COLORADO RIVER RECOVERY PROGRAM
FY 2012 ANNUAL PROJECT REPORT

RECOVERY PROGRAM
PROJECT NUMBER: 98a

I. Project Title: **Middle Yampa River northern pike removal and evaluation; smallmouth bass removal and evaluation**

II. Bureau of Reclamation Agreement Number: 08FG402776

Project/Grant Period: Start date: June 4, 2008
End date: December 30, 2012
Reporting period end date: December 30, 2012
Is this the final report? No

III. Principal Investigator:

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IV. Abstract:

This project is one of several designed for removal of northern pike and smallmouth bass within the Yampa River basin, with evaluation of such efforts. The study area consisted of Yampa River miles 134.2 to 50.5 which were sampled to capture and remove smallmouth bass and northern pike. Due to low flows the 2012 sampling season was reduced to the fewest number of days since inception of these efforts in 2004. During 2012 sampling 618 northern pike individuals were handled and 475 were removed from the river. Data collected for this river section yielded an increased catch per unit effort and population size of northern pike. Based on 2012 capture data and growth rates the majority (greater than 67%) of all northern pike captured were from the 2011 year class of northern pike.

V. Study Schedule:

Initial Year: 2005 (CDOW assisted Colorado State University (CSU) in 2004)
Final Year: Ongoing

VI. Relationship to RIPRAP:

This study involved removing northern pike and smallmouth bass from the middle Yampa River, and evaluating the efficiency of that effort.

Green River Action Plan: Yampa and Little Snake Rivers:
III. Reduce negative impacts of nonnative fishes and sportfish management activities (nonnative and sportfish management)

III.A.1. Implement Yampa Basin aquatic wildlife management plan in reaches of the Yampa River occupied by endangered fishes. Each control activity will be evaluated for effectiveness and then continue as needed.
III.A.1.b. Control northern pike.
III.A.1.b.(1) Remove and translocate northern pike and other sport fishes from the Yampa River.

VII. Accomplishments of FY 2012 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

A. FY 2012 Tasks and Deliverables

Task 1. Establish landowner contacts and obtain permission to access riverside and backwater property for fish sampling.
Schedule: March 2012
Deliverable: **Task Completed**

Task 2. Plan logistics, hire and train personnel, order and maintain equipment, and prepare for sampling.
Schedule: March-April, 2012
Deliverable: **Task Completed**

Task 3. Sample study area to capture, remove, and translocate northern pike and smallmouth bass. Limited data entry
Schedule: April 18-Aug 1, 2012
Deliverable: **Task Completed**

Task 4. Maintenance of equipment. Data entry, data analysis, and prepare final report. Present findings during the Annual Nonnative Fish Control Workshop, and at the Annual Recovery Program Researchers Meeting.
Schedule: August-December, 2012
Deliverable: **Task Completed.** Annual Report Completed and presentation will be given at the Annual Nonnative Fish Control Workshop.

B. Discussion of Initial Findings and Shortcomings

Study Area

The study area for this project with regard to northern pike has been consistent since 2005. It includes the entire portion of the middle Yampa River sampled by CPW and CSU combined, from river mile (RM) 134.2 to 50.5 (Figure 1). CPW samples Reach 1 (RM 134.2 – 124.0), CSU samples Little Yampa Canyon (LYC; RM 124 – 100), CPW samples Reaches 2 through 5 (RM 100 – 60.6), and CSU samples Lily Park (RM 55.5 – 50.5) (Table 1).

CPW Study Methods/Approach

Fiscal Year 2012 marks the fourth consecutive year in which all smallmouth bass data collected by CPW were submitted to CSU for a combined analysis of smallmouth bass, as has been done by CPW with northern pike data since 2005. Thus, the focus of this report is on northern pike. See 2012 report #125 for a detailed analysis of smallmouth bass data collected in the study area.

In addition to standard sampling within the study area, CPW and CSU also participated in a cooperative effort with USFWS. The focus of this effort was concentrated removal and disturbance of spawning adult smallmouth bass in river reaches with relatively high concentrations of adult smallmouth bass, and is referred to here as the Surge and also featured northern pike removal. The Surge lasted from May 30 to June 19. Additional removal passes that were accomplished during the Surge are accounted for in the following paragraphs describing effort.

Due to low flows and therefore access constraints in certain reaches of river, CPW and CSU combined work crews in an effort to complete passes in certain reaches. Combined efforts of CPW and CSU resulted in 6 total sampling passes (1 mark/release, 5 removal) in Reach 1 (RM 134.2 – 124.0). One additional removal pass was performed in this reach by CSU, CPW, and USFWS during the Surge effort, bringing the total to 7 sampling passes (6 removal passes). Six total sampling passes (1 mark/release, 5 removal) were performed in Reach 2 (RM 100 – 91.0) and Reach 3 (RM 88.7 – 79.2). Three total sampling passes (1 mark/release; 2 removal) were conducted by CPW in Reach 4 (RM 79.2 – 71.0). CPW also completed three sampling passes (1 mark/release; 2 removal) in Reach 5 (RM 71.0 – 60.6) (Table 1).

In CSU's study area, five sampling (1 mark/release; 4 removal) passes were conducted in Little Yampa Canyon (RM 124 – 100) with an additional three passes completed during Surge efforts. Three total sampling passes (1 mark/release; 2 removal) were conducted in Lily Park (RM 58.9 – 55.5) (Table 1).

Beginning in 2009 the mark/release pass was postponed in an effort to increase numbers of smallmouth bass tagged by tagging bass when catch rates are highest. With the exception of Reach 5, a removal pass was completed in all CPW reaches prior to the mark/release pass, which commenced on May 7, 2012.

Northern pike and smallmouth bass were captured using Smith Root GPP 5.0 boat mounted electrofishing gear. Electrofishing effort was recorded by reach sampled and by date. "Block and shock" and "snare and scare" techniques were utilized with trammel nets at the mouths of backwaters. Water conductivity and temperatures were recorded at the beginning of each sampling day. All northern pike captured during the tag/release pass were marked near the dorsal fin with a unique, numbered, grey, t-bar FLOY tag. Northern pike tagged by CSU tag numbers ranged from number 7603 to 7811, but not sequentially. Northern pike tagged by CPW ranged from 8226 to 8725, but not

sequentially. Northern pike captured during removal passes were removed from the river. All fish that were less than 20 inches in total length were euthanized, and the majority of those greater than 20 inches total length were translocated to Yampa State Park Headquarters Pond. All translocated northern pike received a FLOY tag, if they did not already have one, as well as a left pelvic fin clip. Northern pike that were translocated but not already tagged, received a new, grey FLOY tag, with tag numbers ranging from 6151 to 6153 or 7780 to 7790 for CSU, and from 8202 to 8210, 8255 to 8279, or 8476 to 8486 for CPW.

All northern pike, smallmouth bass, Colorado pikeminnow, roundtail chub, and incidental non-native centrarchids were measured for total length to the nearest millimeter (mm), and weighed to the nearest gram (g). Northern pike and smallmouth bass captured were examined for the presence of FLOY tags and fin clips. Colorado pikeminnow and roundtail chub were scanned for the presence of PIT (passive integrated transponder) tags. Individuals without PIT tags were implanted with a new PIT tag following the protocol of the Upper Colorado River Recovery Program. All Colorado pikeminnow and roundtail chub were released back to the water immediately

Incidental non-native centrarchids, including black crappie, bluegill, and green sunfish, and black bullheads were euthanized.

Determination of Population Estimates, Catch Per Unit Effort, and Movement

Population Estimates

In 2012, one population estimate was conducted and included the section of river spanning from South Beach (RM 134.2) to Lily Park (RM 50.5), which is a repeated measure from 2004 through 2012. CPW and CSU northern pike data were combined to produce a northern pike population estimate for the Yampa River from South Beach to Lily Park (approximately 84 river miles). Program Mark (White et al. 1982) was used to generate these estimates using the Huggins closed estimator. Northern pike that were less than 300mm in total length were excluded from the analysis.

Catch Per Unit Effort (CPUE)

Catch per unit effort (CPUE) was reported in terms of number of northern pike captured per electrofishing hour. All capture events were considered independent of one another, and all individuals that were recaptured on the same day or a different day, were included in total capture events.

In addition to overall catch per unit effort, CPUE was reported for three sub-sections within the study area: (1) Juniper (RM 134.2 to 91.0), (2) Maybell (RM 88.7 to 60.6), and (3) Lily Park (RM 55.5 to 50.5). For these three sub-sections CPUE was broken down into three categories and reported for each pass. The three categories for which CPUE was reported were: (1) NPK $\leq$ 300mm TL, (2) NPK $\geq$ 301mm TL, (3) All NPK.

Movement

Movement was broadly described in terms of number of fish that were recaptured in 2012, which were initially tagged in a previous year. Additionally, movement was analyzed in terms of movement that occurred within the study area in 2012.

Individual northern pike had to be captured more than once to be included in the movement analysis. Movement distance for individuals was calculated by subtracting river mile at initial tagging location from river mile at subsequent recapture location; negative values represented downstream movement and positive values represented upstream movement. Distance moved was plotted against number of days at large between capture events.

Results and Discussion

Nine different fish species were collected within CPW study reaches. Summary data for all species captured and handled by CPW in 2012 are presented in Table 2.

Northern Pike

Overview

Overall, CPW and CSU captured 618 individual northern pike and a total of 669 capture events occurred (includes recapture events). The total number of northern pike capture events in 2012 (669) decreased from 849 in 2011. However, extremely low flows in 2012 greatly decreased effort compared to 2011 (Table 3), leading to reduced capture numbers. Four hundred and seventy five northern pike were removed in 2012, representing 77% of northern pike individuals handled (Table 4). Sixty four northern pike were translocated to State Park Headquarters West Pond, down from 84 translocated in 2011. Four hundred and seven northern pike were euthanized (Table 5), also down from 2011 when 681 were euthanized.

