

COLORADO RIVER RECOVERY PROGRAM
FY-2006B2007 PROPOSED SCOPE OF WORK
Middle Yampa smallmouth bass and northern pike

Project No.: 125

Lead Agency: Colorado State University

Submitted by: John Hawkins

Address: Larval Fish Laboratory
Department of Fishery and Wildlife Biology
Colorado State University
Ft. Collins, CO 80523

Phone: (970) 491-2777

FAX: (970) 491-5091

E-Mail: *jhawk@lamar.colostate.edu*

Date¹: 1/26/07 (JH)

Category:

- Ongoing project
- Ongoing-revised project
- Requested new project
- Unsolicited proposal

Expected Funding Source:

- Annual funds
- Capital funds
- Other (explain)

I. Title of Proposal:

Evaluation of smallmouth bass and northern pike management in the middle Yampa River

II. Relationship to RIPRAP (March 28, 2004 version @ <http://www.r6.fws.gov/crrip/rip.htm>)

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 to develop nonnative fish control programs 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. Remove and translocate northern pike from the Yampa River.

¹ See last page for revision changes and dates.

III. Study Background/Rationale and Hypotheses

In the Yampa River, nonnative piscivorous smallmouth bass *Micropterus dolomieu* and northern pike *Esox lucius* are a predatory and competitive threat to native and endangered fishes. Northern pike have occupied the river for 25 years and smallmouth bass have occupied the river in significant numbers only in the last 10 years. Northern pike were stocked into the tributary Elkhead Reservoir in the late 1970's the same time they were starting to establish in the Yampa River. In addition to Elkhead Reservoir, northern pike now occur throughout the Yampa River and portions of the middle Green River, both upstream and downstream of the Yampa River confluence, and in addition to Elkhead Reservoir they now have self-sustaining populations in Stagecoach and Catamount reservoirs where they were illegally introduced.

Smallmouth bass were extremely rare in the Yampa River until 1992, when a rapid maintenance draw down at Elkhead Reservoir introduced large numbers of the species into the Yampa River where they are now abundant in reaches downstream from Elkhead Creek. The loss of fish from the reservoir was so great that local fishermen reported a significant decline in the smallmouth bass fishery in Elkhead Reservoir after the draw down. In the early 1980's, smallmouth bass were extremely rare and native fish were common (Wick et al.1985). Native fish numbers are now extremely low and the small-fish prey base has precipitously declined (Anderson 2000). This decline has been attributed to the invasion and abundance of piscivorous northern pike and smallmouth bass. Smallmouth bass have expanded their range into Dinosaur National Monument and pose a threat to young endangered fishes that reside there. Smallmouth bass are also considered food-resource competitors with Colorado pikeminnow *Ptychocheilus lucius* due to their predation of small, prey-sized fish typically consumed by pikeminnow.

Both northern pike and smallmouth bass occupy reaches designated as critical habitat for the federally endangered Colorado pikeminnow, razorback sucker *Xyrauchen texanus*, humpback chub *Gila cypha*, and bonytail *G. elegans*. Northern pike are known predators of wild Colorado pikeminnow (Hawkins unpublished data) and stocked razorback sucker and are presumed predators of humpback chub and recently reintroduced bonytail. Northern pike also pose a significant predation threat to other native species such as roundtail chub *G. robusta*, flannelmouth sucker *Catostomus latipinnis*, and bluehead sucker *C. discobolus* (Martinez 1995). Northern pike were rated the 3rd greatest nonnative species of concern by experts in the Upper Colorado River Basin based on the potential effects of pike predation on endangered and other native fishes (Hawkins and Nesler 1991). Smallmouth bass were ranked low on the list of species of concern but the ranking questionnaire was completed before their 1992 influx into the Yampa River. The Upper Colorado River Endangered Fish Recovery Program (Recovery Program) determined that management actions to reduce abundance of nonnative piscivorous fish was necessary to recover endangered fishes in the Upper Basin. The Colorado Division of Wildlife (CDOW), a Recovery Program participant, developed an Aquatic Wildlife

Management Plan for the Yampa River Basin (Yampa Aquatic Plan) that recommended managing the reach downstream of Craig, Colorado, for native and endangered fishes by removing smallmouth bass *Micropterus dolomieu*, channel catfish *Ictalurus punctatus*, and northern pike. The Yampa Aquatic Plan recommended removal of these three species from the river and relocating them to other waters within the Yampa Basin to provide continued sport-fishing opportunities (CDOW 1998). Removing northern pike from critical habitat should temporarily reduce predation pressure on endangered fishes and reduce the influx of northern pike to downstream river systems. Reducing the abundance of smallmouth bass in the Yampa River should reduce predation pressure on native fish, increase forage for Colorado pikeminnow, and reduce the numbers that move to downstream reaches such as Yampa Canyon. This Scope of Work (SOW) is an evaluation of removal of smallmouth bass in a few reaches of critical habitat of the Yampa River. It also includes removal of northern pike in those reaches to supplement Recovery Program Project 98a being conducted by CDOW. There is currently no plan for removal of channel catfish in this study area.

