below Portland, Missouri. This fish, caught in 1866, was a blue channel cat and weighed 315 pounds. It provided the biggest sensation of those days all through Chamois and Morrison Bottoms. Another 'fish sensation' was brought in about 1868 when two men, Sholten and New, brought into Hermann, Missouri a blue channel cat that tipped the scales at 242 lb." Heckman cites other evidence that 125-200 pound catfish taken from the Missouri and Mississippi Rivers were fairly common in the 1800's. Other authors and historical accounts report similar large catfish from the late 1800's. Such large catfish are no longer reported from Missouri waters, and fish larger than 70 pounds are uncommon. Consequently, one goal of this plan is to improve fishing for large catfish in specific waters.

Although catfish have been popular among Missouri anglers for decades, some trends suggest that catfish angling is growing in popularity across the United States, especially in midwestern and southern states. Popular outdoor magazines are publishing more articles about catfish fishing. For example, In-Fisherman, Inc., publishes a popular fishing magazine fully devoted to catfish and co-sponsored a recent symposium focused on catfish biology and management (Irwin et al. 1999). Catfish tournaments are also occurring with more regularity. Natural resource agencies and groups have recently conducted surveys to assess catfish angler attitudes, demographics, and desires (Burlingame and Guy 1999; Schramm et al. 1999; Wilde and Ditton 1999; Arterburn et al. 2002). Even though much of the growing popularity of catfish angling can be attributed to popular media, there has also been an increasing recognition among anglers and biologists of the trophy potential of channel catfish, blue catfish, and flathead catfish.

Consequently, some state natural resource agencies are planning or have already taken steps to conserve or enhance exceptionally high quality catfish fisheries.

Intensive management of catfish has mostly been limited to put-grow-take and put-take fisheries in small impoundments, despite the obvious importance of catfish in other water types like rivers and reservoirs (Michaletz and Dillard 1999). Major constraints to catfish management identified by Michaletz and Dillard (1999) include low agency priority/angler interest, inadequate habitat, inadequate sampling methods, and inadequate data. Natural resource agencies and biologists have been reluctant to focus much effort on managing catfish because of the inability to efficiently sample and evaluate catfish populations, and because catfish anglers either have been satisfied with their fishing experiences or less vocal than other types of anglers.

The Small Impoundment Catfish Committee has already addressed management needs for catfish in Missouri's small lakes, and several of their recommendations have been implemented (Eder et al. 1997; Appendix A). The primary focus in small impoundments has been on channel catfish and emphasizes sustained harvest, with limited effort to produce high quality catfish populations. Recognizing that catfish in other water types are extremely important to the Missouri fishing experience, and to complete Missouri's catfish management planning, MDC formed a "Quality Catfish Committee" in 2001. This group of Fisheries, Protection, and Resource Science staff was charged with developing strategies for conserving, creating, or enhancing high quality catfish fisheries in big rivers, reservoirs, and small streams.

The goals of the plan are to:

- Provide a framework for developing a diversity of catfish angling opportunities in Missouri, including select water bodies that are managed for high quality catfish.

- Inform Missouri anglers of existing catfishing opportunities and MDC's efforts to enhance catfish management.

- Engage Missouri catfish anglers in the development and implementation of shared catfish management strategies.

As a means of achieving these goals, our committee:

1) identified waters with the best "big fish" potential
2) determined the desires and expectations of Missouri's catfish anglers
3) recommended strategies for conserving or improving special catfish fisheries

A. Identification of Waters with the Best Big Fish Potential

Identifying waters that have the best potential to produce large or exceptionally high quality catfish was a tenuous task because most, if not all, of Missouri's large reservoirs and rivers, and many medium and small streams are capable of producing or harboring large catfish. Given the limited amount of catfish population data available across the state, we felt the best criteria for

identifying potential waters was simply determining waters that currently or historically produced large catfish. We developed a list of candidate waters by asking regional Fisheries and Protection staff to identify waters within their respective regions that, based on surveys, experiences, or angler contacts, have the best potential for producing large catfish. We also examined catfish "Master Angler Awards" from 1987-2001 and Missouri anglers' responses to Mississippi Interstate Cooperative Resource Association's (MICRA) survey question about waters with the greatest potential for producing trophy catfish (Arterburn et al. 2001). We gave serious consideration to regional Fisheries and Resource Science Division staff interests in participating in future data collection and evaluation before making recommendations for specific waters. Waters will be identified separately under each water type.

B. Characteristics and Desires of Missouri's Catfish Anglers

We examined the attitudes and desires of Missouri's catfish anglers in two ways. MICRA randomly surveyed subscribers to the *Catfish In-sider* magazine who resided in the Mississippi River basin (Arterburn et al. 2001). This survey was biased because it targeted a specialized fishing group who may be more pro-regulation, avid, and trophy-oriented than non-subscribers. Nonetheless, this survey, which reported results by state, was useful in determining attitudes of this component of our catfish angling population. MDC also conducted a catfish angler information survey during 2002. Questionnaires were randomly sent to 15,000 of 664,208 Missouri fishing permit buyers (Appendix B). Of the 5,486 surveys returned, 3,265 (64%) indicated that they fished for catfish during 2001. Our committee is confident that this group adequately reflects the opinions and desires of Missouri's catfish angling public.

MICRA Survey Summary

Three hundred seventy-five subscribers from Missouri responded to the MICRA survey. Anglers 35-44 years old comprised the highest portion of respondents (26%) followed closely by 44-54 year olds (25%). Over half indicated that they had been fishing for catfish for 30 years or more. Nearly all were male (96%).

Half of Missouri's anglers indicated they fished for channel catfish most often, followed by flathead catfish (28%) and blue catfish (16%). Pole and line was clearly the most frequently used gear (75%), followed by trotlines (10%) and limb lines (5%). Over 35% indicated they would travel 100 miles or more to fish for catfish. When asked which water body type they pursue catfish in most often, the responses were similar for large rivers (27%), medium or small rivers (24%), and man-made lakes (22%). Fifteen percent fished in reservoirs most often and 3% usually fished in ponds.

Although most Missouri subscribers did not consider themselves to be a "trophy" catfish angler (63%), nearly 75% were either in favor or strongly in favor of developing trophy catfish fisheries, and most would support more stringent regulations if they increased their chances of harvesting a trophy catfish (61%). Finally, when asked which type of water body they would fish if targeting a trophy catfish, 66% indicated large rivers, followed by medium or small rivers (12%) and reservoirs (10%).

MDC Catfish Angler Information Survey Summary (Appendix B)

The survey was designed to answer four main questions:

1) Who are Missouri's catfish anglers?
2) Where, how, and which species do they like to fish for most?
3) What do they think about catfish fishing in Missouri?
4) What do they think about regulations for managing catfish?

Missouri's catfish anglers are mostly males (79%) between the ages of 36 and 55 years old (51%). They live mostly in rural communities or small towns (73%).

Three-quarters of Missouri's catfish anglers fished mostly for channel catfish, followed by flathead catfish (14%) and blue catfish (9%). More anglers preferred to fish for catfish in large lakes and reservoirs (29%) than in other water body types. Interestingly, the Mississippi River and Missouri River were preferred by only 5% and 6%, respectively, of the respondents. Anglers overwhelmingly used rod and reel to fish for catfish most often (87%). Eight percent used trotlines or throw lines most often while 3% used limb lines and 3% used jugs.

Anglers rated their catfish fishing experiences in Missouri during 2001 as fair (40%), good (33%), poor (18%), or excellent (8%). One-third of the anglers felt that the quality of catfish fishing in Missouri has declined during the last 10 years, while 31% felt that it stayed about the same. Forty percent thought that MDC should spend more effort managing catfish in Missouri, and 40% thought MDC should spend about the same amount of effort managing catfish.

In general, Missouri's catfish anglers were evenly split regarding fishing gear restrictions (44% oppose, 42% favor) but most opposed decreases in creel limits (depending on species 51-58% oppose, 29-33% favor). Most anglers would support being required to distinguish channel catfish from blue catfish (55% favor, 25% oppose). Overall, anglers were about evenly split on support of minimum length limits, but anglers who fished mostly for flathead catfish or blue catfish were more likely to support length limits for these species than anglers who fished mostly for channel catfish.

Regardless of which catfish species they fish for most often, more catfish anglers indicated that they would prefer to catch and keep four 5-pound catfish (49%) than either ten 2-pound catfish (30%), two 10-pound catfish (13%), or one 20-pound catfish (8%). When asked what they considered to be the minimum weight in pounds of a trophy catfish, 10 pounds was the most common response for channel catfish and 20 pounds was most common for both flathead catfish and blue catfish.

