

Angler Conflicts in Fisheries Management: A Case Study of the Striped Bass Controversy at Norris Reservoir, Tennessee

ABSTRACT

An intensive stocking program initiated in the 1960s in Norris Reservoir, an aging tributary storage impoundment on the upper Tennessee River, created a striped bass (*Morone saxatilis*) fishery that garnered regional and national attention, particularly from anglers seeking trophy fish. However, some anglers complained of declining catches of native gamefish species. Anglers targeting species other than striped bass postulated that predation by striped bass contributed to the declines of native species. To a lesser extent, interspecific competition for food or space was also considered a factor and anglers complained that their concerns were not being adequately addressed by the Tennessee Wildlife Resources Agency (TWRA). Although no data were available to suggest that striped bass were culpable, opponents of the state's striped bass stocking program sought recourse via legislation. In 1995 and 1996, five bills were introduced in the Tennessee state legislature that would have banned the stocking of striped bass into Norris Reservoir and restricted TWRA's ability to propagate or manage all non-native species. Although the bills were defeated, attempts by TWRA to seek reconciliation with anglers opposed to the striped bass program met with little success. In addition to scientifically defensible biological data, human dimensions data are needed to effectively diffuse fishery management disputes between stakeholder groups and management agencies before they escalate to unmanageable levels. Alternative methods of conflict resolution should be carefully considered when polarized stakeholder groups are involved. Effective communication by management agencies of social, economic, and biological impacts of a fishery are essential to stemming future conflicts.

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Introduction

In the 1930s, the Tennessee Valley Authority (TVA) and the U.S. Army Corps of Engineers began the process of impounding two major river systems in Tennessee (the Cumberland and Tennessee rivers) to provide flood control, navigable waters, and inexpensive hydropower. Some recreational fisheries that initially flourished in new reservoirs began to wane within 15 years post-impoundment following the trophic upsurge stage in productivity (Kimmel and Groeger 1986). The abundance of sauger (*Stizostedion canadense*) in Norris Reservoir, on the upper Tennessee River, was so high in the 1940s (5–10 years after its impoundment in 1936) that biologists proposed letting anglers use gill nets to increase exploitation of that species (Eschmeyer and Haslbauer 1946). The decline of the sauger was documented by TVA biologists during subsequent decades and the fishery was deemed “insignificant” by 1975 (Fitz and Holbrook 1978). Declining stocks of sport fishes native to the impounded river sys-

tems prompted state and federal fishery biologists to initiate stocking programs to boost the abundance of native species and create new sport fisheries through introductions of non-native species.

Striped bass (*Morone saxatilis*) were first stocked in Tennessee in 1964 to provide a pelagic predator that could effectively utilize and control gizzard shad (*Dorosoma cepedianum*). As the quality of some recreational fisheries declined due to trophic depression, concomitant increases in gizzard shad stocks were observed in large, southern U.S. reservoirs. Striped bass were capable of attaining sizes large enough to prey on abundant stocks of gizzard shad and their pelagic nature was considered desirable in terms of providing a sportfishing opportunity in newly-created deep water habitats. Successful striped bass fisheries were developed and maintained by Tennessee Wildlife Resources Agency (TWRA) in several Tennessee reservoirs, including Norris Reservoir. Subsequent sampling in Tennessee and elsewhere revealed that striped bass in reservoirs preyed almost exclusively on gizzard shad and threadfin shad (*D. petenense*) (Stevens 1958; Kohler and Ney 1981; Moore et al. 1985).

Despite the belief of most TWRA fishery biologists and many anglers that the striped bass

stocking program was an overwhelming success in Tennessee, some anglers expressed concern over the stocking program in Norris Reservoir. Declining native sport fisheries coincident with the building of the Norris striped bass fishery led to speculation that predation on native sport fish was heavy. Some anglers felt the state's emphasis on stocking striped bass came at the cost of maintaining and enhancing stocks of native sport fish species.

The series of events described herein chronicle attempts by TWRA and various angler groups to resolve the controversy surrounding the Norris Reservoir striped bass fishery. We describe the inability of the agency to justify its fishery management objectives for Norris Reservoir, resulting in loss of credibility among certain user groups. We also describe how some Norris Reservoir stakeholders protested perceived unilateral decisions by TWRA, leading to polarization within the local fishing community. Resolution of the conflict was achieved only after the agency was able to incorporate a balanced advisory committee approach to fishery decision making.

The Conflict

Background

Norris Reservoir, created in 1936, is a steep-sided, 13,800 hectare tributary storage impoundment. The reservoir is managed by TVA to provide flood control and hydroelectric power and currently experiences an annual drawdown of about 18 m. The forebay is classified as oligotrophic and two arms of the reservoir are classified as mesotrophic (Peterson and Negus 1994; Denton et al. 1996).

