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Daniel Wenk, Superintendent, and
David Hallac, Chief Yellowstone Center for Resources
Yellowstone National Park, WY 82190

Dear Superintendent Wenk and Mr. Hallac,

I am writing regarding letters that were sent by Peter Moyer to Yellowstone National Park, the Congressional Delegation of the state of Wyoming, and the Governor of Wyoming, in which he voiced concern about the Yellowstone cutthroat trout restoration program in Yellowstone Lake and associated lake trout suppression activities. I read with interest the response from Superintendent Wenk that was sent to Mr. Moyer on February 26, 2013. Although I feel that the letter adequately addresses the concerns of Mr. Moyer, as chair of the Lake Trout Suppression Program Scientific Review Panel, I believe that some additional information related to the issues he raised would be appropriate.

Let me begin with some historical context. Following the discovery of lake trout in Yellowstone Lake (1994), the National Park Service convened an independent team of scientists in February 1995 to evaluate the threat of a growing population of lake trout to the native cutthroat trout and to examine and evaluate alternative management actions. All but one of the eleven panel members concluded that persistence of a robust population of Yellowstone cutthroat trout would require an aggressive suppression program by the National Park Service. As a result of this analysis and additional input from management entities throughout the western US, a lake trout suppression program was initiated in 1995.

A Lake Trout Suppression Program Scientific Review Panel convened 13 years later (2008) concluded that there were pressing ecological reasons to continue to suppress lake trout in Yellowstone Lake because the lake trout were the primary cause for declines in Yellowstone cutthroat trout abundance in Yellowstone Lake. The panel maintained that an abundant lake trout population in Yellowstone Lake would jeopardize the native food web, and therefore, lake trout suppression should be enhanced before Yellowstone cutthroat trout declined further. Moreover, observed declines of cutthroat trout required a rededication of National Park Service

resources and expansion of partnerships and programs to restore the Yellowstone Lake ecosystem.

Subsequent reviews of the lake trout program have reiterated the same conclusion. In fact, the Lake Trout Suppression Program Scientific Review Panel convened in 2011 urged the National Park Service to essentially double the gillnetting effort on Yellowstone Lake for at least 10 years, or until Yellowstone cutthroat trout restoration goals were met. After examining new monitoring and research information, a subgroup of the review panel (2012) concluded that there were signs that the Yellowstone cutthroat trout population was responding positively to lake trout suppression, but information gaps persisted. Although lake trout suppression should remain the top priority of National Park Service, the panel stressed that monitoring and research were important components of the suppression program.

I share Mr. Moyer's concerns about spending more than a million dollars for suppressing lake trout in Yellowstone Lake; however, even if you total all the money that has been spent since the program was initiated, it is a drop in the bucket compared to the money that has been lost to businesses in and around Yellowstone National Park as the Yellowstone cutthroat trout population in the lake collapsed following the introduction of lake trout. Estimates from the early 1990s on the economic value of the cutthroat trout fishery on Yellowstone Lake exceeded $30 million dollars annually. Furthermore, the social value of the fishery undoubtedly extends far beyond that. As you are aware, angler use on Yellowstone Lake averaged about 142,000 angler days annually in the 1970s, 1980s, and early 1990s. Fishing on the lake was often the key reason for visiting the park for families from across the nation and around the world. Even non-anglers benefited from the Yellowstone cutthroat trout in the lake, and almost 350,000 visitors (10% of the park visitation in 1990 and 1991) visited Fishing Bridge and LeHardy Rapids to watch the thousands of cutthroat trout that moved through those areas on their annual spawning migration. Unfortunately, lake trout cannot replace the cutthroat trout in a recreational fishery. They are much more difficult to catch, and the average visitor to Yellowstone National Park does not have the required fishing equipment or technical knowledge to capture lake trout. There are no recent estimates of visitation at Fishing Bridge or LeHardy Rapids, but one rarely sees a person on Fishing Bridge today because there are so few fish to see.

Prior to the introduction of lake trout, the cutthroat trout in Yellowstone Lake supported a complex food web that included grizzly bears, otters, bald eagles, white pelicans, and osprey. In recent years, ospreys are rarely observed around the lake. Moreover, evidence from researchers at the University of Wyoming's Cooperative Fish and Wildlife Research Unit suggests that grizzly bears that previously fed on cutthroat trout during the spawning season as they ascended small tributary streams around the lake are now preying on elk calves. The effects of this added predation on the elk population appears to be affecting elk numbers harvested by Wyoming hunters south and east of the park. Again, the lake trout are not a substitute for the cutthroat

trout that evolved in the lake because they spawn in the lake and spend most of the time in cold deep areas of the lake where they are not vulnerable to predatory birds and mammals.