One hundred and sixty five (165) northern pike ≥ 300mm were marked and released during the marking pass (Table 4). One hundred sixty one (161) of these fish were marked by CPW and CSU in 2012, while 3 had been marked in previous years by CSU and CPW (Table 6). Fourteen of 164 (14.7%) northern pike ≥ 300mm that were tagged were recaptured on the subsequent recapture pass. A total of 180 northern pike of all size classes were tagged and released, and 39 of those fish were recaptured and removed across all subsequent removal passes, resulting in a recovery rate for tagged northern pike of 22% (Table 4).

Population Size Structure

Northern pike total length frequency histograms for the entire section of river sampled by CPW and CSU from 2004 to 2012 are presented in Figure 2. In 2012, the northern pike population featured fewer large fish (> 600mm), 8% of total capture events, and fewer

small northern pike (< 300mm), 6% of total capture events, when compared to recent years. The length frequency analysis yielded one predominant size range of northern pike in 2012. Sixty seven percent of northern pike captured were 250 to 450mm. Based on size of YOY northern pike at the end of the 2011 sampling season and established between-year growth rates, northern pike captured in 2012 between 250 and 450mm were part of the 2011 cohort. The largest northern pike captured was 970mm, and was a fish that had not previously been captured.

Compared to 2011 far fewer young of year (YOY) northern pike were captured in 2012. Northern pike YOY were defined as 1-200mm fish captured after June 1 of each corresponding year. Two hundred and seventy eight YOY were captured in 2011 compared to only eleven in 2012. The first YOY of 2012 was captured on June 6 compared to July 8, 2011. This result was directly affected by low flows (Figure 3) which made 2012 the shortest effective sampling season since the inception of the project (as defined by number of days between first and last northern pike captured; Table 3). In 2011 runoff peaked on June 9 at 19,100cfs while 2012 runoff peaked on April 28 at 4,530cfs (Figure 3). Early runoff and low flows during 2012 resulted in an earlier northern pike spawning season and shortened sampling season. In 2012, only 8 days of sampling were conducted after the first YOY capture event compared to 45 days in 2011, partially explaining discrepancies between capture numbers of YOY northern pike. The limited sampling period of 2012 resulted in fewer YOY of large enough size to recruit to sampling methods utilized.

In 2011, YOY pike represented a considerably higher proportion of the catch than in any previous year (Figure 2). Wright (2011) suggested that this might indicate a greater amount of within-channel and connected backwater reproduction than was previously suspected. It has long been believed that most northern pike recruitment in the Yampa River is attributable to immigration from off-channel source populations (Hill 2005, Wright 2009, Wright 2010). Alternatively, Wright (2011) speculated that the observed increase in relative abundance of YOY might be an artifact of the extraordinarily long 2011 sampling season documenting YOY recruitment that went undetected in previous years. 2012 sampling provides no further insight into the possibility of increasing in-river reproduction and recruitment, due to the abbreviated sampling season and limited captures of 2012 YOY northern pike (Figure 4).

Northern pike growth rates, based on capture history of fish recaptured in 2012 that spent at least 30 days at large between capture events were consistent with previous years (Wright 2010), ranging from 0.52 to 7.65 mm/week (Table 7). Generally, fish that were relatively small when initially captured exhibited higher growth rates than those that were relatively large when initially captured.

Population Estimate: South Beach to Lily Park

The population estimate for northern pike in the middle Yampa River in 2012 suggests that northern pike numbers more than doubled from 2011 to 2012 and are currently higher than when the study was initiated in 2004 (Table 8; Figure 5). The Program

MARK Model M(t) population estimate of northern pike in 2012 was 1580 (2482-1069 95% C.I.; SE=348.9; p-hat=0.085), increased from 641 (505-912 95% C.I.; SE=99.15; p-hat=0.147) in 2011. The 2012 abundance estimate resulted in a density estimate of 18.9 NPK ≥ 300mm/mile compared to the 2011 estimate of 7.7 NPK ≥ 300mm/mile. In 2012, 25.9% of the northern pike population ≥ 300mm (estimate of 1580) was removed (410 NPK ≥ 300mm), which was significantly lower than 2011 exploitation rate of 71.8% (Table 8).

Although the number of marked northern pike in 2012 was the highest since 2007, the high population estimate of 2012 was attributable to the low number of marked northern pike recaptured on the recapture pass along with the high number of unmarked fish captured during the recapture run. Low recapture of marked fish during the recapture run led to a decreased p-hat in 2012, an increased population estimate, and wide confidence intervals. The apparent increase in population size is presumably a direct result of a large 2011 cohort of northern pike in the river as explained above under *Population Size Structure*.

Catch Per Unit Effort (CPUE)

CPUE was calculated for sub-sections of the study area (Juniper, Maybell, and Lily Park) and compared to previous years (Table 9). Additionally, CPUE was calculated for three size categories (≤ 300mm, ≥ 301mm, and all sizes of northern pike) across all passes conducted in three sub-sections (Juniper, Maybell, and Lily Park), and expressed as number of northern pike captured per hour electrofishing (# of NPK/hour electrofishing) (Tables 9-10; Figures 6-8). In the Juniper section (Figure 6) CPUE increased between first and second sampling periods then showed a stable decrease through the fifth sampling period. Catch per unit effort in Maybell decreased steadily throughout sampling (Figure 7), and northern pike ≥ 301mm accounted for the majority of fish captured. In Lily Park, CPUE decreased steadily over three passes and northern pike ≥301mm accounted 100% of the catch through all passes (Figure 8).

Overall CPUE for all passes across the entire study area increased from 1.1 (NPK per hour electrofishing) in 2011, to 1.29 (NPK per hour electrofishing) in 2012 (Figure 9). Slight increases in overall CPUE have been documented each year since 2008. However, it should be noted that effort in areas that are known to support relatively higher numbers of northern pike has also increased. Thus, overall CPUE is somewhat biased by change in sampling regime. Nonetheless, CPUE remains a suitable index for validating abundance estimates and assessing trends in catch rate that may be associated with various factors such as discharge and depletion of northern pike numbers as the study progresses.

Movement

Nine northern pike were recaptured that were tagged by CPW and CSU in 2011 and one was recaptured that was tagged by CSU in 2010 (Table 6). Three northern pike were recaptured that were originally tagged and released by CPW in Elkhead Reservoir during

April 2011.

Northern pike movement was also described in terms of the number of recaptured northern pike that moved different distances in both upstream and downstream directions, and was plotted against number of days at large within the 2012 sampling year (Figure 10). Twenty one northern pike that were tagged and recaptured in 2012 moved more than one mile in a downstream direction, while 4 northern pike moved distances greater than one mile upstream. Average within-year movement of northern pike was 2.0 miles. Northern pike that demonstrated downstream movement within 2012 moved distances as great as 15.2 miles, while the greatest distance moved upstream was 4.4 miles (Figure 10).

Northern pike movement between 2012 and previous years averaged 10.0 miles when Elkhead Reservoir escapees were excluded and 16.0 when included. These movement patterns follow general trends from previous years in that greater degrees of movement are observed between years compared to movement within 2012 (Figure 11). Excluding three northern pike that escaped from Elkhead Reservoir in 2011 no fish tagged in previous years and recaptured in 2012 moved more than one mile in a downstream direction, while 9 northern pike moved more than a mile upstream. The greatest downstream movement was by an Elkhead Reservoir northern pike that traveled 60.3 miles downstream from Elkhead Creek. The greatest distance moved upstream was 31.9 miles. The northern pike that travelled 31.9 miles upstream was tagged at river mile 100.0 in 2011 by CSU and was recaptured at river mile 131.9 in 2012 by CPW. Results from 2012 movement analyses are similar to what was observed in 2011 with fish moving upstream between years. However, these results contradict 2010 results that showed the majority of between-year northern pike recaptures generally moving downstream, rather than upstream.

Escapement

Translocation of northern pike to Loudy Simpson Pond was officially discontinued in 2011. No fish were recaptured that were previously translocated to Loudy Simpson Pond. Three northern pike were recaptured that were initially tagged and released in Elkhead Reservoir in April 2011. Data on these fish are specified in Table 7 and Figure 11. CPW initiated a study in 2011, during which 420 northern pike were tagged and released in Elkhead Reservoir in April of 2011, prior to the reservoir spilling over. During sampling in April 2012 two hundred and eleven additional FLOY tags were deployed in Elkhead Reservoir northern pike. Low runoff levels prevented any reservoir spillover in 2012. Escapement of translocated smallmouth bass from Elkhead Reservoir has been previously documented (Hawkins 2010), but prior to the study initiated by CPW in 2011 it was impossible to document escapement of resident northern pike and smallmouth bass from Elkhead Reservoir. Tagging additional northern pike and smallmouth bass continues in Elkhead Reservoir and allows the escapement of resident fish into the Yampa River to be evaluated in greater depth.

Colorado Pikeminnow

Overall, 2 Colorado pikeminnow capture events occurred by CPW in 2012, thirty four less than in 2011 (Table 11). Both Colorado pikeminnow were captured during Pass 4, one in Reach 3 on May 22, 2012 and one in Reach 2 on June 6, 2012. Mean total length of Colorado pikeminnow captured by CPW in 2012 was 609mm. The two Colorado pikeminnow capture events occurred in the main channel, with no capture events in backwaters as low flows resulted in many typical backwater areas remaining dry all year. No evidence of northern pike attack was found on either Colorado pikeminnow.

Roundtail Chub

Overall, 8 roundtail chub capture events occurred by CPW in 2012 (Table 12). Five roundtail chub were captured during Pass 1, two were captured during Pass 2, and one was captured during Pass 3. A total length frequency histogram was developed for all roundtail chub individuals captured by CPW since 2008 (Figure 12). The mean total length of roundtail chub captured in 2012 was 464mm. Three of eight roundtail chub captured did not possess a pit tag and are presumed to be "new" fish.