Anglers first voiced concerns over the declining fishery in Norris Reservoir in the late 1960s (Peterson et al. 1994). Walleye (*Stizostedium vitreum*) anglers reported that the catch and size of walleyes and saugers had declined since the 1950s. The collapse of percid fisheries also was observed in other large Tennessee tributary impoundments in the 1950s and 1960s (Hackney and Holbrook 1978; Schultz 1992) and most Norris Reservoir walleye anglers agreed that reservoir aging and the loss of native river walleye stocks were, in part, responsible for the decline of the walleye fishery. Much angler dissatisfaction with the Tennessee Game and Fish Commission (later to become the TWRA) arose from a political decision to liberalize the creel limit in 1969 (from 5 to 10 walleyes/day) at a time when many anglers were concerned that the fishery was declining. Anglers organized a petition drive to voice their concerns over the declining walleye and sauger fisheries and met with Game and Fish Commission biologists in 1970; however, the

agency was politically unable to make substantial changes in the manner in which those fisheries were managed.

A striped bass fishery was created against this backdrop of angler dissatisfaction with the management of native fisheries in Norris Reservoir. Striped bass were first stocked in 1966 at a rate of about 3.5 fingerlings (51–76 mm) per hectare. Stockings continued annually at that rate for another 8 years. In 1975, the rate was increased to about 5.5 fingerlings per hectare and was maintained through the 1980s. In 1991, the stocking rate increased to about 12 fingerlings per hectare (Peterson and Negus 1995). Striped bass in Norris Reservoir grew rapidly and a successful trophy fishery developed as evidenced by high fishing effort (about 12 hours of intended effort per hectare in 1994; Peterson and Negus 1995). The economic effect of the Norris Reservoir striped bass fishery was never thoroughly investigated, but Schorr et al. (1995) documented the substantial benefit of a striped bass fishery on a local economy.

Despite the fact that a successful fishery for striped bass was created, angler dissatisfaction mounted over native fisheries management in Norris Reservoir. Crappie (*Pomoxis* spp.) and black bass (*Micropterus* spp.) anglers

joined walleye anglers in voicing their concerns, and in 1988 another meeting was held with TWRA. Unlike the meeting in 1970, complaints at this meeting centered on TWRA's promotion of the striped bass stocking program. Anglers proposed causal relationships between poor walleye and crappie fishing and the striped bass stocking program. In particular, many anglers believed that striped bass predation on other sport fish species and direct competition for prey fish were responsible for poor fishing. TWRA biologists countered that predation by striped bass on sport fishes was inconsequential and declining populations of bass and crappie were related to increasing fishing pressure and changes in trophic state. However, TWRA agreed to address concerns over its perceived lack of attention to native fish management by initiating a stocking program for fingerling black crappie (*P. nigromaculatus*). Although this move was largely motivated by the outcry, agency biologists were hopeful that the stocking program would enhance the crappie fishery. No stocking program was undertaken for black bass, and the TWRA tried unsuccessfully to convince anglers that



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size and creel limits enacted in the early 1980s were the best management practices for these species. Many anglers present at the 1988 meeting demanded that TWRA cease its striped bass stocking program immediately.

The response to the public meeting was immediate. Striped bass anglers began to contact TWRA biologists, demanding that the striped bass fishery be maintained. Argument and confrontations between this specialized angler group and those opposed to the Norris striped bass program became commonplace. This led to polarization in the local fishing community with both sides of the issue unwilling to compromise their respective demands.

Reconciliation Attempts

In the early 1990s, TWRA's steps to enhance Norris Reservoir's bass and crappie fisheries were unsuccessful. Anglers of native species continued to complain about fisheries management of Norris Reservoir, and these complaints, coupled with political pressure, eventually led to the formation of the Norris Reservoir Task Force (NRTF) to investigate the Norris Reservoir ecosystem.

The director of the TWRA created the NRTF in 1992 in response to public criticism that more could be done to improve fishing at Norris Reservoir. The task force included representatives from two state universities, TVA, TWRA, two non-specialized anglers, and one boat dock owner. Two additional anglers (one striped bass angler and one non-specialized angler) were added in 1993 to improve angler representation (Wilson et al. 1996). The NRTF was charged with researching fish management issues and developing recommendations for improving the fishing in Norris Reservoir (Peterson et al. 1994). In 1992, monthly meetings were initiated. The public was encouraged to attend and participate. Unfortunately, not all stakeholder groups were identified and participating groups were not equally represented on the NRTF, leading to further doubt and mistrust among participants and observers. Decisions were largely driven by the fisheries professionals in the group which further heightened distrust among the observing public.

In 1994, the NRTF presented its Norris Reservoir Adaptive Fisheries Management Plan (NRAFMP), which attempted to address NRTF concerns about various components of the Norris Reservoir ecosystem. The NRAFMP was a five-year plan proposing a series of field studies using gill nets, hydroacoustic gear, rotenone sampling, limnological gear, electrofishing gear, and creel survey methodologies to determine if fishery management changes were warranted for major sport fish species in Norris Reservoir. Other activities were aimed at habitat enhancement and educating anglers about the lake's carrying capacity and fishery potential.

An aggressive stocking program was undertaken (crappies and walleyes) and more harvest restrictions were enacted (reducing creel limits for walleyes and crappies). Throughout the duration of the plan, the public was to be kept informed on activities and study results via public meetings hosted by NRTF.

A series of public meetings around Norris Reservoir to present the plan were attended largely by anglers with strong opinions about striped bass stocking. Although the plan was hotly debated, the NRTF held its ground for implementation of the plan. Many present at the meetings did not believe that the lake's production capacity had changed as the plan insisted, and accused the TWRA of trying to run the NRTF from behind the scenes to justify their trophy striped bass program. Despite the growing anti-striped bass sentiment in the Norris area, the NRAFMP was reviewed by TWRA biologists, administrators, and by biologists from other states with striped bass programs before being approved by the Tennessee Wildlife Resources Commission (TWRC; TWRA's governing body) for funding at the end of 1994.

