

# A Reappraisal of Gars and Bowfins in Fishery Management

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## ABSTRACT

Gars, *Lepisosteus* spp., and bowfins, *Amia calva*, have long been viewed by many anglers and managers as harmful to game fishes and recreational angling. Most investigations of these ancient, piscivorous predators have centered on their dietary habits, not on their broader ecological role in aquatic communities. Most management has involved eradicating these fishes rather than using them constructively. It is suggested that managers should view gars and bowfins not merely as nuisances to be destroyed, but as contributors to ecosystem stability and function, to balance among predators and prey, and to more successful angling in the long term.

"The time will doubtless come when thorough going measures will be taken to keep down to the lowest practicable limit the dogfish [bowfin] and the gars—as useless and destructive in our productive waters as wolves and foxes formerly were in our pastures and poultry yards."

Forbes and Richardson 1920:41  
*The Fishes of Illinois*

"Man is so constituted that he considers the value of other living things solely on the basis of his own comfort or convenience. A fish is useful or valuable to him only as he can see some direct relation to his needs or pleasures. On this basis, much has been said against the gars and very little in their favor. The fish-culturist says that they eat the food for his young fish, and, later, that they eat the young fish. The commercial fisherman says that they tear his nets and are not saleable if he does land them. The angler says that they are not game and that they eat the fish he wants to catch. These statements are correct, as far as they go. To find the value of the gar we must look at other points."

Weed 1923:10  
*The Alligator Gar*

"Mr. Deputy in charge of fish  
You are informed it is my wish,  
That you take some dynamite in your flivver  
And proceed to Jack's Fork river,  
And, standing on the gravelly bar  
Cast in the shots to kill the gar.

"But when you execute this command  
Don't forget the law will demand  
That while killing a gar, you must not harass  
A single sucker, catfish, or bass.  
You must obey instructions without fail  
Or run the risk of going to jail."

Missouri Assistant Attorney General Lovan,  
interpreting the state's right to kill  
gars. *State v. Freeland* 1927:627.

## One Way to Kill a Gar

On a brisk autumn day in 1985, eight Iowa State University fisheries students and I were in johnboats on the main channel of the upper Mississippi River south of Dubuque, Iowa. State fisheries technicians were demonstrating to us how to drift trammel nets to catch shovelnose sturgeons, *Scaphirhynchus platyrhynchus*. We netted a few sturgeons, but fishing was better that day for longnose gars, *Lepisosteus osseus*. When the portion of the net bearing the first gar was aboard, one technician gingerly disentangled the writhing fish, and put one hand, with fingers together and palm down, around the gar's midportion. His other hand he closed, palm down, over the gar's toothed snout. He then exerted pressure downward with both hands, until the fish's vertebral column snapped, sounding much like a green stick being broken. The gar was then sloughed over the gunwale and sank out of sight in the turbid water.

It was explained to the students that gars made nuisances of themselves by becoming entangled in nets. Under Iowa statutes (since repealed), it was not even legal to release the gar alive. Section 109.114 stated that "It shall be unlawful for any person to place any gar pike in any waters of the state, and such fish when taken shall be destroyed." A couple of the students nevertheless remarked that gars were "neat fish." A less sympathetic student took the next gar netted, however, and showed us all that he had quickly learned the preferred technique for readjusting a gar's spine. We all learned many worthwhile fisheries techniques that day, but was gar-bending one of them? Is our management of these living holosteans, which consists mainly of killing them, justified, or, as Weed (1923) suggested, are there some "other points" that we need to consider? This question is explored in this short essay, which treats not only the five species of gars (the longnose gar; shortnose gar, *Lepisosteus platostomus*; spotted gar, *Lepisosteus oculatus*; Florida gar, *Lepisosteus platyrhynchus*; and alligator gar, *Lepisosteus spatula*) but also their relative, the bowfin (Amiidae: *Amia calva*).

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## No Respect for Elders

Gars and bowfins are among North America's most ancient, most distinctive, and most disliked fish. They are remnants of the ancient holostean lineage first recorded in Permian deposits around 215 million years old. Holosteans reached their greatest diversity and abundance in the Jurassic and Cretaceous periods 150–160 million years ago (Rayner 1941). Fossil gars dating from the Cretaceous period have been found in North America, and three species of gars and two species of bowfins have been identified in the Green River Formation from the Eocene epoch (Grande 1984). Ten genera of bowfins have been described from the Mesozoic era (Patterson and Longbottom 1989).

