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A Review of the Biology and Management of Blue Catfish

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Abstract.—Blue catfish *Ictalurus furcatus* are a big river species, native to major rivers of the Mississippi River basin and Gulf Coast streams of the central and southern United States, south into Mexico, northern Guatemala, and Belize. Blue catfish are native in 20 states and have been introduced into nine others, mostly along the Gulf, Atlantic, and Pacific slopes. Blue catfish are largest of the ictalurid catfishes, sometimes exceeding 45 kg and 165 cm, and can live over 20 years. Numbers in their native range have been greatly reduced because of alteration of riverine habitats, particularly on the periphery of their range. Blue catfish are migratory and prefer open waters of large reservoirs and main channels, backwaters, and flowing rivers with strong current where water is normally turbid. This species occurs over substrate varying from gravel/sand to silt/mud. Blue catfish are opportunistic omnivores but adults eat a variety of animal life, including fish. Sexual maturity is usually attained at 4–7 years, and rapid growth is exhibited throughout life. Estimates of total annual mortality range from 12 to 63%. Blue catfish are presently not popular with aquaculturists, but hybrids developed with channel catfish *I. punctatus* are often used in fee-fishing lakes because of their rapid growth and aggressive disposition. Blue catfish support sport fisheries in seven states, whereas 14 additional states reported that they support both sport and commercial fisheries. About one-half of the 29 states reporting blue catfish as present consider them economically and recreationally valuable. Nine states reported they add diversity to existing fish populations, two manage them to develop quality or trophy fisheries, and seven manage blue catfish for both.

Blue catfish *Ictalurus furcatus* are native to the Mississippi, Missouri, and Ohio River basins of central and southern United States, and occupy Gulf Coast streams from Alabama south into Mexico, and northern Guatemala (Glodek 1980), and Belize (Greenfield and Thomerson 1997). During the past 30 years they have been stocked into both Atlantic and Pacific drainages. Blue catfish are considered a big-river species. There is controversy over the physical appearance of blue catfish from various portions of their native range because early workers were confused by very large catfishes and described the same species several times (Smith 1979), and blue catfish from the Rio Grande River were considered a subspecies (Knapp 1953). Previously, two subspecies were recognized: *I. f. furcatus* in the central United States and northern Mexico, and *I. f. meridionalis* in eastern Mexico and Guatemala (Jordan and Evermann 1896), however Lundberg (1992) considers *I. f. meriionalis* conspecific with *furcatus*. Recently, angling for blue catfish has become popular and several fishing-related television shows and sporting magazines routinely address quality blue catfish sportfisheries.

This paper summarizes the general biology and life history of blue catfish, from a comprehensive literature review, and from personal knowledge gained from nearly 30 years of research on big river species, including blue catfish. As I searched for references, I was surprised at the shortage of technical reports discussing life history and biology of the species. I suspect that the shortage of information on blue catfish results from the difficulty of adequately sampling big river habitats. I also surveyed 48 state natural resource agencies about the status of blue catfish.

Description

Blue catfish are the largest catfish in the United States. The only freshwater fishes that reach larger maximum sizes are alligator gar *Lepisosteus spatula*, lake sturgeon *Acipenser fulvescens*, and white sturgeon *A. transmontanus*. The current pole and line record is 50.3 kg, from below Wheeler Reservoir, Alabama, in 1996, however several states reported that larger blue catfish have unofficially been caught. Few authors provide total lengths, however Cross (1967) reports a 139.7 cm, 40.5 kg blue catfish from the Osage River in Missouri, in 1963, and a 165.1 cm, 45.2 kg blue catfish from the Missouri River in South Dakota, in 1964. Like other catfishes, the blue catfish is often described by several common names, depending upon locality. Common names include: white cat, white fulton, fulton, humpback blue, forktail cat, and blue channel catfish. They are similar to channel catfish *Ictalurus punctatus* in appearance, but differ in never having dark spots on their

back and sides (Pflieger 1997). Blue catfish in the Rio Grande River, Texas, reportedly differ from other blue catfish in that the juvenile and young are quite speckled and many adults retain their spots (Wilcox 1960). Knapp (1953) reported that Rio Grande River blue catfish have 35–36 anal fin rays, rather than the usual 30–35. A major difference between blue catfish and channel catfish is the configuration of the air bladder (Pflieger 1997). The air bladder of blue catfish has a definite constriction giving it a two-lobed appearance, whereas the air bladder in channel catfish is without constriction. Blue catfish can be distinguished from channel catfish by the anal fin which contains more rays (usually 30–35) and its outer margin is straight and tapered like a barber's comb. Their tail is deeply forked, hence the Latin name, *furcatus*, or forked, in reference to the tail. Pflieger (1997) describes blue catfish as displaying a distinctive wedge-shaped appearance because of the high profile of the back near the dorsal fin. Unlike the flathead catfish *Pylodictis olivaris*, which also reaches large sizes, the lower jaw of blue catfish never protrudes beyond the upper jaw. Color can be variable, depending upon water clarity, but most blue catfish larger than about 4.5 kg are pale bluish-silver on the back and sides, grading to silver-white on the sides and white on the belly. Young fish, 50–100 mm, are often nearly transparent, and immature blue catfish, 250–450 mm, are usually more silver or silver-white than adults, hence the common name, "white cat."