By the time field studies commenced in 1995, anti-striped bass anglers viewed the NRTF and its adaptive management plan with much skepticism. These anglers condemned the plan's recommended seasonal size and creel limits for striped bass aimed at reducing fishing mortality. Although the plan called for reduction of striped bass stocking (about 15 fingerlings per hectare or about 200,000 fish in alternate years), it fell short of the stocking moratorium that anti-striped bass anglers demanded. NRTF biologists insisted that the reduction in striped bass stocked would help minimize any potential for food competition among sport fish species, but the second objective of enhancing growth and survival of striped bass fingerlings alarmed anglers against striped bass stocking. During this same period, NRTF biologists reviewed available information on food habits of striped bass and conducted their own studies of Norris striped bass food habits (Smollen 1999), subsequently concluding that striped bass were not preying heavily on other sport fish species or regulating their abundance. At public meetings, the NRTF reported on preliminary data from their rotenone and netting studies which suggested that direct competition between striped bass and native sport fish for Norris Reservoir's shad (*Dorosoma* spp.) and alewife (*Alosa pseudoharengus*) forage base was unlikely. By the end of 1995, angler sentiments regarding striped bass and TWRA management of the Norris Reservoir fishery, first voiced 20 years earlier, had hardened to the point that compromise was going to be difficult, if not impossible, to achieve.

Although the adaptive management plan was praised by many TWRA administrators, fisheries

biologists, anglers, and politicians, the recommendation to continue to maintain and enhance the striped bass fishery was not accepted by an increasingly vocal group of citizens. Many citizens believed fervently that striped bass were responsible for the problems they perceived and thought that stocking should cease. Equally fervent were striped bass anglers who insisted that the striped bass fishery be enhanced and the numbers stocked increased. Leadership of both groups became highly organized and a series of editorials, rebuttals, and letters to the editor were initiated in county and city newspapers.

Legislative and Agency Responses to the Escalating Conflict

Anglers opposed to the adaptive management plan mobilized in 1994 and chartered a grass-roots organization of concerned citizens, the Tennessee Sportsman's Association (TSA), from the counties surrounding Norris Reservoir. This organization stated its objective of "giving Tennessee sportsman a stronger voice in fish and wildlife matters throughout the state" and soon had over 1,000 dues-paying members (*Knoxville News-Sentinel* 1995). TSA's organizers lobbied to make their concerns known to county commissioners, legislative representatives, and TWRA representatives, maintaining that the successful establishment of a striped bass fishery contributed to poor fishing for native species in Norris Reservoir. They formally opposed the Norris Reservoir adaptive management plan because of the continued stocking of striped bass. The TSA also echoed past complaints that the TWRA operated with too much autonomy and was not adequately responding to citizens' concerns. Their short-term goal was to alter the management practices on Norris Reservoir and their long-term goal was to fundamentally alter the way in which TWRA operated. Their campaign against the agency in the local press soon expanded to anti-TWRA billboards and bumperstickers (Figure 1).

The TSA succeeded in getting state legislators to listen. During the 1995 legislative session, two bills (House Bills 969 and 970) were introduced that prohibited the stocking of striped bass in Norris Reservoir and removed striped bass harvest regulations. During hearings of the Conservation and Environment Committee, testimony was offered by expert witnesses, TSA members, and several Norris Reservoir anglers for and against the striped bass program. Prior to the hearings, the state legislator sponsoring the bills charged that TWRA was managing the Norris Reservoir fishery in a manner meant to punish anglers for voicing their concerns 25 years earlier (Tennessee Senate Hearing, 15 February 1995). The bills were defeated in committee.

After defeat of the bills in 1995, several unsuccessful attempts were made to pass "Private Acts" that curtailed or eliminated the stocking of striped bass into Norris Reservoir. In Tennessee, county commissions can ask their representatives to introduce Private Acts for consideration by the state legislature. Private Acts are not subject to committee review and are intended to seek redress for situations affecting only the citizens of a particular county. Because of their local nature, Private Acts are challenged rarely by members of the General Assembly. Despite the failure of the Private Acts, repeated introduction of legislation regarding fishery management at Norris Reservoir prompted the Conservation and Environment Committee to order TWRA to fund a new research project aimed at addressing striped bass competition and predation.

In October 1995, representatives from TWRA and two sportsmen's groups (Tennessee Striped Bass Association—TSBA and Tennessee Conservation League—TCL) met near Norris Reservoir to discuss ideas for the new striped bass study. The TSA was invited but declined to attend that scoping meeting, which disappointed some TWRC commissioners. The lack of input from the TSA in establishing the study objectives during the October 1995 meeting led to more conflicts. As a result of this meeting, the TWRC offered a compromise in November 1995. The TWRA would cease stocking striped bass for two years while funding a study of striped bass predation and competition. All interested parties (TWRA, TWRC, TSA, TCL, and the TSBA) were asked to agree to abide by the findings of that study. Striped bass stocking would not be continued if the study concluded that striped bass were adversely affecting other sport fish populations.

