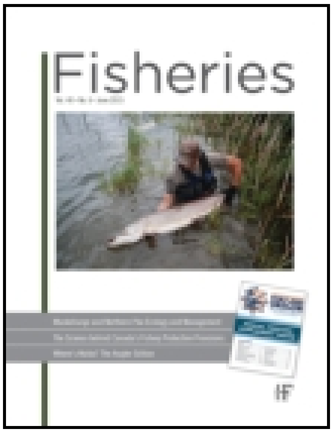

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AFS Responds to an Op-ed in the *New York Times* on Trout Fishing in the Northeast US

"The Cost of Trout Fishing," a recent op-ed piece by Douglas Thompson in the *New York Times* (Thompson 2015), included several inaccurate statements and fundamental misunderstandings of fisheries management and aquaculture. As fisheries research and management professionals, the American Fisheries Society would like to set the record straight. The mission of the American Fisheries Society is to improve the conservation and sustainability of fishery resources and aquatic ecosystems by advancing fisheries and aquatic science and promoting the development of fisheries professionals. We can fulfill that mission, in part, by addressing misinformation about fisheries science that appears in popular media, and helping the interested public to better understand the facts.

Native trout and our aquatic systems in general have been subjected to a wide variety of environmental degradations over the past two centuries or more. Widespread timber cutting, intense mining, dam construction, industrial pollution, invasive species, and many other human activities, not fishing pressure as suggested by Mr. Thompson, resulted in greatly reduced fish populations, including trout, throughout the United States. Only through strong water quality laws and other actions, in many cases advocated for by anglers, have many of our rivers, streams, and lakes recovered. Furthermore, anglers working with other conservationists have helped to ensure that our waters can sustain trout and other fish populations and support fishing.

Thompson suggested that hatchery fish create more problems than they address. Natural resource agencies stock fish to compensate for the inability of impaired ecosystems, especially in urban areas, to support self-sustaining fish assemblages and to meet perceived demands for fish by anglers. In the United States, approximately 1.75 billion fish of all species are stocked annually to counter the effects of habitat loss, harvest, and other stressors affecting fish and fishing opportunities (Halverson 2008). Regarding trout specifically, if wild populations are strong and self-sustaining, they are generally no longer stocked; for streams where natural populations are absent, dwindling or unable to support angling pressures, resource managers weigh costs and benefits before approving a stocking program (Weber et al. 2010; Hyatt et al., no date).

Although some fish are raised in aquaculture systems to a catchable size prior to release, nationwide the majority of fish are stocked as juveniles. Collectively, stocked fish weigh just over 44 million pounds annually (Halverson 2008), meaning that the average size of the fish at release is less than half an ounce. These fish grow to support recreational fisheries that also produce economic benefits and provide a means for an increasingly disconnected population to become acquainted with nature. There are approximately 60 million U.S. anglers—more people than play golf or tennis combined—who contribute $62 billion dollars annually to the gross domestic product (GDP), generate $115 billion in total economic output, and support more than 828,000 jobs. Anglers also generate an additional $15 billion in state and federal taxes, a portion of which goes back into sport fish restoration (Southwick Associates 2013). It has been estimated that hatchery fish support about half of this economic activity.

Another concern suggested by Mr. Thompson is that hatchery production is supported by pellet feed derived from fish and that these fish populations are being devastated by overfishing and the demand for fish meal and oil. In fact, "reduction" fisheries—the ones that give us fish meal and oil—are some of the most carefully and aggressively managed in the world and are actually expected to support modest growth in the future (FAO 2014). Advances in fish nutrition have allowed soy, wheat, corn, and agricultural byproducts to replace fish meal and oil in most fish feeds. In 2000, trout and salmon diets typically contained 30-40% fish meal and 15-25% fish oil; by 2010, estimated fish meal and oil inclusions were down to 17-25% and 8-15%, respectively (Tacon and Metian 2008). By 2022, half of the fish meal and oil will come from improved processing of seafood byproducts, and not wild fish (FAO 2014). What's more, fish are strikingly efficient at turning feed to flesh. Terrestrial animals consume 2-8 pounds of feed or more for every pound of weight gained. For fish, it is routinely near 1 to 1, meaning that most of the feed going into a hatchery comes out "on the fin," not as waste (NRC 2011).

Fish hatchery effluents are regulated by the U.S. Environmental Protection Agency (EPA) and state water quality agencies in accordance with the National Pollutant Discharge Elimination System (NPDES) (EPA 2014). NPDES limits protect the quality of public waters, and hatchery effluents are subject to monitoring and enforcement of the permit's conditions. To comply, hatcheries direct effluents through on-site wastewater treatment systems. Of more than 400 "hatchery" records in the EPA's Enforcement and Compliance History Online database, only seven—less than 2%—are currently in violation of their permits (EPA 2015). Fish hatchery contributions to nutrient loadings are dwarfed by those from agriculture, other confined animal feeding operations, or municipal wastewater discharges.

Hatchery operations also must comply with U.S. Food and Drug Administration (FDA) oversight if they use any drugs in the course of fish production. Drugs are not approved for use until proven safe to the environment, safe to fish, and safe to people who consume fish. Regulatory authorities take a highly precautionary approach to such evaluations (Bowker and Trushenski 2015). In fact, the most common water treatments applied in hatcheries are low doses of hydrogen peroxide (a household antiseptic) and chloramine (the most common disinfectant for

U.S. drinking water). As with nutrient discharges, the amount of these hatchery effluents is minor compared to pharmaceutical and personal care products that enter our nation's waters via municipal and agricultural wastewater discharges.

Fish stocked to bolster wild populations have pedigrees to match that intent, and spawning in hatcheries is carefully managed to maintain the genetic integrity of the wild populations; however, genetic and behavioral factors remain serious concerns (e.g., Reisenbichler and Rubin 1999; Putman et al. 2014). Hatchery-origin and wild fish interact, sometimes with negative consequences (e.g., competition for resources [Daly et al. 2012], straying [Araki et al. 2007], ecological effects [Pearsons 2008]), which must be taken into consideration. A few "conservation" hatcheries employ naturalized conditions to better condition fish for success in the wild (Maynard et al. 2004; Evans et al. 2014). For fish whose only destiny is the creel, breeding programs are relaxed, but are hardly a haphazard mingling of genes. In some cases, hatchery fish are sterilized to prevent reproduction in the wild (Kozfkay et al. 2006). In other cases, hatchery fish are managed to reduce the probability that they occur on the same spawning grounds as wild fish at the same time (HSRG 2014). Hatcheries can also conserve biodiversity. For example, Redfish Lake Sockeye Salmon *Oncorhynchus nerka* are slowly coming back from the brink of extinction because hatchery biologists managed to rescue and successfully breed the few remaining individuals, preserving the species as well as their genetic diversity (Kline and Flagg 2014). Recovery of Lake Trout *Salvelinus namaycush*—now considered self-sustaining in Lake Superior and on track in Lake Huron—is also attributable, in part, to hatchery support (Muri et al. 2012).

Fisheries managers often face conflicting mandates to recover and conserve wild populations while also creating fishing opportunities in the same waters. The most effective management strategies involving hatcheries incorporate all three "Hs"—harvest control, habitat protection or improvement, and hatchery supplementation. The American Fisheries Society has championed that approach and the use of sound science, holding forums every decade to refine recommendations for the best use of hatchery-origin fish in natural resource management (Trushenski et al. 2015). These issues are important, and we encourage readers to learn more. The American Fisheries Society and the expertise of our membership are excellent places to start. Our collective efforts will succeed if we focus on the greatest threats to wild trout and other fish, including habitat loss and introduced species.

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