

I. Project Title: Investigation of nonnative fish escapement from Elkhead Reservoir.

II. Principal Investigator(s):

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III. Project Summary:

Escapement of non-native fish from Elkhead Reservoir has been identified as a potential impact to listed fish in the Yampa River. Fish escapement from the reservoir was included in the 2001 work plan for Elkhead Reservoir enlargement studies conducted by Miller Ecological Consultants, Inc. Miller and Laiho (1997) recommended study of escapement prior to the selecting an escapement control device. The potential cost of building and installing a flexible, Kevlar-like net, suspended in the water column to minimize fish escapement from Elkhead Reservoir is estimated near \$1 million. It is presumed that annual operating and maintenance of this screen will also be significant. These potential costs compel an evaluation of fish escapement as a pre-requisite task to justify this investment in both the recovery of the endangered Colorado river fishes and the reservoir sportfishery.

Project Goal

Document magnitude and characteristics of escapement of nonnative fishes from Elkhead Reservoir to guide design and operational criteria for potential screening, refine sportfishery management, and evaluate translocation of nonnative fish from Yampa River removal actions.

Objectives

The objectives of the study are: 1) Quantify escapement of fishes from Elkhead Reservoir by species and size during spring runoff; 2) Recommend the design and operational criteria for screening reservoir outflows that would be most effective for minimizing escapement; and 3) Evaluate escapement rates of nonnative gamefish relocated from the Yampa River to the reservoir.

IV. Study Schedule: FY 2001 – FY 2004

V. Relationship to RIPRAP:

Green River Action Plan: Yampa and Little Snake Rivers

- III. Reduce negative impacts of nonnative fishes and sportfish management activities.
- III.A. Develop aquatic management plan to reduce nonnative fish impacts while providing sportfishing opportunities.
- III.A.1. Implement Yampa Basin aquatic wildlife management plan.
- IIIA.1.a.(1) Evaluate nonnative fish escapement and control options at Elkhead Reservoir.

VI. Accomplishment of FY 2003 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

Background

Miller Ecological Consultants, Inc. collected aquatic resource information in fall of 1995 on Elkhead Creek for fish and macroinvertebrates (Miller and Rees 1996). Two sites were studied, one downstream of the reservoir and one upstream of the reservoir. This data provides baseline information for the stream aquatic resources downstream of Elkhead and also in the upstream area but should be updated since it has been over 5 years since the last sampling. Results of this survey demonstrated the presence of small numbers black crappie and bluegill, and relatively abundant smallmouth bass in the creek in the site nearest to the dam outlet. Most bass were 30-95 mm in length with only four of 192 fish exceeding 100mm.

Colorado Division of Wildlife collected data on the reservoir fishery in 1999. They sampled with electrofishing and gill nets. The results of that electrofishing and gill netting showed that approximately 80% of the fish captured were nonnative game species. Nonnative white sucker made up the largest segment at 15% and the remainder was comprised of small percentages of individual game fish, including approximately 1% northern pike and 1% channel catfish. No native fish were collected in the reservoir.

Miller Ecological Consultants conducted a preliminary escapement study during the summer and fall of 2001 but due to the short runoff period, data was not collected during runoff. It is hypothesized that the potential for escapement is greatest during the runoff from May through June. This study proposes a means to monitor escapement during that period in the 2003-2004 runoff periods.

Elkhead Reservoir represents the largest reservoir in the Yampa Valley with potential and opportunities for warmwater fishing recreation. Due to its size, it offers considerable capacity to serve as a receiving water for nonnative gamefish species targeted for control and removal from the Yampa River. Removal of adult gamefish from the river to the reservoir serves a net benefit of both reducing their impacts on native riverine fish populations and the federally endangered fish species and providing a quality angling potential in the reservoir sportfishery. In addition to stocked warmwater fish species, potential escapement of these "relocated" fish from the reservoir can also be investigated in this investigation.

Methods

This study relied solely on nets placed in the spillway and on the reservoir outlet during the spring runoff to determine escapement. The nets used in the work are tailrace nets normally designed for hydro-electric projects. The nets consist of a face frame (3 ft. x 3 ft.) and an inner and outer net similar to a fyke net in design. The nets used have ¼ inch mesh with a 10 foot long bag.

Sampling at the reservoir spillway and outlet was conducted during the weeks of April 28, May 5, May 19 and June 2, 2003. One net was set to capture the entire release from the outlet (Figure 1). A second net was on the top of the spillway adjacent to the right retaining wall (Figure 2 and Figure 3).

Each net was anchored with a metal frame and ropes to the spillway chute retaining wall. The nets were left in place during sample sessions and checked for fish every two hours. The nets were set during three or four days of each monitoring week (Table 1). All fish captured were identified, weighed and measured. All live fish were marked (fin clip for small fish and individual floy tag for large fish) and returned to the reservoir. Sampling crews notified CDOW of collection efforts at the end of each sample week.

