I. Project Title: Upper Yampa River Northern Pike Tagging

II. Principal Investigators:

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III. Project Summary

The Recovery Program has established an active program to control nonnative fishes in the main rivers of the upper basin to assist in recovery of the endangered fishes found there. In some cases, such as the Yampa River, northern pike have been removed from the main channel and stocked into off-channel impoundments to provide fishing opportunity for local anglers. Concern has been expressed by sportfish managers for adequate evidence to justify the need to remove northern pike outside of critical habitat for endangered fish. The large population of northern pike in the upper Yampa River is suspected of being a source for continual movement of northern pike into the lower Yampa River and further downstream into the Green River where they coexist with three endangered fishes — Colorado pikeminnow *Ptychocheilus lucius*, razorback sucker *Xyrauchen texanus*, and humpback chub *Gila cypha*. However, the rate of dispersal is unknown. Information on the rate of emigration of northern pike from upstream reaches is important in determining whether ongoing removal efforts for northern pike in downstream, critical habitat reaches are being negated by recolonization from upstream populations. This evidence is important to determine whether northern pike removal in the upper Yampa River is warranted. Objectives of this study are to determine population size and structure of northern pike in the study reach and to determine movement within the study reach and into reaches below, including critical habitat.

IV. Study Schedule: To be continued as needed

V. Relationship to RIPRAP:
GREEN RIVER ACTION PLAN: YAMPA AND LITTLE SNAKE RIVERS
III.A.1.b Control northern pike.
III.A.1.b(2) Reduce northern pike reproduction in the Yampa River.

VI. Accomplishments of FY 2005 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

Study Site

The Yampa is a relatively free flowing river that originates on the west slope of the Rocky Mountains and flows 320 km to its confluence with the Green River. The portion of the Yampa that makes up the study site flows through low gradient agricultural lands and through the community of Steamboat Springs, Colorado. Seasonal flows in the study reach fluctuate between 100 and 6,800 cubic feet per second (USGS, provisional data) however in recent years flows have typically been lower. All sampling for this study was conducted within a 28-mile reach of the Yampa River near Steamboat Springs, CO (Figure 1).

Materials and Methods

Northern Pike were collected during two electrofishing passes through a 28-mile reach of the Yampa River. The first pass was completed by crews of the United States Fish and Wildlife Service (USFWS) and the Colorado Division of Wildlife (CDOW) on April 11-13. The second pass was completed by CDOW crews on May 3-7. Northern Pike were the only fish targeted in this study.

All northern pike captured were tagged and released. Pike were tagged using a T-bar tag with an individual tag number and a passive integrated transponder (PIT) tag. Lengths and weights of northern pike, electrofishing time, release location, and capture reach were recorded.

Movement Determination

The 28-mile study reach for the 2005 sampling effort was broken into sub reaches that are approximately two miles in length. Land ownership and logistics made exact 2-mile reaches impossible. Movement was analyzed by comparing the release location (bottom of the reach the fish is captured and released in) and recapture location. Recapture location was estimated by assuming that when pike were recaptured they were caught in the middle of that reach. For example, if a fish was caught in between river miles 140.9 and 138.9, we know it was released at 138.9, as that is the downstream part of the reach where fish were processed and released. If that fish was then recaptured in reach 146.9 to 144.9 we do not know exactly where the fish was recaptured in the reach. However, if we assume it was recaptured in the middle of the reach, then we determined its recapture location to be 145.9. The assumption of equal distribution of favorable habitat by

reach was made. Given the assumption of random distribution, and considering the large sample size of northern pike recaptured and analyzed for movement in this study, the Central Limit Theorem would dictate this technique valid.

Movement was analyzed using fish captured within this years sampling, tags recaptured from our 2004 effort, and utilizing tags recaptured from other investigators. Movement is difficult to determine in a single year. Fish tagged and released in a lotic ecosystem may exhibit a "fallback response" to being marked, where they are tagged and drift downstream (Moser and Ross 1993, Hughes 1998). When analyzing within sampling period movement, all fish that moved downstream 2 miles or less were eliminated from analysis. We did this to avoid biasing estimates towards downstream movement. We feel that since fish are released at the bottom of a reach, we may have collected fish on the next pass a short distance downstream and erroneously concluded it had moved further without this elimination.