But after a few words on the antiquity of these fish, most fisheries reports and fishing books then describe gars and bowfins in vindictive terms, which I have italicized. In discussing gars Richardson (1914:407) warned that "Certainly if our commercial fisheries are to be properly conserved, stringent measures will have to be taken against these 'weeds' and 'wolves' among fishes." According to Gowanloch (1940:292), "Gars are highly predaceous animals, *stealthy* and persistent *destroyers* of a vast quantity of aquatic life." Elman (1977:108) refers to gars as "*pariahs*" that "*infest* many lakes, sloughs, bayous, and sluggish rivers in the South and Midwest." Potter (1926:23) called them "*very destructive* to other fishes." MacKay (1963:44) suggested that "any [gars] taken during commercial fishing operations should be destroyed." Cook (1959:53) concluded that "it is fitting that they be kept in check, but not exterminated, for although they eat some game fish they also take many undesirable species, such as the bowfin." The bowfin's reputation is not much better. According to Coker (1930:160), "this odd fish is called by a dozen names, none of which is intended to be complimentary."

## Some Fairness from Fairport

Some early and well-respected fisheries scientists had kinder words for these species. Coker (1918) reported that bowfins were fine eating if prepared properly (he provided recipes); and based on his experiments at the Fairport, Iowa, Biological Station, concluded that the bowfin should be an object of commercial pursuit. In recent years, bowfin eggs have been marketed commercially as caviar (B. Boatright, Tempo-Tech, Inc., personal communication).

As for gars, Coker (1930:155) later reported, "It cannot . . . be said that they are universally despised, for the meat of gars is said to be esteemed by Negroes and to have been a common food of Indians. . . . Possibly the ill favor with which it is generally regarded as a food fish by whites arises, as in the case of eels, with some suggestive features of its appearance more than from intrinsic qualities." Netsch and Witt (1962:251) stated that the longnose gar ". . . can be a worthy sport fish, and its flesh is not wholly unpalatable." Gowanloch (1940:292) claimed, "the flesh of gars is not only edible, but highly palatable when properly prepared. It compares favorably with the flesh of highly regarded game and food species." Gowanloch later (1965) described the use of large pits to half-smoke and half-barbecue gars, and reported that the strong ganoid scales of gars were at one time used as arrow points by Indians inhabiting the lower Mississippi River basin. Hides of gars

have also been used for leather (Forbes and Richardson 1920).

Hubbs and Eschmeyer (1938:166) recognized that although gars and bowfins were generally considered to be "the most obnoxious of our fish predators," in some lakes, "these predaceous fishes may even be beneficial to the supply of desirable fish, through the destruction of the more abundant but less desired competitors, such as dwarfed sunfish or stunted perch." Robison and Buchanan (1988) reported that the gars play an important role in preventing overpopulation of many other species and in maintaining a proper natural balance in many natural lakes and impoundments. They also contribute to fisheries themselves. In Arkansas, for example, where gars are important commercially, annual catch from 1975 to 1985 averaged more than 360,000 kg (Robison and Buchanan 1988).

A different ecosystem function of gars was recognized by Howard (1914), at the Fairport station. He showed that gars were important hosts for glochidia of the yellow sandshell, *Lampsilis teres*, a freshwater mussel important at that time to the Mississippi River pearl button industry (Smith 1899, cited by Carlander 1954). In addition, the bowfin is host for glochidia of the mollusk, *Megaloniais gigantea* (Hart and Fuller 1974, cited by Becker 1983).

The angling potential of gars and bowfins has often been overlooked. According to Elman (1977:108) "When hooked, a big gar will run, sulk, roll, and jump, showing good form for a fish never classified as game." Inasmuch as gars are difficult (but not impossible) to hook with conventional angling gear, several other fishing methods have been used, including jug lines (Gutreuter 1988), spearing, bow and arrow, shooting, and snaring. Lagler et al. (1942) reproduced a drawing of a snare useful for catching gars (Figure 1); such snares have been used as the official fishing method in organized events called rodeos. Gars can also be caught with a unique hookless, fibrous nylon lure in which their sharp teeth become entangled (K. Sroka, unpublished manuscript, cited by Becker 1983). Bowfins have long been recognized as excellent fighting fish when hooked (Reighard 1903; McClane 1957).