The TSA quickly voiced conflict-of-interest concerns about the study. They felt the adaptive management plan previously proposed by the NRTF was developed by the same individuals administering the striped bass program and was self-serving. Therefore, research proposals would be solicited *only* from out-of-state scientists to avoid any appearance of conflict of interest. Representatives from the TSA attended the November 1995 meeting and indicated they were not interested in another food habits study and would not agree to accept the study results. In a counter-proposal, TSA requested that TWRA discontinue stocking striped bass for 10 years, relax regulations on the harvest of striped bass, and have an independent research group conduct an extensive study of striped bass impacts over the 10 year period. The counter-proposal was not accepted by TWRC due to the high cost of such a long-term study.

Figure 1. One of several billboards placed outside of Clinton, TN by TSA leadership to voice its frustration with TWRA.



TWRA

Lobbying efforts to end the striped bass stocking program in Norris Reservoir continued as the 1996 legislative session approached. However, groups opposed to the lobbying efforts of TSA joined the debate. For instance, a local chapter of the Wild Turkey Federation contacted its members in November 1995 and urged them to contact their representatives and ask them to oppose any bill that would attempt to legislate fish and wildlife management. Members of the Tennessee Striped Bass Association had a more immediate interest in defeating such legislation and they also began a campaign of letters and newspaper editorials. TSBA and the other sportsmen's organizations (Wild Turkey Federation, Quail Unlimited, Tennessee Smallmouth Bass Alliance, Tennessee Conservation League) argued that fish and wildlife management decisions were best left to biologists, not politicians, and that mechanisms were already in place for citizens to have input on TWRA management of natural resources. Their letters reminded legislators that the agency's predecessor, the Tennessee Game and Fish Commission, had been plagued by similar politicization of fisheries and wildlife issues and a repeat of history would not be tolerated (Davis 1997).

In this highly-charged atmosphere, several Senate bills were drafted in 1996 that, if enacted, would have controlled fisheries management of Norris and other reservoirs. Senate Bill 2501 would have forced TWRA to rely solely on revenues generated by special licenses to fund any activities associated with striped bass management (or any other non-native fishery management). The bill also would have affected TWRA's extensive trout stocking and management program. Senate Bills 2823 and 2824 focused specifically on how the Norris Reservoir fishery was to be managed. Senate Bill 2823 affected the portion of Norris Reservoir within Claiborne County (one of five counties adjacent to the lake) and prohibited stocking of striped bass, its hybrids, or alewives; prohibited harvest restrictions of striped bass in any portion; and prohibited establishment of crappie size limits and imposed a daily creel of 20 crappies. The last mandate in Senate Bill 2823 indicated the willingness of some representatives to legislatively micromanage a fishery resource. Senate Bill 2824 was more succinct. It specified that no agency, person, or group shall spawn, rear, maintain, or stock striped bass, its hybrids, or alewives in any waters of Anderson County (which includes portions of Norris Reservoir). Anderson County is the home of TWRA's largest coolwater hatchery, Eagle Bend State Fish Hatchery, which produces many of the striped bass fingerlings stocked in Tennessee reservoirs.

The three Senate bills debated in the 1996 legislative session also were defeated on the grounds that the legislative actions only

addressed a local issue. The chairpersons of the Senate and House committees that debated the bills indicated that the legislature would abide by the findings of the out-of-state study and promised that no legislative actions would be taken while the study was in progress.

Subsequently, TWRA issued a request-for-proposals in February 1996 to university researchers in surrounding states. Awarding of the contract was made by the chairmen of the state Senate Environment and Conservation Committee and House Conservation Committee. Fisheries scientists at Mississippi State University (MSU) were contracted to examine the feeding ecology of striped bass in Norris Reservoir. The initial scope provided for a concurrent study at Watts Bar Reservoir. Specific objectives were to: (1) identify the extent and effect of predation by striped bass on game fish populations, (2) evaluate the potential for competition for prey resources among game fish populations in the reservoirs, and (3) compare the extent of competitive interactions between the two reservoirs having different productivity levels. The study commenced in October 1996 and the final report was published in 1998 (Miranda et al. 1998). Soon after initiation, MSU identified complications with the Watts Bar evaluation that invalidated comparisons. Objective 3 was voided in early 1997.

In March 1997, TSA representatives contacted members of the TWRC and the state legislature with a critique of the MSU proposal. The critique came in the form of a position paper written by TSA with comments from an external reviewer. In particular, the critique argued that the feeding ecology study was too narrow in its scope to resolve the issue of whether striped bass were negatively impacting native sport fishes. The critique requested that the TWRA develop a conceptual model of striped bass dynamics in Norris Reservoir and collect all potentially important ecological information. The critique noted that certain topics needed to be addressed, such as (1) "Do striped bass alter the behavior of other species or displace them through agonistic encounters?", and (2) "What do juvenile and adult striped bass eat in years of low forage or low reservoir water levels?" The critique also argued that the MSU proposal lacked sufficient detail concerning data to be reported, hypotheses to be tested, and final decision making. The critique suggested that the study be rescoped with new objectives identified and then subjected to peer and public review.