Knowledge gained from previous sampling

In 2003, we obtained population size and capture efficiency information for northern pike in a 75-mile reach, and smallmouth bass in a 12-mile reach of the Yampa River. These statistics provide information useful in guiding management of nonnative fishes. Capture efficiency or capture probability is an estimate of the probability of an animal being captured on each sample occasion. Capture probability can be used to estimate how many sample passes are required to remove a portion of the population. For example, if fish are removed from a population of 1,000 fish and capture probability is 40% then 784 fish or 78% would be removed from the population after three passes.

If the starting population contains 1,000 fish $\times 40\% = 400$ fish removed on pass 1, leaving 600 fish. $600 \text{ fish} \times 40\% = 240$ fish removed on pass 2, leaving 360 fish. $360 \text{ fish} \times 40\% = 144$ fish removed on pass 3, leaving 216 fish in the population. Total fish removed in 3 passes = $(400+240+144) = 784$ or 78%.

To achieve a higher level of removal requires either improved techniques that increase the capture probability or increased effort such as more removal passes. If capture rates double then the number of passes needed to obtain the same level of removal is reduced by half. For example, a capture probability of 5% requires 13 removal passes to remove 50% of the population; whereas, a capture probability of 10% requires only 6 passes to remove a similar percentage. Capture probabilities can be increased by having: experienced and well-trained field crews, knowledge of ecology and behavior of the target species, efficient capture gear and techniques, and sampling in higher-density reaches or areas. Increased effort is achieved primarily by increasing the number of sample passes.

Capture probability for smallmouth bass was 6% in 2003 and averaged 12B14% in 2004, 2005, and 2006. Based on a 12% capture probability, we estimate it will require nine removal passes to reduce the population size by 70%; therefore, we are targeting 9 removal passes in 2006 and 2007. In 2006, the area of removal was increased to 24 miles by converting the 12-mile Control portion of the study to a removal (Treatment) reach. This was done because there was evidence that after intensive removal in only the 12-mile reach in 2004 the Treatment reach refilled with bass by 2005. This refilling was likely due to immigration from other reaches including mixing of smallmouth bass between the 12-mile Control and 12-mile Treatment reaches.

The work described in this SOW focuses primarily on smallmouth bass removal and evaluation and secondarily provides additional removal of northern pike to support control studies of northern pike by the CDOW (Project 98a). Specifically, northern pike will be removed concurrently from smallmouth bass study reaches.

Efforts to increase capture rates

Recovery Program workshops on smallmouth bass and nonnative fish control in 2005, 2006, and 2007 requested additional effort and resources to develop methods for increasing catch rates for smallmouth bass. As discussed above, catch rates greatly influence the total number of fish that can be removed in a given number of sample passes. In 2006, we tested 2-boat tandem electrofishing with the second boat staggered beside and behind the primary shocking boat. This arrangement did not improve our capture rate compared to a single boat. Few bass or pike were seen or captured by the second boat. In 2007, in addition to standard multi-pass removal, we plan try other techniques to increase catch rates. In 2007, we plan to continue to examine techniques and tools that will increase catch rates, including electrofishing during crepuscular and night periods, if we can do it safely. We will also evaluate the use of other sampling gear such as trammel nets, block nets, and bank or small barge electrofishing using both standard and throwable electrodes. If logistically possible, we will also evaluate susceptibility of smallmouth bass at base flows when they likely concentrate in deep pools. During baseflow, navigation of electrofishing boats on the river is limited due to shallow, narrow, unnavigable riffles, so we plan to sample one or more short reaches accessible by two-track roads.

Young smallmouth bass control

A primary measure of the effectiveness of removal of smallmouth bass is the Native Fish Response Project (# 140) that will evaluate the response of native fishes to removal. To measure a response in the native fish community requires a large removal effect. Work described in this SOW primarily targets removal of adult smallmouth bass from a 24-mile treatment area in Little Yampa Canyon and from a 5-mile treatment area at Lily Park. But even

with adult removal small smallmouth bass were the most abundant species collected during fall sampling in 2003 and 2004 (Bestgen *in. litt.*). Anderson (2004) also found Age-0 smallmouth bass were the most abundant fish < 120 mm collected in this area. Smallmouth bass Age-1 and younger exploit shallow habitat unavailable to larger bass and this behavior combined with their high abundance results in a high predation pressure on young native fishes. Based on the large number of young smallmouth bass observed in the fall during the Yampa Native Fish Response Project, the 2004 Nonnative Workshop and the Biology Committee on 12/10/2004 recommended increased effort to remove small (Age-0 and Age-1) smallmouth bass in 2005. While spring removal appears to significantly reduce juvenile and adult smallmouth bass, smaller juveniles (<200 mm) remain abundant due to the difficulty in capturing them during spring using present techniques. In 2004, we observed that small, smallmouth bass were more easily captured in June and July as flows declined and clarity improved. In 2005, capture techniques were modified during adult removal to increase the capture rate of young smallmouth bass; but, we also expanded sampling into August to increase the numbers of small bass removed mostly by using an electric seine. In 2006 and 2007, even though adult smallmouth bass removal was expanded to 24 miles in LYC, young smallmouth bass removal in late July and August will only occur in the lower 12-miles to maintain consistency with previous 12-mile Control Treatment reaches for the Native fish Response Project.