Distribution

Twenty-nine states reported having blue catfish and 17 did not (Figure 1). Minnesota and Pennsylvania considered the species extirpated. Pennsylvania indicated that blue catfish were last reported in the Monongahela River in 1886, and Minnesota reported that they were once present in the Mississippi and Minnesota rivers. In 1977, several thousand were stocked in Lake St. Croix, Minnesota, and two were captured the next year. Since then, no blue catfish have been reported in Minnesota, and they are currently considered a species of special concern.

The current distribution of blue catfish in the United States is within the Mississippi River Basin, and the Atlantic, Pacific, and Gulf coastal slopes (Figure 1). States not recording them are those in the northeastern United States outside of the Ohio River basin, the Great Lake states of Michigan and Wisconsin, most Rocky Mountain states, and North Dakota. During the Lewis and Clark expedition into Montana, an interesting observation was made 22 May 1805: "Game was no longer in such abundance since leaving the Musselshell and few fish were caught and these were white catfish weighing two to five pounds" (Coues 1965).

Sixteen states considered blue catfish to have restricted distribution, while 13 states reported wide distribution (Figure 1). Most of the states reporting wide distribution are in the central and southeastern United States. North Carolina reported that their

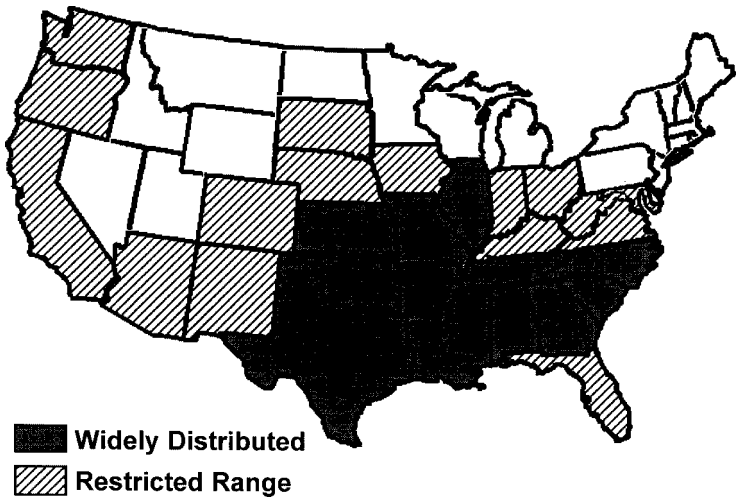

FIGURE 1. Distribution of blue catfish in the conterminous United States.

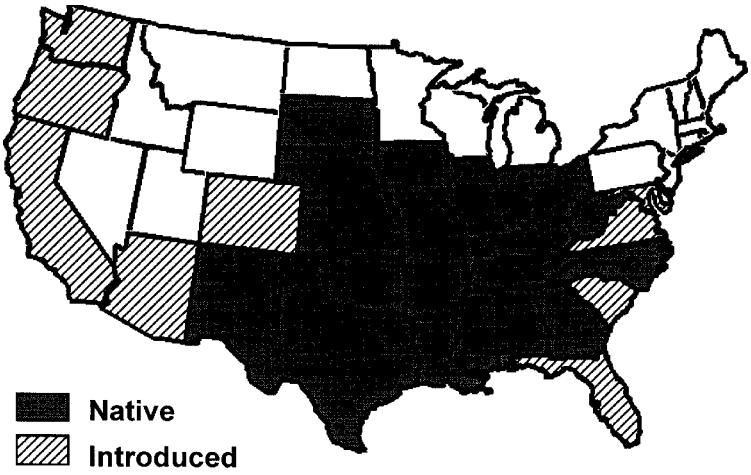

FIGURE 2. Classification of blue catfish as native or introduced in the conterminous United States.

native range of blue catfish is increasing within the state. States reporting restricted distribution are those bordering the Ohio River, upper Missouri River, west coast, and southwestern states. Many of the states reporting restricted distribution, including most of the southwestern and western states and Florida, have small populations resulting from introductions.