In response to TSA's requests, TWRA and MSU biologists worked to clarify the purpose of the study objectives through a series of letters and public meetings, but the duration of the study and its primary objectives were unchanged. The study continued to center around competition potential and the bioenergetics of Norris

Reservoir's striped bass community. TWRA contended that the agency could not commit funding for continuing the study long enough to address all of TSA's concerns.

MSU Study Findings

The MSU study (Miranda et al. 1998) made several important findings. Predation by striped bass on game fish in Norris Reservoir was deemed negligible during the study period. Direct competition between striped bass and other game fish was also negligible in Norris Reservoir during the study period. Potential did exist for competition between striped bass and other predators during periods of low forage abundance at the density of striped bass observed during the study. MSU researchers concluded that low forage abundance may become critical after winter shad kills which have occurred periodically throughout the history of Norris Reservoir. The final report did not include management recommendations for striped bass or other sport fish.

The Norris Lake Fishery Advisory Committee

The NRTF studies also ended in 1998, two years before their scheduled end. The NRTF had been rendered ineffective after angler representatives walked off in 1996, and NRTF study results were criticized by the TSA leadership. TWRA administrators realized that the agency needed to remove itself from any appearance of unilateral decision making. The replacement for the NRTF needed to be a more balanced advisory entity to mitigate the polarization that had occurred between stakehold-

ers and against the TWRA. A new approach to conflict resolution was in order.

After completion of the MSU study, TWRA worked with community leaders to form a representative stakeholder group. Stakeholders with interests in Norris Reservoir's sport fishery were identified following the methodologies of McMullin (1996). TWRA formed the Norris Lake Fishery Advisory Committee (NLFAC) with equal numbers of individuals from each stakeholder group (Figure 2). Besides the two opposing viewpoints on striped bass issues (TSA and TSBA), other groups were included that had not participated in the NRTF. The TWRA acted as advisors in the NLFAC's decision making process. The first two meetings of the NLFAC were facilitated by individuals from U.S. Fish and Wildlife Service's Management Assistance Team and the Indiana Department of Natural Resources to ensure that stakeholders did not perceive TWRA as guiding the process to their own ends over the priorities of the committee.

The first NLFAC organizational meeting was held on in February 1999, followed by a second meeting in March 1999. The group was advised to devise management objectives for each major sport fishery in Norris Reservoir. The committee agreed that TWRA would develop a list of possible management scenarios that would help meet these objectives. TWRA presented the scenarios at the committee's second meeting. Committee members agreed to "informed consent" decision-making, meaning that participants remained silent on an issue unless they were opposed strongly to it. If strong opposition occurred, the issue was discussed until acceptably resolved or the issue was tabled. Informed consent decisions were made on all man-

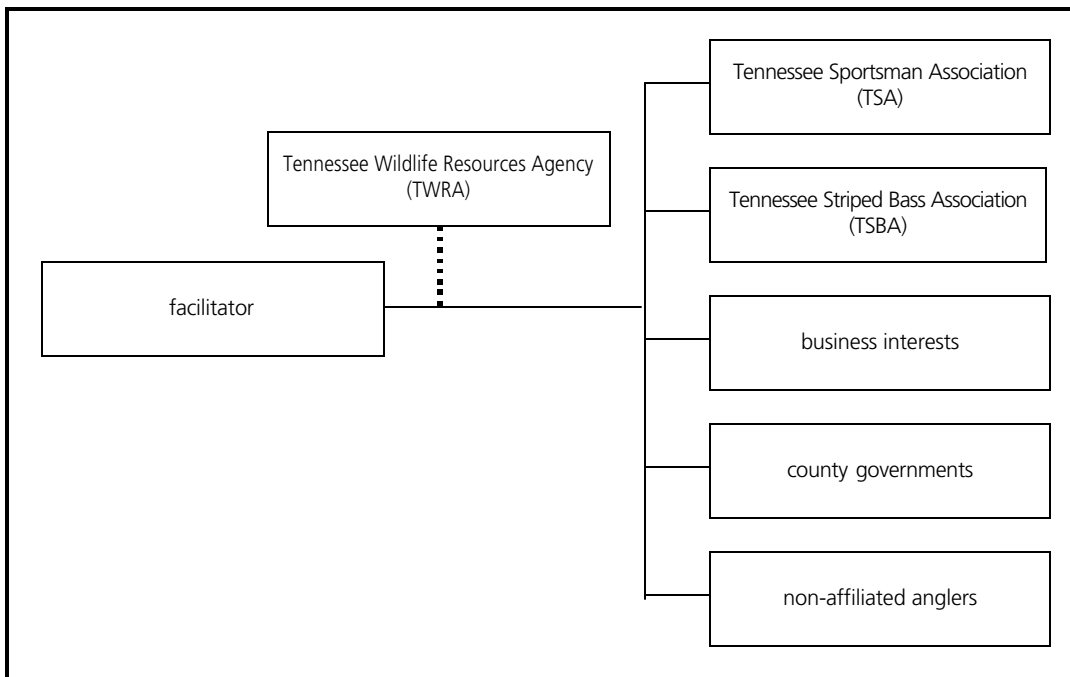


Figure 2. Organization of Norris Lake Fishery Advisory Committee (NLFAC). Dashed line represents advisory role of Tennessee Wildlife Resources Agency (TWRA).