Table 1. Sampling dates for Elkhead Reservoir escapement.

Week	Days sampled
April 28, 2003	April 29, April 30, May 1
May 5, 2003	May 6, May 7, May 8
May 19, 2003	May 19, May 20, May 21, May 22
June 2, 2003	June 2, June 3, June 4, June 5



Figure 1. Elkhead Reservoir outlet capture net.



Figure 2. Net on edge of spillway.



Figure 3. View from above spillway net.

Results

A total of 195 fish in 116 hours of netting were captured leaving the spillway of Elkhead Reservoir in 2003. No fish were captured in 112 hours of netting on the outlet (Table 2). The escapement per hour per net ranged from zero to 12.5 with an average of 2.56. The net captured three feet of the 135 foot total spillway width. The per net captures were multiplied to estimate the range of escapement per hour and per day for the total spillway width. Eight fish species were captured during the 2003 sampling. The most abundant fish were black crappie and bluegill, which comprised 78% and 16% of the escapement respectively (Table 3). Largemouth bass, smallmouth bass and rainbow trout escapement was less than 1% of the total. Fish size classes ranged from 50mm to 350mm total length (Figure 4). The majority of the black crappie were in the 125 mm size class (Figure 5). The majority of the bluegill were in the 75 mm size class (Figure 6). The smallest fish captured were sand shiner and speckled dace.

Table 2. Summary of escapement netting at Elkhead Reservoir, 2003.

	Total Hours set	Total Fish Captured	
Outlet	112	0	
Spillway	117	282	
	Fish per Hour per net		
	Average	Maximum	Minimum
Outlet	0	0	0
Spillway	2.56	12.50	0.00
	Total fish escapement per hour		
	Average	Maximum	Minimum
Outlet	0	0	0
Spillway	115.3	562.5	0
	Total fish escapement per day		
	Average	Maximum	Minimum
Outlet	0	0	0
Spillway	2,766.8	13,500.0	0

Table 3. Total number of fish collected during 2003 escapement study.

Species	Grand Total	Percent	Average escapement number per hour	Average escapement number per day
Bluegill (<i>Lepomis macrochirus</i>)	45	16.0%	18.4	441.5
Smallmouth bass (<i>Micropterus dolomieu</i>)	1	0.4%	0.4	9.8
Largemouth bass (<i>Micropterus salmoides</i>)	1	0.4%	0.4	9.8
Sand shiner (<i>Notropis stramineus</i>)	6	2.1%	2.5	58.9
Rainbow trout (<i>Oncorhynchus mykiss</i>)	1	0.4%	0.4	9.8
Fathead minnow (<i>Pimephales promelas</i>)	7	2.5%	2.9	68.7
Black crappie (<i>Pomoxis nigromaculatus</i>)	220	78.0%	89.9	2158.5
Speckled dace (<i>Rhinichthys osculus</i>)	1	0.4%	0.4	9.8
Grand Total	282	1	115.3	2766.8