C. Statewide

Issues, Problems, Opportunities

Major information gaps about catfish in Missouri and elsewhere hindered our ability to develop sound, biologically-based management strategies, and our current regulations reflect these gaps (Table 1). With few exceptions, little effort has been devoted to assessing catfish populations,

especially in small- or medium-sized rivers and reservoirs. Consequently, data are inadequate for most species in most places. Even in large rivers, where far more effort has been expended, data are sporadic, incomplete, and may not accurately reflect catfish population structure. Therefore, we relied heavily on the opinions and experiences of MDC Fisheries and Protection staff.

Table 1. Current Missouri catfish harvest regulations.

	Daily Limit	Minimum Length Limit
Recreational-Statewide		
channel and blue catfish in the aggregate	10[1]	none[1]
flathead catfish	5[1]	none[1]
Commercial-Missouri River		
channel, blue, and flathead catfish	0	--
Commercial-Mississippi River and St. Francis River		
channel, blue, and flathead catfish	unlimited	15 inches

[1]some exceptions apply

One reason catfish have received comparatively little attention from biologists is the ineffectiveness of most sampling methods. Sampling methods like hoop nets, low-pulse electrofishing, and hook-and-line are most effective, but capture rates are frequently low, or the methods are ineffective at capturing all sizes of fish. For example, hoop nets can be effective at capturing most sizes of adult flathead catfish in large rivers, but capture rates are usually so low that it takes a great amount of effort to obtain adequate sample sizes. Low-pulse electrofishing can return large numbers of flathead catfish and blue catfish, but the method may be biased towards smaller fish. Conclusions based on this sampling method alone may lead to erroneous conclusions about size structure, age structure, and several important population rate functions. Hook and line, at times, is effective at capturing large catfish in all water types, yet return rates are comparatively low, and the method is clearly biased towards larger fish. With the exception of using hoop nets to sample channel catfish in medium-sized streams (Vokoun and Rabeni 2001) and small impoundments (Michaletz and Sullivan 2002), a single, efficient method for accurately assessing catfish populations in most water types has not been fully developed. In addition to population sampling, creel data must also be viewed with caution as most survey designs do not account for night fishing or unmanned gear (trotlines, jugs, limb lines).

Without these types of information, it was not possible for us to completely assess catfish populations. Consequently, it was also difficult to predict population responses to harvest regulations and to develop sound strategies for evaluating population responses. On the other

hand, we also believe that catfish abundance and especially quality in some systems could be declining undetected even in systems where angling success appears to be static or improving. Advancements in electronic technology and angling skill could mask the effects of overfishing and possibly lead to drastic population declines or crashes. In circumstances where we are uncertain about the status of catfish populations, conservative regulations that provide at least a moderate level of protection may be the best management strategy until we are able to determine their necessity.

Catfish anglers place more emphasis on catch and harvest compared to anglers fishing for other species (Wilde & Ditton 1999), but many anglers are not satisfied with the emphasis placed on catfish management (Arterburn et al. 2001), particularly in large lotic systems (Pugh and Schramm 1999). Historically, fisheries managers have managed for the "average" catfish angler through maximum sustained harvest strategies (Schramm et al. 1999). This strategy has not promoted high quality catfishing opportunities and may not optimize maximum growth potential of catfish or desires of anglers who seek these large fish. Even though catfish anglers are most interested in catching fish to eat, the size of fish caught tends to be more important to flathead catfish and blue catfish anglers than channel catfish anglers, and trophy anglers prefer flathead catfish and blue catfish whereas non-trophy anglers prefer channel catfish (Arterburn et al. 2002). Mayhew (1969) indicated that flathead catfish are commonly considered big game from an angling standpoint, and many anglers accept the low productivity often associated with flathead catfishing for the opportunity to catch a few, exceptionally large fish. Results of the MDC catfish angler information survey also indicated that flathead catfish and blue catfish anglers were more likely than channel catfish anglers to support restrictive regulations. Consequently, we believe that our efforts to conserve or enhance high quality catfish fisheries should focus on flathead catfish or blue catfish, and channel catfish should be left for the primary purpose of consumption.

Objectives, Strategies, Evaluation

Objective 1. Improve Missourians' understanding value, importance, and uniqueness of large catfish.

Strategy. Cooperate with Outreach and Education Division in developing educational and promotional materials (ID cards, ID rulers, pamphlets) about catfish, especially species identification. The following media outlets and forums will be utilized in this effort:

- *Missouri Conservationist* magazine
- MDC web sites
- *Missouri Outdoors* television show
- Missouri Fishing Regulations Summary brochure
- Newspaper articles
- Catfish tournaments
- "Town hall" meetings

Objective 2. Maintain or improve the numbers of large blue catfish and flathead catfish.

Strategy. Implement new regulations to restrict harvest of blue catfish statewide while still allowing liberal harvest of channel catfish.

On all state waters except areas with reciprocal state agreements or where special management regulations apply:

Flathead Catfish:	5 daily
Blue Catfish:	5 daily
Channel Catfish:	10 daily

Justification: The blue catfish is a long-lived species that takes many years to reach trophy/quality size. By reducing creel limits, MDC will be emphasizing that large fish are a limited component of the fishery. Unrealized potential remains for these large predators to refill a role they once played within the fish community. Increased encounters with large catfish should also enhance overall angler satisfaction. The statewide catfish survey indicated that the majority of catfish anglers were willing to distinguish between channel catfish and blue catfish for regulation purposes if it led to better fishing. The proposed regulation actually would allow anglers to take five more fish than the current 10 creel limit for blue catfish and channel catfish combined. However, it would restrict harvest of blue catfish to five fish, whereas, currently ten blue catfish can be harvested per day. There may be some waters where more restrictive daily limits for channel catfish or blue catfish or both are warranted; however, these should be addressed on a case-by-case basis.

Evaluation. While it is not likely that widespread formal evaluations of catfish populations will be made, angler attitude surveys could be conducted to determine the response of anglers to the regulation change.

Strategy. Initiate studies to identify habits, habitats, and population characteristics of blue catfish in Missouri.

Justification: Although general life history information about blue catfish is available in published literature, little is known about blue catfish in Missouri, especially in the Mississippi and Missouri rivers. However, blue catfish represent a very important component of both commercial and recreational catfish fisheries. The committee received many comments from anglers during public meetings about the need to more aggressively manage this species (Appendix C). Some anglers believed that blue catfish would be more appropriate for "trophy" fisheries than flathead catfish. We need basic information on seasonal movement and habitat use, abundance, age and growth, and exploitation before developing specific management strategies to optimize fishing for this species.

D. Large Rivers

Issues, Problems, Opportunities

Historically, the Missouri and Mississippi rivers have been important commercial and recreational catfish fisheries (Barnickol and Starrett 1951; Carlander 1954; Fleener 1975, 1989; Fremling et al. 1989; Hesse et al. 1989; Robinson 1993). Weithman and Fleener (1988) found that catfish species (channel, blue, and flathead) were the most popular species among Missouri River recreational anglers, and 70% of angling effort was directed at these species. Robinson (2000) reported that in 1999 catfish accounted for 35% of the total pounds (431,804 pounds) of fish commercially harvested and 57% of the total wholesale commercial value ($128,301) from Missouri's portion of the Mississippi River. These competing interests for catfish on the Missouri River, and a desire to reallocate this resource to recreational anglers, were reasons for banning commercial harvest of catfish on the lower Missouri River in 1992 (Galat et al. 1996). There is no intention to eliminate commercial catfish harvest on the Mississippi River. However, there are strategies to reallocate a portion of the catfish population to recreational anglers while still allowing, and possibly enhancing, commercial fishing for catfish on the Mississippi River. Success of these strategies will require reciprocity with neighboring states. In a recent survey, both anglers and biologists from the Mississippi River basin (Arterburn et al. 2001) agreed that trophy catfish, in particular blue catfish and flathead catfish, are important angling resources worthy of more intensive management, and the survey also indicated that both the Missouri and Mississippi rivers were likely water bodies that could produce trophy blue catfish and flathead catfish. Thus, we suggest several strategies to enhance these opportunities on both the Missouri and Mississippi rivers for blue catfish and flathead catfish.

Potential High-Quality Management Waters

Missouri and Mississippi rivers

Objectives, Strategies, Evaluation

Objective 1. Increase abundance of flathead catfish greater than 30" long in a designated reach of the Missouri River.

Strategy. Establish a Special Management Area on the Missouri River from Glasgow to Jefferson City (80 miles) and implement a regulation that allows anglers to harvest one flathead catfish less than 30 inches long and one flathead catfish 30 inches or longer daily.