## About Those Eating Habits . . .

Among the crimes charged against gars and bowfins, the most heinous, and the one that has united most anglers and fishery managers against them, is that these species, when too abundant, harm recreational angling by preying on and perhaps competing with the more desirable sport or game fishes. Understandably, then, most applied fisheries studies of holosteans have been conducted solely or mainly to assess their diet and how it might affect sport fisheries. These numerous studies (Hussakof 1914; Potter 1923; Scott 1938; Lagler and Hubbs 1940; Bonham 1941; Lagler et al. 1942; Berry 1955; Hunt 1960; Netsch 1964; Goodyear 1967; Scott 1968; Crumpton 1971; Dugas et al. 1976; Pearson et al. 1979; Seidensticker 1988) have shown that gars and bowfins eat a wide variety of fish and invertebrate species, including nongame and game fishes, and that the exact diet depends significantly on the available prey species. Results cited in Lagler et al. (1942) for Indiana waters are typical: in some waters forage fishes were most commonly eaten, whereas in others game fishes were the most common prey. In general, small fishes have been the main dietary items.

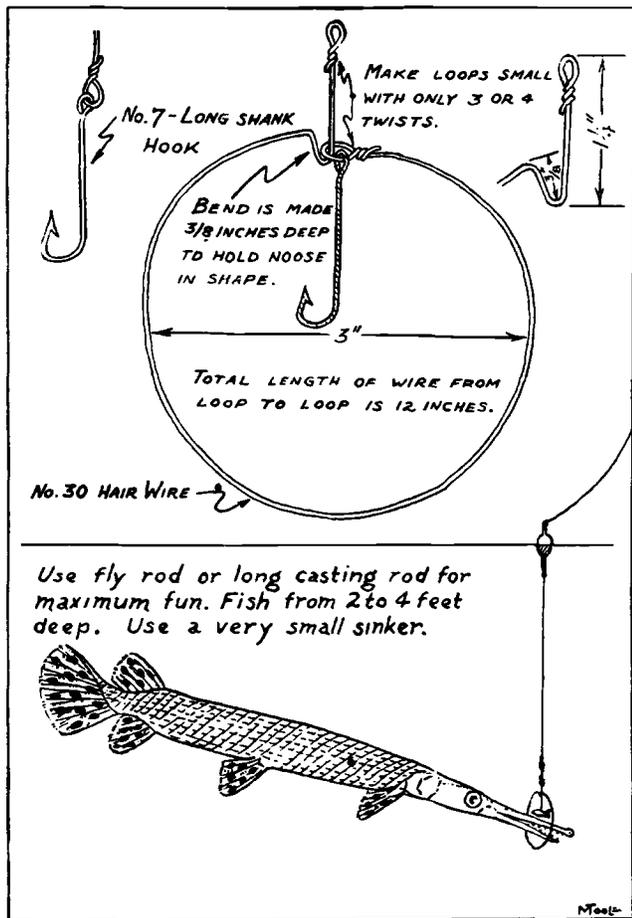


Figure 1. A method of snaring gars. From Lagler et al. (1942). Reprinted with permission of the Indiana Department of Conservation.

For example, Holloway (1954) reported that most of the fish eaten by adult shortnose and longnose gars in Florida were between 5 and 12.7 cm long. Even tiny gars 5–6 cm long have been reported to eat small fish (Forbes and Richardson 1920). Consumption by gars of centrarchid panfishes such as bluegills, *Lepomis macrochirus*, well documented in many studies, has caused concern that the gars may be competing directly with largemouth bass, *Micropterus salmoides*, and other piscivorous game fishes of more interest to anglers. Alligator gars have been shown to consume birds (Raney 1942) and one was even implicated as the probable attacker of a 9-year-old girl who was dangling her feet in Lake Ponchartrain, Louisiana (recounted in Gowanloch 1965).

