Differentiating hatchery from wild origin shovelnose sturgeon, Yellowstone cutthroat trout, channel catfish, and kokanee salmon in Wyoming fisheries and identifying natal origins of Burbot in the Wind River watershed using stable isotope analyses

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Project Objectives

The goal of this two year study is to apply stable isotope analysis to 1) determine if natural reproduction is occurring in shovelnose sturgeon in the Bighorn River, 2) determine the proportion of stocked from naturally produced kokanee salmon in Flaming Gorge Reservoir and validate current kokanee marking techniques in cooperation with Utah Division of Wildlife Resources, 3) determine the proportion of hatchery and naturally produced channel catfish in the North Platte River, and 4) determine the natal origins of burbot in the Wind River Watershed.

The annual report is dived by project (hatchery/wild origins and natal origins) and is further subdivided by region and fish species.

Determining hatchery or wild origins

Cody Region

Yellowstone Cutthroat Trout

In August 2009 we sampled Dead Indian Creek above and below the barrier. We collected 10 Yellowstone cutthroat from above the barrier and 10 of each rainbow trout/cuttbows and Yellowstone cutthroat trout from below the barrier. We collected water samples from two locations in the Dead Indian Creek drainage, from the tensleep creek Fish Hatchery where stocked trout originated, and from 5 brood stock Yellowstone cutthroat from the same hatchery. Water samples and otolith cross-sections were sent to University of California-Davis for analysis of trace elements and strontium isotopes. Data from the cutthroat has not yet been received. Otolith cross-sections are set to be analyzed on August 16, 2010. The second field season to collect cutthroat will be on August 24th, 2010

Shovelnose Sturgeon

Shovelnose sturgeon have been stocked in the Bighorn River by the Wyoming Game and Fish Department since 1996 to support the recovery of this native fish species. Sturgeon have been stocked from the Bozeman Fish Technology Center in Bozeman, Montana, Garrison National Fish Hatchery in Riverdale, North Dakota and Gavin's Point National Fish Hatchery in Yankton, South Dakota. Periodic sampling of the Bighorn River results in the sporadic capture of shovelnose sturgeon using standard electrofishing techniques. It is unclear, however, whether or not these sturgeon represent individuals with hatchery origins or if natural reproduction is occurring in the Bighorn River. The purpose of this study is to determine if natural reproduction is occurring or if the fish sampled are all of hatchery origin. Because strontium stable isotopes are tied to the geology of a drainage, we are using this novel technique by analyzing the fin rays removed from captured sturgeon. Sampling of sturgeon during 2009 yielded only one sturgeon using electrofishing techniques. In May, 2010 we again used electrofishing, but also combined it with the drifting of trammel nets. In May, 2010 we captured 9 additional sturgeon, removed one pectoral fin ray, and we are in process of cross-sectioning these rays for analysis. Water samples

are also being obtained from the three hatcheries that have supported sturgeon recovery to compare isotopic and have analyzed sauger otoliths from the Bighorn River for assignment analysis of hatchery or wild origin. The final field collections will be in September during sauger population estimates.

Walleye

In 2009 a 9 year old walleye was delivered to the Cody Regional office that was recently caught in Buffalo Bill Reservoir. It was unclear whether or not this walleye was an illegal transplant from a local reservoir or whether this walleye had been born in Buffalo Bill. We were interested in whether or not otolith microchemistry could determine the natal origins of this walleye. Using strontium isotopes, we have been able to determine that this walleye was an illegal transplant from one of three reservoirs (Deaver, Harrington, Wardell) known to have walleye fisheries. These three reservoirs have significantly different strontium isotope signatures (Figure 1). However, otolith strontium values for this walleye have variable seasonal oscillations that make assignment to which of these three reservoirs this walleye came from difficult as of now. We can rule out Boysen as a potential source of this illegal stocking as its strontium isotope signature is around 0.712, much higher than was observed in the walleye otolith (Figure 1). Further analysis will reveal at what age and during what season this walleye was illegally introduced. The results of this analysis highlight the usefulness of this technique as a fisheries management tool to determine when and from where a fish was illegally moved and the age at time of movement.

