



Comment: Do Something or Do Nothing—the Fisheries Management Conundrum

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COMMENT

Comment: Do Something or Do Nothing—the Fisheries Management Conundrum

Thompson et al. (2016) proffer a critique of the wild adult Florida Largemouth Bass *Micropterus salmoides floridanus* stocking program at Lake Griffin (2004–2007) and Lake Dora (2007–2010) in Florida’s Harris Chain of Lakes described in Canfield et al. (2013). From their analysis, Thompson et al. (2016) concluded that the stocking of wild adults only provided short-term contributions to each lake’s population. They could also find no evidence that stocking these lakes led to a lasting increase in the abundance of adult bass or to any noticeable effect on recruitment, angling effort, or economic expenditures by anglers. More importantly, they assert that the stocking program led to the genetic contamination of presumably pure Florida Largemouth Bass populations with Northern Largemouth Bass *M. s. salmoides* alleles.

Thompson et al. (2016) offer three recommendations for any future attempts to stock wild Florida Largemouth Bass into public waters:

1. If the objective is to increase angler effort and the economic value of the fishery, stocking events should be widely publicized.
2. Stocking programs should include an appropriate evaluation system for identifying any changes in fish populations as well as the economic benefits that might result from stocking.
3. Before implementing any stocking program, a risk–benefit assessment should be completed to assess potential impacts on the genetic integrity of the species involved.

These recommendations provided support for a 2012 internal Florida Fish and Wildlife Conservation Commission (FWCC) document intended to help FWCC administrators decide whether to issue permits for the collection and relocation of wild bass (Porak et al. 2015).

Stocking adult fish has been done both prior to and after the establishment of fish hatcheries in the USA and Canada, and the pros and cons of such stocking are well known (Lasenby and Kerr 2000). The Thompson et al. (2016) and Canfield et al. (2013) papers continue the ongoing, long-term debate regarding the value of stocking fish into large public waters. Both papers provide valid scientific evidence, but it will be up to the readers to ascertain whether the level of research provided in each paper deserves trust or skepticism.

Initiating a stocking program (“doing something”) or not (“doing nothing”), however, are actions that are based on multiple scientific and sociological factors. While the management of fish populations on the basis of “science-based” evidence is the desired goal and the recommendations made by Thompson et al. (2016) are valid given sufficient money and time, management agencies like the FWCC have to manage peoples’ expectations (e.g., those of anglers and other lake users, riparian landowners, and fishery-dependent businesses like fish camps). Politics can drive decisions, and management agencies often have to base their decisions on whether politically driven courses of action will cause harm or not. No public organization, however, can prosper if political forces begin to see their programs as do-nothing activities.

The purpose this comment is to place the adult Florida Largemouth Bass stocking program at the Harris Chain of Lakes in a broader context so that readers of Thompson et al. (2016) and Canfield et al. (2013) can better understand why such a program came into being (i.e., its history), the benefits and costs of this short-term management action, and the potential long-term genetic implications of the project. Lessons learned at the Harris Chain of Lakes may well be applicable to other regions facing similar circumstances, so it is hoped that the discussion provided here will help management agencies and other interested parties determine whether the stocking of wild adult bass is a viable management tool for their waters when only limited scientific information and money are available and risks may exist.

WHY STOCK ADULT FISH?: THE HISTORY

Largemouth Bass fishing is big business at the Harris Chain of Lakes, and the City of Leesburg declared itself the “Bass Capital of the World” early in the 20th century. Bass fishing was excellent in the early years because many of the lakes, like Lake Apopka and Lake Griffin, had extensive growths of aquatic macrophytes, an important habitat for Largemouth Bass. During the 1940s, in fact, the aquatic macrophyte cover in Lake Griffin was estimated to be 50% (see Pecora 2009). Since then, however, macrophyte cover has experienced a significant decline. The FWCC estimates that the macrophyte cover in Lake Griffin declined from approximately 35% in 1960 to less than 2% by 1975. The commission further documented a major decline in Lake Griffin’s Largemouth Bass fishery

from 1966 to 1984 (see Pecora 2009). Why Lake Griffin changed from a macrophyte-dominated system to a phytoplankton-dominated system is subject to debate, but the factors considered most important include stabilized water levels, urban growth, aquatic plant control, and eutrophication.