Virginia reported that blue catfish were introduced in 1974, and that sport anglers indicate that blue catfish may be replacing native channel catfish populations in some areas of the state. Twenty states reported blue catfish native, while nine indicated that blue catfish in their respective states were introduced (Figure 2). Most of the central, southern, and southeastern states report native populations of blue catfish. Western and southwestern states of Washington, Oregon, California, Arizona, Colorado, and eastern and southeastern states of Maryland, Virginia, South Carolina, and Florida have introduced blue catfish. Washington and Oregon apparently introduced blue catfish into the Snake River in the early 1900s, however they are presently extremely rare in both states. California stocked them into large reservoirs in the southern portion of the state in 1969. They adapted well and currently provide sport fisheries. Also, aquaculturists have developed hybrids with channel catfish and routinely stock them in fee fishing lakes. Arizona stocked blue catfish in a private pond in 1981 and report that they have never stocked them in public waters, however they are known to exist in extremely low numbers in the Colorado River system. Blue catfish were stocked into reservoirs in the eastern portion of Colorado in the Arkansas River drainage in 1982. They were also stocked into the Chesapeake Bay drainage in Virginia in 1974, in the Potomac River in Maryland sometime between 1898 and 1905, and in the Escambia River drainage in Florida, however these Florida introductions were probably the result of escapees from Alabama, rather than physical introductions. One of the most popular blue catfish fisheries is in Santee-Cooper Reservoir in South Carolina where blue catfish were introduced, beginning in 1965.

Historical perspective

Records of large catfish date back to the Lewis and Clark exploration of the Missouri River. They described large "white" catfish, undoubtedly blue catfish, reaching nearly 1.5 m in length. Heckman (1950), in his *Steamboating Sixty-Five Years on Missouri's Rivers*, provides the following account: "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 lb. 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 provides other evidence that it was common to catch catfish weighing 125–200 lb from the Missouri River during the mid 1800s. Even Mark Twain, talked about seeing "a Mississippi catfish that was more than six feet long" (Coues 1965).

In November 1879, the U.S. National Museum received a blue catfish weighing 150 lb from the Mississippi River near St. Louis. The fish was sent by Dr. J. G. W. Steedman, chairman of the Missouri Fish Commission, who purchased it in the St. Louis fish market. The following quote from a letter from Dr. Steedman to Professor Spencer F. Baird, U.S. Commissioner of Fish and Fisheries, suggests that catfish of this size were not uncommon. "Your letter requesting shipment to you of a large Mississippi catfish was received this morning. Upon visiting our market this afternoon, I luckily found two—one of 144 lbs, the other 150 lbs. The latter I shipped to you by express."

Habitat

Blue catfish prefer open waters of large reservoirs and main channels, backwaters, and embayments of large, flowing rivers where water is normally turbid and substrate varies from gravel-sand to silt-mud (Burr and Warren 1986). Many rivers and reservoirs with blue catfish populations have only mud or silt substrate. Blue catfish prefer deep, swift channels and flowing pools (Jenkins and Burkhead 1994), and large specimens were often found in tailwaters below dams where currents were swift and substrates consist of sand, gravel, and rock (Mettee et al. 1996). Fish from these habitats are extremely difficult to sample. Their affinity for swift water and deep channels explains why blue catfish life history is not well known. Although these catfish can be stocked into small reservoirs to develop specialized fisheries (Fischer et al. 1999, this volume), they are well suited to large, open-water reservoirs, especially those with gizzard shad *Dorosoma cepedianum* as forage (Graham and DeiSanti 1999, this volume). Blue catfish tolerate moderately high levels of salinity and can be grown in coastal waters which does not exceed 8 ppt salinity for any extended period of time (Perry and Avault 1970), however they can tolerate salinity in estuaries to 11 ppt (Perry 1968), and in some waters at 14 ppt (Allen and Avault 1970).

In twelve states, blue catfish are found primarily in riverine habitats (Figure 3). All of these states, except Florida and Washington, border the middle and upper Missouri River or the northern borders of the Ohio River and northeastern Atlantic slope states. In Colorado and California, blue catfish are found in reservoirs, and most of the states in the lower Mississippi River basin, Gulf slope states, and southeastern Atlantic slope states (14 states) reported that they are found in both rivers and reservoirs.

Movement

Blue catfish are the most migratory of the ictalurid catfish, moving upstream in the spring and downstream in the fall (Lagler 1961) in response to water temperature (Pflieger 1997). They move farther down the lower Mississippi River where water is warmest in winter, and upstream in summer (Jordan and Evermann 1916). These migratory movements can span several hundred km. Blue catfish moved considerably more during spring than any other season in a 97-ha reservoir in

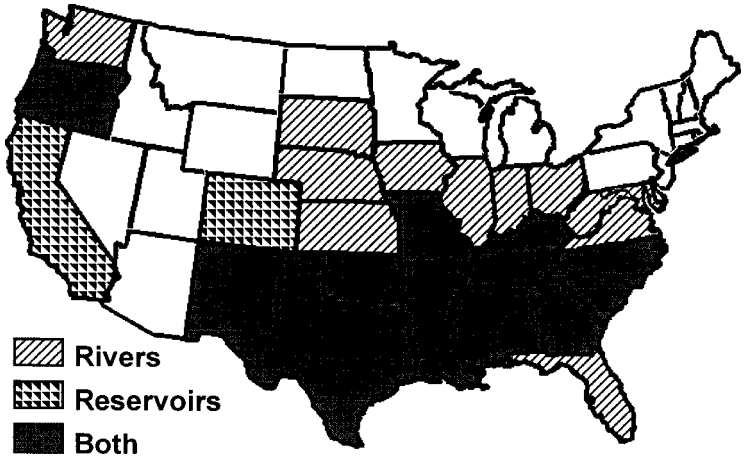

FIGURE 3. Primary waters with blue catfish in the conterminous United States.