Population Estimation Techniques

The northern pike adult population was estimated using a standard Petersen mark recapture method. We eliminated 11 juvenile fish (< 300mm) from population estimate analysis data set as they were very small, and unlikely to be recaptured. Of the 11 juvenile fish caught and tagged, none were recaptured.

Recruitment and movement into and out of the study reach over the sampling period is an issue in meeting closure assumptions. Considering the small length of time covered by the study, we felt that recruitment and movement into and out of the population were not significant issues in determining population closure.

Results and Discussion

Overview

Three hundred and three northern pike (119 male, 23 female, and 161 undetermined) were collected in the main study area. Length-weight relationship is similar to that of 2004 (Figure 2).

Population Size and Structure

The adult population estimation of northern pike in the 28.3-mile reach of the upper Yampa River for 2005 is 722 (509 to 935 95% C. I.). The 2004 estimate for the same reach was 616 (560 to 691 95% C. I.). The three-pass method in 2004 was able to achieve a more accurate estimate. The 2005 estimate appears higher, however the 2005 estimate and C. I. capture the 2004 estimate and its confidence intervals.

Length frequencies in the main reach were broken out into three sections. These three sections are from river mile 198.8 – 194.1, 194.1 – 183.3, and 183.3 – 170.8. The top, or upstream, reach is above Steamboat Springs where the river channel has more natural hydrography with numerous side channels and backwaters. The middle reach, through Steamboat Springs and below has been channelized and altered for development and whitewater recreation. The lower section is also relatively unaltered but has the input of the Elk River, a large tributary to the Yampa. The mean northern pike lengths for the upper, middle, and lower main reaches are 582.11mm, 661.89mm, and 749.86mm, respectively, and are significantly different (d.f. = 295, F = 25.971, P <0.001, Figure 3). The upper reach contains smaller fish and is a probable spawning ground and nursery area due to meandering channel topography and the associated slow water vegetated habitats. Most of the reach is public ground contained within the Chuck Lewis State Wildlife Area.

Movement

Within sampling period and between year movements were detected from a total of one hundred and twenty three fish captured during this years tagging effort and collected in downstream reaches by other investigators. One fish moved into critical habitat for Colorado pikeminnow and 24 fish moved into the Hayden to Craig reach (see Finney and Haines 2004), 12 from this years study and 12 tagged in 2004. One fish moved upstream 14.9 miles into our reach that was tagged below Hayden in 2004.

Northern pike movement in our reach between years 2004 and 2005 ranged from 19.55 miles upstream to 11.65 miles downstream with an average of 1.154 miles upstream. Almost 14 percent of the pike tagged in 2004 were recaptured in reaches downstream, 10.6 percent in 2004 and 3.2 percent in 2005. Northern pike movement in our reach within this year's effort ranged from 10.7 miles downstream to 14.05 miles upstream with an average of 1.176 miles upstream.

The range for all pike tagged in our reach in 2004 and 2005 and recaptured anywhere in the Yampa River in 2005 was 53.1 miles downstream to 19.55 miles upstream with an average movement of 3.378 miles downstream. The 2004 and 2005 movement trend for all pike captured and released in our reach and recaptured anywhere was downstream. Interestingly however, the movement trends for 2005 within our reach and our sampling timeframe were upstream. In 2004, and the within the same reach (sampled April 14th to April 30th), the general movement trend was downstream (Finney and Atkinson 2004). We believe that a general upstream movement is occurring in the pre-runoff spring followed by a general downstream movement later in the spring. We detected the upstream movements in 2005 due to our earlier sampling period. Downstream investigators are detecting the subsequent downstream migration during their later sampling period.

Removal Potential

The potential for removal of a large number of pike in this reach is high. This is due to the high probability of capture in the reach (0.43 in 2004 and 0.25 in 2005 vs. ~ 0.07 in the 98b reach) associated with a narrow channel and subsequent increase in sample efficiency. Capture per unit of effort, broken up by portion of the study area sampled, indicates a higher proportion of the pike population reside in the upper reach (Table 1).

Catamount Reservoir Escapement

One northern pike we captured in our sampling that had escaped from Catamount Reservoir. The fish was caught at river mile 195.2. A more intensive study would be needed to accurately examine escapement rates from Catamount Reservoir.