Agencies like the Florida Department of Environmental Regulation (now the Florida Department of Environmental Protection [FDEP]) and the Saint Johns River Water Management District (SJRWMD) were charged by the Florida legislature with correcting these problems in order to restore the fishery, but the point source and non-point-source nutrient control programs (e.g., buyout of lakeside muck farms to reestablish former wetlands) were going to take years and cost millions of dollars. When asked to initiate an action to quickly improve the Lake Griffin Largemouth Bass fishery, the FDEP and SJRWMD had no immediate answers and deferred to the FWCC, who proposed an experimental, extreme lake drawdown for 1984 (a do-something approach).

The FWCC obtained a permit from the SJRWMD to lower Lake Griffin's water level. Following the drawdown, aquatic vegetation coverage increased to 20% and the CPUE of young-of-year Largemouth Bass (<200 mm TL) was the highest ever recorded by the FWCC. This year-class subsequently produced large catches of harvestable-sized fish (>360 mm), reaching a high point of 20,000 fish caught in 1987. Success—from the standpoint of the fishery—was achieved and documented with excellent scientific evidence. However, management is not only about science. By the 1980s Lake Griffin had become a multi-use lake. Nonangler recreational boaters, riparian landowners, and businesses (including fish camps) viewed the experimental drawdown as the creator of a major aquatic weed problem. Hydrilla *Hydrilla verticillata* cover in the lake reached 11%, and aquatic plants blocked boat docks, beaches, and access canals, resulting in the FDEP's having to institute a major aquatic weed control program. The control program targeted the main lake, and no assistance was provided for access canals, private boat docks, or commercial marinas. The FDEP reduced Lake Griffin's lakewide macrophyte cover from 20% in 1986 to less than 2% by 1988 (see Pecora 2009). The CPUE of young-of-year Largemouth Bass declined to nearly zero by 1989, and by 1990 bass anglers were stating that the fishery had collapsed (<https://bassonline.com/florida-lakes/lake-griffin/>).

The Bass Anglers Sportsman Society's (B.A.S.S.) Megabucks Tournament came to the Harris Chain of Lakes in 1986. The economic impact of this major national fishing tournament on Lake County was widely recognized, and local governments began to recruit tournaments. The 2012 Bass Pro Shops Southern Open #1 and the 2015 Fishers of Men National Championship provided over \$551,000 and \$598,000 directly to the Lake County economy during their 3-d fishing events. It is now estimated that fishers outspend other Lake County tourists by three to one (Adam Sumner,

Economic Development and Tourism Department, Lake County, Florida, personal communication). However, B.A.S.S. held a disastrous national tournament at the Harris Chain of Lakes in early 1990, setting a record for the lowest average catch rate of any national tournament. Major national tournaments left or threatened not to return to the area, and many of the weekly bass tournaments ceased (Wilson 1992). The loss of the Largemouth Bass fishery became an economic calamity.

The FWCC documented that Lake Griffin's fisheries (especially the Largemouth Bass fishery) had declined about 90% and that there were indeed substantial economic losses to the community (Benton 2000). In response to pressure from the angling public, the FWCC implemented two do-something management actions. A five-bass 14-in (356-mm) daily limit was established, and an extreme lake drawdown was proposed for 1995 as the only practical answer for quickly rehabilitating the Largemouth Bass fishery (Herzog 1994). The 1990s, however, were a difficult period at Lake Griffin. In addition to the collapse of the bass fishery, American alligators *Alligator mississippiensis* and Florida softshell turtles *Apalone ferox* were dying and a potentially toxic blue-green alga, *Cylindrospermopsis* sp., was blooming in the lake (Associate Press 2000). The deaths of the alligators could not be linked to organochlorine compounds, organophosphate pesticides, heavy metals, disease, botulism, or cyanobacterial toxins (Schoeb et al. 2002; Honeyfield et al. 2008), but a possible link to thiamine (vitamin B₁) deficiency (Perran Ross et al. 2009) was hypothesized due to the neurological impairment of adult alligators. The thiamine deficiency, in turn, was related to the rate of thiaminase activity in Gizzard Shad *Dorosoma cepedianum*.