> *Justification:* A Beverton-Holt dynamic pool model (Ricker 1975) was used with the Fishery Analysis and Simulation Tools (FAST) modeling software (Slipke and Maceina 2000) to evaluate and compare several size and creel limits for flathead catfish in the Missouri River. We compared minimum length limits, slot length limits, and reduced creel limits for fish over a certain size. Modeling indicated that growth overfishing was occurring for flathead catfish in the Missouri River (i.e., most fish were being harvested before reaching their growth potential). Input at public meetings indicated a strong desire to harvest some flathead catfish less than 30 inches long. The above recommendation provides the opportunity for anglers to harvest one flathead catfish less than 30" inches long daily while providing a substantial increase in the number of memorable size fish (≥34"). This regulation is also simple to understand and remember.

The Glasgow to Jefferson City designated reach was selected based on the following criteria:

- Entirely within the confines of the State of Missouri to eliminate coordination with other states
- At least 50 miles long and without a major tributary to reduce effects of movement into or out of the reach (V. Travnichek and J. Vokoun, unpublished data)
- Easily recognized boundaries

Evaluation. Monitor relative abundance, size structure, growth rates, and catch (via creel surveys) of flathead catfish prior to and after implementation of this regulation. Control reaches upstream or downstream or both of the Special Management Area will be monitored as well.

Objective 2. Increase yield of catfish on the Mississippi River to recreational and commercial fishers.

Strategy. Gather catfish harvest and size information from 4 to 6 commercial fishers for a minimum of two years. This information will then be used in a yield model to evaluate the effects of various commercial harvest regulations. A regulation that provides the best combination of increased commercial yield and increased recreational opportunity should then be implemented. Large increases in minimum length limits, if appropriate, should be implemented in stages to lessen immediate impacts to commercial fishers. *Any proposed regulation change should only be implemented if states bordering Missouri along the Mississippi River adopt the regulation as well.* Currently, Illinois' commercial harvest regulations include a 15-inch minimum length limit for channel catfish, blue catfish, and flathead catfish.

Justification: Catfish are the most sought after commercial fish species from the Mississippi River because of their high market value. Catfish account for about 150,000 pounds or 35% of the total annual commercial harvest from the Mississippi River in Missouri (Robinson 2000). However, catfish are also an important component of the recreational fish harvest from the Mississippi River (Fleener 1975), and thus, both user groups compete for the same resources. This competing interest and the desire to reallocate catfish resources to more users (i.e., recreational anglers) was one reason for the closure of commercial harvest of catfish from the Missouri River in 1992 (Galat et al. 1996). However, an adjustment in the commercial length limit will likely benefit both commercial and recreational fishers by increasing commercial yield (total pounds harvested) while reallocating a portion of the catfish resources to recreational anglers. Slipke et al. (2002) recently showed that recruitment overfishing (i.e., spawning adults reduced to a point where sufficient progeny are not produced to sustain the population) occurred prior to increasing the commercial fishing size limit on channel catfish from 13 inches to 15 inches on the Mississippi River in Iowa (also see Pitlo 1997). While problems associated with recruitment overfishing are reduced with a 15-inch minimum length limit on commercial harvest of catfish, growth overfishing is likely still a problem, particularly for blue catfish and flathead catfish. Thus, by increasing the commercial minimum size limit on these species, overall commercial yield will likely increase, and thus, an increase in profits to commercial fishermen. However, numbers

harvested commercially will be reduced, and some portion of blue catfish and flathead catfish smaller than the minimum size limit will ultimately be reallocated to recreational anglers. The MDC survey indicated that about half of catfish anglers would prefer catching four 5-pound catfish (Appendix B), so any proposed management scenario should strive to provide this opportunity on the Mississippi River.

Evaluation. Monitor relative abundance, size structure, growth rates, and recreational catch (via creel surveys) of blue catfish and flathead catfish in the Mississippi River prior to and after implementation of any regulation change. In addition, continue monitoring commercial harvest of catfish from the Mississippi River through standard reporting procedures, and gather catfish harvest and size data from 4 to 6 individual commercial fishermen beginning at least two years before and at least ten years after any regulation change.

Objective 3. Continue to refine existing standardized sampling techniques that provide a more representative sample of flathead catfish and blue catfish populations in large rivers.

Strategy. Compare existing methods or develop new methods to sample flathead catfish and blue catfish in large rivers.

Evaluation. Once sampling techniques are refined they should be tested in several regions of the state to ensure they are applicable in both the Missouri and Mississippi rivers as well as pooled and open river segments of the Mississippi River.

Objective 4. Develop creel survey methods that will accurately measure angler effort and harvest of catfish populations in large rivers.

Strategy. Work with biometrics staff to develop techniques for estimating creel statistics in large rivers where much of the angling effort is exerted via unmanned gear types.

Evaluation. Once creel techniques are developed they should be tested in a river reach where a known amount of experimental angler effort is being exerted.

E. Reservoirs

Issues, Problems, Opportunities

Catfishes are popular sport fishes in Missouri's large reservoirs, ranking third in effort expended by anglers (Weithman 1991). Channel catfish inhabit all 17 large reservoirs, whereas, flathead catfish and blue catfish are in fifteen and nine reservoirs, respectively. Recently, catfish anglers and resource managers have expressed concern about perceived declines in the quality of blue catfish and flathead catfish fisheries in some reservoirs. However, population assessments or creel surveys have not been conducted to confirm population changes. Little is known about Missouri's reservoir catfish populations because effective sampling methods have not been developed. Hence, catfish populations in most large reservoirs are not routinely sampled. Catfish angler effort and harvest have been difficult to measure because catfish anglers commonly use fishing methods that do not require constant attendance. It is unlikely that these

anglers will be contacted during standard roving reservoir creel surveys. Blue catfish and channel catfish populations and their fisheries in the Truman Lake tailwater have been intensively studied (Graham and DeiSanti 1999), and sampling methods were evaluated (Gale et al. 1999), but findings of these studies are not broadly applicable to reservoir populations. Accurate catfish population and angler harvest assessments are essential for the purposes of understanding and managing catfish populations in large reservoirs.

Because blue catfish and flathead catfish reach large sizes in reservoirs, there may be opportunities for high quality management of these species. Currently, the only special regulations that protect large catfish in large reservoirs occur in the Truman Lake tailwater. However, restrictive regulations could be used in several reservoirs to protect and enhance numbers of large catfishes. Truman Lake was identified by both anglers and biologists as one of the "top ten" places to catch a trophy catfish in the Mississippi River basin (Arterburn et al. 2002).

The subject of set lines not being regularly attended was a common theme at the six public meetings we conducted to unveil this catfish plan. Anglers repeatedly voiced their frustration over the high number of set lines not attended at least every 24 hours in Missouri waters, and especially in large reservoirs. Unattended set lines not only pose an inconvenience to anglers and boaters, they also damage the resource when fish are hooked, but never removed from the lines.

Potential High-Quality Management Waters

Truman Lake, Lake of the Ozarks, Montrose Lake, Smithville Lake

Objectives, Strategies, Evaluation

Objective 1. Develop standardized sampling techniques for sampling numbers and sizes of channel catfish, blue catfish, and flathead catfish in proportion to their relative abundance.

Strategy. Compare existing methods or develop new methods to sample catfishes in large reservoirs. A comprehensive study is being conducted on Truman Lake to satisfy this strategy.

Evaluation. After sampling techniques are developed they will be tested in several reservoirs to determine if they are widely applicable.

Objective 2. Develop catfish creel survey methods that accurately measure catfish angler effort and harvest.

Strategy. Work with biometrics staff to develop techniques for estimating creel statistics in reservoirs where much of the angling is exerted via unmanned gears.

Evaluation. Potential creel techniques can be tested in a portion of a reservoir where a known amount of experimental angler effort is being exerted.

Objective 3. Maintain or improve the numbers of large blue catfish and flathead catfish in Lake of the Ozarks, Montrose, Smithville, and Truman lakes.

Strategy. Implement new regulations, based on the information gathered by Objectives 1 and 2, that protect large catfishes in these waters. Other reservoirs may be added as sufficient information is gathered.

> *Justification:* Blue catfish and flathead catfish are long lived and it may take many years to reach quality or trophy size. Thus, individuals can be easily harvested by anglers before reaching a large size. Fisheries biologists and local conservation agents have observed an increase in catfish fishing pressure and anglers are complaining that the number of large catfish has declined. By reducing the harvest of flathead and blue catfish, the number of large catfish may increase, thus improving the quality of these fisheries. A regulation that allows anglers to continue to harvest small catfish, with the opportunity to harvest the occasional large catfish may maintain a quality fishery. Restricting the daily harvest of large catfish may also distribute these fish among more anglers. Tributaries will be included in any regulation changes to simplify enforcement and to ensure adequate protection of catfishes that may make seasonal movements into tributaries. The one catfish 24 inches and larger regulation (4 daily in the aggregate) that is currently in effect below Truman Dam has been readily accepted by anglers and a number of anglers have asked for a similar fishing regulation on Lake of the Ozarks and Truman Lake.