Game fishes also form a significant portion of the bowfin's diet (e.g., Lagler and Hubbs 1940; Berry 1955). In addition, crayfish may be important prey in some waters (Dugas et al. 1976). As with gars, fishes eaten by bowfins usually are small (Cahn 1927).

The concern about gar and bowfin feeding habits has persisted to the present. As recently as 1988, Seidensticker wrote (p. 100): "The Texas Parks and Wildlife Commission increased harvest restrictions on largemouth bass . . . and crappie [*Pomoxis* spp.]. . . in 1986 due to signs of overfishing for the species. Anglers, marina operators, guides, and other business owners near Sam Rayburn Reservoir, however, expressed concern that declines in these sport fisheries



Figure 2. Killing longnose and shortnose gars in Spirit Lake, Iowa, in the early 1930s. The caption attached to the photo read: "1600 of these fish were removed here in one afternoon. Thousands of these fish are destroyed annually by the Fisheries Department." Courtesy of the Iowa Department of Natural Resources.

were due to gar predation rather than to fishermen." Seidensticker (1988) found that the most frequently consumed prey of alligator gars in the reservoir were nongame species, and that the gars ate whichever fish species were abundant in the lake. Serious depletion of game fishes from predation was unlikely unless the gars were abundant, which they were not (Gutreuter 1988).

## More Ways to Kill Gars

Mainly because of their eating habits and the perception (not carefully substantiated) that sport fishing suffers when gars and bowfins are present, these species have been subjected to serious eradication attempts by anglers and fishery managers for a century or more (Figure 2). Jordan (1905:30) reported that "Fishermen everywhere destroy it [the longnose gar] without mercy." Burr (1931) developed early methods of electrocuting gars while evidently preserving more desirable species. He reported that when the gars were shocked with his electrical apparatus, they would sink to the bottom and die within the hour because they could not surface to obtain oxygen from the air. Gowanloch (1965) summarized Burr's approach as well as trapping and angling methods for gars. In a previous report, he had described a uniquely selective gar-trapping device that took advantage of the gar's limited ability to turn in close quarters: "The fish are simply presented with an obstacle to one side

of which they must turn. Gar fish 12 inches and over cannot flex themselves sufficiently to make that turn, whereas game fish of 20 inches in length can easily accomplish it" (Gowanloch 1940:293). Johnston (1961:205) reported success in killing gars in North Carolina streams with dynamite. The best results were obtained when gars congregated for spawning. In his words, "During one day's operation, over 3.5 tons of gar were removed while killing 8.3 pounds of game fish. . . . [In all], a total of 12,707 longnose gar weighing 47,142.3 pounds were (sic) removed with 7 cases of dynamite." In other states, methods of gar and bowfin eradication varied according to local conditions and laws (Figure 2; summarized for gars in Lagler et al. 1942). In many instances, especially early in this century before extensive regulation of rivers, gar and bowfin control was an endless task because floodplain lakes were repeatedly restocked naturally when rivers flooded.

Some eradication efforts were successful, perhaps too successful. There is evidence that the alligator gar is much depleted in Arkansas (Robison and Buchanan 1988), in the upper Mississippi River (Harlan and Speaker 1951), and perhaps in other locations.

## Villains or Scapegoats?

Accounts of gars and bowfins often speak of their great abundance. Hunt (1952), for example, reported that spotted gars were abundant, even dominant, in the Tamiami Canal of Florida, although he did not assess population size in relation to the other fish present. But according to Lagler et al. (1942), fish community studies indicate that numbers of so-called "obnoxious" predatory fishes such as gars and bowfins are much lower than commonly presumed. This conclusion is consistent with the high trophic status of gars and bowfins. Also, with a few significant exceptions, it is supported by the data. For example, gars constituted fewer than 1% of the fish sampled by rotenone in Barkley Lake, Kentucky (Aggus et al. 1980). Using rotenone, Lambou

(1960) studied six Mississippi River oxbow lakes and found that gars were not a major component of the fish fauna. In Lake Bistineau, Louisiana, Lambou (1962) sampled with rotenone and found that gars constituted fewer than 1% of all fish captured. Ellis et al. (1979), sampling with electrofishing, found that gars and bowfins constituted no more than 3%, and usually much less, of the fish captured in side channels of the upper Mississippi River. Other investigators (e.g., Posey 1959; Turnage 1964) reported relatively few gars compared with forage and game species. Why, then, the perception that these predators are so abundant?