northwestern Missouri (Fischer et al. 1999). In Lake of the Ozarks, Missouri, 75 of 1,500 (5%) stocked blue catfish emigrated and were captured downstream by anglers (Graham and DeiSanti 1999). Forty percent of nearly 3,000 tagged blue catfish moved more than 16 km from their original point of capture. In Kentucky Lake, Kentucky-Tennessee, a greater number of tagged blue catfish moved upstream than down and their mean distance traveled during the eight-year study (23.6 km) was more than twice that of channel catfish (Timmons 1999, this volume). Blue catfish in the lower Mississippi River moved 5–12 km from their release site after 363–635 d, and were more mobile than flathead catfish (Pugh and Schramm 1999, this volume). Pugh and Schramm also report that because of the fishes ability to move great distances, blue catfish management plans should consider a broad spatial scale. Long-range movements, both upstream and downstream, are common for large individuals as they seek spawning sites.

Diet and feeding

A few published studies on food habits suggest blue catfish were opportunistic and omnivorous feeders. Blue catfish consume a variety of animal life, including fishes, immature aquatic insects, crayfish, fingernail clams, and freshwater mussels (Brown and Dendy 1961; Minckley 1962; Perry 1969). In California reservoirs, they were reported to eat Asiatic clams *Corbicula fluminea* (Richardson et al. 1970). Pflieger (1997) reported that blue catfish as small as 100 mm ate some fish, but the bulk of their diet was small invertebrates. Larger individuals, about 290 mm, ate mostly fish and larger invertebrates (Perry 1969). In many large southern reservoirs, the diet of large blue catfish was mostly gizzard shad or threadfin shad *Dorosoma petenense*. Biologists along the upper Mississippi River in Missouri, reported that blue catfish were so gorged on freshwater mussels one could see and feel mussel shells protruding from the stomach wall. The senses of taste and smell are more important than sight in locating food (Robison and Buchanan 1988; Pflieger 1997); and Pflieger (1997) suggested blue catfish feed mostly on or near the bottom and to a lesser extent in the midwater. In clear-water reservoirs, or tailwaters, blue catfish capture their prey by sight. Mark Ambler (Oklahoma Department of Wildlife Conservation, personal communication) reported that blue catfish often suspend in deep water beneath schools of gizzard shad being fed upon by striped bass *Morone saxatilis*, and seek and eat wounded and dead shad. Before sophisticated fish-locating electronics, these large catfish, often suspended 20 m from the bottom, were inaccessible to anglers. Similarly, blue catfish eat wounded gizzard shad after they pass through the turbines of Harry S Truman Dam (Graham and DeiSanti 1999).

Sexual maturity and spawning

Maturity is generally reached at an earlier age in the southern portion of their range than in the north. Blue catfish mature at 4 or 5 years and at total lengths of 350–662 mm in Louisiana (Perry and Carver 1973); Texas (Henderson 1972); and Kentucky (Hale 1987; Hale and Timmons 1989). In the Mississippi River near St. Louis, blue catfish become sexually mature at about 381 mm (Barnickol and Starrett 1951). Based on lengths of blue catfish captured in upper Lake of the Ozarks, Missouri, sexual maturity is 420–480 mm, but at ages of 6–7 years (Graham and DeiSanti 1999). In Louisiana, blue catfish spawn in April through June (Perry and Carver 1973), and early July in Iowa (Harlan et al. 1987).

The genital orifices of the two sexes are distinct (Moyle 1976). He reported that in the male, the papilla is more prominent with a circular opening; in the female, it is more recessed and the opening slitlike. The testes of ictalurid catfishes are morphologically different from most warmwater fishes in that the glands are lobate and not compacted into a solid-appearing gland (Sneed and Clemens 1963). They also report that the posterior one-fourth of the testes is reduced and retains a pink color throughout the year, but the anterior three-fourths becomes progressively larger and whiter as the spawning season approaches. Brooks et al. (1982) report that when grading blue catfish (6- and 18-month-old individuals) for future broodstock use, the sex ratio was equal during simple grading for the largest individuals, whereas when grading for the largest channel catfish of the same age, the sex ratio was dominantly males. They also report that the weight-frequency distributions for 6- and 18-month-old blue catfish were similar, but channel catfish males were larger than females.