VII. Recommendations:

1. Continue to follow movement of fish marked in previous years
2. Mitigate for impacts associated with the escapement of pike from Elkhead by removing pike from the public land areas of the study reach.

VIII. Acknowledgements:

The authors wish to thank numerous seasonal personnel for their help in the field. We would also like to thank Tim Modde for providing valuable comments to an earlier draft.

IX. Project Status:

The project is considered on track but minor revisions are suggested. It is subject to review prior to continuation.

X. FY 05 Budget Status:

A. Funds provided: $25,356
B. Funds expended: $25,356
C. Difference: -0-
D. Percent of the FY 2005 work completed: 100
E. Recovery Program funds spent for publication charges: -0-

XI. Status of Data Submission:

Data will be sent to the database manager in 2005. Data are currently being entered in Microsoft™ Excel spreadsheets.

XII. Signed: Sam Finney and Bill Atkinson — November 8, 2005
Principal Investigators — Date

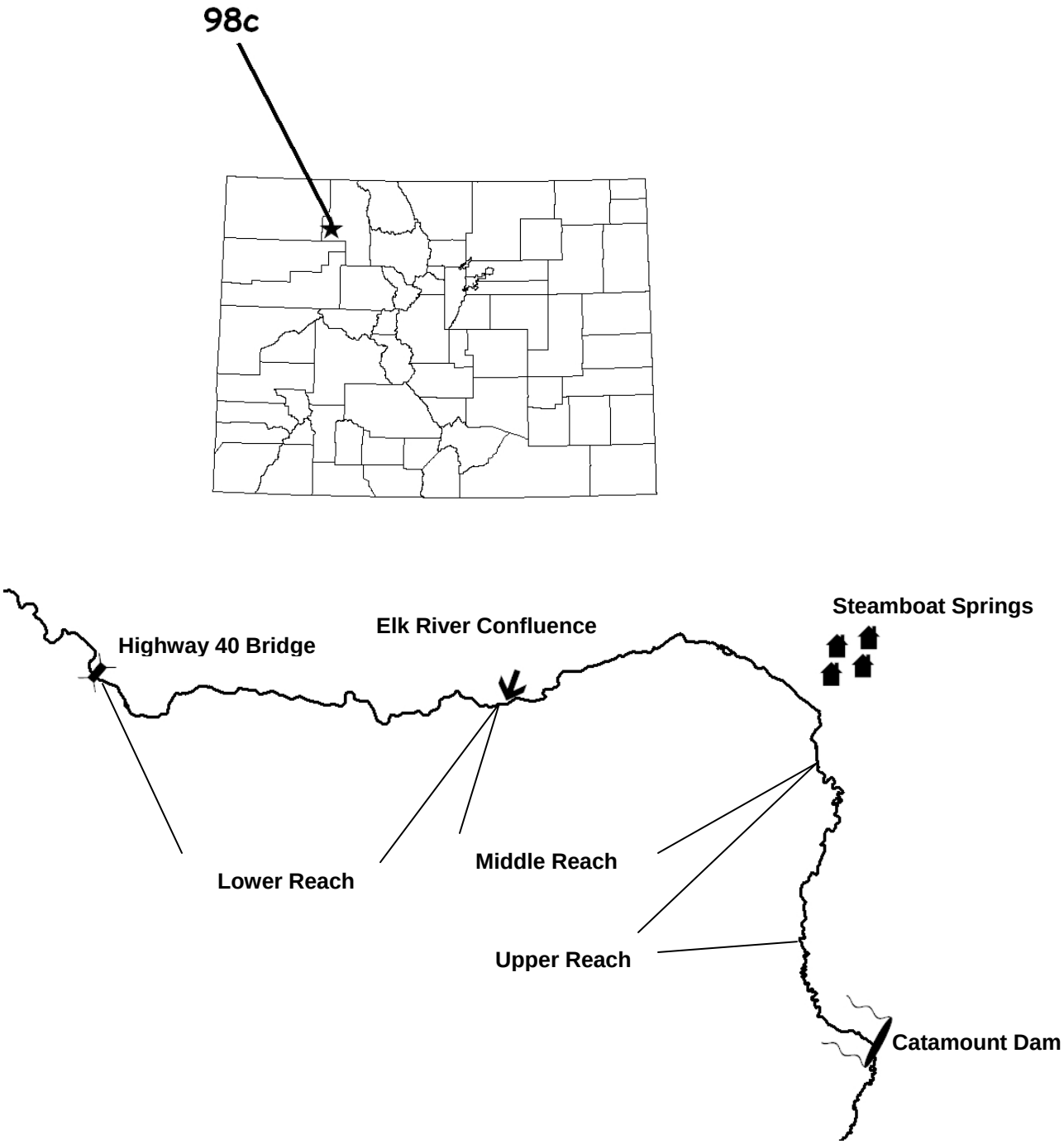


Figure 1.—Map of the study area of 98c.