In the broader picture, the collapse of the Yellowstone cutthroat trout population in Yellowstone Lake threatens the probability of persistence of the subspecies across their historical range. Although the last status review associated with the Endangered species act suggested that listing as a threatened species was unwarranted because they still occur across 42% of the historic range, no more than 28% of the historic populations are still genetically pure, and most are found in small streams with less than 150 fish/mile. Furthermore, a majority of these populations currently coexist with introduced trout, which threaten their persistence because of hybridization, predation, and competition. It was apparent at the time of the review that the Yellowstone cutthroat trout in Yellowstone Lake represented the largest genetically pure assemblage of the subspecies left on the face of the earth. It was this assemblage, probably more than any other factor, that precluded listing of the subspecies, and if this population is not restored, the probability of listing increases substantially.

Are lake trout inherently bad fish? Absolutely not. In fact, tens of millions of dollars are being spent to restore, conserve, and protect lake trout in the upper Midwest and other portions of their native range in North America following decades of overfishing, industrial pollution, and introduction of nonnative fishes such as the sea lamprey and round goby. As Mr. Moyer has pointed out, there are many people who thoroughly enjoy lake trout and seek out places to capture them. On the other hand, in the Intermountain West, it is the native cutthroat trout that support the greatest amount of fishing and provide the greatest overall value to local residents and visitors alike. Furthermore, the National Park Service in Yellowstone National Park is not alone in efforts to suppress invasive lake trout. In fact, there are aggressive suppression programs in the states of Idaho (Lake Pend Oreille and Upper Priest Lake) and Montana (Swan Lake and numerous lakes in Glacier National Park), and efforts to control the negative effects of lake trout are being considered in Colorado, Washington, Wyoming, and California. The bottom line is that in the western USA, lake trout are often a good fish in the wrong place.

The effects of lake trout on Yellowstone cutthroat trout and the Yellowstone Lake ecosystem have been especially severe because prior to the lake trout introduction, there were no predatory fish in the lake. Historically, the longnose dace was the only other fish species found in Yellowstone Lake, but by the 1950s, lake chub, longnose sucker, and redside shiner were also present. Longnose suckers are common throughout much of the lake, but the longnose dace, lake chub, and redside shiners are limited to shallow lagoons and areas near stream mouths. Although there was some concern that longnose suckers competed with the cutthroat trout in the lake, by the 1980s, studies failed to support that assumption. At the same time, diet studies dating to the 1950s suggested that none of the fish species in the lake were fish predators. For

example, less than 1% of Yellowstone cutthroat trout stomachs sampled in the 1970s and 1980s contained fish.

Mr. Moyer is dubious about the consumption of Yellowstone cutthroat trout by lake trout, and he asserts that studies conducted by personnel from Wyoming Game and Fish in Jackson Lake suggest that predation by lake trout has not affected the cutthroat trout population. As Superintendent Wenk pointed out in his letter, the fish community structure is quite different in the two lakes. First of all, Yellowstone cutthroat trout in Jackson Lake and other lakes in the upper Snake River drainage evolved with a much greater number of fish species. For example, in Heart Lake in Yellowstone National Park there were seven other fishes in the lake prior to the introduction of lake trout. Therefore, the effects of a new predator in these systems would be moderated by the diversity of prey available. Furthermore, evidence suggesting that the abundance of Yellowstone cutthroat trout has declined drastically in Yellowstone Lake since the lake trout introduction is essentially irrefutable. Although I am unaware of abundance estimates of cutthroat trout in Jackson Lake prior to invasion of lake trout (around 1910), historical photos suggest that large numbers of Yellowstone cutthroat trout were being harvested during that period.

Mr. Moyer argues that the lack of data from stomach analyses of lake trout in Yellowstone Lake casts substantial doubt concerning cutthroat trout consumption by these introduced predators. In fact, data collected from almost 600 stomachs from lake trout in the late 1990s documented that 95% of the diet of older (age 9 and older) larger (greater than 23 inches) lake trout was composed of fish, and most of the fish were cutthroat trout. Although the diet of younger lake trout (3-4 years old) was only about 17% fish, they represented about 60% of the diet of lake trout between 4 and 8 years old. These data come from stomach samples collected in Yellowstone Lake, not model predictions, and this information was included in the package of materials provided to Mr. Moyer. I agree with Mr. Moyer that contemporary samples would be quite informative given the reduction in Yellowstone cutthroat trout abundance in recent years, but there is little doubt that in the late 1990s, cutthroat trout were a major item in the diet of lake trout over the age of 4 years old. Given the number of lake trout removed annually since the late 1990s, it is difficult not to conclude that predation was the most important factor influencing the decline in Yellowstone cutthroat trout abundance. Moreover, this underscores the conclusion of the Scientific Review Panel that without direct intervention by the National Park Service, persistence of a robust population of cutthroat trout was doubtful.