First, gars may seem to be more abundant than they are because of their readily observed behaviors (in the warm season) of resting near shore close to the surface (Lagler et al. 1942) and periodically breaking the water to gulp air (Mark 1890). According to Cook (1959:53), "the same fish may be seen several times within a short while and may be taken for several fish." Such behavior could aggravate anglers docking their boat after an unsuccessful angling trip.

Second, gars congregate during the spawning season and can be very numerous in specific areas at a given time (Forbes and Richardson 1920). Such tendencies have facilitated gar eradication projects in the past (e.g., Johnston 1961).

Third, the relative abundance of gars and bowfins in the fish community may increase markedly above typical levels because of selective harvest of other species. If anglers leave gars and bowfins while harvesting associated game species such as bass and crappies, an imbalance may occur. From trammel-net catches in the lower Mississippi River, Guillory (1982) found that gars constituted 4.2% of the fish by number and 5.5% by weight. Bowfins were more common, constituting 14% by number and 20% by weight. He noted that neither gars nor bowfins were important commercial species in the area. It is reasonable they would suffer lower mortality rates than targeted commercial and recreational species. Lagler et al. (1942:132) recognized this potential problem

when they stated: "Perhaps one of the most ideal forms of gar control is . . . the subjection of these fishes to angling pressure. This tends to balance the circumstance created by the more ordinary fishing which is for predaceous game fishes that are presumably in themselves natural controls for gars. It seems logical that . . . every time a legal bass is removed the gar population is favored."

Fourth, similar imbalances can occur as a result of poor-quality habitat. Geagan (1960) reported that the percent composition by weight of spotted gars in Chicot Lake, Louisiana, increased from less than 2% in 1954 to nearly 25% in 1958. This change was associated with summerkill of less tolerant game and forage species. But although percent composition of gars increased more than 15 times, actual standing stock increased only twofold. Largemouth bass and crappies, in contrast, each declined severalfold from 1954 to 1958. The tolerance of gars and bowfins to low dissolved oxygen concentrations—a useful adaptation to their colonization of floodplain lakes, ponds, and other variable or marginal habitats—makes them more likely survivors than most other fishes when habitat quality deteriorates. Bowfins have even been reported to estivate when their habitat dries up (Neill 1950).

Perhaps, then, high abundance of gars and bowfins in a water body may be a symptom of another management problem (overharvest of game or commercial species, or habitat degradation), rather than the problem itself. Basic ecological principles such as Elton's pyramid of numbers tell us that lakes and streams will not be dominated numerically by top predators for any but brief periods (such as on spawning grounds) or in stressful situations (such as a lake recently suffering partial winterkill or summerkill).

## Is There a Place for Gars and Bowfins in 21st Century Fishery Management?

In waters inhabited by both holosteans and popular game fishes, more emphasis should be on maintaining diversity and balance (*sensu* Swingle 1950) rather than on simply eradicating the less stylish species. In this century much emphasis in warmwater fishery management has focused on providing anglers with popular species such as largemouth bass, crappies, and other centrarchids. In the north central states, walleyes, *Stizostedion vitreum vitreum*; yellow perch, *Perca flavescens*; northern pike, *Esox lucius*; and muskellunge, *Esox masquinongy*; along with bass and other centrarchids, have been among the most desired game species. The smaller centrarchids, perch, and forage species such as shad, *Dorosoma* spp., have provided forage for bass and walleyes. Management has sought to simplify fish communities by greatly reducing or eliminating native fishes such as gars and bowfins (and other so-called rough fish such as buffalo, *Ictiobus* spp., and freshwater drums, *Aplodinotus grunniens*) not favored by anglers. Management would be easier, or so it seemed, if we worked only with fish species important as game fishes or as food for game fishes.