Table 1. Management chronology of Norris Reservoir sport fisheries 1970–present. NRTF = Norris Reservoir Task Force, TWRC = Tennessee Wildlife Resources Commission, and NLFAC = Norris Lake Fishery Advisory Committee.

<u>Species</u>	<u>Management Objectives</u>	<u>Management Strategies</u>
Largemouth bass	1970—Maximize sustained harvest 1981—Sustained harvest of 3+ year old fish 1994—Reduce stockpiling 1999—Sustained harvest of 3+ year old fish	No size limit, 10 per day 356 mm minimum size limit, 10 per day creel limit 356 mm minimum size limit, with 2 less than 14 inches allowed, 10 per day creel limit 356 mm minimum size limit, 5 per day creel limit
Smallmouth bass	1970—Maximize sustained harvest 1981—Sustained harvest of 3+ year old fish 1999—Manage for a high quality fishery 2000—Manage for a high quality fishery	No size limit, 10 per day 356 mm minimum size limit, 10 per day creel limit 356–457 mm slot limit, only 1 fish >457 mm per day 457 mm minimum size limit
Spotted bass	1970—Maximize sustained harvest 1981—Sustained harvest of fish >14 inches 1988—Increase harvest and reduce abundance 1999—Increase harvest and reduce abundance	No size limit, 10 per day 356 mm minimum size limit, 10 per day creel limit No size limit, 10 per day Increase creel limit to 15 fish per day
Crappie	1970—Maximum sustained harvest 1988—Improve distribution of catch among anglers 1988—Enhance crappie fishery 1992—Sustained harvest of 3+ year old fish 1995—Reduce harvest to improve reproduction 1995—Enhance crappie fishery 1998—Sustained harvest of 3+ year old fish 1999—Enhance crappie fishery	None Creel limit reduced to 20 fish per day Stock black crappie based on availability 254 mm minimum size limit, 20 fish per day 254 mm minimum size limit, 5 fish per day Increase black crappie stocking to 100,000 fish per year into 5 embayments 254 mm minimum size limit, 10 fish per day Increase black crappie stocking to 12 fingerlings per hectare annually lakewide
Striped bass	1970—Build striped bass fishery 1975—Enhance striped bass fishery 1991—Enhance striped bass fishery 1994—Reduce potential for interspecific competition, per NRTF directive 1995—Reduce potential for interspecific competition, per TWRC directive 1995—Reduce seasonal mortality 1999—Maintain striped bass fishery, per NLFAC directive	Stock 3.5 fingerlings per hectare annually; 381 mm minimum size limit, 2 fish per day Increase stocking to 5.5 fingerlings per hectare annually Increase stocking to 12 fingerlings per hectare annually Stock 15 fingerlings per hectare on alternate years Stocking moratorium April–October: 381 mm minimum size limit, 2 fish per day; November–March: 610 mm minimum size limit, 1 fish per day Stock 7.4 fingerlings per hectare annually
Walleye	1970—Maximize sustained harvest 1993—Sustained harvest of 2+ year old fish 1994—Enhance walleye fishery 1995—Sustained harvest of 2+ year old fish 1997—Enhance walleye fishery 1999—Enhance walleye fishery (NLFAC)	No size limit, 10 per day 381 mm minimum size limit, 10 fish per day Stock unknown numbers of walleye annually from Doakes Pond sub-impoundment 381 mm minimum size limit, 5 fish per day Stock fingerlings at a rate of 10 per hectare annually Increase fingerling stocking rate to 24.7 per hectare annually
Sunfish	1970—Maximize sustained harvest 1999—Improve distribution among fishermen	None No size limit, 30 per day

agement objective and strategy scenarios after consultation with TWRA fisheries personnel regarding their potential effects. Committee members further agreed that the NLFAC would exist for a five-year period (1999–2003), and continuance would be discussed at the end of that period.

Management objectives and strategies were incorporated into a Norris Lake Fishery Advisory Committee Management Plan (Table 1). Increased stocking of sport fish, more restrictive

length and daily creel limits, and resumption of striped bass stockings at a reduced rate (7.4 per hectare) were among the management strategies incorporated into the plan. The striped bass stocking reduction was a NLFAC compromise reached in light of the MSU study conclusion that interspecific competition was possible during periods of low forage abundance. NLFAC agreed to follow the recommendations of the plan for three years and allow TWRA to present the results at periodic

meetings. It was further decided that these meetings would be open to the press and other non-participating public.

Although management evaluations are currently underway, local controversy about Norris Reservoir appears dampened since the inception of the NLFAC. The balanced role of stakeholders in the management of the fishery and the compromise in the maintenance of the striped bass fishery have likely played a major role in quieting opposed stakeholder groups and their criticisms of TWRA. All stakeholder groups involved in the NLFAC expressed desire to end ill will between themselves, and were willing to compromise to achieve that goal. Several individuals leading anti-striped bass movement were convinced that the NLFAC was another deception by TWRA and have left the TSA leadership, giving the organization's NLFAC representatives ability to compromise. Despite progress, disagreements involving decisions made by NLFAC continue to emerge and controversy over management issues continues to simmer.

