

- I. Project Title: Yampa northern pike sources.
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- III. Project Summary: Northern pike (*Esox lucius*) are an introduced predator in the Yampa River ecosystem and little is known about their movements or sources of recruitment. An estimation of the major spawning areas and subsequent sources of recruitment would allow management efforts to be focused on areas that produce the greatest numbers of pike. The goal of this project is to estimate northern pike recruitment in off-channel ponds and reservoirs along the Yampa River. To accomplish our goal we needed to develop otolith elemental signatures in spawning areas basin wide. The signatures can then be used to classify fish of unknown origin that are collected in the Yampa River. We have collected fish from all major reservoirs and several ponds in the basin. Data collection and analyses are complete for the fish collected in 2005. Otolith preparation and chemical analyses are complete for fish collected in 2006 and we are beginning to statistically analyze these data. Initial results indicate that otolith microchemistry will be an effective technique to estimate recruitment of northern pike from reservoirs into the Yampa River. However, initial analyses suggest that estimation of the relative contributions of ponds is more uncertain.

- IV. Study Schedule: [Initial year-Final year.]

Fish collection for developing elemental signatures is complete. Laser ablation mass spectrophotometry is completed on all otoliths from all years. Microchemistry data from fish collected in 2004 and 2005 have been statistically analyzed. We are currently anticipating that the 2006 otolith microchemistry data will be transferred from the USGS mineral resources lab in mid November. Final data analyses will be completed in spring 2007.

- V. Relationship to RIPRAP:

GREEN RIVER ACTION PLAN: YAMPA AND LITTLE SNAKE RIVERS

III.A.1.b. (3) Identify sources of northern pike and implement remedial measures as needed.

- VI. Accomplishment of FY 2006 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

We collected and analyzed 2005 young-of-year pike from Stagecoach Reservoir, Lake Catamount, Lafarge Pond, Haymaker Golf Course Pond, Ski Pond, and the Yampa River State

Wildlife Area (sample sizes shown in Table 1). Age-1++ pike were collected from Elkhead Reservoir due to extremely low water levels, which resulted in low recruitment. Multiple water samples were also collected at each location. We used a discriminant function to classify fish and cross classification accuracy was generally high, especially for the three major reservoirs (Table 1). However, we did have relatively low classification rates in some ponds, particularly Haymaker Golf Course pond (Table 1). These results indicate that recruitment from the major reservoirs should be detectable using otolith microchemistry; however, it may be difficult to detect recruitment from some ponds that have populations of northern pike. We have not yet statistically analyzed data from the 2006 samples.

Table 1. Cross classification rates of northern pike collected in 2005 from various spawning locations along the Yampa River. Data were analyzed using a discriminant function and cross classification results are percentages of young-of-year pike that were correctly classified into the location they were collected from. Elements included in the statistical model were strontium, barium, manganese, zinc, and sodium. These elements were selected because their concentrations were above detectable levels at every location for every fish.

Location	Cross Classification Rate (%)	Sample Size
Catamount	84	55
Stagecoach	68	34
Elkhead	74	34
Ski Pond	54	52
Haymaker	32	57
Lafarge	80	46
Yampa River S.W.A.	68	47

Managers and home owners at Lake Catamount are interested in reducing or removing pike from the lake and we felt it was important to estimate the possible movement of northern pike from Stagecoach Reservoir into Catamount. If movement rates are high, then Catamount would require more intensive management and removal of pike than if movements were low. To estimate the potential use of otolith signatures to estimate the movement of pike from Stagecoach Reservoir to Lake Catamount, we ran the same discriminant function analysis, including only pike collected in Stagecoach and Catamount. The classification rates are very high, indicating that we can reliably detect fish collected in Lake Catamount that were spawned or moved from Stagecoach Reservoir (Table 2).

Table 2. Cross classification rates of northern pike collected in 2005 from Stagecoach Reservoir and Lake Catamount. Data were analyzed using a discriminant function and cross classification results are percentages of young-of-year pike that were correctly classified into the water they were collected from. Elements analyzed included strontium, barium, manganese, zinc, and sodium. These elements were selected because the concentrations of the elements were above detectable levels for every location in every fish.

Location	Cross Classification Rate (%)	Sample Size
Stagecoach	97	34
Catamount	95	55

During 2006 young-of-year pike were collected from all sites except Elkhead Reservoir (Table 3). Collecting these fish will allow us to examine temporal variation in the otolith elemental signatures. These otoliths have been chemically analyzed and we are waiting to receive the data from the USGS mineral resources laboratory. Adult pike were collected by personnel from CDOW and USFWS. These otoliths have been chemically analyzed and we are waiting to receive data from the USGS mineral resources laboratory for these fish as well. Multiple water samples were also collected at each spawning location (Table 3). We are waiting to receive results for the water chemistry from the University of Southern Mississippi.

Table 3. Sample sizes of northern pike otoliths and water chemistry samples collected during 2006 from various locations along the Yampa River.

Location	Age-0 Pike	Adult Pike	Water Samples
Catamount	40	-	3
Stagecoach	41	-	3
Ski Pond	39	-	3
Haymaker	25	-	3
Lafarge	27	-	3
Yampa River S.W.A.	33	-	3
Yampa River from Bill Atkinson	-	37	-
Yampa River from Pat Martinez	-	140	-

- VII. Recommendations: We feel otolith microchemistry will be an effective technique to estimate recruitment of northern pike from reservoirs into the Yampa River and will allow managers to effectively target pike control efforts. However, initial analyses suggest that estimation of the relative contributions of ponds is more uncertain. We suggest that more adult pike be collected from the river to assess our accuracy in estimating their provenance. Data from fish collected in 2006 should be available and analyzed by the end of December and should enhance our understanding of the efficacy of otolith microchemistry for guiding management efforts in the Yampa River.
- VIII. Project Status: Current data analyses and writing should be complete in Spring 2007. We suggest that additional northern pike be collected from various area in the Yampa River and classified using the otolith signatures developed in this segment of the project.
- IX. FY 2006 Budget Status
- A. Funds Provided: \$10,000
 - B. Funds Expended: \$0 *[Please identify funds expended, not just those obligated.]*
 - C. Difference: *[Include an explanation for any major difference.]*
 - D. Percent of the FY 2006 work completed, and projected costs to complete: approximately 50% completed and all funds are obligated. *[For projects funded by the Bureau of Reclamation.]*
 - E. Recovery Program funds spent for publication charges: \$0
- X. Status of Data Submission (Where applicable): none *[Indicate what data have been submitted to the database manager.]*
- XI. Signed: Dana Winkelman 11/08/06
Principal Investigator Date