Local elected officials responded to the problems at Lake Griffin by forming the Lake Griffin Restoration Task Force. The task force was charged with making recommendations for restoring the water quality and Largemouth Bass fishery of Lake Griffin. It voted nine to two to support the FWCC's proposed drawdown, but a minority of the members of the task force organized public opposition to it. Riparian homeowners, nonangler boating interests, the business community, and anglers in Lake Griffin's other major fishery (that for Black Crappies *Pomoxis nigromaculatus*), as well as some bass anglers, argued against the drawdown because of fears that it would create another expensive hydrilla problem. Bass anglers were concerned that the State of Florida would then use more herbicides to eliminate the plant, many of these anglers believing that the excessive use of herbicides had contributed to the collapse of the bass fishery in the first place (Bassmaster 1992). Black Crappie anglers and fish camp owners argued that the proposed winter drawdown would create economic hardships because access to the lake would be greatly limited during the peak of the Black Crappie fishing season. The opposition also saw an extreme drawdown as a temporary fix that would

have to be repeated every 3–5 years. Political pressures became so great that the SJRWMD did not issue a draw-down permit to the FWCC.

The FWCC's failure to obtain a permit to conduct an extreme drawdown led to another do-something action in 1997, namely, the stocking of advanced Largemouth Bass fingerlings into Lake Griffin. Although it was more costly to produce these advanced fingerlings, the FWCC argued that larger fingerlings had a greater chance of survival. The FWCC released 52,000 advanced fingerlings produced at their Richloam Hatchery into Lake Griffin, stating that stocking these bass was part of an ambitious program to restore the lake to its status as one of the region's premier bass lakes (Wilson 1997).

Unfortunately, the stocking was not successful. The FWCC attributed the failure to nutrition, culture, and fish health protocols at the hatchery. The commission also reported in 1999 that the sport fish population and the fishery of Lake Griffin were at a historical low point, with electrofishing showing an extremely low density of Largemouth Bass and no reproduction among the samples taken (Benton 2000). Not having a stocking option, the FWCC again proposed an extreme drawdown for 2000–2001 as the do-something option. Public opposition and politics again prevented a drawdown, essentially leaving the FWCC with only the do-nothing option.

Eutrophication control efforts by the SJRWMD and other public agencies were not proceeding fast enough for the citizens. Public frustration grew because of the belief that all of the state and local management agencies were doing nothing beneficial for the Harris Chain of Lakes. The Florida legislature intervened in 2001 and established the Harris Chain of Lakes Restoration Council (HCOLRC), which was charged with establishing a restoration plan for the entire system (Harris Chain of Lakes Restoration Council 2002).

As a compromise, the HCOLRC supported the SJRWMD's proposal for enhanced lake level fluctuations at Lake Griffin rather than an extreme drawdown as the do-something option (HCOLRC 2002). A major condition for the support of the HCOLRC, however, was that the canals and access points adjoining Lake Griffin be completely dredged before the lake level fluctuation program was implemented. Dredging was seen as necessary to provide access for Black Crappie anglers and boaters during the winter tourist season; further, the fluctuation schedule would only be implemented with sufficient rainfall. Dredging costing over US\$9 million was completed in 2007, but enhanced water level fluctuations were not implemented because Florida experienced a very dry period from 2000 to 2012. Faced with a do-nothing situation, the HCOLRC asked the FWCC to reconsider stocking Lake Griffin.