VIII. Recommendations:

A. Consider an adaptive management approach based on environmental conditions to determine whether or not to conduct a mark recapture estimate during years with high northern pike catch rates, or to adjust the timing of mark and recapture passes to maximize removal efforts. .
B. Repeat 2012 standard northern pike removal effort and consider shifting more effort from the peak of the hydrograph, when northern pike catch rates have been shown to be lower, to the descending limb of the hydrograph, when northern pike catch rates have been shown to be higher. The highest catch rates of northern pike occur prior to and after peak runoff.
C. Prioritize sampling to occur later in the sampling season, which can be accomplished by the Surge, to document the presence or absence of YOY northern pike in future years.
D. Repeat the 2012 Surge effort in future years, as the Surge was complimentary to northern pike management objectives in the Yampa River.
E. Continue work to control potential northern pike source populations. Prioritize work schedule to focus on populations of immediate concern. Continue CPW study aimed at marking northern pike in Elkhead Reservoir and estimating abundance.
F. Continue marking and documentation of roundtail chub and Colorado pikeminnow.
G. Continue contacts with Yampa River landowners and stakeholders before, after, and during the study.

Acknowledgements: The author wishes to thank in particular previous 98a lead biologist Boyd Wright, CPW, for his assistance during field work and analysis, Jenn Logan, CPW, for her leadership assistance in the field, and Lori Martin, CPW, for her lead on this project from 2004 to 2007. The author also appreciates the assistance of numerous CPW

personnel and personnel from other agencies who assisted during the field season. The author recognizes Aaron Weber and John Hawkins for sharing and exchanging data.

IX. Project Status: This project is considered on track, with minor revisions to be considered. Study direction and sampling design for 2013 may be adjusted per results from the 2012 Nonnative Fish Control Workshop.

X. FY 2011 Budget Status:

A. Funds Provided: $196,073, Funds Expended: $196,073
B. Difference: -0-
C. Percent of the FY 2011 work completed: 100%
D. Recovery Program funds spent for publication charges: -0-

XI. Status of Data Submission: Data for Colorado pikeminnow collected by CPW will be provided to the database Manager by March 1, 2013.

XII. Signed: Kyle Battige November 21, 2012
Principal Investigator Date

. **Literature Cited:**

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Appendix: Tables and Figures

Table 1. Middle Yampa River reaches, river sections, reach descriptions, river miles, agency responsible, and pass summaries for 2012.

River Reach	River Section	Reach Description	River Miles	Agency Responsible	# Mark/Release Passes	# Removal Passes	# Total Passes
1	Juniper	South Beach launch to Round Bottom	134.2-124.0	CPW	1	6	7
CSU 1	Juniper	Little Yampa Canyon	124.0-112.0	CSU	1	7	8
CSU 2	Juniper	Little Yampa Canyon	112.0-100.0				
2	Juniper	Ups. Government bridge to mouth of Juniper Canyon	100.0-91.0	CPW	1	5	6
3	Maybell	Dwn. Juniper Canyon to Old Maybell launch	88.7-79.2	CPW	1	5	6
4	Maybell	Old Maybell launch to Sunbeam launch	79.2-71.0	CPW	1	2	3
5	Maybell	Sunbeam launch to ups. Cross Mountain launch	71.0-60.6	CPW	1	2	3
CSU 3	Lily Park	Lily Park	55.5-50.5	CSU	1	2	3

Table 2. A summary of the total number of individuals captured for all species of interest by CPW, unless otherwise noted, in the Middle Yampa River in 2012, including incidental non-natives that were lethally removed: black bullhead, black crappie, bluegill, green sunfish, white crappie, brook stickleback, and creek chub.

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Species	Number of Capture Events
Northern Pike	435 (CSU + CPW 669)
Smallmouth Bass	1360
Colorado pikeminnow	2
Roundtail Chub	8
Channel Catfish	4
Black Bullhead	3
Black Crappie	0
Bluegill	11
Green Sunfish	6
White Crappie	0
Brook Stickleback	0
Creek Chub	3

Table 3. Middle Yampa River sampling season 2004 to 2012. 1st NPK Capture was the date for a given year when the first northern pike was captured. Last NPK Capture was the date for a given year when the last northern pike was captured. # Days Between 1st and Last Capture was number of calendar days between dates listed for a given year.

Year	Date of 1st NPK Capture	Date of Last NPK Capture	# Days Between 1st and Last Capture
2004	4/21/2004	7/8/2004	78
2005	4/22/2005	7/21/2005	90
2006	4/21/2006	7/4/2006	74
2007	4/17/2007	6/30/2007	74
2008	4/15/2008	7/15/2008	91
2009	4/7/2009	7/14/2009	98
2010	4/13/2010	7/11/2010	89
2011	4/26/2011	8/22/2011	118
2012	4/17/2012	6/19/2012	63

Table 4. Number of northern pike ≥ 300mm TL tagged on the marking pass, number northern pike ≥300 mm TL that were tagged on the marking pass and recaptured on the recapture pass, number of northern pike in all TL classes that were tagged on the marking pass and removed during all subsequent passes, % of northern pike of all size classes that were tagged on the marking pass and removed on subsequent passes, total number of northern pike handled during study period, total number of northern pike that were removed during study period, and percent of handled northern pike that were removed in the middle Yampa River from 2004 through 2012.

Year	# NPK Tagged on First Pass	# NPK Recaptured on the Second Pass	# NPK Tagged, Recovered, and Removed on Subsequent to Marking Pass	%Recovery of Tagged NPK	Total # of NPK Individuals Handled	Total #NPK Removed	%NPK Handled that were Removed
2004	159	NA	76	48%	942	665	71%
2005	195	NA	83	43%	526	410	78%
2006	214	NA	79	37%	520	384	74%
2007	181	NA	93	51%	878	775	88%
2008	154	41	72	47%	503	417	83%
2009	92	13	16	17%	558	495	89%
2010	67	11	31	46%	662	623	94%
2011	79	11	20	25%	824	765	90%
2012	165	14	39	22%	618	475	77%

Table 5. Disposition totals for northern pike removed from the middle Yampa River in 2012. Northern pike were either moved to the State Park Headquarters Pond or euthanized.

Disposition	Number of Northern Pike
State Park Headquarters Pond	64
Loudy Simpson	0
Elkhead Reservoir	0
Euthanized and Incidental Mortality	407
*Yampa River State Wildlife Area	4
Total	**475**

*CSU-LFL crew accidentally translocated four NPK to the Yampa River State Wildlife Area pond thinking it was the State Park Headquarters Pond

Table 6. Number of northern pike (NPK) 2012 recaptures that featured "foreign" tags, including those tagged and released by CPW and CSU in 2008, 2009, and 2010, as well as those tagged by project 98b in previous years and those tagged and released by CPW in Elkhead Reservoir in 2011.

Source of "Foreign" Tags	**Number of NPK Recaptured**
Tagged and Released by CPW and CSU in 2008	0
Tagged and Released by CPW and CSU in 2009	0
Tagged and Released by CPW and CSU in 2010	1
Tagged and Released by CPW and CSU in 2011	8
Tagged and Released by USFWS (98b) in Previous Years	0
Tagged and Released by CPW in Elkhead Reservoir in 2011	3
Tagged and Released by CPW in Elkhead Reservoir in 2012	0

Table 7. Growth rate calculations based on capture history of northern pike that were recaptured in 2012 and spent a minimum of 30 days at large between capture events. For each fish fitting such description, the table includes TL (mm) at first capture, date of first capture, TL (mm) at recapture, date of recapture, length difference between the two capture events, growth rate expressed in mm/week, and growth rate expressed in mm/day.

TL @ first Capture(mm)	Date of First Capture	TL @ Second Capture(mm)	Date of Second Capture	Change in TL(mm)	Growth Rate(mm/week)	Growth Rate (mm/day)
253	5/2/2010	660	4/18/2012	407	3.97	0.57
345	5/13/2011	570	5/15/2012	225	4.28	0.61
350	5/12/2011	540	4/30/2012	190	3.76	0.54
355	5/11/2011	605	5/14/2012	250	4.74	0.68
361	5/3/2012	408	6/15/2012	47	7.65	1.09
371	5/9/2012	405	6/16/2012	34	6.26	0.89
373	5/11/2011	517	5/10/2012	144	2.76	0.39
395	5/9/2011	567	5/31/2012	172	3.10	0.44
397	5/14/2011	533	5/17/2012	136	2.58	0.37
411	5/12/2011	586	5/3/2012	175	3.43	0.49
525	5/12/2011	682	4/30/2012	157	3.10	0.44
*610	4/21/2011	669	4/18/2012	59	1.14	0.16
*698	4/20/2011	772	5/1/2012	74	1.37	0.20
714	5/11/2011	791	5/22/2012	77	1.43	0.20
*771	4/20/2011	800	5/17/2012	29	0.52	0.07
774	5/9/2012	793	6/18/2012	19	3.33	0.48

*Northern pike originally tagged in Elkhead Reservoir.

Table 8. Northern pike ≥300 mm TL population estimate and the 95% confidence interval, generated using Program MARK Huggins closed estimate; estimated capture probability (p-hat); number of northern pike ≥ 300mm removed; and exploitation rate of northern pike in terms of percent of the abundance point estimate removed for 2004 through 2012 in the middle Yampa River.