IV. Study Goals, Objectives, End Product:

Smallmouth bass

The goal is to remove as many smallmouth bass as possible from a 24-mile treatment reach and a 5-mile concentration reach and estimate the proportion of the population removed from each reach.

Objectives:

1. Obtain an estimate of the number of smallmouth bass in a 24-mile treatment reach in Little Yampa Canyon and a 5-mile reach in Lily Park using a mark-recapture abundance estimator.
2. Remove a large portion of the estimated population of smallmouth bass from the 24-mile treatment reach in Little Yampa Canyon and the 5-mile concentration area in Lily Park.
3. Calculate the proportion of smallmouth bass removed from each study area based on initial population size and compare capture rates on each sample pass over time.
4. Remove large numbers of age-0 and age-1 smallmouth bass from a 12-mile treatment reach in Little Yampa Canyon.

5. Understand movement of recaptured smallmouth bass tagged in previous years or during the first (tagging) pass each year.

Northern pike

The goal is to remove as many pike as possible from critical habitat and estimate the fraction of the population removed. (Primarily accomplished by Project 98a and supplemented by this Project (#125).

Objectives

1. Obtain an estimate of the number of northern pike that reside in the 95-mile study reach in the Yampa River using a mark-recapture abundance estimator. (This will be done by Project 98a).
2. Remove a large portion of the estimated population of northern pike from the smallmouth bass study reaches and from other reaches opportunistically as needed to support Project 98a.
3. Calculate the proportion of northern pike removed based on initial population size. (We will assist the PI of Project 98a to accomplish this objective).

V. Study area:

Our research will focus on two smallmouth bass study reaches in the Yampa River, Colorado, a 24-mile reach in Little Yampa Canyon between Round Bottom (RM 124) and about 1 mile upstream of Government Bridge (RM 100) and a 5-mile reach at Lily Park between Cross Mountain Canyon (RM 56) and the Little Snake River confluence (RM 51). The northern pike study reach for Project 98a is 91 miles long and is located between Craig, Colorado (River Mile, RM 136) and Yampa Canyon (RM 45) and our contribution will be the removal of northern pike from the two study reaches described for bass.

Sampling Dates

Sampling for adult smallmouth bass will occur primarily between April and July, during runoff. Both northern pike and smallmouth bass are susceptible to electrofishing when they occupy shallow shoreline and flooded off-channel habitats. Spring runoff sampling is preferred to other seasons because adults are more susceptible to electrofishing capture from shallow shorelines, higher flows allow safer navigation, and cool water temperatures allow successful transport of live fish. As discharge declines and water clears, young smallmouth bass become more susceptible to capture. From July through August young bass will be removed only from the lower 12-miles of the LYC reach. Therefore, this maintains the 12-mile Control-Treatment reaches originally designated and sampled in 2004 and 2005 for small, smallmouth bass.

VI. Study Methods/Approach

Smallmouth bass sampling will focus on two main areas, a 24-mile reach in and around Little Yampa Canyon (LYC) and a 5-mile reach at the upper end of Lily Park. The 24-mile reach in LYC was previously divided into two 12-mile Control and Treatment reaches in 2004 and 2005. In 2006, these two reaches were combined into one 24-mile control (removal) reach because of mixing of bass between the two 12-mile control and treatment reaches. In 2007, we will attempt to complete at least ten sample passes in Little Yampa Canyon and Lily Park. During the first pass at both sites, smallmouth bass will be marked and released alive. On all subsequent sample passes smallmouth bass will be removed from the river. The purpose of marking fish on the first pass is to use the recapture of tagged fish to estimate the initial size of the population before removal. The number of fish removed as a proportion of the population size provides a measure of removal efficiency. This estimate also provides a measure of change in the population over several years.

In 2005, northern pike control (Project 98a) became primarily the responsibility of the CDOW. The CDOW study sites for northern pike include critical habitat from RM 136-124, RM 100-90, and RM 90-60. The CDOW will conduct one marking pass and three removal passes including one recapture pass to obtain an abundance estimate of northern pike in critical habitat. We will assist that project by capturing and handling northern pike in the smallmouth bass study areas in a manner that is compatible with the objectives of Project 98a. On the first pass we will mark northern pike and on subsequent samples we will remove northern pike. If logistically feasible and requested, we plan to assist CDOW in sampling some of their study sites.