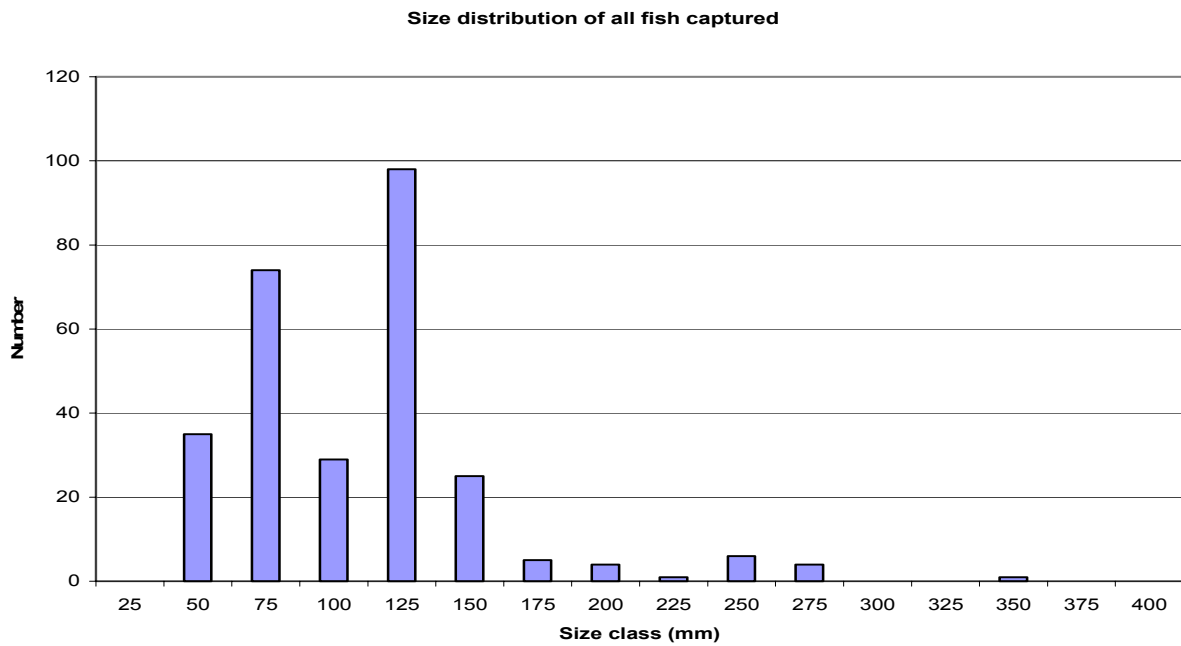


Figure 4. Size distribution of all fish captured.

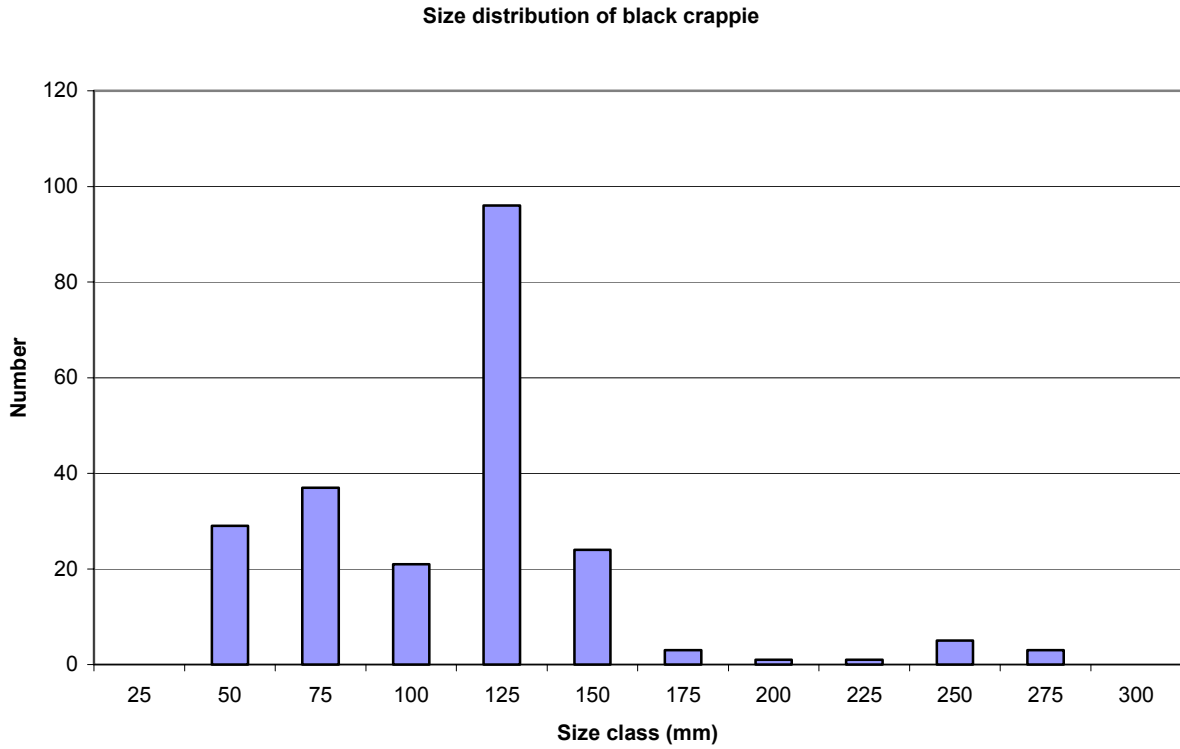


Figure 5. Size distribution of black crappie.

