**COLORADO RIVER RECOVERY PROGRAM** Project No.: 128
**FY-2008-2009 PROPOSED SCOPE OF WORK**

Lead Agency: Larval Fish Laboratory (LFL)

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Category:
__ Ongoing project
__ Ongoing-revised project
X Requested new project
__ Unsolicited proposal

Expected Funding Source:
x Annual funds
_ Capital funds
_ Other (explain)

I. Title of Proposal: **Abundance Estimates for Colorado pikeminnow in the Green River Basin, Utah and Colorado**

**Note: During Colorado pikeminnow monitoring, any centrarchids/esocids captured incidentally will be removed (except in the Yampa River). In the White River, capture locations will be recorded.**

II. Relationship to RIPRAP:
Green River Action Plan: Mainstem
V. Monitor populations and habitat and conduct research to support recovery actions (Research, monitoring, and data management).
V.C. Population estimate for Colorado pikeminnow.
V.C.1. Middle Green River.

III. Study Background/Rationale and Hypotheses:

*Background*.—Abundance estimates of endangered Colorado pikeminnow *Ptychocheilus lucius* are needed to better monitor population status and provide benchmarks against which progress toward recovery can be measured. The 1998 meeting of the *Interagency Standardized Monitoring Program* (*ISMP*) workgroup recommended obtaining abundance estimates for each population of endangered fish. The Genetics Management Plan identified a population (the Yampa-Green stock) of Colorado pikeminnow that inhabits the middle Green River (Middle Green River reach) from Lodore Canyon downstream to approximately the White River. The middle Green River stock includes fish in the Yampa River (Yampa River reach) and the White River (White River reach); the few fish captured in the Duchesne River are included in the middle Green River reach. The other Green River stock resides in the mainstem Green River downstream of the White River. Two reaches include the Desolation-Gray Canyon portion of the Green River (Desolation-Gray Canyon reach) and the lower Green River (lower Green River reach) from about the town of Green River, Utah, downstream to the confluence of the Colorado River. This scope of work outlines a procedure to obtain abundance estimates for sub-adult (400 to 449 mm total length (TL)) and adult (> 450 mm TL) Colorado pikeminnow in each of the five reaches of the Green River Basin, Colorado and Utah, as described above. From those reach estimates, an abundance estimate for each length-based life stage will be estimated for the entire Green River Basin.

Catch/effort data that describes abundance of sub-adult /adult Colorado pikeminnow have been collected in the Colorado (three reaches), Green (five reaches), Yampa (three reaches), and White (two reaches) rivers from1986 to 2000 under the auspices of the *ISMP*. Abundance estimates based on capture-recapture sampling were made from 2000-2003 in the middle Green River and from 2001 to 2003 in the lower Green River. Collectively, these data suggested increased abundance of Colorado pikeminnow in the Green River Basin until 2000 but abundance estimates indicated an apparent decline after that (Bestgen et al. 2005, In press). Recovery goals call for sampling on a three year on, two year off schedule and abundance estimates for the Green River population are due again from 2006 to 2008. Therefore, this proposal outlines procedures to conduct capture-recapture sampling similar to that conducted from 2000 to 2003 using uniquely marked animals so that the necessary abundance estimates can be calculated.

*Parameter estimation models and assumptions.*—Two general classes of models can be used to estimate abundance of animal populations in the wild and are differentiated based on assumptions about population demographics. The first class of models are closed population estimators. Closed population estimators have three main assumptions. The first is that the population is closed so that N, the true population size, is constant during the short-term annual sampling event. Geographic closure assumes that there is no immigration to or emigration from the population of interest. Demographic closure assumes no births or deaths within the sampling period. A second assumption that is often difficult to meet is that all individuals in the population have the same probability of being captured during each sampling occasion. Differences in capture probability among individuals are well-known in fish populations, often involving size related differences in susceptibility to the sampling gear. Another situation that may cause unequal probability of capture is a group of individuals that occupy a habitat type different than that used by most individuals in the population. Behavioral differences may also cause differences in capture probability among individuals. Capture probabilities may also vary among capture occasions because of changes in environmental conditions such as stream flow. A third assumption of closed abundance estimators is that previously marked animals can be reliably distinguished from unmarked animals.