Starting in 2005 and continuing in 2006 and 2007, sample techniques will be modified to increase the catch of young smallmouth bass concurrently with larger adult sampling. Areas with abundant young smallmouth bass will be sampled rigorously by modifying electrofishing techniques and using smaller mesh dipnets to increase the catch of smaller-sized bass. In addition, starting in mid-July when flow recede, removal will focus on young smallmouth bass (≤ 200 mm) and continue through August in the lower 12 miles of the LYC site using electric seine, boat or backpack electrofisher, seines and nets. We may also try other gear as necessary including trap nets or cages and possibly baited or scented attractants (Table 1). We will conduct at least three separate sampling occasions, in July and August, each about 10 days long. Removal will occur over the 12-mile treatment reach as established in 2004 and 2005. All nonnative species will be handled as specified in Table 2 or as specified by CCDOW collecting permit.

In summary, smallmouth bass sampling and removal will be restricted to the Little Yampa Canyon and Lily Park reaches unless we are assisting CDOW crews in other reaches. Smallmouth bass in the treatment reach of Little Yampa Canyon and if possible Lily Park will be sampled 10 times (one mark and release, nine removal passes). Northern pike will also be sampled in the smallmouth bass study reaches with the first pass a mark and subsequent passes

removals. CDOW study sites will be sampled opportunistically in coordination with CDOW during each of our trips to supplement sampling. In 2007, smallmouth bass will be moved to Elkhead Reservoir and possibly a few to Craig Justice Center ponds.

Generally fish will be captured by boat electrofishing both shorelines concurrently, although other gear types may be used (Table 1). A third boat will be used to process, maintain, or transport live fish. Off-channel habitats such as backwaters and flooded tributaries will be sampled with block and shock, seining, trammel nets, or fyke nets. Pike and bass will be handled concurrently in the bass study reaches. Capture locations will be identified to the nearest 1/2 mile. Fish handling time will be reduced by subsampling lengths and weights of fish, except for tagged or recaptured fish, which we will measure and weigh. Northern pike and smallmouth bass will be tagged with numbered Floy tags (Color = Yellow) on the marking pass. On the removal passes all fish that are moved to ponds or reservoirs will be marked with a unique color in order to clearly detect them as escapees if they return to the river. Tags on recaptured fish will be removed prior to tagging with the unique-colored tag to clearly signify that the fish was removed and translocated away from the river. Endangered fishes and roundtail chub will be handled per guidelines and permits of the CDOW and the USFWS. All Colorado pikeminnow and roundtail chub will be captured, PIT tagged per Recovery Program protocol, their location recorded within 0.1 mile, and UTM coordinates recorded. We will record tag data for all recaptured fish originally tagged by other agencies. All fish will be examined for external injury from sampling gear or pike attacks.

Northern pike removed from the river will be translocated to Loudy Simpson pond in Craig or other locations as identified by CDOW. If fish are to be moved to locations outside of the Craig-Hayden area, then we will transfer fish to CDOW staff at the boat ramp or in Craig for further transport. We will also collaborate with Pat Martinez, Aquatic researcher with CDOW and provide him or other CDOW researchers with smallmouth bass, northern pike, channel catfish, or other species for trophic ecology studies, stable isotope analysis, stomach analysis, or other research. Any fish killed will be euthanized and either provided to CDOW researchers, kept as a voucher specimen and cataloged in the LFL collection, or disposed of by burying.

Because we primarily capture only target species such as bass, pike, and pikeminnow, we often do not maintain records of other species observed during sampling. In order to monitor the relative abundance of other species in the study site, we will continue our samples of 1-mile sections in the study site and capture and record length and location data for all fish species in that reach. We will document spawning timing and location by documenting sexual condition of target species over time, especially by their production of gametes (ripeness). We will watch for male bass guarding nests and document locations and habitats. Young will be removed from active nests and nest sites physically disrupted.

We will assist as needed with Recovery Program or CDOW information and education efforts in the Yampa Valley. Primarily we will do this by providing information during informal contact with two important target groups: landowners near the river and anglers that fish the river or receiving waters.

VII. Task Description and Schedule

Task 1	Oct-Jan	Prepare and present results at three annual Recovery Program meetings: smallmouth bass workshop, nonnative summit workshop, and Researchers Meeting in Grand Junction.
Task 1.5	Jan- Jun (>07 only)	Analyze data and write summary report for 2004-2006 data and present to Biology Committee.
Task 2	Feb- Mar	Contact landowners and obtain permission for property access for sampling. Attend agency and public meetings. Hire and train field crew; purchase and prepare and fabricate equipment.
Task 3	Apr - Jul	Yampa River sampling in Critical Habitat. Capture, remove and translocate fish.
Task 3.5	Jul- Aug	Capture and remove small smallmouth bass from treatment sites (Task added in 2005). Evaluate base flow capture techniques (Task added in 2006).
Task 4	Aug - Oct	Equipment maintenance. Data entry and analysis. Prepare Recovery Program annual progress report. Interaction and data sharing with DOW aquatic researchers.