Spawning habits are relatively unknown (Lagler 1961), but are believed to be similar to those of channel catfish (Pflieger 1997; Hubert 1999, this volume). The species is a cavity nester. Blue catfish seek protected areas behind rocks,

root-wads, depressions, under cut streambanks, or other areas where the currents are minimal to deposit eggs. Coker (1930) reports that mature eggs of blue catfish attain a diameter of 2.5 mm, whereas mature ova of 7–9 kg female blue catfish were 3.0–3.3 mm in diameter (R. Dunham, Auburn University, personal communication). He also stated that clutches of blue catfish fry from spawns in ponds contained between 40,000 and 50,000 individuals. Hatching of eggs occurs in 7 or 8 d at water temperatures of 21°C to 24°C (Henderson 1972; Pflieger 1997), and like most other ictalurid catfishes, the male guards the eggs and fry. Hatching success for blue catfish was estimated at 90%, and fry production per kg of female was higher for blue catfish than for channel catfish (Tave and Smitherman 1982). Fecundity estimates were from 900 to 1,350 eggs/kg of body weight (Dunham, personal communication).

Survival and mortality

There was little information documenting mortality of blue catfish, however, Kelley (1969) reported a total annual mortality of blue catfish at 39% from Tombigbee River, Alabama. In upper Lake of the Ozarks, Missouri, blue catfish began to enter the harvest at about 6 years of age and can contribute to the sportfishery until they are 18 years of age (Graham and DeiSanti 1999). Total annual mortality estimates for this population ranged from 12 to 32%. Because of rapid growth rates, these fish have the capability to reach large sizes and provide high quality fisheries. Estimates of mortality for blue catfish from Lake of the Ozarks were less than the 36–63% reported from Kentucky Lake, Tennessee (Hale 1987). Hale also reported that catfish from Kentucky Lake began entering the harvest at ages 4 and 5 and contributed to the fishery until they were 13 years of age.

Age and growth

Blue catfish growth is rapid, particularly after they become piscivorous. Blue catfish growth rates in upper Lake of the Ozarks, Missouri, were relatively consistant between ages and sizes (Graham and DeiSanti 1999). Growth of blue catfish in rivers and reservoirs can be similar, if forage is adequate. Growth rates of blue catfish in Lake Texoma, Oklahoma, were reported to be more rapid than channel catfish and nearly equal to flathead catfish (Jenkins 1956).

During the past 25 years, I have aged several blue catfish from Missouri waters that exceeded 40 kg and 20 years. I determined catfish age and growth rates by examining annual growth marks on sections cut from pectoral spines, then back-calculated annual growth (Marzolf 1955). Structures other than pectoral spines that are sometimes used for aging include: opercular bones, vertebrae, and dorsal spines (Ramsey and Graham 1991). Increased growing season, warmer water, and often times, a more diverse forage base contribute to faster growth in southern regions. Lengths at age for blue catfish from several states (Table 1)

TABLE 1. Comparison of mean lengths (mm) of aged blue catfish from various populations and locations.

State	Tennessee	Tennessee	Tennessee	Kentucky	Kentucky	Kentucky	Kentucky
Location	Tennessee River[a]	Kentucky Lake[b]	Kentucky Lake[b]	Kentucky Lake[c]	Kentucky Lake[d]	Kentucky Lake[e]	Barkley Lake[d]
Age 1	135	142	145	132	76	117	76
2	198	229	239	221	165	213	188
3	252	287	295	274	239	310	302
4	297	343	356	318	302	391	376
5	356	401	427	363	311	480	455
6	429	447	483	424	432	559	584
7	513	500	551	485	483	627	658
8	582	423	627	549	564		
9	699	551	671	584	666		
10	846	587		607			
11				693			
12				737			
13				813			
Number of fish	134	369	467	655	492	756	115

provides comparison, however caution must be used because of differences in lengths of growing seasons, ages of fish used in back-calculations, and physical and chemical characteristics of the aquatic environments. Blue catfish in the Rio Grande River, Texas, grew at a faster rate than fish in the 3-year-old Amistad Reservoir, Texas (Henderson 1972), however, fish from different sites within the reservoir grew at different rates. Jenkins (1956) attributed decreasing growth rates of blue catfish through 9 years in Lake Texoma, Oklahoma, to inter-specific competition that occurred as the fish community reached carrying capacity. Intra-specific competition caused slow growth of blue catfish in Kentucky Lake, Kentucky (Conder and Hoffarth 1965), whereas growth impairment of blue catfish in Kentucky Lake were believed to be caused by both intra- and inter-specific competition (Freeze 1977). The fastest growth rates for Kentucky Lake blue catfish are believed to be in areas where intra-specific competition was reduced by high harvest (Hale 1987).

In Oklahoma (Jenkins 1956) and Missouri (Graham and DeiSanti 1999), blue catfish typically grew faster than channel catfish after the first two years. In Missouri, growth rates remain consistant among years through age 18 (Figure 4). Porter (1969) revealed that blue catfish in Kentucky Lake, Tennessee, grew faster than channel catfish, but displayed a slow, declining growth rate. In another Kentucky Lake study, blue catfish exhibited slow growth between ages 3 and 7 (Conder and Hoffarth 1965), whereas average lengths of age 7 blue catfish in Barkley and Kentucky lakes were 12 and 4% greater, respectively, than age 7 channel catfish (Freeze 1977). No significant differences in growth patterns were found between sexes for blue catfish (Hale 1987; Hale and Timmons 1990).