Year	NPK ≥ 300 mm Population Estimate and 95% Confidence Interval	P-Hat	Number NPK ≥ 300 mm Removed	NPK ≥ 300 mm Exploitation Rate
2004	981 (774-1288)	0.23	560	57.1%
2005	678 (555-861)	0.22	380	56.0%
2006	623 (517-780)	0.22	328	52.6%
2007	1073 (825-1321)	0.23	679	63.3%
2008	633 (518-806)	0.28	384	60.7%
2009	765 (553-1160)*	0.15	378	49.4%
2010	664 (492-1002)**	0.20	481	72.4%
2011	641 (505-912)***	0.15	460	71.8%
2012	1580 (1069-2482)****	0.08	410	25.9%

*137 northern pike were removed prior to conducting the abundance estimate and were added to the point estimate and upper and lower confidence limit for comparison with previous years

**175 northern pike were removed prior to conducting the abundance estimate and were added to the point estimate and upper and lower confidence limits for comparison with previous years.

***246 northern pike were removed prior to conducting the abundance estimate and were added to the point estimate and upper and lower confidence limits for comparison with previous years.

****130 northern pike were removed prior to conducting the abundance estimate and were added to the point estimate and upper and lower confidence limits for comparison with previous years.

Table 9. Northern pike Catch Per Unit Effort (CPUE) from 2004 to 2012 in three sub sections of the middle Yampa River: (1) Juniper (RM 134.2 – 91.0), (2) Maybell (RM 88.7 – 79.2), and (3) Lily Park (RM 55.5 – 50.5)

Year	Juniper CPUE	Maybell CPUE	Lily Park CPUE
2004	2.01	2.92	1.96
2005	1.69	1.23	0.81
2006	1.48	1.64	0.58
2007	1.90	2.26	0.54
2008	0.93	1.15	0.49
2009	1.05	1.04	0.27
2010	1.13	1.07	0.41
2011	1.27	0.75	0.37
2012	0.97	2.23	1.76

Table 10. Number of northern pike captured, electrofishing effort expended (hours), and northern pike catch per unit effort (CPUE; # NPK/ hour electrofishing) across each pass for each of sub-section (Juniper: RM 134.2-91.0, Maybell: RM 88.7-60.5, and Lily Park: RM 55.5-50.5) in 2012.

	Pass 1	Pass 2	Pass 3	Pass 4	Pass 5	Sub Section Totals
JUNIPER						
NPK Captured	108	115	75	46	7	351
Effort (hours)	71.67	85.7	93.12	100.86	17.03	368.38
CPUE (NPK/hour)	1.51	1.34	0.81	0.46	0.41	0.95
MAYBELL						
NPK Captured	99	104	47	18		268
Effort (hours)	31.74	39.58	30.41	18.45		120.18
CPUE (NPK/hour)	3.12	2.63	1.55	0.98		2.23
LILY PARK						
NPK Captured	31	11	8			50
Effort (hours)	10.68	8.24	9.46			28.38
CPUE (NPK/hour)	2.9	1.33	0.85			1.76

Table 11. Number of Colorado pikeminnow (CPM) capture events, number of CPM marked, number of CPM recaptures, number of CPM released, number of CPM removed, and number of CPM mortalities for across all passes in 2012 performed by CPW.

CPW Reach #	#CPM Capture Events	#CPM Marked	#CPM Recaptures	#CPM Released	#CPM Removed	#CPM Mortalities
1	0	0	0	0	0	0
2	1	0	1	1	0	0
3	1	0	1	1	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
Total	2	0	2	2	0	0

Table 12. Number of roundtail chub (RTC) capture events, number of RTC marked, number of RTC recaptures, number of RTC released, number of RTC removed, and number of RTC mortalities for across all passes in 2012 performed by CPW.

CPW Reach #	#RTC Capture Events	#RTC Marked	#RTC Recaptures	#RTC Released	#RTC Removed	#RTC Mortalities
1	1	0	1	1	0	0
2	2	0	2	2	0	0
3	0	0	0	0	0	0
4	1	0	1	1	0	0
5	4	3	1	4	0	0
Total	8	3	5	8	0	0

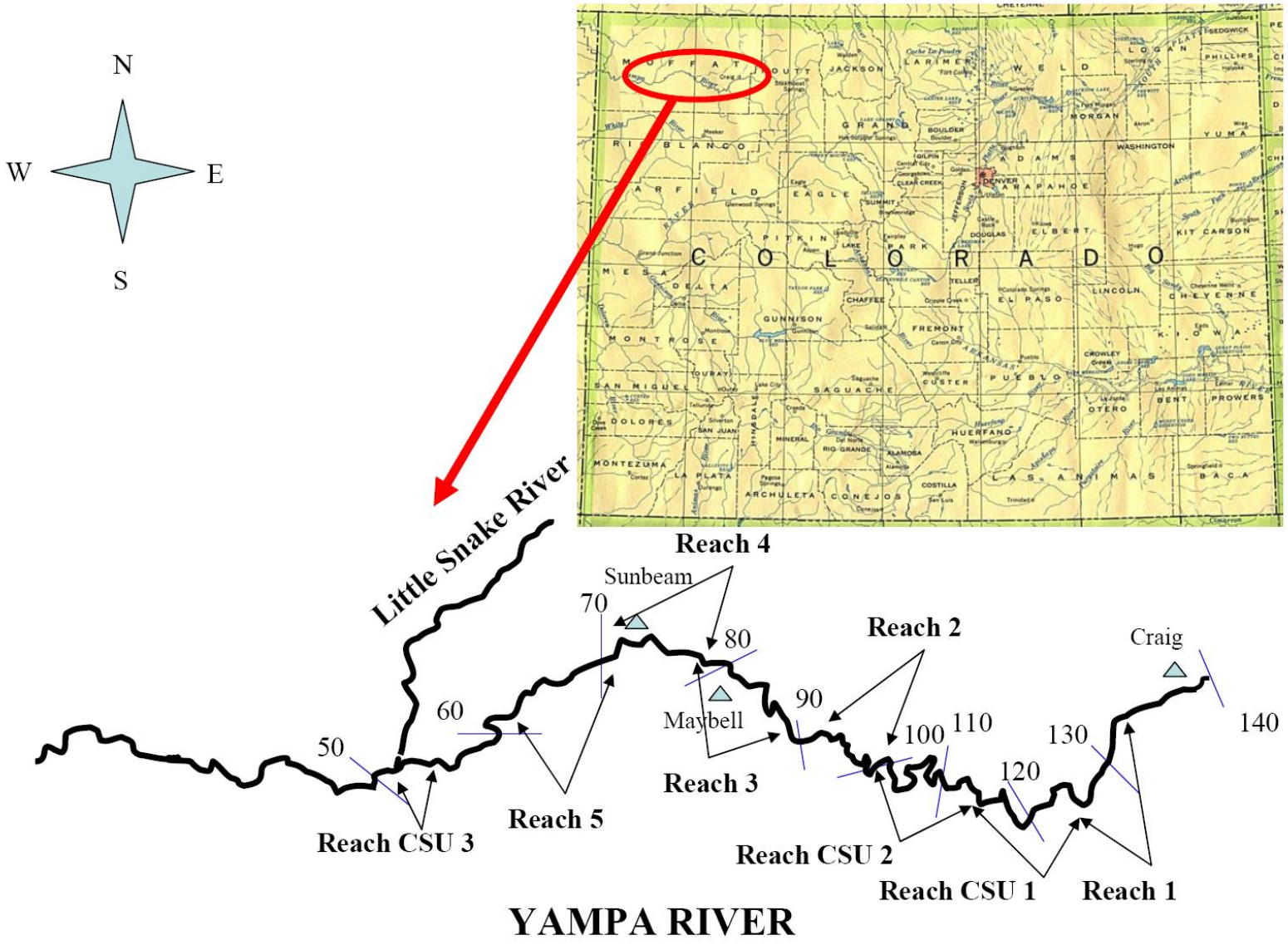

Figure 1. River reaches of the middle Yampa River sampled by the CDOW and CSU (Graphics courtesy of P. Martinez and R. Anderson)