VIII. FY-2006 and FY-2007 Work

Deliverables/Due Dates:

Recovery Program Annual Report: Nov 11, 2006
 Summary Synthesis Report of 2004-2006 data March 2007

FY-2006 Budget by Task (see footnotes for details)

Task 1: Researcher IV (1111/week-3 wks).....	3333
Researcher II (750/week- 3 wks).....	2250
Truck lease (\$677/month x 2 months).....	1354
Travel-Lodging (\$65/night x 2 nights/trip x 2 people x 3 trips)	780
Travel-Per diem (\$25/day x 3 days/trip x 2 people x 3 trips)	450
Truck mileage (\$0.39/mile x 600 miles/trip x 3 trips)	<u>702</u>
Total Task 1	8869
Task 2: Researcher IV (1111/week-4 wks).....	4444
Researcher II (750/week- 4 wks).....	3000
Travel-Lodging (\$35/night x 4 nights/trip x 2 people x 2 trips)	560
Travel-Per diem (\$25/day x 5 days/trip x 2 people x 2 trips)	500
Truck mileage (\$0.39/mile x 560 miles/trip x 2 trips)	437
Truck lease (\$677/month x 2 months).....	1354
Travel (lodging and per diem)	<u>1512</u>
Total Task 2	10295
Task 3: Researcher IV (1111/week x16 wks).....	17776
Researcher II (750/week x 16 wks)	12000
Technicians (5 x 623/week x 16 wks)	49840
Travel-Lodging (\$65/night x 2 nights/trip x 6 people x 7 trips)	5460
Travel-Per diem (\$25/day x 10 days/trip x 6 people x 7 trips)	10500
Truck mileage (\$0.39/mile x 900 miles /trip/truck x 3 trucks x 7 trips).....	7371
Truck Lease (1-ton crew-cab pickup lease \$677/month x 4 months)	2708
Truck purchase (1-ton 4X4 crew cab pickup)	23500
Truck purchase (3/4-ton 4X4 crew cab pickup)	22500
Boat gas (\$1000/boat/season x 3 boats)	3000
Fyke net replacement (\$580 x 2 nets)	1160
Repair and maintenance boats	2000
Field supplies	2485
Services (Welding, rigging, factory calibration of electrofisher).....	<u>1500</u>
Total Task 3	161800
Task 3.5	
Researcher IV (1111/week x 4 wks).....	4444
Researcher II (750/week x 4 wks)	3000
Technicians (5 x 623/week x 4 wks)	12460
Travel-Lodging (\$65/night x 1 nights/trip x 6 people x 4 trips)	1560
Travel-Per diem (\$25/day x 10 days/trip x 6 people x 4 trips)	6000
Truck mileage (\$0.39/mile x 900 miles /trip/truck x 2 trucks x 4 trips).....	2808
Throwable electrofishing anode (supplies to build)	500
Field supplies	<u>500</u>
Total Task 3.5	31272

Task 4	Researcher IV (1111/week-8 wks).....	8888
	Researcher II (750/week- 8 wks).....	6000
	Research Scientist (2 weeks).....	3603
	Travel-Lodging (\$65/night x 3 nights/trip x 1 trip x 2 people).....	390
	Travel-Per diem (\$25/day x 3 days/trip x 2 people x 1 trips)	150
	Truck mileage (\$0.39/mile x 400 miles /trip/truck x 1 trucks x 1 trips).....	156
	Total Task 4	19187
	Sub-total.....	231423
	CSU Overhead rate to BOR (15%) applied to all items except trucks (\$232485 - 46000) X 15%	34023
	TOTAL (2006).....	265446

FY-2007 Budget by Task (see footnotes for details)

Task 1: Researcher IV (1111/week-3 wks).....	3333
Researcher II (750/week- 3 wks).....	2250
Truck lease (\$677/month x 2 months).....	1354
Travel-Lodging (\$65/night x 2 nights/trip x 2 people x 3 trips)	780
Travel-Per diem (\$25/day x 3 days/trip x 2 people x 3 trips)	450
Truck mileage (\$0.39/mile x 600 miles/trip x 3 trips)	702
Total Task 1	8869
Task 1.5:	
Researcher IV (1111/week-4 wks).....	4444
Researcher II (750/week- 2 wks).....	1500
Travel-Lodging (\$65/night x 3 nights/trip x 1 person x 1 trips)	195
Travel-Per diem (\$25/day x 3 days/trip x 1 person x 1 trips)	75
Truck mileage (\$0.39/mile x 600 miles/trip x 1 trips)	234
Total Task 1.5	6448
Tasks 2:	
Researcher IV (1111/week-4 wks).....	4444
Researcher II (750/week- 4 wks).....	3000
Travel-Lodging (\$35/night x 4 nights/trip x 2 people x 2 trips)	560
Travel-Per diem (\$25/day x 5 days/trip x 2 people x 2 trips)	500
Truck mileage (\$0.39/mile x 560 miles/trip x 2 trips)	437
Total Task 2	8941
Task 3: Researcher IV (1111/week x16 wks).....	17776
Researcher II (750/week x 16 wks)	12000
Technicians (5 x 623/week x 16 wks)	49840
Travel-Lodging (\$65/night x 2 nights/trip x 6 people x 7 trips)	5460
Travel-Per diem (\$25/day x 10 days/trip x 6 people x 7 trips)	10500
Truck mileage (\$0.39/mile x 900 miles /trip/truck x 3 trucks x 7 trips).....	7371
Boat gas (\$1000/boat/season x 3 boats)	3000
Fyke net replacement (\$580 x 2 nets)	1160
Repair and maintenance boats	2000