The FWCC recommended stocking Lake Griffin with advanced fingerlings in 2003 (HCOLRC 2003). The previous year, the commission had proposed a multimillion dollar renovation of their Richloam State Fish Hatchery. Dedicated in 2007, the new state-of-the-art facility, the

Florida Bass Conservation Center (FBCC), was dedicated to the propagation and conservation of genetically pure Florida Largemouth Bass. Genetics became an issue because the FWCC and others were pushing to have the Florida Largemouth Bass declared its own species, *Micropterus floridanus* (Kassler et al. 2002). Unfortunately, the FWCC had to inform the HCOLRC that considerable research was still being conducted on the production, stocking, and survival of the FBCC's advanced fingerlings (HCOLRC 2003). The FWCC also informed the HCOLRC that Lake Griffin probably could not be stocked until 2009. As doing nothing for Lake Griffin for 5–6 years was unacceptable to the HCOLRC, they sought other options.

As the University of Florida's representative to the HCOLRC's technical advisory group, I proposed stocking wild adult Largemouth Bass from waters not adjoining the Harris Chain of Lakes to provide temporary relief to the fishery (HCOLRC 2004). I informed the HCOLRC that stocking adult bass was a do-something practice employed by many fish management agencies early in the history of fish management. The practice was ended when the public became opposed to taking adult fish from public waters, resulting in agencies' focusing their efforts on the establishment of hatcheries. Florida, however, has millions of unfished private retention ponds, quarry lakes, and other private systems that could serve as source populations with no impact on the Largemouth Bass stocks in public water bodies. It was discussed how these waters could provide trophy bass greater than 4.5 kg as well as large numbers of other adult fish for stocking.

The FWCC stated that they could not undertake such a project because of limited personnel and inadequate funding. They were also concerned that not enough adult fish could be collected and moved without massive mortality to make a difference in a lake the size of Lake Griffin. However, the HCOLRC concluded that a wild adult Largemouth Bass stocking program was worth a try when I indicated that Florida LAKEWATCH staff and students at the University of Florida could conduct such a transfer program. Seeing this as a do-something program that might be able to rejuvenate Lake Griffin's and the Harris Chain of Lakes' fishing reputation, the HCOLRC approached the Lake County Water Authority (LCWA) for start-up funding.

The HCOLRC explained to the LCWA that it was better to be seen as doing something rather than doing nothing after a decade or more of no major success. The HCOLRC and the LCWA, however, were informed by both me and the FWCC that the key to successful management of Largemouth Bass in large Florida lakes like Lake Griffin is the maintenance of adequate habitat. Without such habitat, stocking must be considered a temporary fix, unless long-term funding is maintained for annual stocking. The stocking at Lake Griffin had to be considered a put-and-take stocking program because (1) fish move out of the lake into other waters

(Dequine and Hall 1950), (2) anglers move fish from Lake Griffin and Lake Dora into Lake Harris (the weigh-in site) during tournaments, (3) bass are still harvested for food (Lange et al. 1993), and (4) bass die from natural causes as well as during tournaments (Schramm et al. 1985; Wilde 1998). Finally, it was noted that a comprehensive economic analysis of the sport fishery, such as was done by Milon and Welsh (1989), probably should be conducted simultaneously because future funding agencies would ask what the benefits and costs of such an effort were.

After public discussion and consideration of the cost of a comprehensive economic study, the LCWA accepted the recommendation of the HCOLRC to fund the University of Florida's wild adult bass stocking proposal, but without an economic study. The LCWA and the HCOLRC agreed to an allocation of \$69,000 for the sole purpose of collecting and transferring adult bass. The funding was not to be used for research (UFFAS 2007).

THE STOCKING PROJECT'S BENEFITS AND COSTS

One of Thompson et al.'s (2016) concerns is that there is no evidence that stocking the lakes led to a lasting increase in economic expenditures by anglers. Without a comprehensive economic analysis of the sport fishery, both Canfield et al. (2013) and Thompson et al. (2016) had to use supplementary information to estimate benefit: cost ratios, but even with the results of a study such as Milon and Welsh's (1989) differences of opinion would probably persist because of the political pressures.