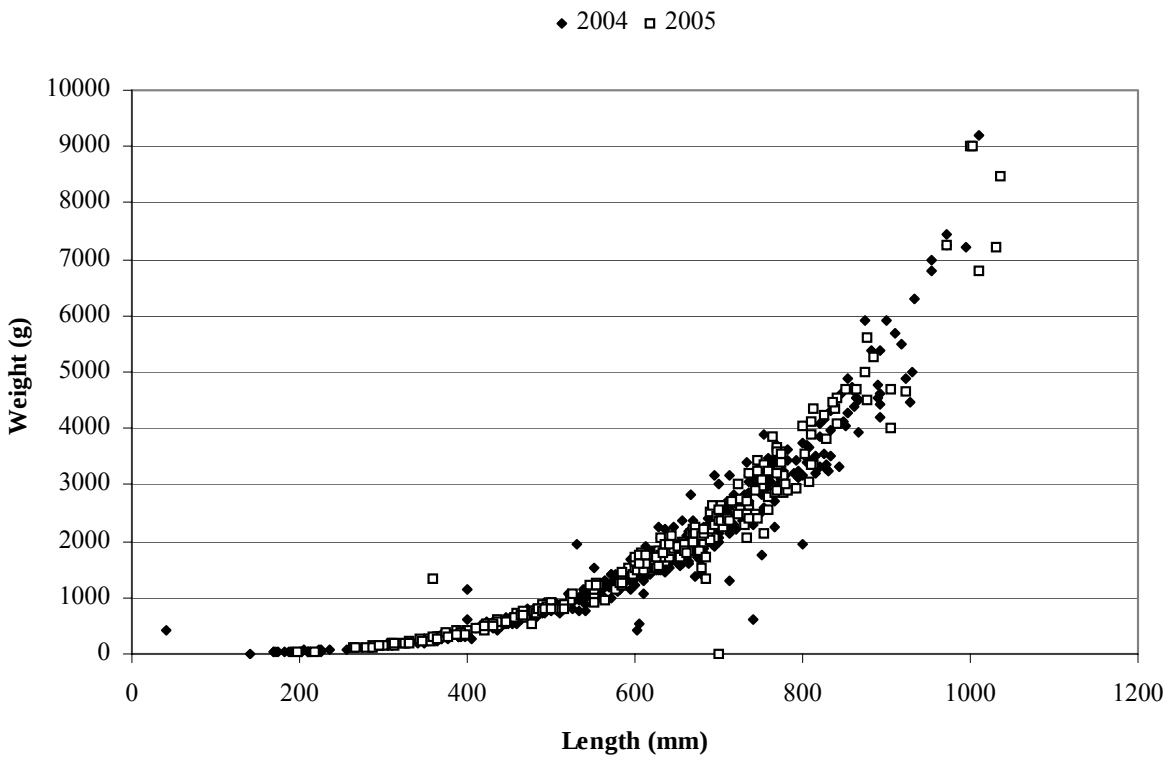
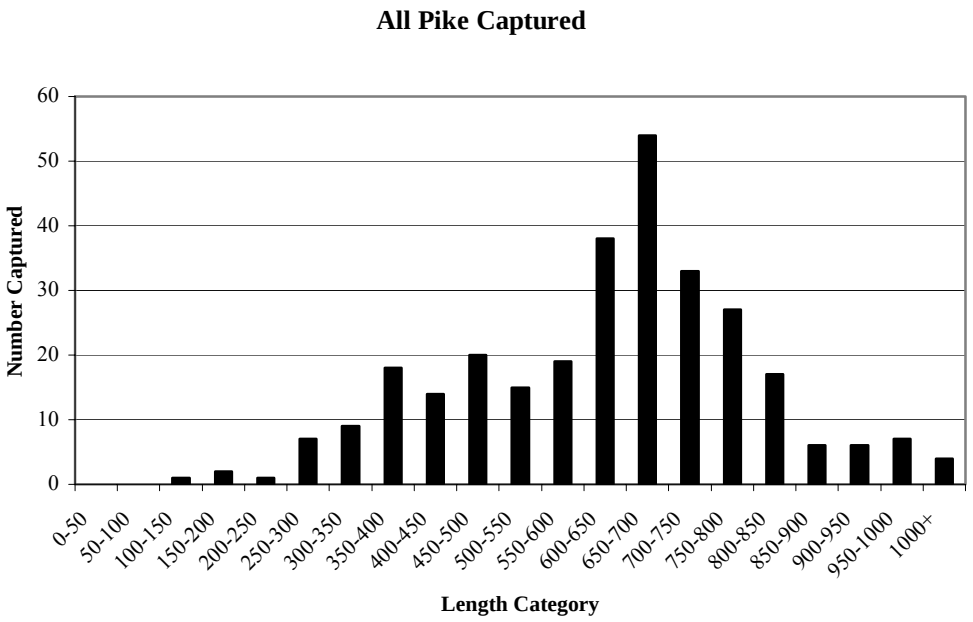