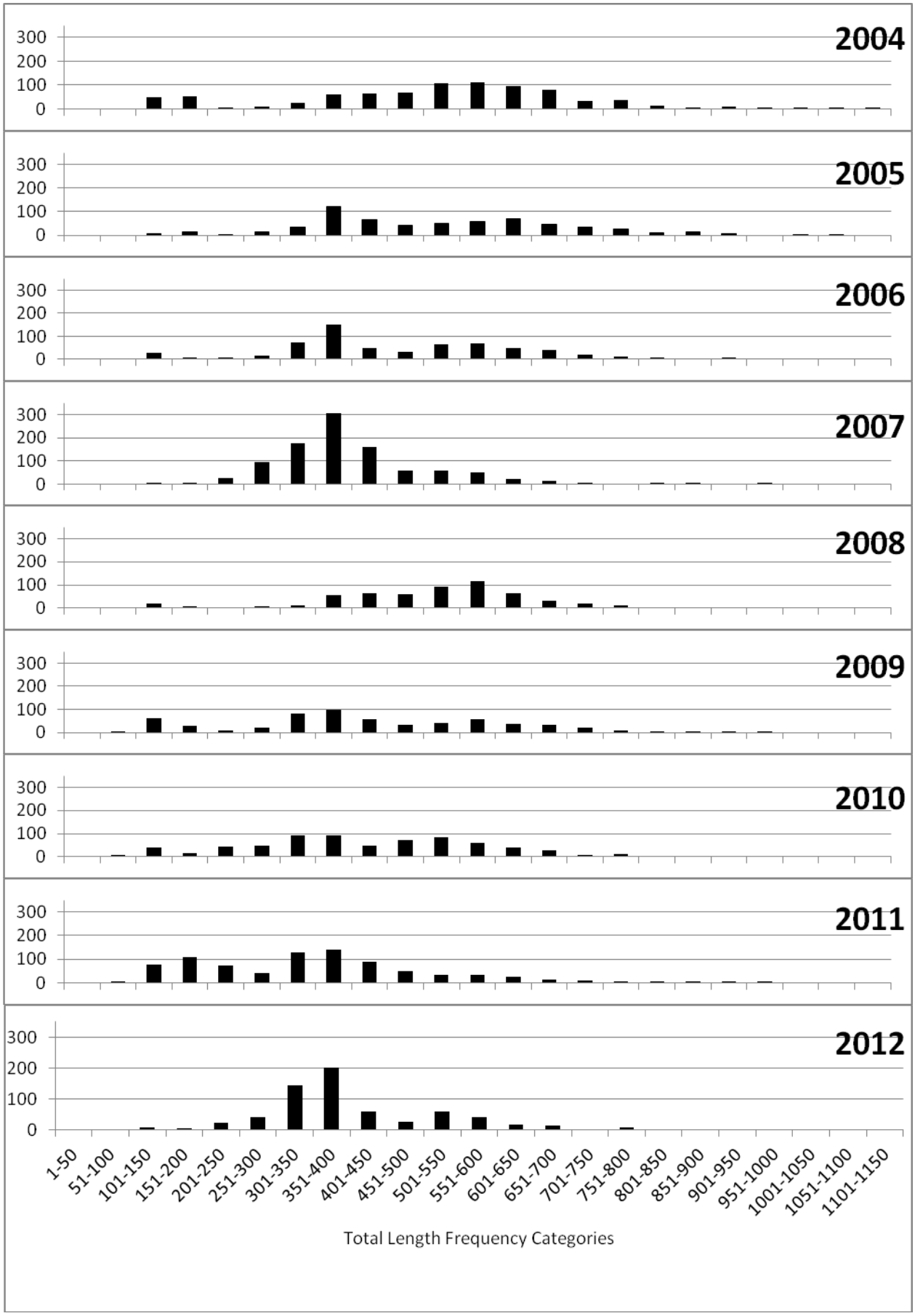

Figure 2. Northern pike total length frequency distributions, in the middle Yampa River, South Beach to Lily Park (RM 134.2-50.5)

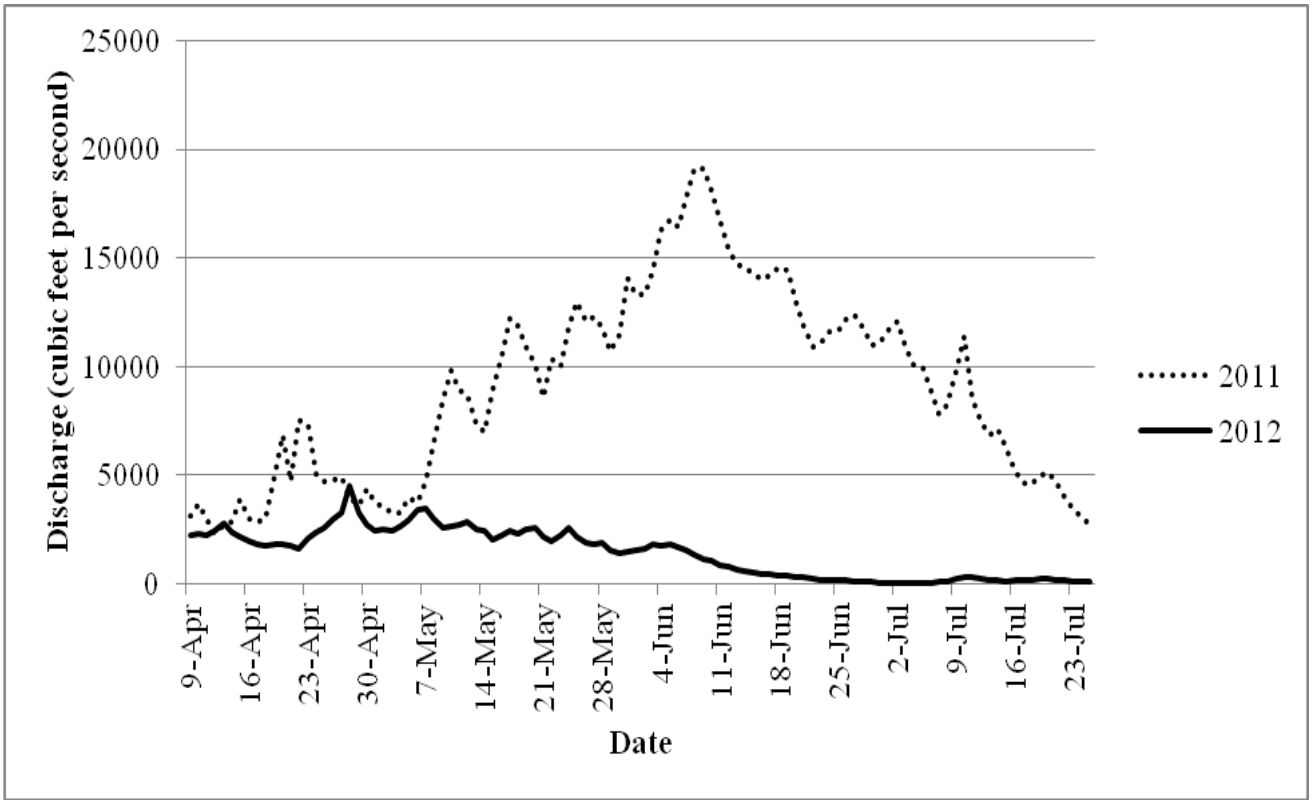

Figure 3. United States Geological Survey Maybell gaging station data for 2011 and 2012 spring runoff.

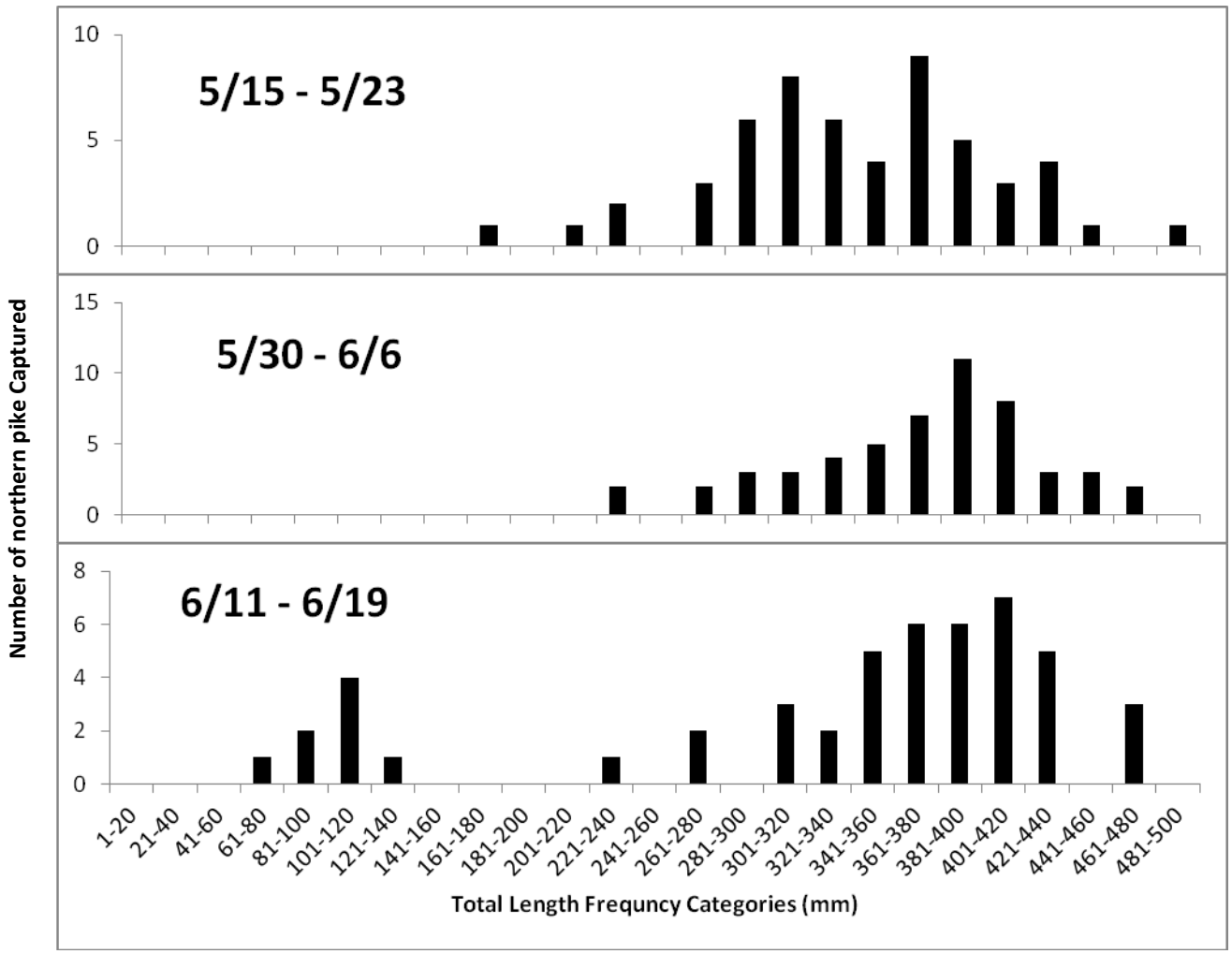

Figure 4. Length frequency distribution for Juniper section northern pike ≤ 500mm TL, in increments of 20mm, across three sampling periods in 2012.