	Field supplies	2485
	Services (Welding, rigging, factory calibration of electrofisher).....	1500
	Total Task 3	113092
Task 3.5	Researcher IV (1111/week x 4 wks).....	4444
	Researcher II (750/week x 4 wks)	3000
	Technicians (5 x 623/week x 4 wks)	12460
	Travel-Lodging (\$65/night x 1 nights/trip x 6 people x 4 trips)	1560
	Travel-Per diem (\$25/day x 10 days/trip x 6 people x 4 trips)	6000
	Truck mileage (\$0.39/mile x 900 miles /trip/truck x 2 trucks x 4 trips).....	2808
	Electric seine repair and maintenance	500
	Field supplies	500
	Total Task 3.5	31272
Task 4	Researcher IV (1111/week-8 wks).....	8888
	Researcher II (750/week- 8 wks).....	6000
	Research Scientist (2 weeks).....	3603
	Travel-Lodging (\$65/night x 3 nights/trip x 1 trip x 2 people).....	390
	Travel-Per diem (\$25/day x 3 days/trip x 2 people x 1 trips)	150
	Truck mileage (\$0.39/mile x 400 miles /trip/truck x 1 trucks x 1 trips).....	156
	Total Task 4	19187
	Sub-total.....	168622
	CSU Overhead rate to BOR (15%)	25293
	TOTAL (2007).....	193915

Budget Footnotes:

- 1 Supplies include consumable items like nets, camping equipment, safety gear, and consumable field equipment.
- 2 Mileage rate for CSU vehicles as of 8 Feb 2006. Mileage totals 900 miles per truck/trip based on 500 miles round trip from Ft Collins to Morgan Gulch field site each sample trip plus 400 miles per truck per trip (50 miles per truck per day for 8 days for shuttles and fish hauling).
- 2 We will continue to lease the same trucks we currently have until new trucks are purchased, which could be as late as June, 2006. After the new trucks are purchased we will continue to lease one truck.
- 3 We currently use three trucks for transport of people, equipment, and trailered boats. Two of these trucks are old (13 & 14 yrs.), high mileage (>200k), and prone to breakdown. Because of a vehicle shortage during the sampling season, we have been unsuccessful at obtaining adequate replacement vehicles through the University motor pool and retail rental agencies do not allow off-road travel or towing which are required for completion of this project. To prevent project disruption by unreliable vehicles we propose the purchase of two replacement vehicles through a CSU state purchasing contract. These trucks will be used to transport people and equipment to the sample sites, run shuttles among sample sites, and transport fish as required by the permitting agencies. An outright purchase will provide uninterrupted field sampling and reduce transportation costs in out years by eliminating lease fees.

- 3 Services include long distance, cell phone, and outside labor costs such as boat rigging and tune ups, welding, and factory calibration of Smith Root GPP 5.0 (\$150) as required by Federal collecting permit.
- 4 Boat repair includes replacement, repair, and maintenance of parts used, broken, or damaged in previous years such as: throttle, steering, motor, jet sleeves and impellers and electrofishing assemblies. It also includes consumable supplies such as 2-stroke oil, grease, and maintenance parts.
- 5 Overhead was not applied to equipment (Truck purchase).

IX. Budget Summary

FY-2006	\$ 265,446
FY-2007	\$ 193,915

X. Reviewers: Biology Committee

XI. References

- Anderson, R. 2000. Riverine fish flow investigations. Federal Aid Project F-289-R3, Colorado Division of Wildlife, Ft Collins, Colorado.
- Anderson, R. 2004. Riverine fish flow investigation. Quantification of impacts of the 2002 drought on native fish populations in the Yampa and Colorado rivers. Colorado Division of Wildlife, Fort Collins, Colorado.
- CDOW (Colorado Division of Wildlife). 1998. Aquatic Wildlife Management Plan: Yampa River Basin, Colorado. Colorado Division of Wildlife, Aquatic Wildlife Section, Denver.
- Kaeding, L R and M. A. Zimmerman. 1983. Life history and ecology of the humpback chub in the Little Colorado and Colorado rivers of the Grand Canyon. Transactions of the American Fisheries Society 112:577-594.
- Karp, C.A. and H. M. Tyus 1990. Humpback chub (*Gila cypha*) in the Yampa and Green river, Dinosaur National Monument, with observations on roundtail chub (*G. robusta*) and other sympatric species. Great basin Naturalist 50: 257-264.
- Hawkins, J. A. and T. P. Nesler. 1991. Nonnative fishes of the Upper Colorado River Basin: an issue paper. Larval Fish Laboratory, Colorado State University, Ft. Collins, Colorado.
- Hawkins, J. C. Walford, and T. Sorensen. In Press. Northern pike management studies in the Yampa River, 1999-2002. Larval Fish Laboratory, Colorado State University, Ft Collins.
- Mann, R. H. K. 1980. The numbers and production of pike (*Esox lucius*) in two Dorset rivers. Journal of Animal Ecology 49:899-915.