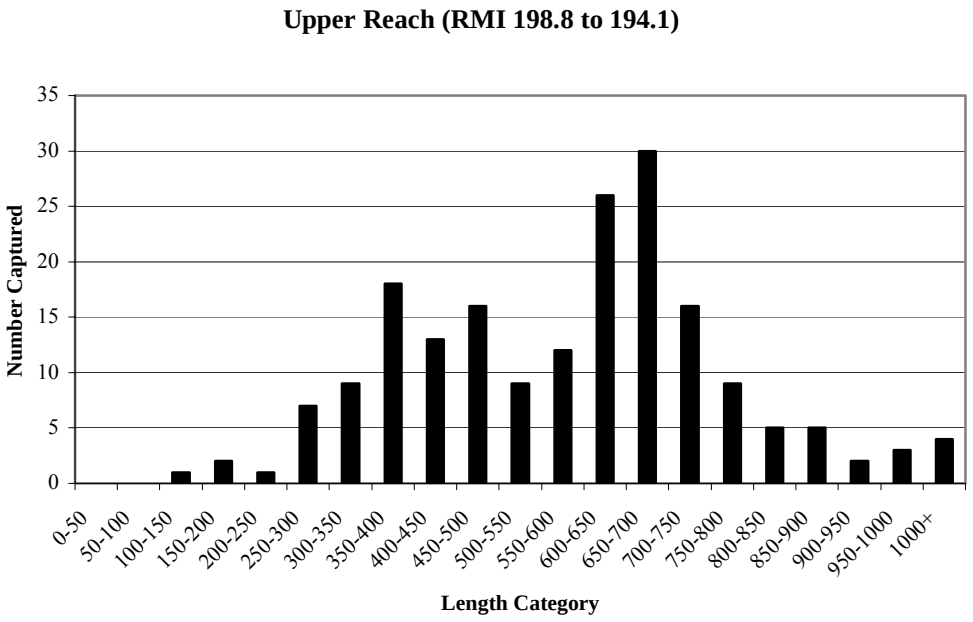