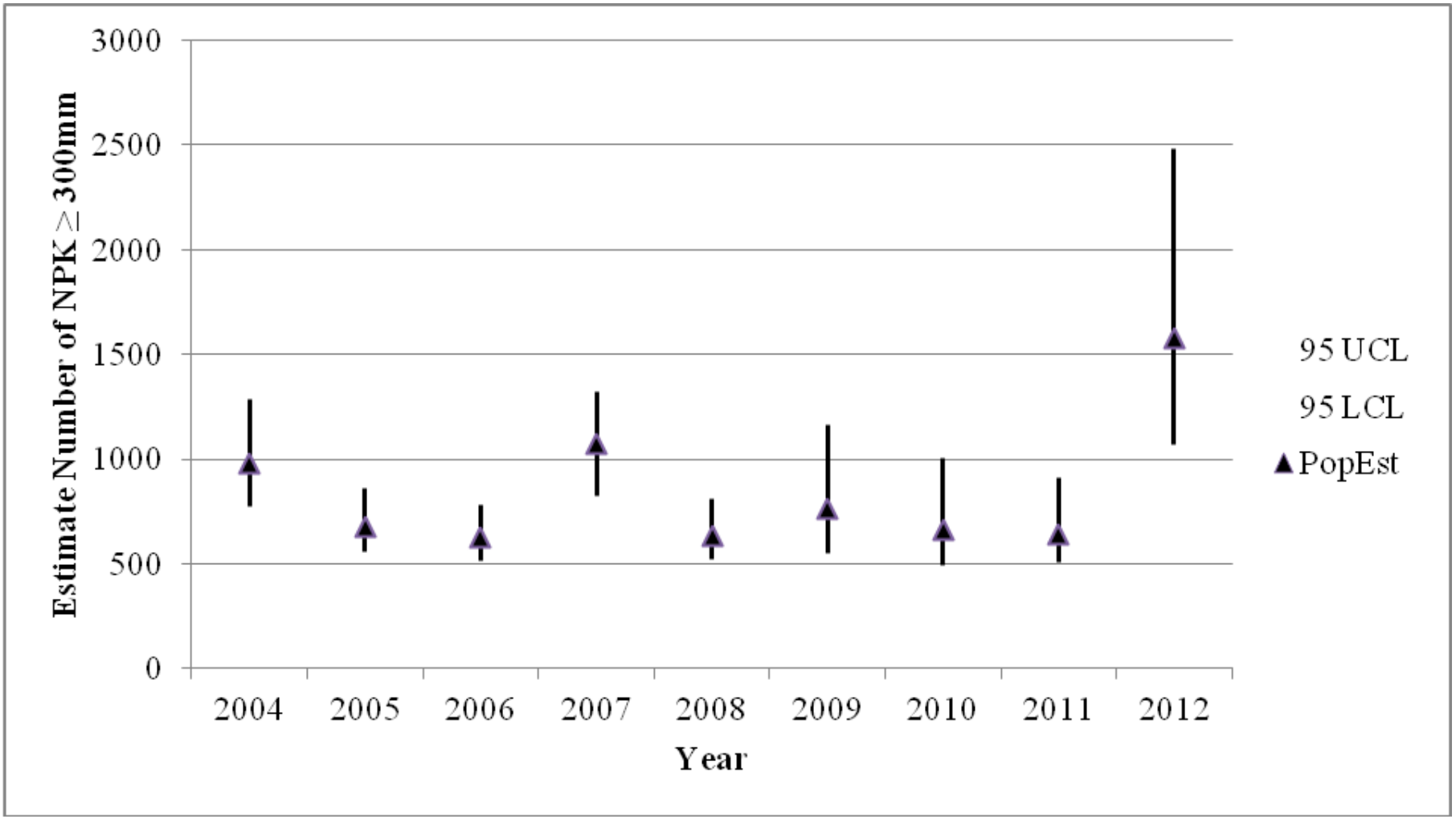

Figure 5. Northern pike ≥300 mm TL population estimates and 95% Confidence Interval generated for Yampa River northern pike from river mile 134.2 to 50.5.

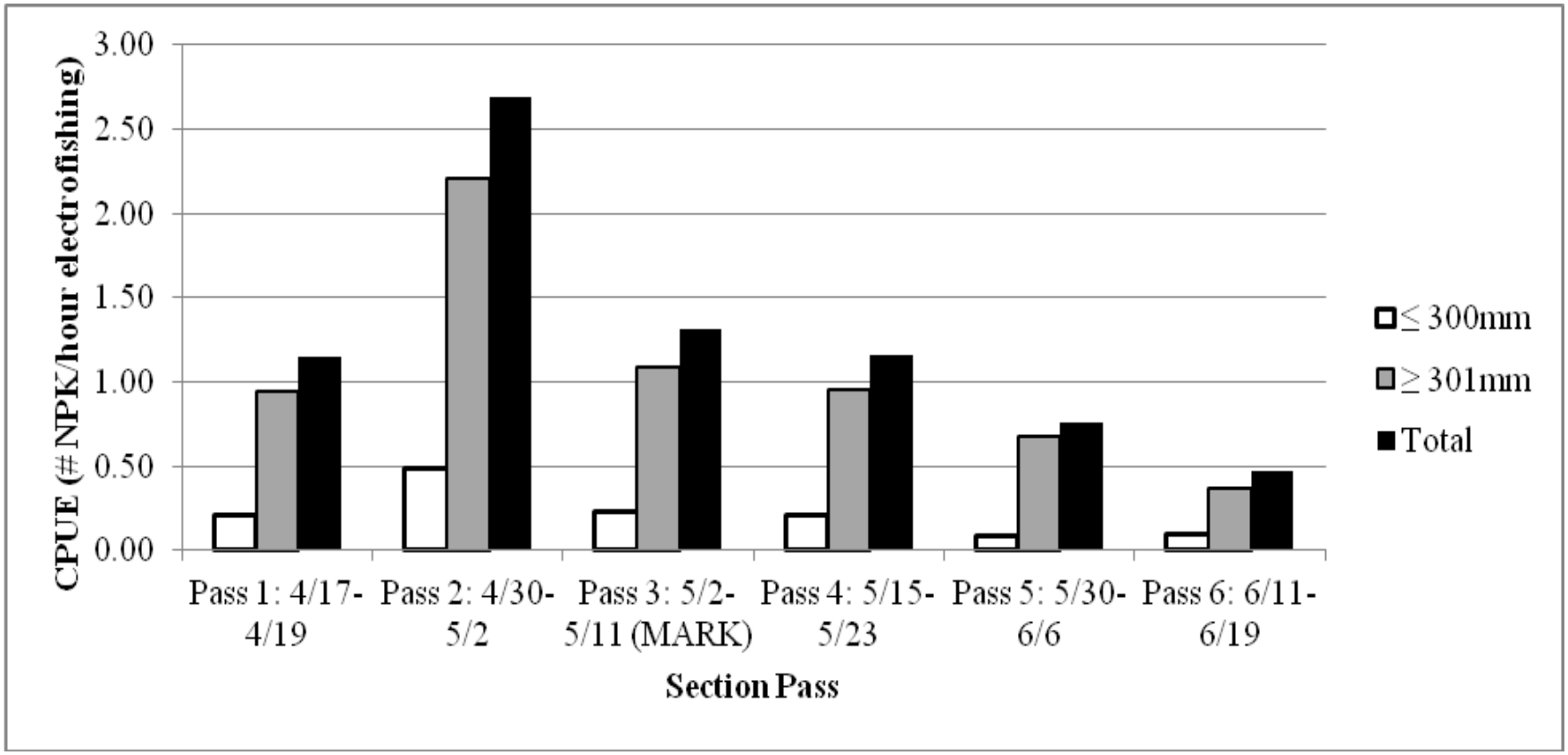

Figure 6. Northern pike (NPK) catch per unit effort (CPUE; # NPK/hour) for three categories (≤ 300mm, ≥ 301mm, and all NPK) across 2012 sampling periods in Juniper sub-section.

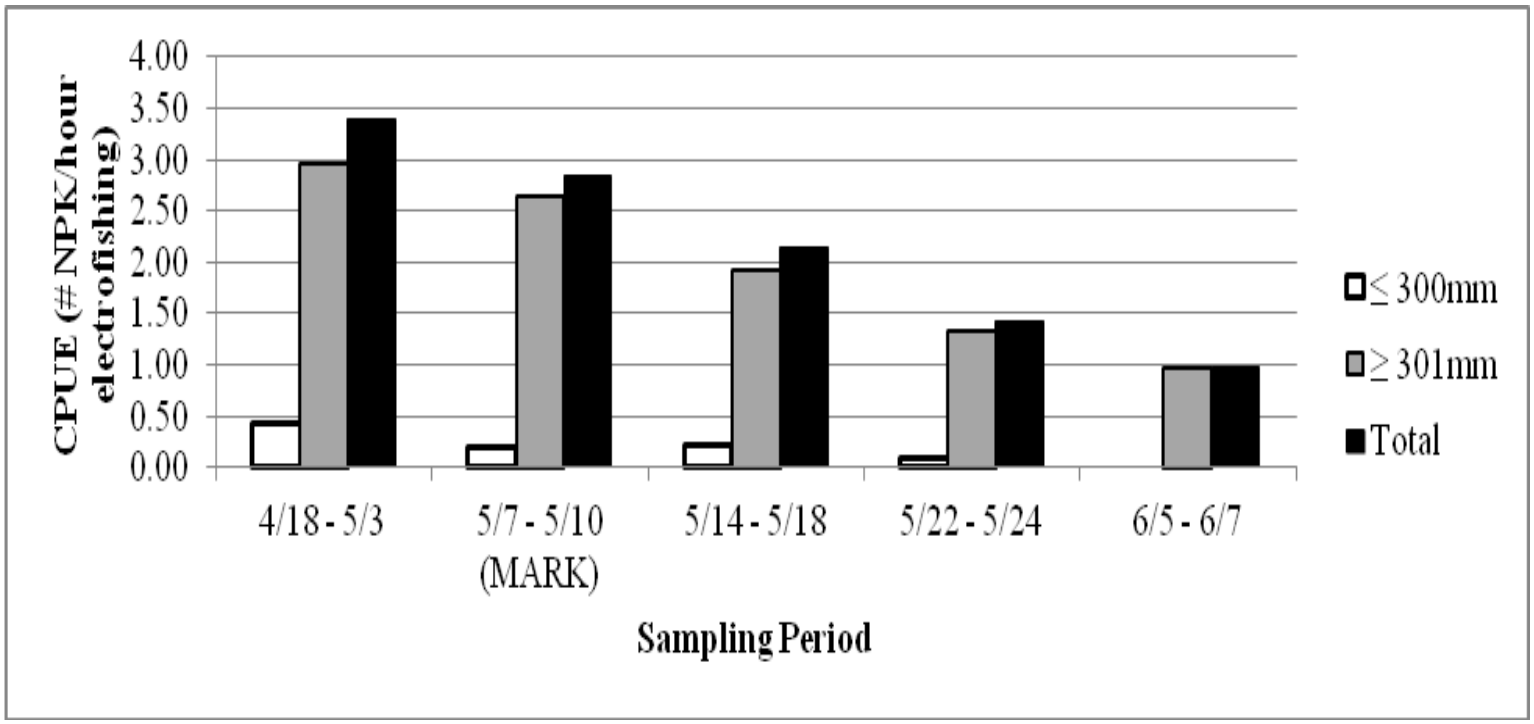

Figure 7. Northern pike (NPK) catch per unit effort (CPUE; # NPK/hour) for three categories (≤ 300mm, ≥ 301mm, and all NPK) across 2012 sampling periods in Maybell sub-section.