Canfield et al. (2013) reported the total expenditure over the 6 years of the project as \$492,775. The approximate cost for just capture and transport alone (not including the university's evaluations, infrastructure, or overhead) was \$250,000. Contrary to the findings of Canfield et al. (2013), Thompson et al. (2016) surmise that the benefit: cost ratio was less than 1.0, indicating that the wild adult bass stocking program was not cost-effective. They were particularly critical of Canfield et al.'s (2013) use of a fish replacement value calculated from the FDEP's fish kill mitigation and restitution program (Aquatic Animal Damage Valuation 1993). The calculated FDEP replacement value for unfished waters was \$441,634, and the recreational value was \$462,086. These values are conservative because quality- and trophy-size fish are worth more (\$500 to \$1,000 per fish) to private organizations (e.g., Bass Pro Shops) that maintain aquarium exhibits. The FDEP replacement-value approach, however, was chosen because it has been used by the FWCC to estimate the value of fish to be stocked each year by the FBBC (http://myfwc.com/media/244911/FBCC_Flyer.pdf), thus permitting a fairer comparison with potential FWCC hatchery stockings.

Thompson et al. (2016) and Canfield et al. (2013) both used the FWCC's creel surveys to estimate the value of the fishery at Lake Griffin. Thompson et al. (2016) estimated that

the annual value of the Largemouth Bass fishery averaged \$353,599 in Lake Griffin, whereas Canfield et al. (2013) estimated the value at over \$1 million per year. Determining the value of a fishery in an open system such as Lake Griffin, where fish movement is extensive (Dequine and Hall 1950), is as much an art as a science. Another difficulty is the possible difference stemming from the FWCC's use of roving creel surveys on the main lake as opposed to a survey of both the main lake and adjoining waters, where Canfield et al. (2013) reported many anglers caught stocked fish. The FWCC had concluded in 1986 that creel surveys on large lakes should include canal areas connected to the lake if realistic harvest figures are to be obtained (Mesing and Wicker 1986). This recommendation, however, was never implemented by the FWCC at Lake Griffin, so the economic values presented by Thompson et al. (2016) are most likely conservative.

Thompson et al. (2016) recommended that if the objective was to increase angler effort and the economic value of the fishery, stocking events should have been widely publicized. An intangible benefit of the adult stocking program, however, was that the marketing was essentially free. Anglers must wait a period of time before stocked fry or fingerlings reach legal size, whereas the stocked adult Largemouth Bass were immediately available to them. Anglers observing the stocking of quality and trophy fish reported by Canfield et al. (2013) also provided extensive word-of-mouth advertising to other bass fishers and tournament participants. The HCOLRC concluded that this word-of-mouth advertising changed angler perceptions of the fishing situation at the Harris Chain of Lakes and helped bring in more tournaments (Skip Goerner, vice chairman, minutes of a September 7, 2012, meeting of HCOLRC), fishing is a big, highly competitive business, and the holders of tournaments need to advertise. The percentage of gross revenues dedicated by businesses to marketing range from just under 4% to more than 20%, the higher values being associated with highly competitive industries (Boykin 2017). Expressing Canfield et al.'s (2013) total project costs in terms of annual expenditures and comparing them with the estimated values of the bass fishery suggested by Thompson et al. (2016) and Canfield et al. (2013), the percentages are found to fall within the range reported by private industries for marketing. So, if management agencies consider stocking adult bass as a marketing tool, the disagreement between Thompson et al. (2016) and Canfield et al. (2013) over benefit: cost ratios becomes more of an academic exercise than a factor affecting a good business decision.