Evaluation. The effectiveness of the new regulations will be determined by monitoring blue catfish and flathead catfish populations after sampling and creel methods are developed in objectives 1 and 2.

Objective 4. Increase angler compliance with set line regulations in reservoirs.

Strategy. Cooperate with Outreach and Education Division in developing pamphlets and/or bulletin board signs that highlight the growing problem of abandoned or unattended set lines, and the importance of checking or removing set lines every 24 hours.

Strategy. Write a feature article for the *Missouri Conservationist* magazine or produce a segment for *Missouri Outdoors* that highlights the growing problem of unattended set lines in reservoirs.

Strategy. Work with local MDC District Conservation Teams and volunteers to conduct periodic set line clean up days in high use areas.

Strategy. Increase MDC Conservation Agent group patrols in high use areas.

F. Other Streams

Issues, Problems, Opportunities

Catfish provide important angling opportunities in Missouri streams. More anglers fishing in streams sought catfish species than any other group of fishes (Weithman 1991). Both channel catfish and flathead catfish are very common in streams, but managing these species has been difficult because little is known about their populations, movements, and the effects of angler exploitation. Obtaining a representative sample from these populations has proven difficult. However, a recent study by Vokoun and Rabeni (2001) provides a method to assess channel catfish populations in streams. This method requires 11-20 repetitions of 15, 24-hour hoop net sets (165-360 hoop net days), depending on the desired precision. A suitable sampling method for flathead catfish is still lacking.

Flathead catfish provide the best opportunity for a high quality fishery. Flathead catfish grow more rapidly than channel catfish in streams (Turner 1990) and attain much larger sizes. Channel catfish populations in streams are usually dominated by slow-growing individuals less than 15 inches long with few greater than 24 inches (Congdon 1971; Hickman 1975; Turner 1990). In contrast, flathead catfish populations can be dominated by much larger individuals. For example, a 22-mile reach of the South Grand River contained a flathead catfish population with a relative stock density of 24 inches of 86% (M. Bayless, unpublished data). This population may have been unique because angler access to this reach was restricted by a log jam. However, it demonstrates that growth rates of flathead catfish were sufficient to produce large fish where angling pressure was not high.

Recent evidence suggests that flathead catfish populations may experience high angler exploitation in the lower Grand River and an adjoining section of the Missouri River (J. Vokoun, personal communication). In 2001, 37 flathead catfish longer than 20 inches were implanted with radio transmitters. Within one year, 12 of these fish were harvested and two were caught and released. The anglers who released the fish indicated that if it were not for the implanted transmitters, they would have harvested the fish. These observations show that exploitation of large flathead catfish can be high in streams. However, measuring exploitation of stream catfish populations is difficult because of the variety of unmanned gears used, and because streams are open systems.

One obstacle to developing a high-quality fishery for flathead catfish in streams is the uncertainty of fish movements. While some studies have reported that flathead catfish are rather sedentary (see Jackson 1999), recent telemetry studies have documented large-scale movements in spring and fall in the Grand River (J. Vokoun, personal communication). Fish that occupied the Grand River during the summer overwintered in the lower portion of the Grand River and in the Missouri River. These large-scale movements could reduce the effectiveness of restrictive regulations in small reaches of a stream because fish could move out of the protected reach and be harvested. Hence, restrictive regulations may have to be applied to an entire watershed or even larger geographic area in order to be effective.

Potential High-Quality Management Waters

Grand River, Lamine River, Platte River, Marmaton River, South Grand River

Objectives, Strategies, Evaluation

Objective 1. Compile existing information on flathead catfish and channel catfish populations in Missouri streams.

Strategy. Solicit and compile information on stream catfish populations and summarize this information in a written document.

Objective 2. Develop sampling methods that provide a representative sample of flathead catfish populations in streams.

Strategy. Compare existing methods or develop new methods to sample flathead catfish in streams.

Evaluation. After sampling techniques are developed they should be tested in a several streams to determine if they are widely applicable.

Objective 3. Develop creel survey methods that will accurately measure angler effort and harvest of catfish populations in streams.

Strategy. Work with biometrics staff to develop techniques for estimating creel statistics in streams where much of the angling effort is exerted via unmanned gear types.

Evaluation. After creel techniques are developed they will be tested in a river reach where a known amount of experimental angler effort is being exerted.

Objective 4. Determine seasonal movement patterns of flathead catfish in several streams.

Strategy. Initiate telemetry studies to document movements of flathead catfish.

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REPORT OF THE SMALL PUBLIC IMPOUNDMENT CATFISH COMMITTEE

JANUARY 1997

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INTRODUCTION

Currently, Missouri's small public impoundment resource consists of 253 small lakes comprising 21,615 acres, 466 ponds comprising 1,316 acres, and 36 urban lakes comprising 133 acres. Most small public lakes are stocked with channel catfish annually. There is no standardized

supplemental catfish stocking rate for public lakes because of the variability in fertility, turbidity, fishing pressure, species composition and management objectives (Eder and McDannold 1987). Most of the ponds received initial stockings of channel catfish and some receive supplemental stockings on a periodic basis. The urban fishing program lakes are stocked from April through September with either channel catfish or bullheads. St. Louis lakes are stocked twice a month; Kansas City lakes are stocked monthly except for July and August.

Catfish are the second most popular group of fish in Missouri's small public impoundments comprising 21% of total angler effort (Weithman 1991). This percent of total effort is similar to other small public impoundments in Kentucky (7-22%; Rold 1995) and Ohio (6-25%; Marshall and Bright 1993). Almost all Missouri impoundments are open to fishing day and night throughout the entire year. In Missouri, daytime angler effort for catfish has comprised as high as 59% of total effort in some multi-species fisheries and as high as 95% in intensively managed catfish lakes on urban conservation areas. In addition, a significant amount of catfishing can occur at night (Eder and McDannold 1987). Despite their popularity in small impoundments, streams and some large reservoirs, catfish have only recently drawn the attention of a nationwide organized fishing group, the National Catfishing Association headquartered in Chapel Hill, North Carolina.

The demand for establishing and maintaining catfish fisheries grew correspondingly with the construction of Department of Conservation-owned lakes which began in 1948. Demand accelerated when the Community Assistance Program (CAP) was initiated in 1981. Presently, cooperative CAP agreements are in effect with 62 municipalities, counties and other governing entities involving the management of 107 small impoundments. When the annual supplemental channel catfish stocking program began in 1963, 22,172 fish were stocked. In 1995, MDC Hatcheries Section produced 189,524, six to fourteen-inch channel catfish at an approximate cost of $95,000 for the put-grow-take fisheries. According to the FY95 Federal Aid Public Lake Management Report, approximately 31% of annual warmwater hatchery costs for put-grow-take fisheries were attributed to catfish (channel, blue and flathead) production. In 1995, approximately 85,670 catchable-size channel catfish and 69,600 bullheads were purchased from commercial sources at a cost of $99,109 and $25,496, respectively, (primarily from out-of-state suppliers) for the urban put-and-take lakes.

Eder and McDannold (1987) found that the benefits:costs ratio was relatively high (40:1) at Pony Express Lake, a very popular channel catfish fishery, in comparison to ratios (2-10:1) reported by other states. Some small public impoundments (Blind Pony, Limpp, Worth Co. Busch Area, Reed Area) support catfishing effort comparable to Pony Express (0 = 133 hours/acre). Catfishing effort exceeds 1,400 hours per acre in some St. Louis urban fishing program lakes.

Despite significant angler interest in catfish and large hatchery commitments required to sustain these popular fisheries, Fisheries Division does not have clear objectives for managing this statewide resource. Therefore, all catfish fisheries are managed individually at the discretion of district biologists.

The Small Public Impoundment Catfish Committee was formed in 1995 and charged with thoroughly examining the program and providing recommendations to guide Fisheries Division policy and future management efforts. The goal of the program is to provide diverse, satisfying

catfish angling opportunities in small public impoundments statewide. Four major management strategies were identified as means to attain the goal: put-and-take, put-grow-take, specialty, and prey control. Each of these will be discussed in greater detail below:

PUT-AND-TAKE FISHERIES

Issues, Problems, and Opportunities

Put-and-take catfish fisheries are generally associated with the urban fishing program. The urban fishing program began in St. Louis in 1969 with the objective of providing an outdoor recreational fishing experience for urban dwellers in the inner city (Ikeda 1971). The program was expanded to Kansas City in 1978, St. Joseph in 1981, and to Sedalia and suburban St. Louis in 1983 (Haas 1983). More mobile metropolitan residents also have the opportunity to partake of put-and-take fisheries on the Busch and Reed Conservation Areas located outside of the inner cities of St. Louis and Kansas City, respectively.