Population declines

Although populations of blue catfish are present in several areas of the United States, primarily in southern and southeastern states, blue catfish num-

TABLE 1. (continued.)

State	Alabama	Louisiana	Oklahoma	Texas	South Carolina	South Carolina	Missouri
Location	Tombigbee River[f]	Mississippi River Delta[g]	Lake Texoma[h]	Rio Grande River[i]	Santee-Cooper Lake[j]	Santee-Cooper Lake[k]	Lake of the Ozarks[l]
Age 1	125	191	145	175	168		105
2	221	386	254	262	307	262	178
3	338	508	351	282	427	325	243
4	450	638	442	373	554	381	309
5	508	749	533	406	696	429	371
6	612	848	655	465	840	460	426
7	693		770		958	508	484
8	803		871		955	546	542
9	942		1,026				600
10	930		1,069				657
11	986		1,118				708
12	1,041						762
13	1,067						807
14							869
15							923
16							1,032
17							956
18							923
Number of fish	122	57	190	103	93		2,389

[a]Conder and Hoffarth (1965)
[b]Hale and Timmons (1990)
[c]Hale and Timmons (1989)
[d]Freeze (1977)
[e]Porter (1969)
[f]Kelley (1969)
[g]Kelley and Carver (1966)
[h]Jenkins (1956)
[i]Henderson (1972)
[j]White and Lamprecht (1990)
[k]White (1980)
[l]Graham and DeiSanti (1999)

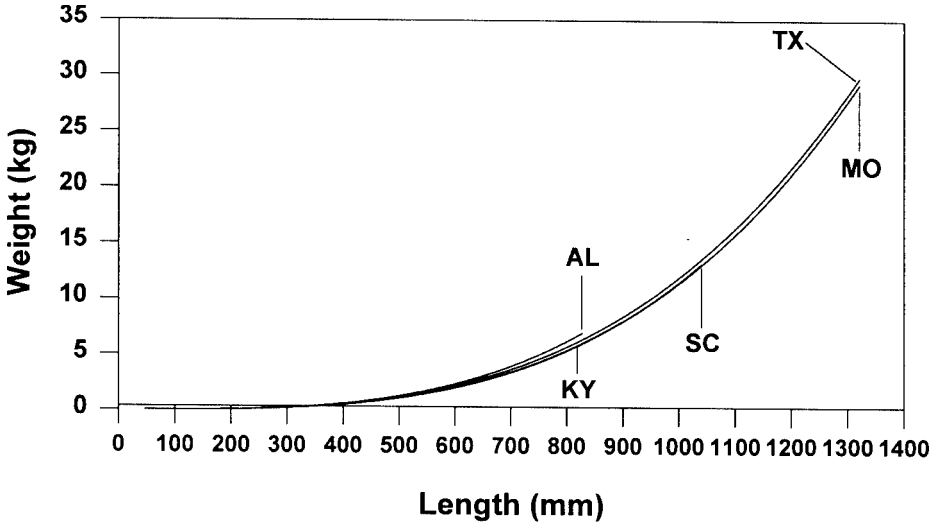

FIGURE 4. Length-weight relations for blue catfish from Alabama ($\log_{10}W = -6.000 + 3.354 \cdot \log_{10}L$, N = 1,073), Kentucky ($\log_{10}W = -5.921 + 3.342 \cdot \log_{10}L$, N = 306), Missouri ($\log_{10}W = -6.023 + 3.283 \cdot \log_{10}L$, N = 7,725), South Carolina ($\log_{10}W = -6.155 + 3.406 \cdot \log_{10}L$, N = 3,147), and Texas ($\log_{10}W = -6.279 + 3.368 \cdot \log_{10}L$, N = 10,960). Slopes for relationships from Kentucky and South Carolina overlay Missouri's. State labels designate maximum size. $r^2 \geq 0.98$ for all relations.

bers are greatly reduced in waters in the periphery of its native range. Declines are often associated with aquatic habitat modification (stream channelization), increased turbidity and siltation, changes in flow regimes, drainage of natural standing water habitats, industrial and domestic pollutants, pesticides, and construction of impoundments. Before construction of impoundments on the upper Missouri River and navigational locks and dams on the upper Mississippi and Ohio rivers, numbers of blue catfish were higher. Trautman (1981) reports, "…it is obvious that the readily-identifiable 'Mississippi' or 'White' catfish was present before 1900 in the Ohio River between the Indiana state line and Belmont County. The fishermen are in universal agreement that blue catfish were far more abundant before the Ohio River was ponded (before 1911) than it has been since, at least many more fishes were caught before than after ponding." The reduction in numbers of blue catfish is directly correlated with the effort to remove snags from the Missouri River to enhance early steamboat travel (Hesse 1987). Hesse also reports that channelization severely reduces the amount of shallow water along a river, and confines fish to a narrow, limited amount of habitat. Additionally, blue catfish are apparently more sensitive to low dissolved oxygen than channel catfish because they surface before channel catfish in fish kills resulting from low oxygen. According to sport anglers, blue catfish are found dead more often than channel catfish when harvested using trotlines in reservoirs having thermoclines (R. Dent, Missouri Department of Conservation, personal communication).