But it is worth asking if overpopulation and stunting of species such as crappies, perch, bluegills, and black bullheads, *Ictalurus melas*, and the millions of dollars spent remedying these problems throughout North America (Ben-

nett 1970), are often a result of predator removal and of our deliberate or accidental simplification of fish communities. Gars and bowfins have been shown to eat mostly small fish, thereby reducing prey fish numbers but increasing the growth rate of survivors. Becker (1983:254) noted that the presence of bowfins in many waters in Wisconsin is often associated with successful angling for game species, and that "some fishery managers are considering the possibility of using this species, as well as the gar . . . , in lakes which are plagued by stunted panfish populations." Although this idea is not new (Lagler et al. 1942; Pflieger 1975), the idea of a diverse fish community often gets lost at the management level amid feverish efforts to turn our lakes and reservoirs into feedlots for game species or aquatic playing fields for bass and walleye tournaments. With the burgeoning demand and interest in competitive fishing, and with the millions of dollars of Wallop-Breaux funds contributed by users, the tendency more than ever is to try to produce as many bass and walleyes as possible, and to ignore the ecological roles of "nuisance" species such as gars and bowfins (unless of course they are suspected of eating too many game fishes—then we try to eradicate them).

In a recent nationwide review of competitive fishing by Schramm et al. (1991), no mention whatsoever was made that nongame predator and prey species may suffer because of intensive management for game fish. Despite this omission, a potential problem exists. From the standpoint of minimizing intellectual creativity, the easiest way to deal with gars and bowfins (other than ignoring them completely) is to attempt to eradicate them. But maybe, as Weed (1923) suggested, there are some "other points" the new generation of fishery managers should consider. As most of us know, the way to healthy fish communities and quality fishing is not always direct, nor obvious. Our waters (and we ourselves) may be much better off ecologically and aesthetically with a diverse fish community including gars, bowfins, and other less-favored species of all sizes (in natural frequencies of occurrence) than with game-fish feedlots.

## Are We Resourceful Enough to Manage These Species Well?

In their native habitats, gars and bowfins can be not only desirable for the diversity they provide but they may also function to stabilize the fish community and to provide additional fishing. Haase (1969, cited by Becker 1983) concluded from ecological research in Wisconsin that gars probably do not harm sport fishing and may in fact improve it. Gars and bowfins may perhaps function effectively as predators where other species fail. In warm, shallow lakes with extensive aquatic vegetation, coolwater predators such as walleyes and northern pike may be inactive or stressed in summer, and bass may be overharvested. In such situations gars and bowfins may alleviate severe stunting problems with species such as crappies, bluegills, and black bullheads, thereby reducing the need for costly fish-eradication projects. If the holosteans overpopulated, they could be depleted, by netting if necessary, from shoreline areas in spring. Fishing for gars and bowfins might also be promoted. But there are many unanswered questions about how gars and bowfins would interact with bass and prey species. Much new research is needed on how these pre-

dators function in fisheries systems, research analogous to that needed when considering reintroduction of terrestrial vertebrate predators such as wolves. Research into the integration of holosteans into fisheries management systems within the species' native ranges would be a legitimate and desirable use of Wallop-Breaux funds. In the past, our fisheries research has not been oriented with approaches such as this in mind.

Gars and bowfins can provide much more angling enjoyment than is now the case. I speak from experience that gar fishing with hook and line can be fun and challenging. The size and ferocity of the alligator gar combine to give a unique fishing experience. Yet there is reason to be concerned for the welfare and very existence of this species in many portions of its range. We as managers are continually seeking to introduce exotic species for diversity; perhaps we should simply maintain and conserve our natives, some of which are ancient, adaptable, and misunderstood.

## The Future

To fishery managers of the 21st century, a major challenge will be to maintain diversity, not only of fishing opportunity, but also of traditionally nongame and economically unimportant species. Much research needs to be conducted on how gars and bowfins interact with other species in lakes and rivers (Holloway 1954), and how these holosteans can become part of a constructive management plan that does not regard them merely as nuisances to be destroyed. Much of the pressure on fisheries researchers and managers to destroy gars and bowfins has come from anglers, and there is every indication that this pressure will continue. It is up to us to look at gars and bowfins not just from the narrow perspective that they eat some game fish, but from the perspective of how they can contribute positively to ecosystem stability and function, to balance among predators and prey, and to more successful and satisfying angling.

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