No guidelines exist for expanding the urban fishing program to other cities. Expansion of the urban fishing program from the metropolitan areas of St. Louis and Kansas City to the smaller cities of St. Joseph and Sedalia created questions concerning eligibility requirements. The absence of put-and-take fisheries in the five cities larger than Sedalia could be construed as discriminatory if population were the governing factor. If limited public impoundment fishing opportunities is a key factor, Sedalia's inclusion in the urban fishing program is well justified. Regardless, if more cities were added to the program, a significant demand would be placed on the Division to produce or obtain fish to support the new fisheries. Increasing the demand for fish would only exacerbate the current chronic problems (dead, diseased, undersized and oversized fish, poor compliance with delivery dates and loading instructions, limited number of bidders) associated with obtaining channel catfish and bullheads from commercial producers under state purchasing contracts.

There is no established formula for computing stocking rates for the urban put-and-take lakes. Presently, annual average catfish stocking rates vary from 767 to 1,560 pounds per acre. Fishing pressure is intense at these lakes, averaging 2,000 to 3,000 hours/acre/year, making it difficult to maintain standing stocks at levels high enough to ensure satisfactory angler success ratings (Jeffries 1980; Meneau 1995). Miko et al. (1995) described the difficulties of producing acceptable angler catch rates in the face of intense angling pressure for rainbow trout in urban put-and-take fisheries in Texas. They found that angler catch rates were positively correlated to stocking rates; but the proportion of stocked fish caught, angler fishing success rating and angler trip satisfaction rating did not differ among stocking treatments. Stocking costs would have been exorbitant to provide enough fish to raise the fishing success to a Agood@ rating. We have documented a similar relationship for catfish fisheries in St. Louis and Kansas City. Most anglers in a 1979 survey at Kansas City put-and-take lakes rated their fishing success as poor. However, almost all Kansas City anglers rated trip enjoyment as excellent. A similar relationship between fishing quality and trip quality was documented at St. Louis lakes (Alcorn 1981). In our most recent survey (1990-91), most St. Louis anglers (54%) rated their fishing quality poor; trip enjoyment was not measured. Some anglers may intentionally provide an unsatisfactory response about their catch in hopes of generating more frequent stockings. Knowing that anglers have satisfying trips despite poor fishing success (Weithman and Katti

1979), our greatest challenge might be identifying the minimum threshold in stocking rates necessary for maintaining excellent trip satisfaction at our put-and- take fisheries.

Recommendations

* Adopt the following guidelines for creating additional fishing opportunities using the put-and-take strategy:

  Criteria

  Statewide application

  Cooperative agreement required (CAP, CAPP or Memorandum of Understanding).

  Fishery with a record of unsustainability.

  Impoundment can not exceed 10 surface acres.

  Annual mean stocking rate not to exceed 1,000 lbs/acre (for total surface acres of all lakes in the agreement designated as put-and-take fisheries).

  Considerations

  Proximity to other existing or proposed small public impoundments.

  Population density as it relates to providing potential fishing opportunities.

  Per capita income of the community.

  Age composition of the community.

  Racial composition of the community (for metropolitan areas).

  Proximity to mass transit routes (for metropolitan areas).

  Potential for chemical contamination problems.

  Current and projected costs to supply catchable-size fish.

  Adequate personnel available to support the program.

  Capability of impoundment to serve disabled anglers.

  Capability of enforcing prescribed regulations.

* Improve the quality of fish used in the urban fishing program by one or more of the following:

Raising the fish in our hatchery system.

Arranging for multiple-year state contracts.

Advising the Missouri Aquaculture Association and the Missouri Aquaculture Advisory Council to encourage bidding from instate producers.

* Establish 12 to 16 inches as the preferred size range for channel catfish stockings. Twelve inches is considered a minimum acceptable size, and an upper size range is necessary to avoid loads from commercial dealers dominated by a few large fish.

* Establish a minimum acceptable size of ∃8 inches for bullhead stockings.

* By FY2002, determine minimum stocking rates necessary for maintaining angler interest.

PUT-GROW-TAKE FISHERIES

Issues, Problems, and Opportunities

There are no established criteria (e.g. minimum impoundment size) for classifying an impoundment as a put-grow-take channel catfish fishery. Nearly all lakes that support largemouth bass and bluegill are stocked with channel catfish. Currently, no standardized supplemental stocking rates exist for public impoundments.

Hatcheries Section has consistently met the demand for providing channel catfish for supplemental stocking of put-grow-take fisheries. However, based on expansion projections in the Division's Public Lakes Acquisition and Development Plan (Ryck 1991), demand for channel catfish fingerlings could increase by approximately 17% over the next 10 to 15 years with the potential of adding 20 CAP lakes (1,731 acres) and 9 MDC lakes (approximately 600 acres).

Some years, overproduction and mid-year cancellations have resulted in a surplus of channel catfish fingerlings. Disposal of surplus fish is handled by the Assistant Chiefs of Hatcheries and Fisheries Management by notification through the chain of command. Surplus fish are often stocked in oxbow lakes or large reservoirs.

Cost effectiveness has not been considered when delivering catfish to ponds located on conservation areas that are somewhat removed from normal delivery routes. Hatchery personnel have encountered problems with locating and delivering fish to ponds on conservation areas lacking all-weather road access.

Previous studies have determined that stocked channel catfish should exceed eight inches to minimize bass predation (Krummrich and Heidinger 1973; Spinelli et al. 1985; Storck and Newman 1988). Fish stocked in our put-grow-take lakes have a wide length range (5 to 14 inches); however, over 80% exceed eight inches with mean lengths ranging from 9 to 10 inches.

Chesapeake Hatchery provides this size of fish within one growing season from early spawned catfish while the Paho Rearing Station requires two growing seasons.

Although one would expect different channel catfish stocking rates based on lake trophic status, an examination of current stocking rates indicated that mean rates were identical (Table 1). However, in general, stocking rates have decreased over the last 20 years as managers have attempted to improve channel catfish growth rates and size structure. Routine annual stocking rates of 30 to 50 fish per acre in the 1960s and 1970s have dropped to about 10 to 20 fish per acre in the 1980s and 1990s. Hanson (1986) confirmed that this monitoring and adjusting approach was effective for establishing appropriate stocking rates at the three lakes (Blind Pony, Little Dixie, and Pony Express) in his study. Direct competition between channel catfish and other sport species has not been documented in Missouri's small public impoundments. However, Mitzner (1990) found competition for food between channel catfish and bluegill in an Iowa lake where benthic biomass was extremely low (9 lb/acre).

Table 1. A comparison of 1992 mean annual stocking rates of channel catfish by productivity classification for small public lakes in Missouri. (Productivity ratings based upon summer 1992 data from Dr. Jack Jones, University of Missouri).

PRODUCTIVITY CLASSIFICATION	NUMBER OF LAKES	MEAN NUMBER OF CATFISH STOCKED PER ACRE	RANGE IN ANNUAL STOCKING RATES (FISH/ACRE)
Oligotrophic	7	13.7	5 - 30
Mesotrophic	10	13.7	3 - 29
Eutrophic	31	13.6	4 - 39
Hypereutrophic	7	13.7	3 -25

Natural recruitment of channel catfish occurs but is negligible in most small impoundments we manage because of largemouth bass predation. Depending on the relative abundance of natural recruits, supplemental stocking is maintained, reduced or terminated.

Biologists evaluate their management impacts using a variety of parameters (e.g. mean length at age, incremental growth, relative abundance-CPUE, PSD/RSD, angler catch rate, average length harvested). Individual lake objectives are quite variable not only among Management districts but also among biologists within a district.

Only a small percentage of lakes we manage are routinely sampled for catfish. At most medium and high priority small impoundments, catfish populations are sampled less frequently (every third or fourth year) than other important sport fish (annually or biennially). Catfish collections are made primarily during summer months with standardized experimental (monofilament or multifilament) gill nets; a few managers use single mesh gill nets. Mitzner (1990) found fall gillnetting with experimental, multifilament, 1.0 and 1.5-inch mesh nets to be the most effective

impoundment sampling method for channel catfish compared to fyke netting and electrofishing. An intensive study of gillnetting as a sampling method for channel catfish and blue catfish was conducted at Little Dixie Lake in 1985 and 1986, but the results have not been analyzed.

In comparison to centrarchids, personnel time expenditures are relatively high for capturing catfish. For example, 100 bass and bluegill are often caught during one hour of electrofishing by a two-person crew. Total trip effort, assuming two hours of driving time, would consist of about 8 work hours. Obtaining a similar sample size of channel catfish might require more than 10 gillnet-nights of effort from a two-person crew, totaling more than 34 work hours.

Mortalities of target and non-target species occur even when nets are set properly and run frequently. Because of increased chances of netting mortality, managers have been hesitant to conduct mark and recapture studies of adult fish.