The effects of lake trout predation have been most apparent on younger, smaller cutthroat trout. In fact, the average size of cutthroat trout has increased dramatically since lake trout were introduced. Reasons for these shifts have not been assessed directly, but it appears that the reduction in competition for food and the selective pressures of predation for faster growing cutthroat trout have influenced this change. Yellowstone cutthroat trout abundance has declined

so much that there has been a scientifically documented alteration of the invertebrate food web in the lake. Young cutthroat trout that escape predation grow fast, and eventually they reach a size where they become less vulnerable. In fact, the number of cutthroat trout consumed by lake trout is probably much lower today than it was in the 1980s and 1990s when cutthroat trout numbers were extremely high. In the mid-1960s, when anglers were harvesting over 300,000 cutthroat trout a year and annual predation by birds was estimated to be about the same number, there was a detectable decline in the abundance of cutthroat trout, but it was nothing compared to the depressed population observed in the late 2000s.

In the absence of the current lake trout suppression program, the Yellowstone cutthroat trout assemblage would probably continue to decline. On the other hand, it is doubtful the native trout would disappear completely from Yellowstone Lake. The foodweb of the lake would remain in an altered state, however, and numerous bird and mammal predators would be forced to find other food sources or to move to other areas where food was more plentiful. Beyond a low number of cutthroat trout in the lake, there would be only a few small stream populations remaining in the headwaters of a handful of lake tributaries where they persist over winter. Of course, if this occurs, the probability of listing under the Endanger Species Act will increase substantially.

As Mr. Moyer has pointed out, lake trout predation is not the only factor influencing the Yellowstone cutthroat trout in Yellowstone Lake. Natural disturbances, such as drought and fire and other invasive species, such as the protozoan parasite causing whirling disease, may also affect fish populations. Of these, interannual fluctuations in spring runoff may have the greatest effect, and it has been well documented in salmonid populations throughout the world. Certainly, drought conditions may have reduced cutthroat trout reproduction and year-class strength during the drought of the late 1990s and early 2000s, but there is no evidence of, or precedence for, declines in abundance of the magnitude observed in Yellowstone Lake.

Whirling disease is another confounding factor in the Yellowstone Lake watershed that may have local effects on some spawning populations. Studies in the mid-2000s suggested that up to 20% of all juvenile and adult Yellowstone cutthroat trout in Yellowstone Lake were infected, but infection was not uniform throughout the watershed. For example, the organism causing the disease was found in two tributaries and the Yellowstone River downstream from the lake, but the Yellowstone River upstream of the lake inlet and 13 other spawning tributaries tested negative for the parasite. Risk of infection was highest in the Yellowstone River and Pelican Creek. Although few cutthroat trout fry were observed in the lower portions of the Pelican Creek in the mid-2000s, stream resident cutthroat trout are common in the headwaters of the stream despite high densities of the parasite. Again, there have undoubtedly been some effects of whirling disease on the cutthroat trout population in the Yellowstone Lake drainage, but they seem to pale in comparison with the effects of lake trout predation. Furthermore, recent

evidence from other streams in the Intermountain West where whirling disease has had population-level effects on wild trout populations, suggests that surviving trout are becoming resistant to the disease, and populations are increasing despite continued presence of the parasite causing the disease.

Finally, the Lake Trout Suppression Program Scientific Review Panel is optimistic that the lake trout suppression program is showing important signs of progress, and that if levels of effort can remain at, or exceed those expended in 2012, the lake trout population will begin to decline within five years. The lake trout in Yellowstone Lake cannot be completely removed, but the Panel believes that the National Park Service goal of restoring the Yellowstone cutthroat trout population to levels approaching those documented in the late 1980s and early 1990s is possible. The fact that Yellowstone Lake has a relatively simple fish assemblage and the rapid response of the National Park Service to the discovery of lake trout in the lake probably prevented complete collapse of the cutthroat trout population. Suppression activities will always be a part of the management of Yellowstone Lake, but as lake trout numbers begin to decline, it appears that less expensive suppression techniques that target vulnerable portions of the lake trout life cycle may be substituted for current netting strategies that are effective while lake trout abundance is high. The Panel has encouraged the National Park Service to maintain the suppression program at, or above, 2012 levels of effort for the next 5 years. At the same time, it is apparent that monitoring and targeted applied research will be necessary to evaluate and facilitate success of the program in coming years, and perhaps most importantly, provide a means to insure that the money being spent on Yellowstone cutthroat trout in Yellowstone Lake is being used wisely and efficiently.

All of the members of the Lake Trout Suppression Program Scientific Review Panel have reviewed this document and approved its contents.

Sincerely,

Robert E. Gresswell

Robert E. Gresswell, Chair
Lake Trout Suppression Scientific Review Panel