The second class of models is open population estimators. Open population models are useful to estimate population abundance as well as the joint probability of survival/immigration, and births or recruitment/emigration (Burnham et al. 1987, Lebreton et al. 1992). This general model class is termed the Jolly-Seber (J-S) model (Jolly 1965, Seber 1965). Similar to closed population models, J-S population estimation models assume that tagged fish are representative of the population to which inferences are being made and that the fate of individuals is independent of each other. An assumption not common with closed abundance estimators is that fish in an identifiable class or group (e.g., adults) have the same survival and capture probabilities for each time interval. A consequence of this component in J-S population models is that all releases should be made within a short time period so that rates among individuals are the same. The J-S models do not generally require assumptions of no immigration/emigration, and no recruitment or mortality. An exception is that geographic closure is still important when population size is the parameter of interest. Although open models can estimate more and different parameters and have less restrictive underlying assumptions, abundance estimates generated from such models are often less precise than those for closed population models. Another disadvantage of abundance estimates calculated from open population models is that they are all based on model $M_t$, a model that allows for time varying probabilities of capture. Although time variation is likely among sampling occasions, J-S models assume no heterogeneity or behavioral response among individuals in the estimated population. Thus, abundance estimates calculated from open population models do not allow as thorough an evaluation of assumptions as do closed population models.

*Robust design for capture-recapture studies.*—The robust design attempts to capitalize on the strengths of closed and open population models by combining the use of each in an overall sampling and estimation program (Pollock 1982, 1990). The robust design employs sampling at two scales. Sampling occasions completed at closely spaced intervals (e.g. weeks) are used to estimate population size using closed population models. That level of sampling completed in two or more consecutive years allows for estimation of population probabilities of capture, recruitment, and annual survival rates. The robust design approach was employed by Osmundson and Burnham (1998) and Bestgen et al. (2005) to estimate abundance and survival rate of Colorado pikeminnow in the Colorado River and the Green River, respectively. This approach offers advantages of both closed and open population estimation methods if certain assumptions are met. A particular advantage is that the robust design allows evaluation of heterogeneity effects within individuals among capture occasions. We can meet the requirements of the robust study design with the approach described below. We will also analyze razorback sucker data gathered associated with this project.

IV. Study Goals, Objectives, End Product:

Goals: Obtain accurate (unbiased) and reliable (precise) estimates of adult population abundance and survival of Colorado pikeminnow that occupy the Green River study area.

Objectives:

1. Complete a minimum of three sampling passes through the five Green River Basin reaches listed to capture sub-adult and adult Colorado pikeminnow:

   a) Green River between the confluence of the White River upstream to the lower end of Whirlpool Canyon (i.e., upper Rainbow Park).

   b) White River between the confluence of the Green River upstream to Taylor Draw Dam,

   c) Yampa River between Deerlodge Park and Craig, excluding Cross Mountain Canyon,

   d) Green River from the White River confluence downstream to near Green River, Utah, and,

   e) Green River from downstream of Green River, Utah, to the confluence with the Colorado River.

   The LFL and CDOW will attempt up to six sampling passes in the Yampa River, in part associated with bass and northern pike removal projects, in order to obtain a more precise and accurate Colorado pikeminnow abundance estimate.

2. Obtain highest possible rates of capture of Colorado pikeminnow within concentration habitats and maximize number of individuals marked and captured on each sampling occasion.

3. Obtain estimates of probability of capture and abundance for Colorado pikeminnow in each of the five reach and for the entire study area. Razorback sucker data gathered concurrently will also be analyzed, mostly related to survival rate estimation. We will also assist with analysis of Colorado pikeminnow data in the Colorado River.

End Product: The end products are abundance and survival estimates for sub-adult and adult Colorado pikeminnow for each of the White, Yampa, and Green River populations. An overall estimate will also be calculated. Available razorback sucker data gathered concurrently will also be analyzed. Analyses will also be conducted on Colorado pikeminnow data collected in the Colorado River (Dr. White will be a lead on this).