Determinations of adequate sample size and sampling frequency are subjective at best under current statewide small impoundment sampling guidelines. Miranda (1993) determined that a sample size of 96 fish would be needed to estimate the PSD of a population with a confidence interval of ∀10% at a significance level of 0.05. Gustafson (1988) concluded that a sample size of 120 fish would be needed if the estimated PSD was between 40 and 60. Currently, managers wishing to evaluate changes in catfish size structure in small impoundments would have a difficult time (i.e. spend several work days) collecting an adequate sample with current sampling methods. However, the time commitment might be justified if the majority of anglers are pursuing catfish.

Despite a concerted effort by technicians at the Research Center and District 6, spine processing has lead to significant delays (up to three years) in age and growth analyses statewide.

Techniques vary for ageing catfish between Research and Management personnel and among the various Management districts. Some staff use only the cross section from the articulating process while others use the articulating process cut for ageing the fish and the distal cut for back-calculations of growth increments. Most biologists use mean length at age as a growth parameter while some advocate the use of length increments because of variability in size at the time of stocking.

Small impoundment catfish anglers have diverse views about what sizes of catfish they prefer to catch. When given a choice, most Busch Area anglers (70%) would prefer four, 12-inch catfish to a 2 fish, 15-inch option (21%) or a one fish, 18-inch option (9%). Given the same choices, rural anglers at four north central lakes preferred the 15-inch, 2 fish combination (42%) over the 12-inch, 4 fish (36%) and the 18-inch, 1 fish combination (22%). Rold (1995) found a similar diversity in channel catfish anglers' opinions of quality size.

Most Missouri catfish anglers are harvest oriented. Release rates averaged just 4% at Pony Express Lake, 19% at Little Dixie Lake and 25% at Jamesport Community Lake. Release rates in Kentucky impoundments varied from 17% to 43% (Rold 1995). Santucci (1994) reported relatively low annual hooking mortality (<8%) for 8 to 10-inch channel catfish (one day holdover in a cage) in Ridge Lake, Illinois while Rutledge (1975) documented 33% catch and release mortality for channel catfish less than 12 inches (six-day holdover in a cage) from experimental

ponds in Texas. Czarnezki (1989) found hooking mortality (with immediate release) to be less than 4% over a 17-month period for fish averaging 11.6 inches in experimental ponds in Missouri.

No studies have been conducted in Missouri to identify a minimum acceptable, harvestable- size for channel catfish anglers. However, judging from harvest percentages by total length increments from multiple year creel survey data at two rural lakes, anglers are more likely to keep fish over 13 inches but still harvest most of the fish twelve inches or less that are caught (Table 2).

Table 2. Size selective harvest trends for channel catfish caught by anglers at Pony Express and Jamesport Community lakes.

LAKE	% of <12" fish harvested	% of 12.0-12.9" fish harvested	% of >13" fish harvested
Pony Express	73	78	98
Jamesport Community	63	67	84

Kentucky anglers appeared to be more size selective than Missouri anglers; only 25% of anglers surveyed indicated a willingness to keep fish less than 12 inches (Rold 1995). Santucci et al. (1994) found that Illinois anglers released 73% of newly stocked fish averaging 10.5 inches versus 26% for stocked fish averaging 13 inches.

Almost all channel catfish populations are managed without a length limit. First year returns of stocked fish have varied from 45 to 59% at Hunnewell and Limpp Community lakes to 9 to 11 % at Pony Express and Jamesport Community lakes (Eder and McDannold 1987). Total estimated exploitation of stocked fish ranged from 64% at Pony Express Lake to 70% at Hunnewell Lake (Eder and McDannold 1987), which are similar to exploitation (74%) at Ridge Lake, IL (Santucci et al. 1994). Lower exploitation rates have been reported from other states (Eder and McDannold 1987; Rold 1995). In general, most Missouri lakes where angler surveys have been conducted are supporting put-grow-take fisheries based on a comparison of the mean lengths of fish stocked (averaging 9 to 10 inches) to the mean lengths in the harvest (13 to 18 inches).

At five lakes, (Macon, Marceline, Blind Pony, Hazel Hill and Manito) a 15-inch length limit has been utilized either to protect developing fisheries or to improve the size structure in established fisheries. Unfortunately, there have been no evaluations of these catfish length limits. Angler acceptance of the length limit concept varied in recent surveys from 68% with a favorable view at four lakes in north central Missouri, to 63% at Little Dixie Lake, to 7% at the Busch Area. Rold (1995) reported that only 18% of anglers surveyed at four lakes in Kentucky were in favor of catfish length limits. Santucci et al. (1994) suggested that channel catfish fisheries might benefit from a minimum length limit regulation if characterized by high exploitation, fast growth and low hooking mortality.

Daily limit options of 2 or 4 fish appear to be appropriate regulations for most small impoundment catfish fisheries. In either case, most anglers do not catch the daily limit.

Recommendations

* A comprehensive sampling methodology study, supervised by a Research biologist with statistical support from the Biometrics Unit and field support from the Management districts, should be initiated in FY98 and completed in three to five years. Biometric's analyses of Mark Zurbrick's 1985-1986 Little Dixie Lake gillnetting data should be completed in FY97 as a precursor to the study.

  The study should focus on gear type biases (size-selectivity, seasonality), adequate sample size, species specific differences (i.e., channel, blue, flathead), efficiency and cost effectiveness of sampling methodology, size of water body, impact on non-target species, and on investigating the potential for developing technologically advanced sampling equipment. A summary report with recommendations for different systems or species, if necessary, should be the final product.

* Initiate a multi-section project to determine appropriate channel catfish stocking rates/periodicity based on water productivity, angler catch and harvest, and desired channel catfish and bluegill population parameters. Study design and data analysis will be completed by Research and Biometrics. Hatcheries will be responsible for producing and stocking requested fish. Sampling will be completed by Management.

* Develop standardized guidelines for processing and reading catfish spines.

  After consulting with Dr. John Casselman, Ontario Ministry of Natural Resources, Dr. Roy Heidinger, Southern Illinois University, Douglas Blodgett, Illinois Natural History Survey, we suggest that only the articulating process cross section be used for age and growth analysis.

* Establish standard put-grow-take operating procedures that include:

  Small public impoundments should not be stocked initially or supplementally with channel catfish unless they meet the minimum requirements for MDC pond stocking assistance to private landowners.

  Average size of stocked fish should exceed 8 inches with at least 80% of stocks meeting the desired size.

  Hatcheries will provide the Management districts with a composite length frequency from each rearing station (Chesapeake and Paho) after the fall harvest. This information sharing will help managers document the extent or frequency of natural recruitment.

  By special written request from a Research or Management supervisor to the Assistant Chief-Hatcheries, fish will be hand-graded to satisfy specific stocking needs for special evaluations or research studies.

Lightly fished and/or relatively inaccessible walk-in ponds less than 5 acres and low priority lakes that are not routinely sampled should not be stocked with more than 20 fish per acre. Periodic stockings can be scheduled but not on an annual basis.

Management districts should be responsible for directing Hatchery personnel and/or providing stocking assistance for ponds located off all-weather roads. To facilitate stocking coordination, Conservation Agent notification, and local media contacts, permanent harvest dates should be established (i.e. Paho harvest the first full week of October; Chesapeake harvest the second full week of October).

All channel catfish stocked to supplement put-grow-take fisheries should be requested through Hatcheries Section. Local purchases will be coordinated through Hatcheries Section when cost effectiveness is an issue or when time of stocking is critical.

* Establish production guidelines that will minimize surplus stocks.

Establish acceptable tolerance limits for production above and below the annual request and monitor for surplus production minus Management Section cancellations.

Rearrange annual harvest stocking routes so that one or more of the largest impoundments are stocked on the final day of the harvest (e.g. Lake Jacomo for Paho and Duck Creek Pool#1 for Chesapeake). Consequently, if there is a shortage at a rearing station, only one impoundment will be affected rather than several. In the event of shortages, fish should be purchased to fulfill needs for high priority fisheries.

Establish a list of impoundments that Hatcheries can use for the distribution of surplus fish, preferably in close proximity to each rearing station. If large numbers are involved, consider other states and commercial producers as outlets.

SPECIALTY FISHERIES

Issues, Problems, and Opportunities

Few large catfish are available in small lakes; however, surveys have shown that most catfish anglers would appreciate an opportunity to catch a memorable-size fish. Most of the interviewed anglers at Pony Express Lake considered a fish exceeding 10 pounds to be of trophy-size (Eder and McDannold 1987). Ninety-two percent of catfish anglers surveyed at Little Dixie Lake during May 1995 indicated that a trophy-size fish should weigh 10 pounds or more.