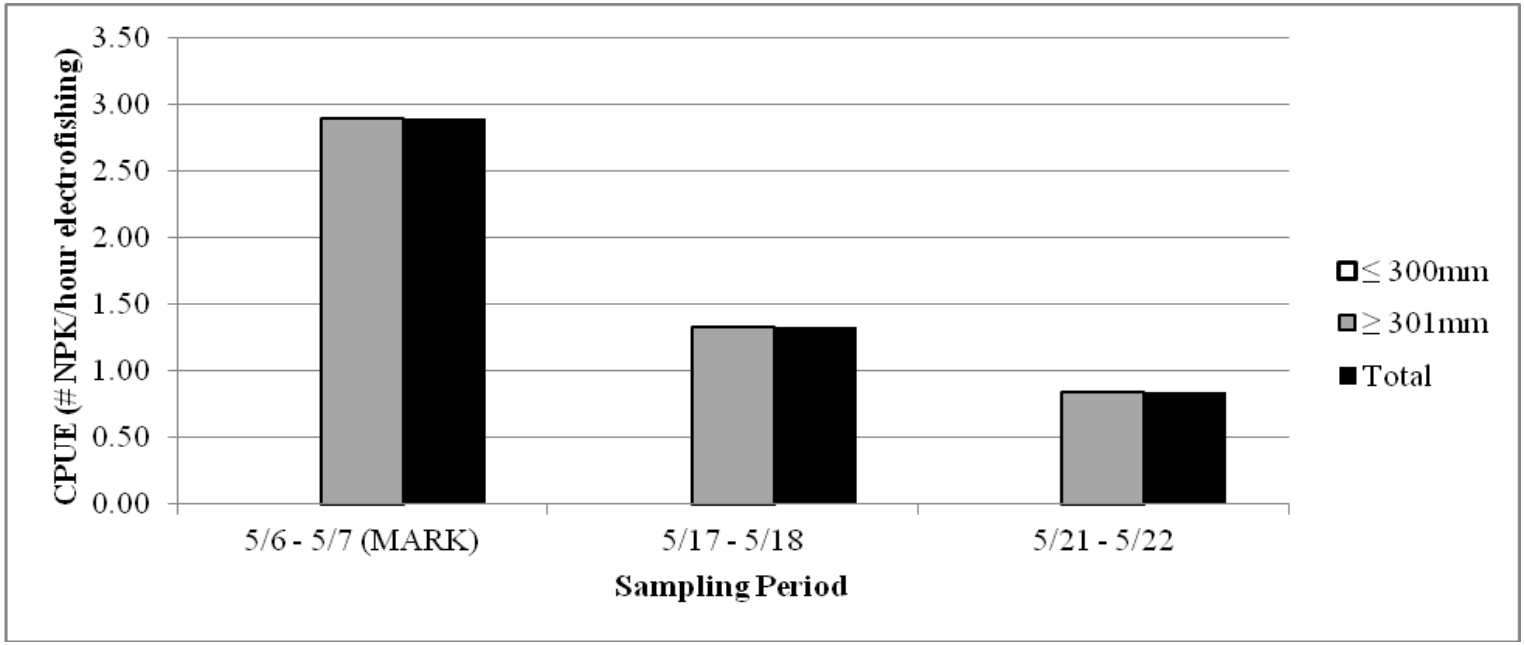

Figure 8. Northern pike (NPK) catch per unit effort (CPUE; # NPK/hour) for three categories (≤ 300mm, ≥ 301mm, and all NPK) across 2012 sampling periods in Lily Park sub-section.

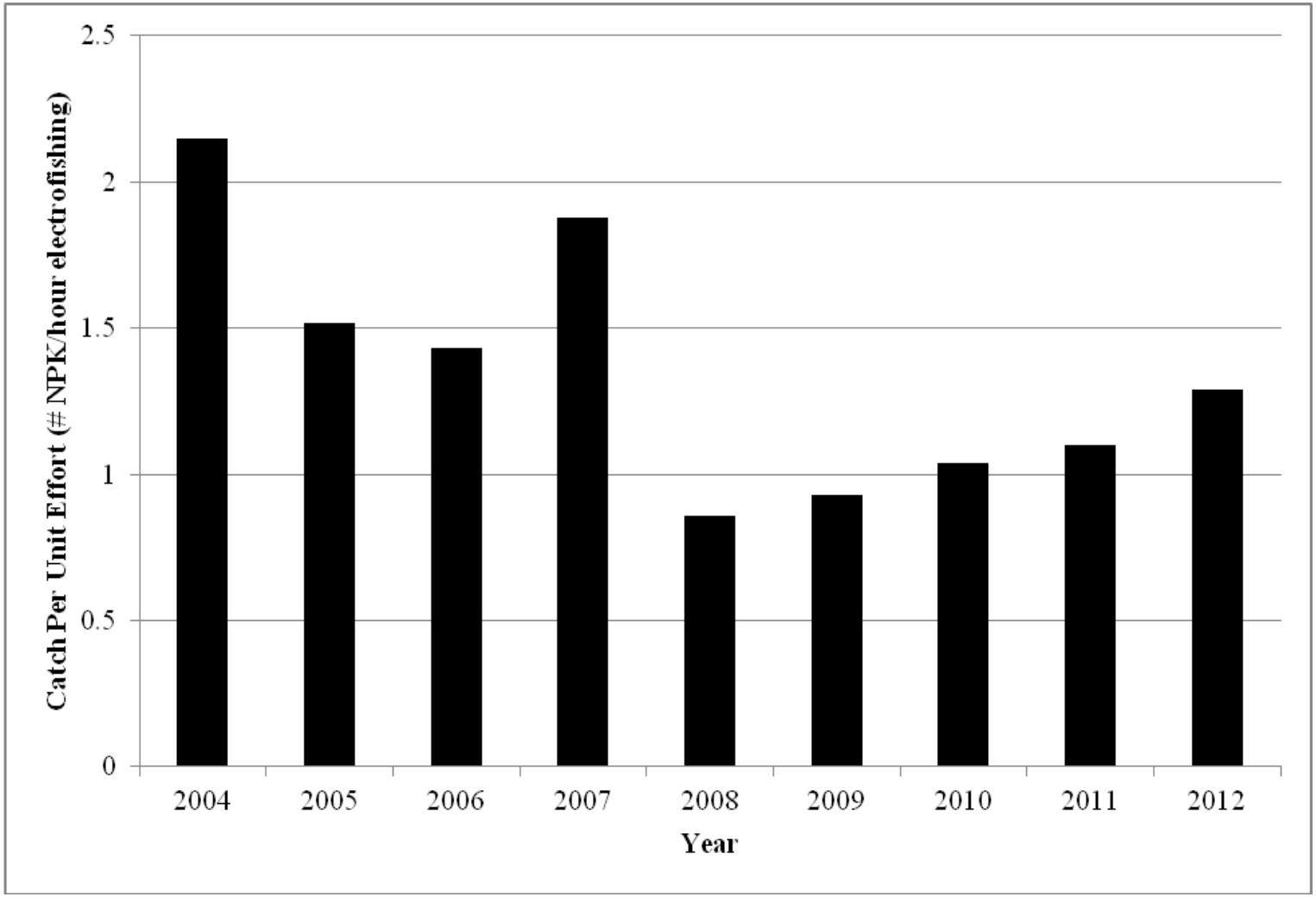

Figure 9. Northern pike Catch Per Unit Effort (CPUE; number of NPK/hour) across all passes in entire study area sampled by CPW and CSU, for 2004 through 2012.