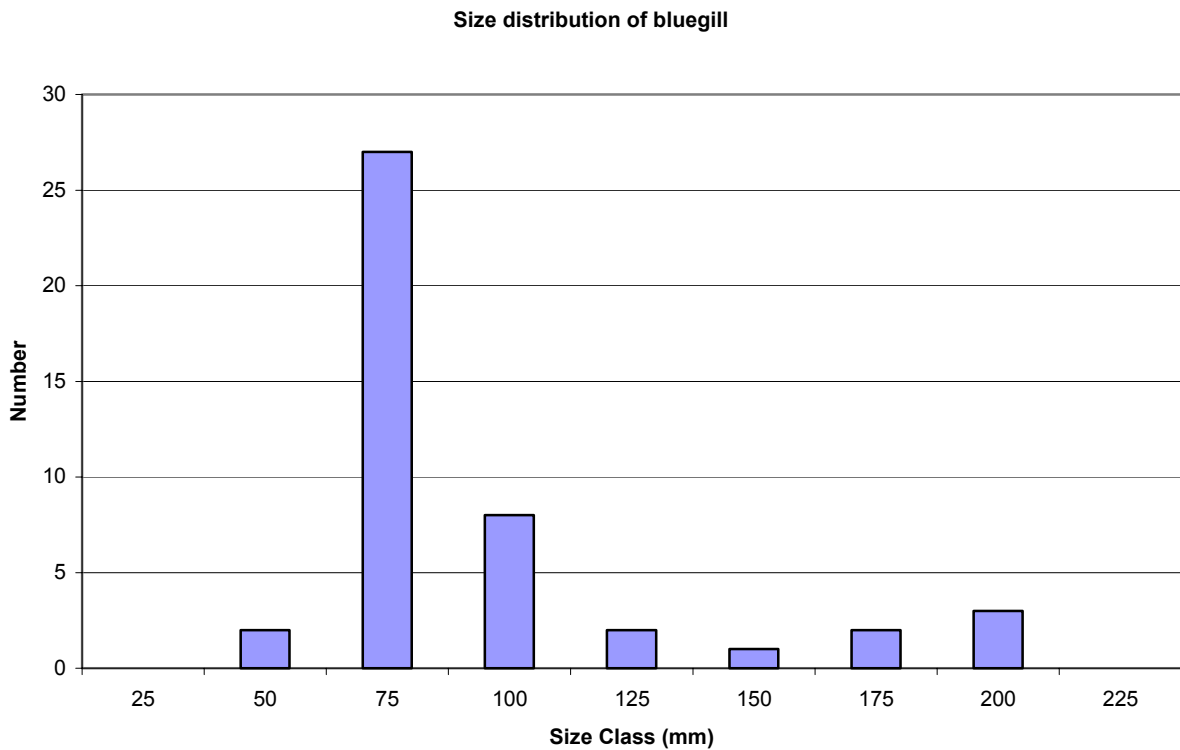


Figure 6. Size distribution of bluegill.

The highest escapement occurred just after sunset. The highest escapement rates occurred during the week of highest runoff. The stream flow during was approximately 600 cfs the week of April 28th, 2003, peaked at approximately 1000 cfs during the week of May 19th, 2003 and dropped to approximately 350 cfs the week of June 2nd, 2003. Highest escapement rates in all weeks sampled occurred between 8:00pm to 10:00 pm in the evening.

Discussion

The escapement sampling in 2003 confirmed that fish leave Elkhead Reservoir during runoff. The majority of the fish captured during netting were less than 150mm in total length. The escapement was dominated by black crappie, however, more bluegill were captured in the last week of sampling than any other species. There may be a seasonal pattern to the escapement but sampling late into the runoff (late June) would be required to verify this hypothesis. There appears to be a temporal pattern to escapement with the majority of the fish captured in late evening. This may be related to fish becoming more active with the onset of darkness and those in proximity to the spillway are entrained in the flow and lost over the spillway. Very few large individual fish were captured during the study. The larger size classes may be able to avoid entrainment better than the smaller fish.

VIII. Recommendations:

It is recommended that the sampling for next year (spring 2004) be conducted in the same manner as 2003. No changes are anticipated to the sampling protocols with the exception of an additional net set at the left side of the spillway. The current net locations, adjacent to the spillway abutment and at the outlet are feasible locations for net placement. The conditions within the spillway during runoff are not suitable for net placement and capture of fish.

VIII. Project Status: On track and ongoing through 2004

Draft report to coordinator: September 30, 2004

Revised draft report to peer reviewers/BC: October 30, 2004

Revised final draft report for BC consideration: January 15, 2005

IX. FY 2003 Budget Status

A. Funds Provided: \$46,295

B. Funds Expended: \$46,295

C. Difference: \$ 0

D. Percent of the FY 2003 work completed, and projected costs to complete: 100%

E. Recovery Program funds spent for publication charges: \$0

X. Status of Data Submission (Where applicable): NA

XI. Signed: **Thomas P. Nesler** 11-14-2003
Principal Investigator Date

APPENDIX: References

Miller, W.J. and D. Laiho. 1997. Feasibility Evaluation of Non-native fish control structures. Final Report Upper Colorado River Basin Recovery Implementation Program. Prepared for Colorado River Water Conservation District, Glenwood Springs, Colorado.

Miller, W. J., and D. E. Rees. 1996. Survey of fish, benthic macroinvertebrates, and habitat in Elkhead Creek near Craig, Colorado. Final report. Prepared for Ayres Associates, Fort Collins, Colorado.