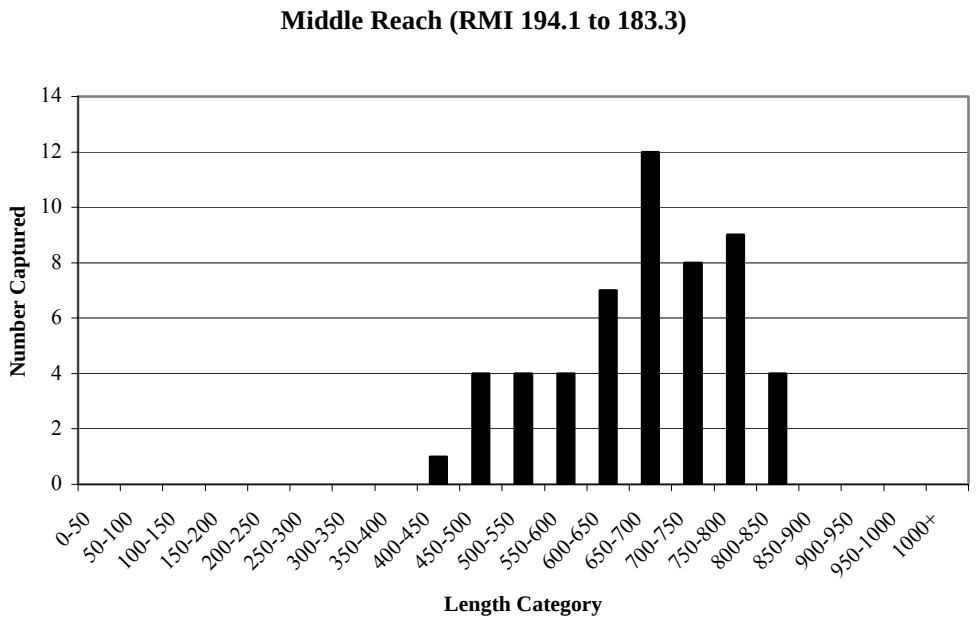
Figure 2.—Length-weight relationship of northern pike captured in the upper Yampa River, 2004 and 2005.


All Pike Captured
Number Captured
0
10
20
30
40
50
60
0-50
50-100
100-150
150-200
200-250
250-300
300-350
350-400
400-450
450-500
500-550
550-600
600-650
650-700
700-750
750-800
800-850
850-900
900-950
950-1000
1000+
Length Category

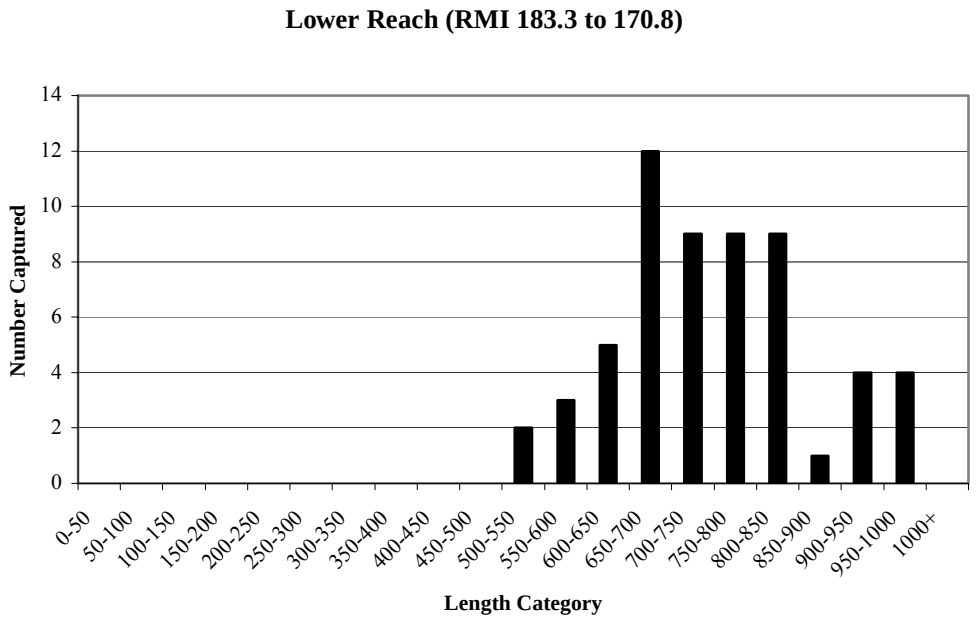
(a)


Upper Reach (RMI 198.8 to 194.1)
Number Captured
0
5
10
15
20
25
30
35
0-50
50-100
100-150
150-200
200-250
250-300
300-350
350-400
400-450
450-500
500-550
550-600
600-650
650-700
700-750
750-800
800-850
850-900
900-950
950-1000
1000+
Length Category

(b)



(c)



(d)

Figure 3.—Length histograms of all northern pike captured (a), and all pike captured in the upper (b), middle (c), and lower (d) reaches of the study area of the upper Yampa River, Spring, 2005.