Since production of large channel catfish in small impoundments has been uncommon, we have opted for stocking catfish species with a greater maximum size potential. Blue catfish fisheries were established in several small impoundments with well-established channel catfish populations (Pony Express-1978; Little Dixie-1978; Blind Pony-1978 and again in 1991 after renovation; Henry Sever and Hunnewell-1981; and Hazel Creek-1991). Slow growth rates were exhibited by blue catfish at the lakes with stocking rates ∃10 fish/acre (Henry Sever-13/A; Little Dixie 10/A; Hunnewell 13/A). Blue catfish stocking was discontinued at Henry Sever after 1990

because of chronic slow growth. In contrast, Pony Express Lake, which has the lowest annual stocking rate of blue catfish (2.5 to 5 fish/A), has been the most consistent producer of Master Angler-size fish (>34 inches) in small impoundments. Similarly, blue catfish growth rates and size structure improved at Little Dixie when the stocking rate was dropped from 10 to 2.5 fish per acre.

Master Angler-size blue catfish (>34 inches) are being produced in Pony Express, Little Dixie and Blind Pony lakes without size protection. A minimum length limit for blue catfish would be difficult to enforce because of the similarity in appearance to channel catfish.

Because of the current, low demand for blue catfish, stocking requests are filled through commercial sources.

Flathead catfish have been stocked in several small impoundments in the Kansas City and St. Louis districts to diversify urban fishing opportunities (Fisheries Division Plan FY91-FY95 and Kansas City and St. Louis Urban Fishing Plan FY94-FY05). These low density populations are managed with a 24-inch minimum length limit. Low density populations are difficult to evaluate by routine methods. Consequently, we have been unable to determine the success or failure of these flathead catfish introductions.

Recommendations

* Establish a Division objective to develop fisheries that produce catfish over 30 inches long.

* Selection of potential specialty catfisheries should focus on the following impoundment characteristics:

    Presence of high density prey populations
    Minimum size of 100 acres
    Supports fishing pressure less than 500 hours/acres
    Proximity to other specialty catfisheries
    Angler interest in large catfish

* Provide or obtain fingerlings that exceed 8 inches in length.

* Restrict the stocking rate to no more than 5 fish/acre/year.

* Provide a regulation option where only one fish out of the daily limit of four can exceed 30 inches for combination blue catfish/channel catfish fisheries.

* Monitor success (i.e. are 30+-inch fish being caught?) with volunteer angler records and/or point-of-sale permit surveys. Use the survey data to establish a more quantifiable measure of success.

PREY CONTROL

Issues, Problems, and Opportunities

Small numbers of flathead catfish were stocked in several Missouri small impoundments in the late 1970s for the purpose of prey control. These early attempts failed due to emigration (King Lake) or because of an inconsistent supply of fingerlings. Subsequently, flathead catfish stockings were initiated at Che-Ru Lake in 1990, Higginsville Lake in 1991, Edwin A. Pape Lake in 1992, Kellogg Lake in 1994 and Busch Lake#33 in 1996. Evaluations are being conducted on the impact of flathead catfish on stunted bluegill, crappie and channel catfish at Higginsville, on crappie and gizzard shad at Pape, and on bluegill, crappie and gizzard shad at Kellogg and Busch #33. These flathead catfish fisheries, except Kellogg Lake, are managed with a 24-inch minimum length limit; there is no length limit on flathead catfish at Kellogg Lake.

Currently, very limited information exists concerning the use of flathead catfish for prey control in impoundments. Existing literature indicates that desired target species in small impoundments (crappie, bluegill) are not the preferred prey items of flathead catfish when gizzard shad are present (Turner and Summerfelt 1970). Pond studies conducted by Swingle (1964) resulted in high exploitation of bluegill when flathead catfish (5+ lbs) were stocked at 16 fish per acre; flathead catfish was the only predator stocked in one experiment, while 1 pound bass were included in another. Davis (1985) documented substantial declines in trapnet catch indices for carp and bullheads following the introduction of flathead catfish in a 110-acre lake (9 fish/acre with a mean weight of 3.7 pounds). In contrast, Hackney (1965) stocked flathead catfish (14-16") at a rate of 50 fish per acre in a stunted bluegill pond, but no improvement resulted after one year.

While flathead catfish culture has advanced in recent years, maximum stocking size of cultured fish is currently six inches. Larger fingerlings (8+@) are obtained by capturing wild fish from the Missouri River and Mississippi River by electrofishing. Raising larger fingerlings (up to 10 inches in two years) is possible if statewide annual requests do not exceed 1,000 fish.

<u>Recommendations</u>

* Continue the evaluations of flathead catfish food habits and prey species growth at Higginsville, Pape, Kellogg and Busch #33 lakes through the year 2000. Prepare individual lake reports on the success or failure of flathead catfish introductions.

* Discontinue rearing flathead catfish fingerlings.

* If current evaluations prove inconclusive, maintain a moratorium on future flathead catfish introductions until a well-designed research study can be initiated.

CONCLUSION

- Fisheries Division has focused much of its catfish management efforts on culture efficiency. However, catfish have not received a proportionate share of Management and Research time despite their documented popularity. Catfish have not been considered a controlling factor in the predator/prey Abalance@ of most small impoundment fisheries. Consequently, managers have focused more of their efforts on other sport fish. Some of the inattention can be attributed to the difficulty in collecting an

adequate number of catfish in a reasonable amount of time. Currently, fisheries managers are handicapped by a limited number of time-consuming collection techniques. Consequently, we view development of effective sampling methodology as the highest priority initiative. If more effective sampling techniques are developed, there is the potential for applying them in streams and large reservoirs where obtaining an adequate sample is difficult.

- Once effective sampling methods are developed, a statewide stocking rate/periodicity evaluation should be initiated. Based on projected resource expansion, we anticipate a 17% increase in demand for channel catfish fingerlings assuming current stocking strategies. Therefore, wise use of limited hatchery product is essential for maintaining angler satisfaction. Much of the study design could be completed concurrent with the sampling methodology project.

- A research biologist should be designated to serve as project leader for the two high priority studies (sampling methods and stocking regimens). A coordinated, multi-unit experimental approach offers the advantage of a larger sample size from which we can learn faster and with greater certainty. Though we do not recommend that our managers table all creative strategies, a concerted, statewide effort will ensure that we will know much more 10 years from now than we do today.

- The problems associated with providing fish for the put-and-take urban lakes must be remedied. Current procurement procedures are unsatisfactory and are jeopardizing the urban fishing program.

- A determination should be made of whether or not flathead catfish can be utilized as a biological control for overabundant prey species.

- Because of the diversity in habitat and productivity characteristics across the state, delegation for establishing channel catfish fisheries and corresponding management objectives should remain with the districts. District biologists with put-grow-take channel catfish fisheries should be aware of the diversity in anglers' views regarding size and number preferences.

- Managers are encouraged to determine clientele preferences (including their desire for catching an occasional large fish) and incorporate them into operational strategies when feasible. Special fisheries evaluations should include attempts to estimate catch and release mortality rates.

- An advisor should be appointed to facilitate the conversion of the report's recommendations into actions. In totality, the prescribed actions in this report should enable the Division to reach its goal of providing diverse, satisfying catfish angling opportunities in small public impoundments statewide.

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Appendix B. Overall results of Missouri Department of Conservation's Catfish Angler Information Survey conducting during 2002.

CATFISH ANGLER INFORMATION SURVEY
Random survey of 664,208 permit purchasers
5,486 of 15,000 surveys returned

PART 1

1. Did you fish in Missouri in 2001?
   No = (372) 7% Yes = (5114) 93%

2. Approximately how many days did you fish in Missouri in 2001?
   1-5 = 21%
   6-10 = 18%
   11-15 = 13%
   16-20 = 11%
   21-25 = 7%
   More than 25 = 30%

PART 2

1. Did you fish for catfish in Missouri in 2001?
   No = (1834) 36% Yes = (3265) 64%

   IF NO, SKIP TO PART 5, IF YES CONTINUE

2. Approximately how many days did you fish mainly for catfish in Missouri in 2001?
   1-5 = 40%
   6-10 = 20%
   11-15 = 10%
   16-20 = 8%
   21-25 = 5%
   More than 25 = 17%

3. Where do you prefer to fish for catfish in Missouri?
   Large lakes or reservoirs = 29%
   Small lakes = 21%
   Mississippi River = 5%
   Missouri River = 6%
   Private farm ponds = 19%
   other rivers or streams = 15%

4. Which species of catfish did you fish for the most in 2001?
   - Channel catfish = 75%
   - Flathead catfish = 14%
   - Blue catfish = 9%
   - Bullhead catfish = 2%

5. Please rate the quality of your overall catfish fishing experiences in Missouri in 2001?
   - Excellent = 8%
   - Good = 33%
   - Fair = 40%
   - Poor = 18%
   - No Opinion = 1%

6. What type of fishing gear/method do you most often use for catfishing in Missouri?
   - Rod and Reel = 87%
   - Trotline/throwline = 8%
   - Limbline/setline = 3%
   - Jugs = 3%

PART 3

1. Do you think the Missouri Department of Conservation should spend more, less, or about the same amount of effort managing catfish in Missouri?
   - More = 40%
   - Less = 2%
   - About the same = 40%
   - Don't know = 16%

2. In your opinion, has the quality of catfish fishing improved, declined, or stayed about the same during the last 10 years in Missouri?
   - Improved = 16%
   - Declined = 33%
   - Stayed the same = 31%
   - Don't know = 20%

3. Would you favor restricting the use of setlines, juglines, or trotlines on some waters to improve your chances of catching a trophy-sized catfish by rod and reel?
   - No = 44%
   - Yes = 42%
   - Don't know = 13%

4. Channel catfish and blue catfish in Missouri are managed with the same regulations because they are similar in appearance. Fishing for one or both of these species may be better managed if separate regulations were implemented. Would you be willing to distinguish between channel catfish and blue catfish if it improves fishing?