Current Status

The conflict over TWRA management of Norris Reservoir's sport fishery simmered for several decades until it boiled over in the early 1990s. The formation of a grassroots organization with the stated purposes of changing management of the reservoir and fundamentally altering the operation of TWRA is strong evidence that early attempts to resolve the conflict were unsuccessful. Although it can be argued that there always will be dissatisfied anglers, TWRA has learned that it cannot ignore an empowered group of frustrated anglers. Most would agree that managing fisheries resources through legislative mandates is undesirable, including elected representatives who went on record saying that such issues are best left to professional fisheries biologists. The TWRA must effectively communicate with its stakeholders to prevent having its actions perceived as unilateral or arrogant.

The TSA has voiced many concerns since 1994; some were hotly contested and others widely supported. For instance, the TSA repeatedly demanded that TWRA be technically competent and that management decisions should be based on sound science. All sides of the debate agreed that rigor and accountability should be introduced into fisheries management. All sides agree that management decisions need to be based on sound science; however, the definition of "sound science" is broad and subject to different interpretations.

Opponents of TWRA are justified in requesting a broader ecosystem-approach to assessing the role striped bass play in Norris Reservoir; however, the cost of a long-term ecological assessment of that system is unrealistic. Such knowledge is expensive to obtain, and some degree of uncertainty would

still accompany resulting conclusions. Opponents of TWRA also discounted research generated in other systems. Again, most biologists agree that system-specific data are desirable, but the costs of studying every possible ecological interaction, in many different systems, is difficult to justify. To automatically discount any research that was not conducted on-site is unreasonable and presumptuous. Agreement among all interested parties of what is and is not important to study at Norris Reservoir is imperative to resolving this conflict. Unfortunately, TSA's exit from the NRTF and the lack of TSA representation at the October 1995 scoping meeting prevented a consensus resolution. TWRA may have been justified in proceeding with their plans to conduct additional research without the TSA support, but subsequent developments revealed the shortcomings of that decision. The TSA continued to push for changes in the operation of TWRA and in the fisheries management of Norris Reservoir. TSA also condemned the NLFAC and questioned the results of the MSU study, which did not conclude that all striped stocking should cease in Norris Reservoir.

The formation of the NLFAC helped to diffuse TSA's influence and prevented them from attempts to legislatively manage Norris Reservoir's sport fishery (e.g., no new bills regarding the management of Norris Lake have been introduced since 1996). The NLFAC provided a better balance of stakeholders that allowed informed decisions based on open dialogues between differing interest groups. Another great benefit of the NLFAC has been the re-establishment of lines of communication between oppositional elements in the Norris Reservoir fishing community and TWRA (Figure 3).

Conclusions

When the Norris Reservoir conflict began in the late 1960s, fisheries managers in Tennessee and elsewhere paid little heed to the human dimensions component of modern fisheries management. The recent surge of human dimensions research is evidence that fisheries agencies around the country are devoting more resources to describing and understanding the attitudes of different user groups and resolving conflicts among those groups (Mather et al. 1995; Jakus et al. 1996). Once rare, human dimensions researchers are increasingly common on the staff of resource management agencies (Knuth and McMullin 1996). The study and characterization of angler demographics and desires should be a routine, integral part of state fisheries management programs.

More information on the stakeholders and the


Figure 3. Chief of Fisheries Bill Reeves is consulted by members of the Norris Lake Fishery Advisory Committee.



economic benefit of the striped bass fishery might have helped defuse the conflict at Norris Reservoir years ago. Some angler opinion data were collected by the NRTF (O'Bara 1999), but that component of the fishery (and the conflict) was not studied in great detail before or after the task force was created to resolve the dispute. A single attempt was made to quantify the economic effects of the Norris striped bass fishery for the legislature after bills were introduced to eliminate stocking. A contracted phone survey conducted on anglers who fished Norris Reservoir during the 1995 height of the conflict indicated that 36% wanted TWRA to stop stocking striped bass into the lake (Fly and Jakus 1996). However, the survey indicated 48% of Norris anglers wanted the agency to continue stocking. These results justified the continuation of TWRA's striped bass program only if the results of the MSU study showed negligible biological impact on other sport fish species. Hindsight suggests that the agency should have collected sociological, demographic, and economic information data with the same intensity as biological data prior to the escalation of the conflict in the early 1990s.

Future efforts to understand the human and economic dimensions of the Norris Reservoir conflict could help resolve a decades-old problem; however, human dimensions research alone can

not resolve such conflicts. Traditional biological information collected by resource managers should be complemented by an understanding of who the clients are and why they value a particular resource. The public is increasingly skeptical about government activities supported with tax dollars and management biologists are urged to redouble their efforts to collect and archive data that can withstand intense public scrutiny. In the absence of extensive "pre-treatment" fisheries data, no amount of "post-treatment" data would allow TWRA biologists to argue conclusively that the establishment of a striped bass fishery was not related to changes (perceived or real) in other components of the ecosystem. Management agencies must determine if levels of rigor for biological data that were suitable for making management decisions in the recent past should be raised to prevent future escalation of conflicts.

The advisory committee approach used at Norris Reservoir should be used only when major management conflicts are developing and unilateral decisions by the management agency will heighten the conflicts (McMullin 1996). For advisory committees to be most effective, fisheries management agencies must strive to balance stakeholder decision-making and place themselves in an advisory role. As Knuth and McMullin (1996) noted, human dimensions expertise is rapidly growing in natural resource agencies and today's traditionally-trained management biologists will have more opportunities in the future to gain experience and develop such expertise through collaborative research and management programs. We urge university educators to incorporate human dimensions and conflict resolution courses into fisheries curricula to better expose students to this aspect of fisheries management. 