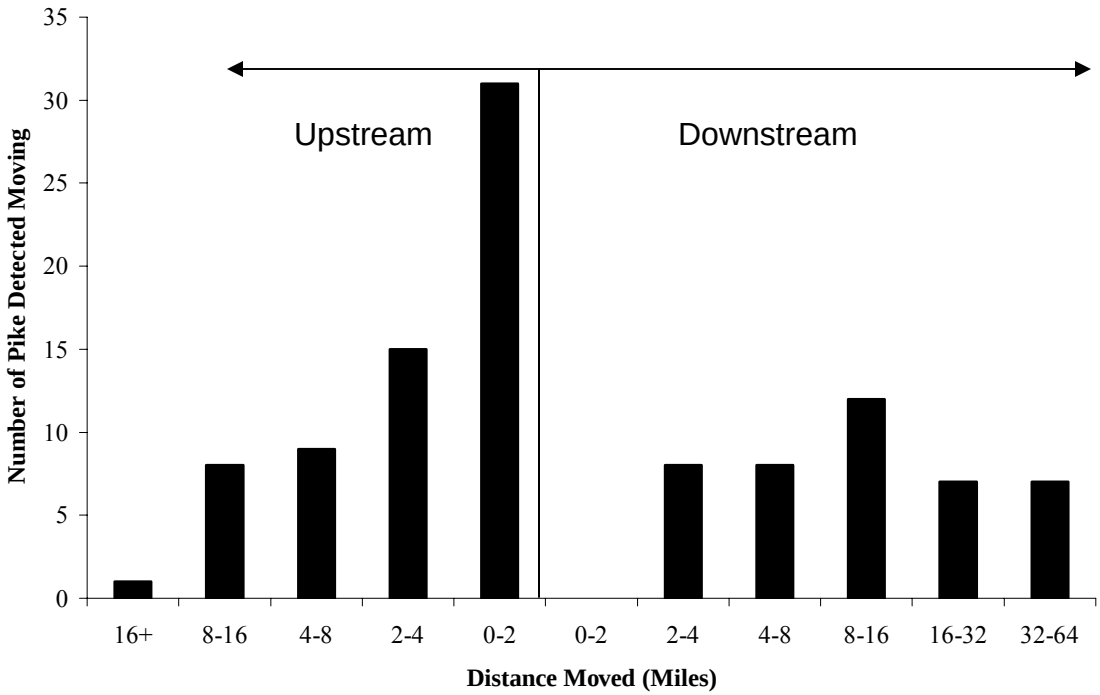


Figure 4.—Graphical representation of the distance and number of northern pike that moved upstream or downstream in 2004 and 2005. Pike moving downstream less than 2 miles are excluded.

Table 1.—Catch per unit effort (NP/hr) for the three subsections of the study area sampled in 2004 and 2005

	Upper Reach	Middle Reach	Lower Reach
Year			
2004	13.931	3.375	6.086
2005	12.722	3.876	3.437

Literature Cited

Finney, S. T. and B. Atkinson. 2004. Upper Yampa River northern pike tagging. Annual Report to the Recovery Program for the Endangered Fishes of the Upper Colorado River, Project 98c. U. S. Fish and Wildlife Service, Vernal, Utah.

Finney, S. T. and G. B. Haines. 2004. Translocation of northern pike from the Yampa River upstream of Craig, Colorado. Annual Report to the Recovery Program for the Endangered Fishes of the Upper Colorado River, Project 98b. U. S. Fish and Wildlife Service, Vernal, Utah.

Hughes, N. F. 1998. Reduction in growth and tagging may change interannual movement behavior of stream salmonids: evidence from arctic grayling in an interior Alaskan stream. Transactions of the American Fisheries Society 126:1072-1077.

Moser, M. L., and S. W. Ross. 1993. Distribution and movements of anadromous fishes of the lower Cape Fear River, North Carolina. Final Report to U.S. Army Corps of Engineers, Wilmington, North Carolina.