   No = 25%
   Yes = 55%
   Don't know = 20%

5. For each of the 3 catfish species listed, would you favor a change in regulations if it increases your chances of catching a trophy-sized catfish, but decreases the number of catfish you are allowed to keep?

Channel catfish-	No = 58%	Yes = 29%	Don't know = 13%
Blue catfish-	No = 52%	Yes = 33%	Don't know = 15%
Flathead catfish-	No = 51%	Yes = 33%	Don't know = 16%

6. For each of the 3 catfish species listed, would you favor a change in regulations if it increases your chances of catching a trophy-sized catfish, but requires you to release catfish below a specified length?

Channel catfish-	No= 46%	Yes = 44%	Don't know = 9%
Blue catfish-	No = 43%	Yes = 47%	Don't know = 11%
Flathead catfish-	No = 42%	Yes = 47%	Don't know = 11%

7. Some anglers like to catch and keep a lot of fish regardless of size, while others anglers prefer catching larger fish even if it means catching fewer of them. Which of the following scenarios best describes the number and size of catfish you would prefer to catch and keep?

   One 20-pound catfish = 8%
   Two 10-pound catfish = 13%
   Four 5-pound catfish = 49%
   Ten 2-pound catfish = 30%

8. For each of the 3 catfish species listed, in Missouri what do you consider to be the minimum weight (in pounds) of a trophy catfish?

   Channel catfish- range 1-200, 10 lbs = 24%
   Blue catfish- range 1-165, 20 lbs = 16%
   Flathead catfish- range 1-165, 20 lbs = 15%

PART 4

1. Did you fish for catfish on Truman Lake in 2001?

   No = 84% Yes = 16%

2. Approximately how many days did you fish mainly for catfish on Truman Lake in 2001?

1-5 = 56%
6-10 = 15%
11-15 = 10%
16-20 = 6%
21-25 = 4
More than 25 = 9%

3. What type of fishing gear/method do you use catfishing on Truman Lake?

Rod and reel-	No = 3%	Yes = 97%
Trotline/throwline-	No = 60%	Yes = 40%
Limbline/setline-	No = 83%	Yes = 17%
Jugs-	No = 60%	Yes = 40%

4. What gear/method do you consider to be the most successful for your catfishing on Truman Lake?

Rod and reel = 62%
Trotline/throwline = 20%
Limbline/setline = 3%
Jugs = 14%

5. What species of catfish do you prefer to fish for most on Truman Lake?

Channel catfish = 36%
Blue catfish = 15%
Flathead catfish = 18%
No preference = 30%

6. In your opinion, has the quality of catfish fishing on Truman Lake improved, declined, or stayed about the same during the last 10 years?

Improved = 12%
Declined = 35%
Same = 27%
Don't know = 26%

7. For each of the 3 catfish species listed, would you favor a Truman Lake regulation change that would decrease your daily limit of catfish but would increase your chance of catching and harvesting more larger catfish?

Channel catfish-	No = 49%	Yes = 38%	Don't know = 12%
Blue catfish-	No = 42%	Yes = 43%	Don't know = 15%
Flathead catfish-	No = 42%	Yes = 42%	Don't know = 15%

PART 5

1. You are:
   Male = 77%
   Female = 23%

2. Would you consider yourself to have a background that is:
   Rural = 35%
   Small town = 34%
   Urban = 31%

3. What is your present age?
   Under 25 = 10%
   26-35 = 16%
   36-45 = 26%
   46-55 = 26%
   56-65 = 20
   over 65 = 2%

4. What county do you live in? Responses available upon request.

Appendix C. A summary of the six statewide meetings to gather public comment on the draft Missouri Catfish Plan and how the committee incorporated public comments into the final plan.

Statewide Objective #2 – Proposal to change statewide regulations on catfish to 5 blue catfish daily

- Most in attendance felt there was at least some difficulty differentiating between channel catfish and blue catfish but that many of the problems could be overcome with education and practice.
- Some questioned whether or not this proposed regulation change would have any impact on catfish populations, and actually suggested more restrictive regulations. A number of anglers suggested a statewide minimum length on flathead catfish. Most felt 18" would be appropriate if we did implement a minimum on flatheads.
- ***The MDC committee will proceed with their proposal to change the statewide catfish limits to the following: 5 flathead catfish per day, 5 blue catfish per day and 10 channel catfish per day. Even though we are moving forward with this proposal, an actual regulation change will not become effective for quite a while. To prepare for a statewide regulation change, we must first take time to educate anglers on species identification.***
- We received numerous comments and questions about blue catfish movement, age, abundance and harvest rates. Those are all areas where we need more information. ***The committee therefore is proposing to initiate studies to identify habits, habitats, and population characteristics of blue catfish.***

Large Rivers Objective #1 - Establish Special Management Zone on Missouri River

- Opinions were mixed across the state – some very supportive and some were opposed. Many anglers who fished the Missouri River felt that not allowing harvest of at least one or two flathead catfish less than 30" long was too restrictive, especially for rod/reel anglers.
- A number of anglers suggested making restrictions on blues instead of flatheads. Others believed that blues were actually overabundant in mid-Missouri. Most thought it would be unwise to put special regulations on both at the same time.
- Several thought that a 50-mile reach was too short because the speed of today's boating rigs would make enforcement too difficult.
- ***The MDC committee will recommend establishing an 80-mile special management area between Glasgow and Jefferson City. In this special management area, anglers would be allowed to take one flathead catfish under 30 inches and one flathead catfish 30 inches or larger. Even though we are moving forward with this proposal, an actual regulation change will not become effective for quite a while. We will follow up with additional public meetings to discuss the 80-mile special flathead catfish management area on the Missouri River.***

Large Rivers Objective #2 - Increase sustainable pounds (yield) of catfish on Mississippi

- There was considerable disagreement on the value of commercially caught catfish.

- There was little opposition to more restrictive commercial harvest regulations.
- Some recreational anglers felt that if a higher commercial length limit was implemented, it would only be fair to impose the same length limit on recreational anglers.
- Some anglers didn't like the fact that commercial fishers had no limit on the number of catfish they could harvest, but none wanted to deny their right to fish commercially.
- At least a few folks suggested that the most effective approach for us to protect large blue catfish in the rivers (especially the Mississippi) was to protect wintering holes.
- ***The MDC committee will proceed with Large Rivers Objective #2 as originally drafted.***

Reservoirs Objective #3 - Establish special catfish regulations on Truman, LOZ, Montrose and Smithville

- We had at least a half dozen or more write-in comments, and all but one were strongly supportive of more restrictive regulations on Truman and Lake of the Ozarks.
- We received numerous comments that there are too many setlines and too many anglers that don't attend their setlines often enough. Several folks suggested limiting the number of hooks allowed on setlines. Some suggested that there be a season for setlines – especially trotlines. During these setline discussions, a number of folks suggested stepped up enforcement efforts to address this problem.
- When polled, anglers favored some restrictions, but thought a regulation that allows anglers to keep only 1 fish over a certain size was too restrictive. They were much more open to two over a certain size. A few also suggested that a five pound blue catfish was too small to keep.
- ***The MDC committee will proceed with Reservoir Objective #3 as originally drafted, and will monitor the results of the reservoir catfish evaluation being conducted at Truman Reservoir. No special reservoir catfish regulations are being recommended at this time.***
- ***The committee has also inserted into the plan a new objective and associated strategies to address the issue of anglers not complying with set line regulations.***

Stream Comments

- Only one comment was heard (Cape); Too many setlines in the smaller streams.
- ***The MDC committee will proceed with the stream objectives as originally drafted.***