Thompson et al. (2016) also concluded that the stocking of wild adult Largemouth Bass only provided short-term benefits. The LCWA and the HCOLRC were well aware that the adult stocking program had to be considered a temporary fix unless habitat was restored. The terms "temporary" and "long-term" need to be placed in the context of other fish management activities, however. An extreme

drawdown will produce bass, but there will be a lag before the young-of-year fish enter the creel, and the same is true for advanced bass fingerling stockings. Further, the effects of both management tools would only last a few years. In the case of Brook Trout *Salvelinus fontinalis* and other catchable sized salmonids, hatcheries produce adult fish economically but angling pressure forces stocking to be done every year (CTDEEP 2016). Given all the possible considerations, Canfield et al.'s (2013) conclusion that stocking wild adult bass is a viable management tool (a do-something activity) still seems worthy of consideration.

THE GENETIC CONTAMINATION ISSUE

Perhaps the most critical point made by Thompson et al. (2016) is that the stocking program led to the genetic contamination of presumably pure Florida Largemouth Bass populations with Northern Largemouth Bass alleles. They estimated that as many as 1,000 of the 24,781 stocked bass might not have been pure Florida Largemouth Bass.

Agencies like the FWCC have been concerned about fish genetics since 2000 because of problems associated with stockings by hatcheries. When Canfield et al. (2013) began their program, the most readily available and inexpensive technique that could detect alleles from either subspecies was electrophoresis (Childress 2004). Fish from potential donor sites were tested to determine the genetic composition of the individual bass populations. The FWCC permit stipulated that adult bass were only to be taken from populations that tested out as pure Florida Largemouth Bass. The FWCC administrators had information from an internal genetic study conducted from 1999 to 2003 (prior to the stocking reported in Canfield et al. 2013) that the Ocklawaha River and other central Florida systems (i.e., the Harris Chain of Lakes) should *not* be assumed to contain pure Florida Largemouth Bass populations (Barthel et al. 2010). The risk of genetic contamination's adversely affecting indigenous bass populations was therefore deemed minimal. Based on the available information and the fact that nearly all donor waters were located south of the Harris Chain of Lakes and well below the traditional Suwannee River boundary line for Florida Largemouth Bass, FWCC administrators issued a permit for the adult bass stocking program.

The FWCC later developed new genetic markers that they felt could be used to confidently ensure that individual fish were "pure" Florida Largemouth Bass (Tringali et al. 2010). Despite ongoing debates within and outside academia regarding the role of genetics in determining a species, the FWCC began to develop a risk-based decision making process for the transfer of wild bass in Florida in 2012 (Porak et al. 2015). The need to develop the policy was based on the belief by individuals within the FWCC and elsewhere that Florida Largemouth Bass should be declared its own species (Kassler et al. 2002). Fisheries biologists that were part of

the conservation genetics movement were also pushing to protect and conserve endemic black bass populations (Tringali et al. 2015). The FWCC staff promoting the policy wanted to prevent a situation like that at the Harris Chain of Lakes (Porak et al. 2015), but the FWCC's stocking guidelines still authorize the issuance of stocking permits south of the Suwannee River. The release of fish must provide a benefit to the resource and its users as deemed by management staff.

Agency decisions about public benefits have never been based completely on scientific facts, but there is no doubt that the FWCC is leaning toward relying heavily on genetics. In their 1999–2003 genetic study to assess the geographic location of genetically pure Florida Largemouth Bass, Barthel et al. (2010) further divided Florida into four black bass genetic management units (GMUs). This led to an FWCC policy whereby state and federal stocking programs using hatchery-reared fish are prohibited from translocating bass between GMUs, thereby ensuring that hatchery fish are released into water bodies in the same GMU from which their parents were collected. This represents another impediment to adult stocking programs.