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References

- Davis, M. 1997. Sportsmen united: the story of the Tennessee Conservation League. Bench Top Books, Mt. Juliet, Tennessee.
- Denton, G. M., C. S. Freeman, and K. A. Larrieu. 1996. The status of water quality in Tennessee 305(b) report. Tennessee Department of Environment and Conservation, Nashville.
- Eschmeyer, R. W., and O. F. Haslbauer. 1946. Utilization of the sauger crop in Norris Reservoir, Tennessee. *Journal of the Tennessee Academy of Science* 21:72-75.
- Fitz, R. B., and J. A. Holbrook. 1978. Sauger and walleye in Norris Reservoir, Tennessee. Pages 82-88 in R. L. Kendall, ed. Selected coolwater fishes of North America. American Fisheries Society Special Publication 11.
- Fly, J. M., and P. M. Jakus. 1996. Survey of public opinion about the Tennessee Wildlife Resources Agency. Tennessee Agricultural Experiment Station. University of Tennessee, Knoxville.
- Hackney, P. A., and J. A. Holbrook. 1978. Sauger, walleye, and yellow perch in the southeastern United States. Pages 74-81 in R. L. Kendall, ed. Selected coolwater fishes of North America. American Fisheries Society Special Publication 11.
- Jakus, P. M., J. M. Fly, and J. L. Wilson. 1996. Explaining public support for fisheries management alternatives. *North American Journal of Fisheries Management* 16:41-48.
- Kimmel, B. L., and A. W. Groeger. 1986. Limnological and ecological changes associated with reservoir aging. Pages 103-109 in G. E. Hall and M. J. Van Den Avyle, eds. Reservoir fisheries management: strategies for the 80's, Reservoir Committee, Southern Division American Fisheries Society, Bethesda, Maryland.
- Knoxville News-Sentinel. 1995. Letter to the editor by Richard L. Doub, Tennessee Sportsman Association. July 23.
- Knuth, B. A., and S. L. McMullin. 1996. Measuring the human dimensions of recreational fisheries. Pages 651-684 in B. R. Murphy and D. W. Willis, eds. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.
- Kohler, C. C., and J. J. Ney. 1981. Consequences of an alewife die-off to fish and zooplankton in a reservoir. *Transactions of the American Fisheries Society* 110:360-369.
- Mather, M. E., D. L. Parrish, R. A. Stein, and R. M. Muth. 1995. Management issues and their relative priority within state management agencies. *Fisheries* 20(10):14-21.
- McMullin, S. L. 1996. Natural resource management and leadership in public arena decision making: a prescriptive framework. Pages 54-63 in L. E. Miranda and D. R. DeVries, eds. Multidimensional approaches to reservoir fisheries management. American Fisheries Society Symposium 16.
- Miranda, L. E., M. T. Driscoll, and S. W. Raborn. 1998. Competitive interactions between striped bass and other freshwater predators. Final report. Mississippi State Cooperative Fish and Wildlife Research Unit. Mississippi State University, Starkville.
- Moore, C. M., R. J. Neves, J. J. Ney, and D. K. Whitehurst. 1985. Utilization of alewives and gizzard shad by striped bass in Smith Mountain Lake, Virginia. *Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies* 39:108-115.
- O'Bara, C. J. 1999. Norris Reservoir fishery investigation 1992-1998. Final report. Center for the Management, Utilization, and Protection of Water Resources. Tennessee Technological University, Cookeville.
- Peterson, D. C., and J. Negus. 1994. Norris Reservoir annual report 1993. Tennessee Wildlife Resources Agency, Nashville.
- _____. 1995. Norris Reservoir annual report 1994. Tennessee Wildlife Resources Agency, Nashville.
- Peterson, D. C., D. Tomljanovich, G. Carden, B. Kincaid, C. O'Bara, J. W. Stair, D. Scott, M. Smith, I. Vanderpool, L. Wilson, and N. Woome. 1994. Norris Reservoir Adaptive Fishery Management Plan. Tennessee Wildlife Resources Agency and Tennessee Valley Authority, Nashville.
- Schultz, R. D. 1992. Walleye and clupeid interactions in Dale Hollow Reservoir, Tennessee. MS thesis, Tennessee Technological University, Cookeville.
- Schorr, M. S., J. Sah, D. F. Schreiner, M. R. Meador, and L. G. Hill. 1995. Regional economic impact of the Lake Texoma (Oklahoma-Texas) striped bass fishery. *Fisheries* 20(5):14-18.
- Smollen, M. A. 1999. Food habits of adult predators in Norris Reservoir during winter drawdown. MS thesis, University of Tennessee, Knoxville.
- Stevens, R. A. 1958. Striped bass of the Santee-Cooper Reservoir. *Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies* 11:253-264.
- Wilson, J. L., D. A. Tomljanovich, D. C. Peterson, and C. O'Bara. 1996. A partnership approach to reservoir fisheries management. Pages 38-41 in L. E. Miranda and D. R. DeVries, eds. Multidimensional approaches to reservoir fisheries management. American Fisheries Society Symposium 16.