- Marsh, P.C. and D. R. Langhorst. 1988. Feeding and fate of wild larval razorback sucker. *Environmental Biology of Fishes* 21:59-67.
- Martinez, P. J. 1995. Coldwater Reservoir Ecology. Colorado Division of Wildlife Federal Aid in Fish and Wildlife Restoration Project. # F-242R-2, Job Final Report, Ft. Collins.
- McAda, C. M. 1983. Colorado squawfish, *Ptychocheilus lucius* (Cyprinidae), with a channel catfish, *Ictalurus punctatus* (Ictaluridae), lodged in its throat. *The Southwestern Naturalist* 28:119-120.
- Nesler, T. P. 1995. Interactions between endangered fishes and introduced game fishes in the Yampa River, Colorado, 1987-1991. Final Report. Colorado River Recovery Implementation Program Project number 91-29, Federal Aid Project SE-3. Colorado Division of Wildlife, Aquatic Research Section, Ft. Collins, Colorado.
- Vanicek, C. D. 1967. Ecological studies of native Green River fishes below Flaming Gorge Dam, 1964-1966. PhD. Dissertation, Utah State University, Logan.
- Wick, E. J., J. A. Hawkins, and C.A. Carlson. 1985. Colorado squawfish and humpback chub population and habitat monitoring, 1981-1982. Endangered Wildlife Investigations, Colorado Division of Wildlife, Denver, CO.
- White, G. C., D. A. Anderson, K. P. Burnham, and D. L. Otis. 1982. Capture-recapture and removal methods for sampling closed populations. Los Alamos National Laboratory, LA-8787-NERP, Los Alamos, New Mexico.

Tracking

Filename = 07-MYampa-SMB-Pike-125-Sow-revised by JAH-2007.wpd

Revision dates:

1/09/04: Original draft based on recommendations from Nonnative workshop, 3B4 December 2003 and Biology Committee conference call, 23 December 2003.

1/22/04: Second draft, revised based on comments at Biology Committee meeting (1/15-16/04) and conference call (1/21/04) with Muth and Nels on (RIP), Pfeifer (FWS), Nesler (CDOW), and Bestgen and Hawkins (CSU). Purpose: explain details of pike and bass removals, how they coordinate, and reduce cost. Combine northern pike (Project 98a) and smallmouth bass (Project 125) SOWs to better explain coordination and cooperation between the two projects and to reduce costs.

2/13/04: Revised based on minor changes recommended during 1/29/04 Biology Committee conference call. Deleted ~~Apike@~~ from objective #3. Added information about Floy tag color. Fixed computational error for FY05 budget. Minor editorial corrections. Added sentence that we would record tag data for recaptured fish tagged or marked by other agencies.

1/10/05: JAH revised after 2004 Nonnative Workshop and Biology Committee Meeting of 12/10/04) Added language that smallmouth bass > 8 inches (200 mm) would be transported to Elkhead Reservoir while smallmouth bass ≤ 8 inches would be euthanized. Added description that sampling would be modified to increase the catch of age-0 and age-1 smallmouth bass. Added 2005 budget details.

2/4/05: JAH revised per BC meeting 1/21/05. Budget for 2005 was reduced by \$59,530 for spring smallmouth bass and northern pike sampling and added \$33,960 for additional 1.5 months and additional two crew members for targeted removal of young smallmouth bass.

Reduced costs in 2005, including not adding 4.5 % inflation adjustment, reduced Task 2 time by one month (1/2 of

time allocated in 2004), removed time for Researcher II from Tasks 1, 2, and 3. Reduced per diem by one person for Tasks 1, 2, And 3. Added objective, methods, and costs to Task 3.5 to increase removal of smaller, young smallmouth bass during and after adult bass removal. Revise methodology to focus on smallmouth bass removal and change northern pike removal to supplement CDOW Project 98a.

2/8/05: Pat Nelson edited, and removed budget table for FY 04.

04/28/05 Revised by JAH as 2006 SOW: Updated RIPRAP text,

7/6/05 by John Hawkins and Pat Nelson; 7/21/05 by Pat Nelson Updated 2007 budget and added final report task for 2007.

2/07/06 JAH Modified tasks, study design, and budget based on 2/2/06 BC meeting request to combine Control-Treatment reaches into one Treatment reach, add additional sampling to evaluate gear and techniques that increase catch rates and evaluate low-flow tandem electrofishing.