The push by the FWCC and other management agencies for 100% genetic purity of stocked fish, however, must be challenged in light of a 2003 U.S. District Court decision (American Wildlands v. Kempthorne 2007) regarding the stocking of Westslope Cutthroat Trout *Oncorhynchus clarkii lewisi* (USFWS 2003). As the U.S. Fish and Wildlife Service had found that hybrid Westslope Cutthroat Trout with up to 20% of their genes from Rainbow Trout *O. mykiss* were indistinguishable morphologically, behaviorally, and ecologically from Westslope Cutthroat Trout, the court ruled that genetic purity is not a condition for including populations or individual fish in the Westslope Cutthroat Trout subspecies. The Largemouth Bass stocked into the Harris Chain of Lakes (Canfield et al. 2013) were morphologically indistinguishable from Florida Largemouth Bass inhabiting other Florida waters. The FWCC's genetic sampling of the Harris Chain of Lakes in 2010 and 2011 indicated that 10.7% of 234 collected bass (not stocked by Canfield et al. 2013) were interspecific hybrids, leading Porak et al. (2015) to suggest that the wild adult bass stocking program had contributed to the genetic contamination of the system. This conclusion was surprising because Barthel et al. (2010) had concluded, based on the FWCC's sampling, that the Harris Chain of Lakes should not be assumed to contain pure Florida Largemouth Bass populations. The two stocked hybrids caught by Porak et al. (2015) also had less than 3% Northern Largemouth Bass alleles. These fish would be Florida Largemouth Bass per the U.S. District Court decision for Westslope Cutthroat Trout. So, was there really genetic contamination by the wild adult Largemouth Bass stocking program?

Molecular genetic techniques have provided biologists an additional set of biological characters that can be used to help distinguish species, subspecies, and hybrids, but they are not always definitive and must be placed in the context of how the

scientific community has delineated species. Advocates for using the 100% genetic purity test for stocking Florida Largemouth Bass assume superior growth to trophy size and longevity. Not all research supports this assumption (Kleinsasser et al. 1990), and the longer growing season and other favorable environmental factors may have a greater influence than genetics in Florida (Chew 1975). U.S. management agencies must now also consider that a U.S. District Court has ruled that genetic purity is not a condition for including populations or individual fish in a subspecies. Thus, given the ability of Largemouth Bass to move long distances and the previous finding of intergrades upstream and downstream of Lake Griffin, the FWCC will have great difficulty in distinguishing between anthropogenic and natural hybridization at the Harris Chain of Lakes. The FWCC should therefore conduct a study similar to the Fish and Wildlife Service's study for Westslope Cutthroat Trout rather than relying too extensively on their GMUs before declaring the Florida Largemouth Bass a separate species.

CONCLUSION

Despite the critique by Thompson et al. (2016), the weight of evidence suggests that stocking wild adult Largemouth Bass (a do-something action) is a management tool deserving of consideration by management agencies. The pros and cons of different types of stocking programs have been debated for over 100 years and this most likely will continue, especially given the emergence of the conservation genetics movement and the push for 100% genetic purity. Fishery administrators, biologists, and managers, however, must not confound their science with their values or decisions can become capricious and arbitrary, as noted by the U.S. District Court for the District of Columbia.

The HCOLRC (2014, 2015) also continues to recommend the stocking of adult Largemouth Bass because the stockings of advanced fingerlings by the FWCC have not yet achieved success in the Harris Chain of Lakes after 20 years of study. The HCOLRC emphasizes that the stocking of large, wild adult bass described by Canfield et al. (2013) provided anglers with fish that they could catch immediately. If the FWCC's hatchery-stocked fish ever survive, it will be years before the community derives any economic benefits, which is an unacceptable time frame for the HCOLRC. Perhaps more importantly, stocking adult fish (especially quality- and trophy-size wild fish) can quickly change anglers' perceptions about a fishery, regardless of whether the impacts can actually be measured. Thus, the HCOLRC emphasizes that stocking adult bass is an excellent marketing tool when anglers perceive that a fishery has collapsed.

Management is not only about science. Agencies manage fish, habitat, and people, with a strong emphasis on people. In the real world, management agencies must constantly decide between doing something and doing nothing. A do-something approach that does no harm is typically better than a do-nothing approach, even if the former is a "temporary fix." A meaningful do-something action should provide not only public benefits but

also public relation benefits to the management agency. As caretakers of our public resources, the FWCC and other North American fishery management agencies should not become known as do-nothing agencies, else they may suffer political consequences that will limit their abilities to manage public resources in the future.

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