Fisheries

Because of their renowned qualities as a food fish, sport and commercial fisheries are popular in several states, and blue catfish are often found in fish markets. Forbes and Richardson (1920) reported that the flesh is of excellent quality and demands a high price. According to Pflieger (1997), blue catfish is a highly valued food fish because of its large size and firm, well-flavored flesh. Blue catfish provide sport fisheries in seven states: the four midwestern states of Nebraska, Kansas, Oklahoma, and Colorado, the two western states of Washington and California, and Florida in the southeastern United States (Figure 5). Blue catfish support both sport and commercial fisheries in 14 states, most of which are in east-central and southeastern states within the middle and lower Mississippi River and Ohio River basins. No state considered the fish as only a commercial species. Eight states on the periphery of their native range (Oregon in the west, Arizona and New Mexico in the southwest, South

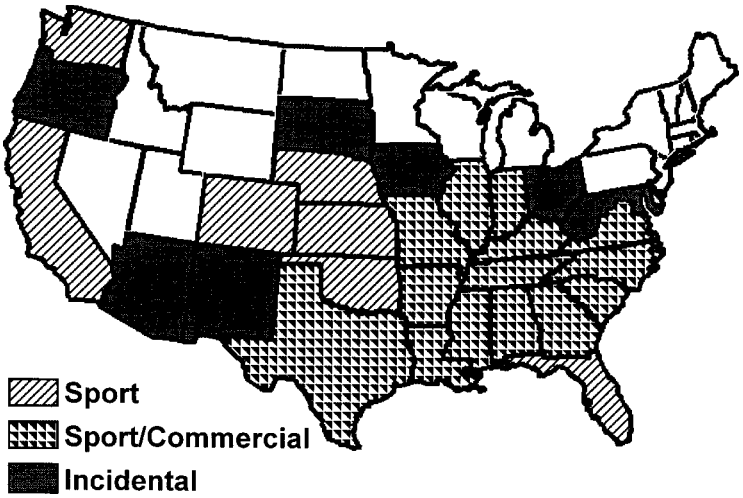

FIGURE 5. Status of sport, commercial, and incidental fisheries for blue catfish in the conterminous United States.

Dakota and Iowa in the northern midwest, and Ohio, West Virginia, and Maryland in the northeastern United States) considered blue catfish populations to be incidental in nature because their populations are too small to support dependable sport or commercial fisheries.

About one-half of the states where blue catfish occur (15) considered the species recreationally important. Blue catfish are considered recreationally valuable in most states within the lower Missouri and Ohio River basins, and the middle and lower Mississippi River basin, and in Virginia, North Carolina, South Carolina, and Texas. They are not considered important sport or commercial fish in western and southwestern states, most upper midwest states, states in the upper Ohio River basin and in Georgia and Florida.

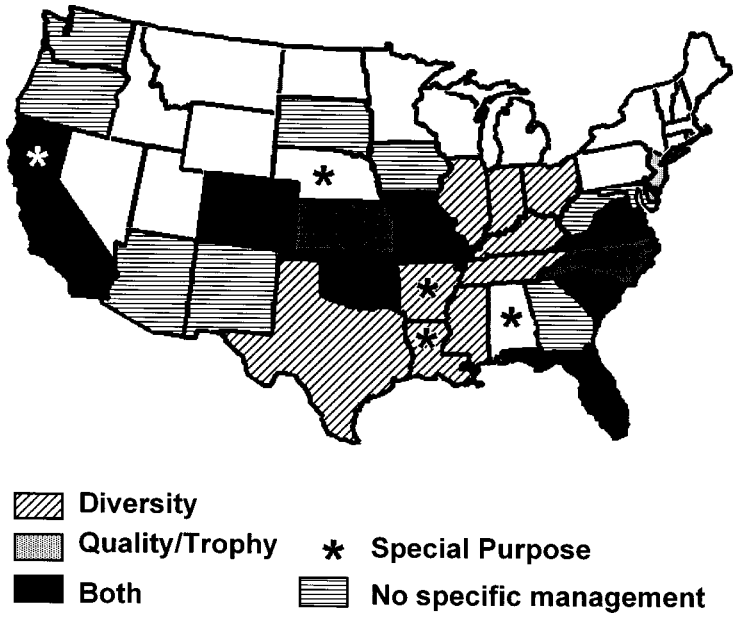

FIGURE 6. Management objectives for blue catfish in the conterminous United States.

TABLE 2. Estimates of sport and commercial harvests (kg), mean size (mm), harvested by sport anglers, and minimum sizes (mm) in the commercial harvest for blue catfish from various populations, as reported by state natural resource agencies.