01/26/07 JAH modified to include changes requested in 2007 work plan guidance memo from P. Nelson 01/22/07 email . Added appendix of sampling gear and list of species, their tagging status, handling, and disposition guidelines. Added descriptions of fish disposal previously listed in State collecting permits, expanded with new sample techniques to increase catch rates, 1-mile samples to document species composition, and documentation of spawning periods and locations.

Appendix Table 1C Sampling gear that may be used by CSU on the Yampa River.

Electrofishing: boat, bank, backpack, or seine.

Nets: Gill, trammel, dip, hoop, fyke, or trap; cages (i.e. minnow traps) - various lengths and mesh sizes.

Seines: various lengths and meshes.

Angling: with bait, lures or artificial flies.

Suction devices to collect larvae or young.

All gear may be baited or scented with attractants.

Appendix Table 2C Summary of handling, tagging, and disposition requirements for fish captured by CSU researchers in the Yampa River, 2007.

Species	Tag type	Disposition
Native-Colorado pikeminnow	RFID-PIT	measured, marked, and released at capture site
Native-roundtail chub	RFID-PIT	measured, marked and released at capture site
Native-Other species, bluehead sucker flannelmouth sucker hybrid native suckers mountain whitefish speckled dace mottled sculpin	none	measured and released at capture site
Nonnative-northern pike	Pass 1- Yellow Floy tag ¹ Pass-2 Unique color (Green?) Floy tag ²	Pass-1: measured, marked and released on first pass Pass-2: measured, marked and moved to Loudy Simpson ponds, Craig, CO.
Nonnative-smallmouth bass	Pass 1- Yellow Floy tag ¹	Pass-1: If <150 mm TL then euthanized, if ≥150 mm TL then measured, marked and released ³

	Pass-2 Unique color (Green?) Floy tag ²	Pass-2: If <250 mm TL then euthanized, if ≥250 mm TL then measured, marked and moved to Elkhead Reservoir or Craig Justice Center Ponds ³
Nonnatives: bluegill black crappie green sunfish largemouth bass pumpkinseed yellow perch walleye black bullhead grass carp burbot gizzard shad	none	measure, remove, and euthanize, some black crappie, walleye, and largemouth bass will be provided to other researchers for additional research on SOW project C18/19.
Nonnatives: salmonids (trout) white sucker hybrid nonnative suckers common carp channel catfish	none	measure and release at capture site
Nonnative-Prohibited fish species per Colorado Revised Statutes -see list below.	none	measured, euthanized, and preserved

Footnotes:

1. Smallmouth bass and northern pike will be tagged with traditional yellow Floy tags during the first sample pass when they are released back into the river as marked fish for use in calculating an abundance estimate.
2. Smallmouth bass and northern pike will be tagged with blue Floy tags when they are transported for stocking in local reservoirs or ponds to serve as a distinctive tag to monitor possible escapement back to the river. Tags will be removed from recaptured fish prior to tagging with a blue tag.
3. On the first sampling pass, we will mark smallmouth bass ≥ 150 mm total length (TL) because bass recruit to the sampling gear at this size and in order to monitor the abundance of potential recruits to next years adult population. On subsequent sampling passes, we will only tag and move smallmouth bass ≥250 mm TL because large numbers of smaller fish could harm the fishery of the stocking location.

List of Prohibited Aquatic species per Colorado Revised Statutes, Title 33, Article VII, 12, adopted by the Wildlife Commission on 01/11/07: <http://wildlife.state.co.us/RulesRegs/Regulations/>

1. Bowfins: Amiidae.
2. Carp of the following genera: *Aristichthys*; *Catla*; *Catlocarpio*; *Carrassius*; *Cirrinus*; *Cyprinus* [except as noted above]; *Hypophthalmichthys*; *Labeo*; *Mylopharyngodon*; and *Tor*.
3. Catfish, Walking: *Clarias batrachus*.
4. Crayfish, Rusty: *Orconectest rusticus*.
5. Eel, Asian Swamp: *Monopterus albus*.
6. Frog, Green: *Rana clamitans*.
7. Gars: Lepistosteidae -- All species.
8. Gobies: Gobiidae.
9. Mussel, Quagga: *Dreissena bugensis*.
10. Mussel, Zebra: *Dreissena polymorpha*.
11. New Zealand mudsnail: *Potamopyrgus antipodarum*.
12. Perch, White: *Morone americana*.

13. Piranha: Including members of the genera *Serrasalmus* and *Pygocentrus*.
14. Rudd: *Scardinius erythrophthalmus*.
15. Ruffe, Eurasian: *Gymnocephalus cernuus*.
16. Snakeheads or murrels: Members of the genera *Channa*, *Parachanna* and *Ophiocephalus*.
17. Sticklebacks: Members of the genera *Apeltes*, *Aulorhynchus*, *Gasterosteus* and *Pungitius*.
18. Tilapia: All species.
19. Trahira: *Hoplias malabaricus*.
20. Water Fleas, Fish Hook and Spiny: *Cercopagis pengoi*, *Bythotrephes longimanus*, and *Daphnia lumholtzii*.