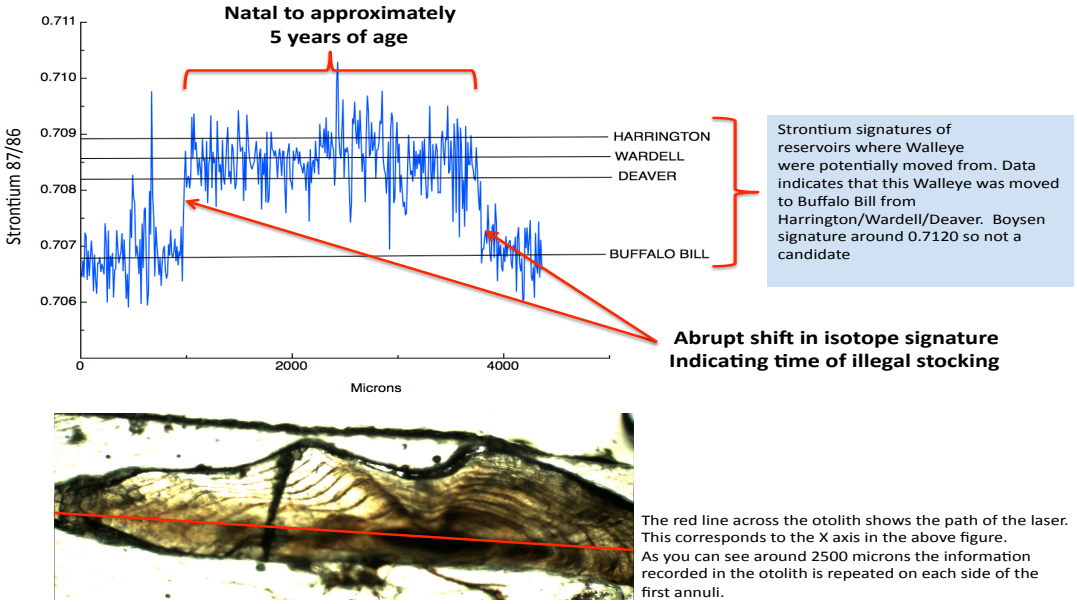

Figure 1. Otolith microchemistry analysis reveals the timing and potential origins of an illegally stocked walleye in Buffalo Bill Reservoir.

Lander Region

Burbot

Otolith microchemistry revealed large differences between drainages throughout the Wind River drainage (Figure 2). Differences were large enough to allow assignment of individuals back to their natal origins and revealed the movement of burbot from the upper to the lower portions of the drainage. Data analysis also revealed the origin of burbot entrained in Pilot Canal (Figure 3). Results of this study are being written up for a final report for this portion of the study.

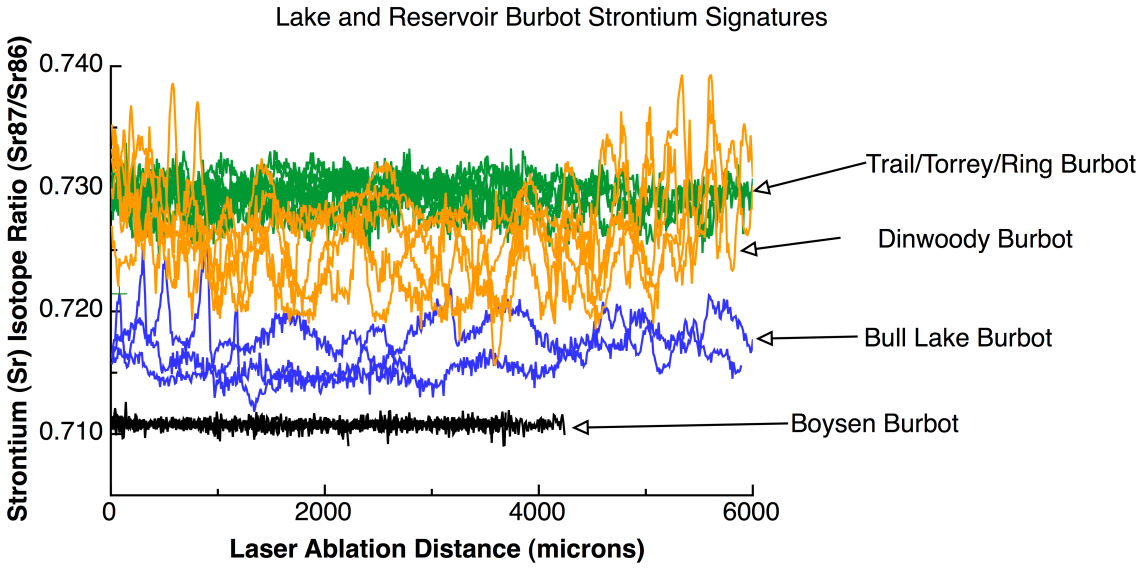

Figure 2. Strontium otolith microchemistry analysis reveals large differences across the Wind River watershed useful for differentiating populations of burbot.