	Sport		Commercial	
State	Harvest (kg)	Average sizes (mm)	Harvest (kg)	Minimum size (mm)
Alabama	NA	356–457	NA	None
Arkansas	NA	NA	905,891	406
Illinois	NA	NA	345,098	381
Indiana	NA	NA	<22,222	254
Kentucky	72,171	351	2,031,706	None
Louisiana	46,667	356–381	4,888,889	305
Mississippi	NA	NA	48,0431	305
Missouri	85,822	599	79,947	381
South Carolina	971,904	356-610	414,889	None
Tennessee	1,381,409	516	411,153	None
Virginia	NA	NA	NA	None

Nine states reported that blue catfish add only diversity to already existing fish populations (Figure 6). Two states indicated blue catfish provide only quality and/or trophy fisheries, seven reported they provide both diversity and quality and trophy aspects, five states reported that blue catfish were managed for other specific reasons, and nine states reported that although blue catfish are present in their state, they were not managed for any specific purpose. States using blue catfish to add diversity to fisheries include those states along the lower Ohio and Mississippi River basins, and Texas. Kansas and North Carolina were the only states that manage their catfish as only quality or trophy species, whereas seven states manage their blue catfish populations for both diversity and quality/trophy. Those seven states show no distributional pattern by watershed. They range from California in the west to Virginia in the east, and to Florida in the south. Five states indicated that their blue catfish populations were managed for specific reasons. Nebraska stocked blue catfish into several small public lakes to increase diversity, however they no longer stock them and their few remaining blue catfish are managed similar to channel catfish. California stocked blue catfish for Asiatic clam control and for aquaculture purposes, probably as hybrids with channel catfish, in pay lakes. Arkansas managed blue catfish for shad control, and Alabama and Louisiana managed them specifically for sport and commercial fisheries. It was not surprising that nine states, most of which are on the periphery of their native range, do not manage for them. In most cases, blue catfish numbers were low and sometimes provided only accidental or unplanned fisheries.

Commercial harvest estimates were reported from only nine states (Table 2). States with harvest estimates were those along the middle and lower Mississippi River basin, the lower Ohio River basin, and South Carolina. Sport harvest estimates were available from only five states (Table 2). These estimates were difficult to evaluate because in many cases not all blue catfish sport fisheries had creel surveys. For example, in Missouri, our sport harvest estimates were from only two large reservoirs, yet there are blue catfish sport fisheries in several mid-sized public lakes and sport angling is becoming more popular on the Missouri and Mississippi rivers. It appears that the highest sport harvests occur in Tennessee and South Carolina, and although Alabama considers blue catfish an important sport fish with high harvest, they had no estimates.

Due to self reporting, commercial fisheries statistics were difficult to evaluate. It appears that Louisiana, Kentucky, and Arkansas had the largest blue catfish commercial harvests.

Culture

Blue catfish possess several attributes that make them desirable for culture in temperate regions (Tidwell and Mims 1990; Webster et al. 1995). Blue catfish have a similar or higher dressing percentage than channel catfish, have an aggressive nature making them suitable for pay-lakes (fee fishing) industry, and resistant to some diseases that affect channel catfish, such as enteric septicemia and channel catfish virus. Giudice (1970) and Chappell (1979) report that a major advantage to blue catfish in aquaculture was that they were relatively easy to seine from ponds and they have high individual weight gains in temperate regions (Tidwell and Mims 1990).

However, blue catfish are currently unpopular with the aquaculture industry because of reported slow maturation rates, poor food conversion, and poor spawning success in captivity. Some aquaculturists believed that blue catfish were more easily stressed and more susceptible to bacterial diseases than channel catfish, especially after handling or hauling.

Hybridization between blue catfish and channel catfish increases growth (Giudice 1966; Giudice 1970; Yant et al. 1976; Chappell 1979; Tave et al. 1981). Chappell (1979) reported that the hybrid produced by crossing male blue catfish with female channel catfish had a faster growth rate, exhibited greater feeding vigor, and had a better food conversion and dressing percentage than either parent species. Tave et al. (1981) indicated that these hybrids were more susceptible to angling than either parent, and that fishing success in pay lakes could be improved by stocking hybrids.

Summary

Blue catfish are widely distributed in the United States but restricted to states within the Mississippi River basin and Atlantic, Pacific, and Gulf coast slopes. Numbers of blue catfish generally increase southward in the United States. It is a large river species and the largest of all North American catfishes. Its ability to reach large sizes makes the blue catfish one of the most popular catfishes for pole and line anglers. Blue catfish grow rapidly, are relatively easy to catch, and the flesh is white, flakey, and of extremely good texture. Commercially, the blue catfish is a recreationally valuable species. During the past several years, it has been introduced into several states as a trophy species, to increase species diversity for anglers, and as a predator to control shad and Asiatic clams. Blue catfish populations will probably not expand their range substantially in the near future because of their apparent affinity for warmer climates, however those states where blue catfish are already popular will likely continue to manage the species a valuable sport and commercial fish.

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