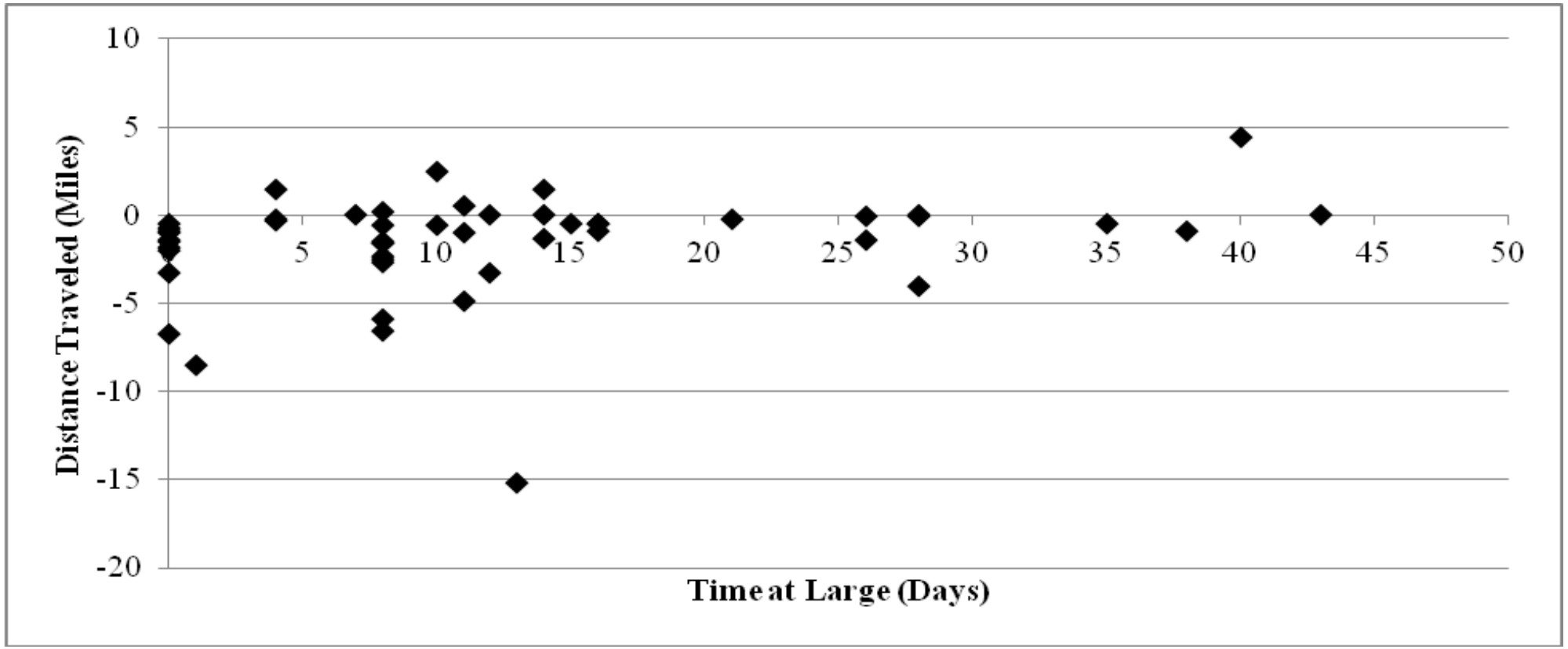

Figure 10. Movement distances of northern pike that were tagged and recaptured in the middle Yampa River in 2012, plotted against number of days each fish spent at large between capture events. Negative values on y-axis represent downstream movement and positive values represent upstream movement.

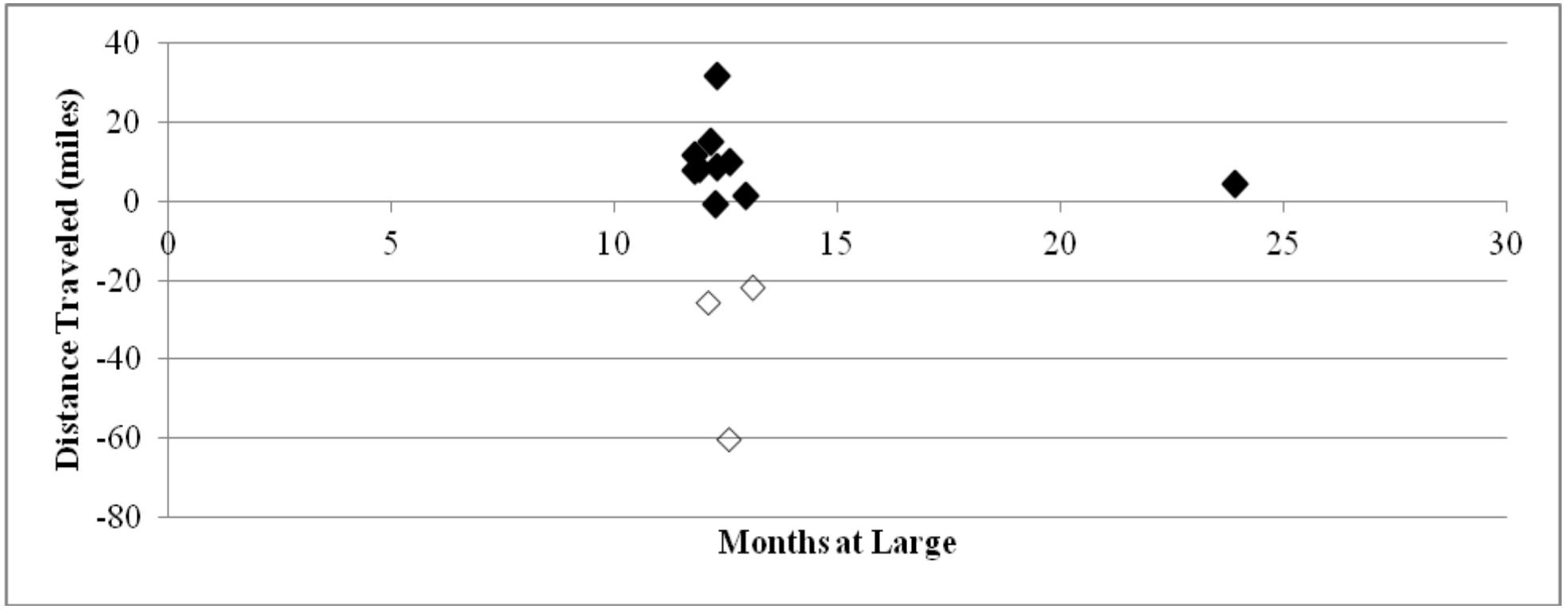

Figure 11. Movement distances of northern pike recaptured in the middle Yampa River in 2012,initially tagged in previous years, plotted against number of months each fish spent at large between capture events. Negative values on y-axis represent downstream movement and positive values represent upstream movement. ◇ represent northern pike originally tagged in Elkhead Reservior in 2011.

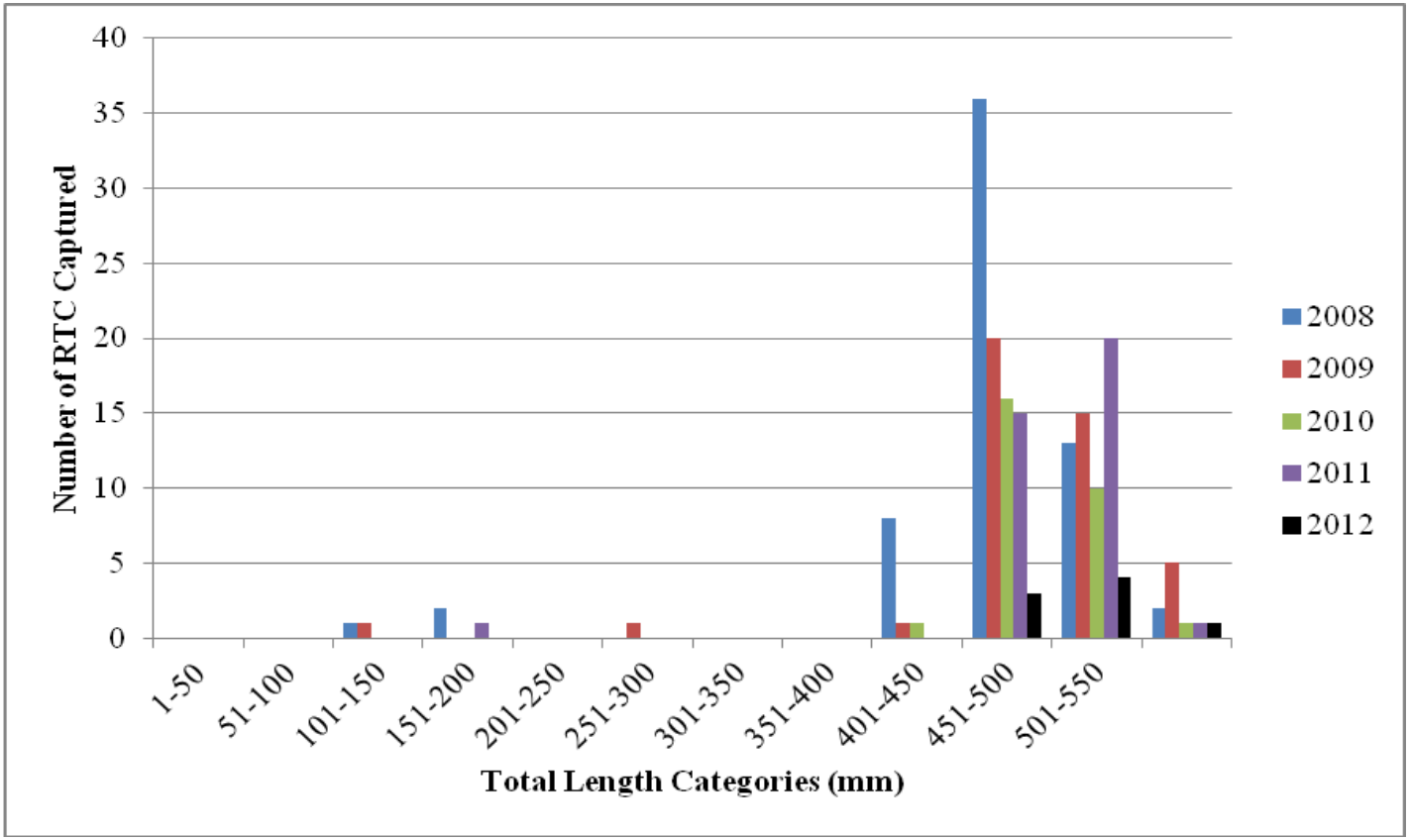

Figure 12. Roundtail chub (RTC) total length (mm) frequency distribution, with size classes in increments of 50 mm, for RTC captured by CPW in the five reaches of the middle Yampa River from 2008 to 2012.