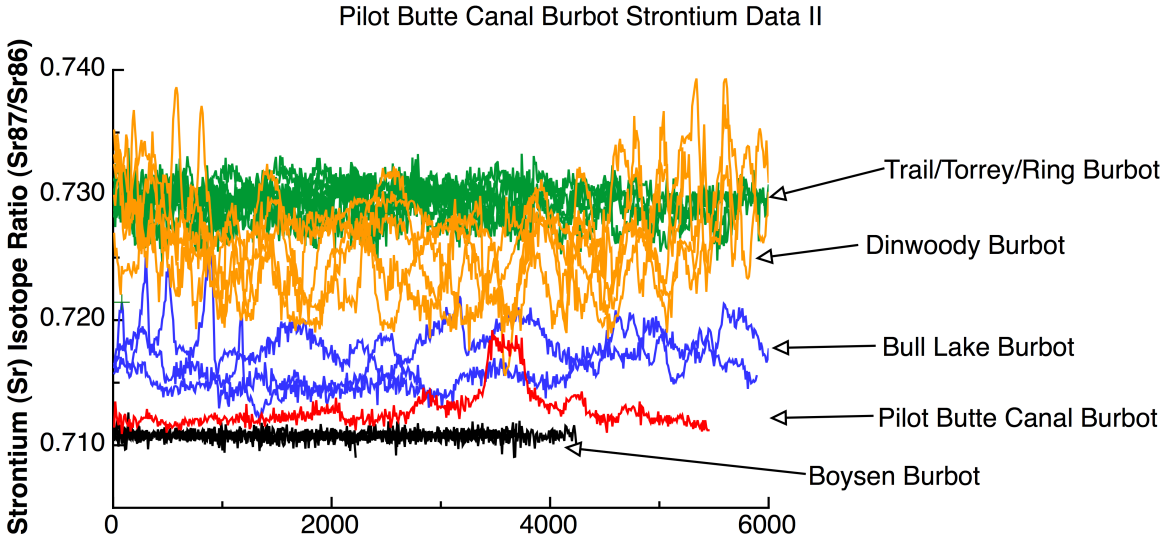

Figure 3. Analysis of a burbot entrained in Pilot Canal reveal its natal origins in Bull Lake.

Green River Region

Kokanee Salmon

Otolith microchemistry has been completed for hatchery fingerlings from Auburn, Daniel, and Saratoga in Wyoming and Jones Hole and White Rock in Utah. Analysis reveals that differences exist between the hatcheries that will allow us to differentiate hatchery from wild origin Kokanee salmon (Figure 4). Completion of otolith microchemistry on Lake Trout and on Kokanee from Flaming Gorge Reservoir will aid in the differentiation between natal and wild origins.

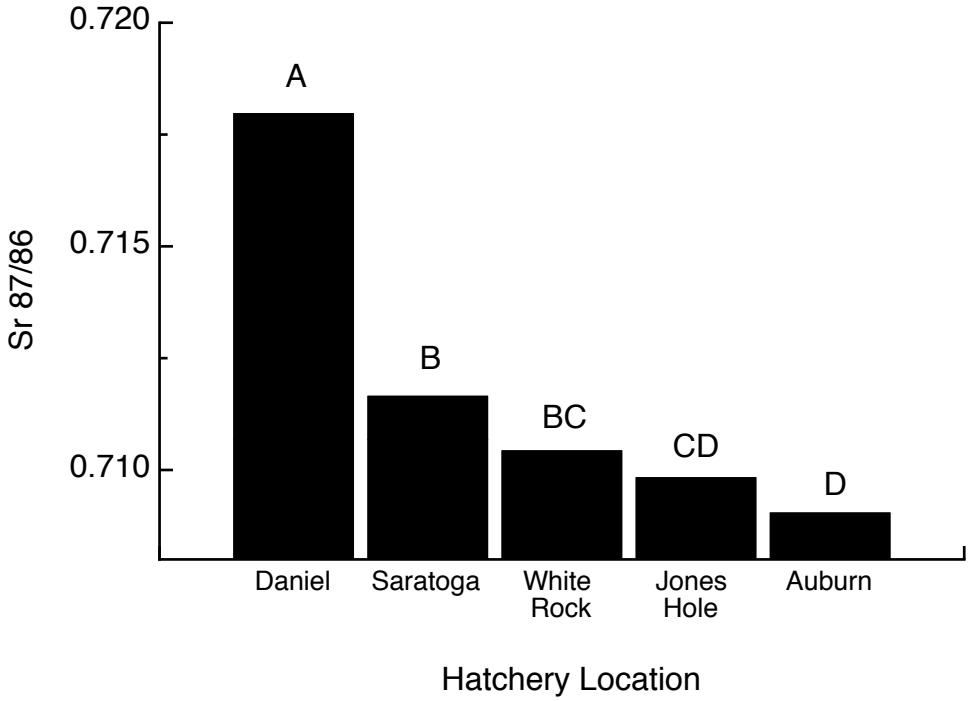

Figure 4. Strontium results for hatchery Kokanee stocked in Flaming Gorge Reservoir. Hatchery signatures were significantly different ($F_{4,39} = 127.8$, $p = 0.001$). Tukey-Kramer HSD revealed hatchery differences (letters above denote similarities and differences). Saratoga/White Rock, White Rock/Jones Hole, and Jones Hole/Auburn were not different from each other. However, large differences still exist between most of the hatcheries.