Report Review schedule: Annual reports will be submitted each year. A final summary report for Colorado pikeminnow data will be submitted to the Recovery Program Coordinator 31 Dec. 2008, to peer review 31 Jan. 2009, 31 March 2009 to Biology Committee, 15 June 2009 final report ready. A final report on razorback sucker data analysis will be submitted to the Recovery Program Coordinator 31 Aug. 2008, to peer review 30 Sept. 2008, and to Biology Committee 31 Oct 2008. A report on the Colorado pikeminnow data analysis will be submitted to the Principal Investigator, Doug Osmundson, as soon as it is available (Dr. White will be a lead on this). Mr. Osmundson is responsible for completion of the final report. A final report will be submitted 15 December 2008.

The Colorado pikeminnow analyses (including the Colorado River data analysis and the Green River data analysis and report) will include:

1. Abundance estimates for all reaches and the entire basin for all three years.
2. A summary of sampling effort and discussion of issues related to sampling efficiency.
3. A list of PIT tagged fish will be submitted to the database manager at the end of each year.
4. Depending on the wishes of the Biology Committee and the Recovery Program, other parameter estimates such as survival rates and population rates of change may be estimated.

The razorback sucker data analysis report will include: A summary of razorback stocking in each river basin over time.

1. A summary of sampling effort in applicable river basins and discussion of issues related to sampling coverage.
2. Survival estimates by river or river reach, if possible.
3. Additional analyses as the data and time permits. This may include analyses of movement patterns related to survival of fish, and covariates such as length or fish condition at time of stocking.

## V. Study Area

The primary study sites will include the Green River from Rainbow Park downstream to the Colorado River confluence and the major tributaries of the Green River including the Yampa River from Craig to Deerlodge Park, the White River from Taylor Draw Dam to the Green River confluence, and the lower Duchesne River when accessible. Because capture data indicate that Yampa Canyon, Lodore Canyon, Whirlpool Canyon, and Split Mountain Canyon generally contain fewer Colorado pikeminnow than the alluvial reaches, canyons will not be sampled (Bestgen et al, 2005). The Vernal Field Station of the U. S. Fish and Wildlife Service will be responsible for sampling the White River, and the Desolation-Gray Canyon reach of the Green River, Utah Division of Wildlife Resources, Vernal, will be responsible for sampling the middle Green River reach, Utah Division of Wildlife Resources, Moab, will be responsible for sampling the lower Green River reach. Colorado State University and the Colorado Division of Wildlife will share responsibility for sampling the Yampa River upstream of Dinosaur National Monument; details of sampling responsibility need to be discussed yet.

## VI. Study Methods/Approach

We propose to conduct abundance estimation for sub-adult and adult life stages of Colorado pikeminnow in the Green, White, and Yampa rivers as outlined in the Study Area description. Investigators will thoroughly sample habitat where Colorado pikeminnow are known to congregate (concentration habitat) in each reach on three separate, consecutive occasions (passes) during springtime beginning just after ice-off and ending prior to or during runoff. Concentration habitats are usually shorelines, eddies, pools, flooded tributary mouths, and backwaters. This approach will permit annual abundance estimate calculations for populations by reach and also allows for a combined estimate for the study area. This sampling program conducted over a three-year period will fulfill the requirements of the robust design and also permit calculation of survival estimates for pikeminnow in the study area.

*Annual sampling to estimate pikeminnow abundance*.—Annual sampling will involve a minimum of three sampling occasions through the five river reaches identified above. The three sampling occasions will be conducted in spring between the time when ice off occurs and end prior to or during spring runoff before pikeminnow migration begins. Sampling will begin at the top of each major reach and proceed downstream. It is important to maximize the number of fish captured on each pass (Lebreton et al. 1992). Different gear types may be used in different sampling areas. Electrofishing will be the primary gear in main channel and small backwaters. Large backwaters and concentration areas may be sampled with a blocking trammel net and perhaps electrofishing. Gear use depends on habitat availability as well but will be applied as consistently as possible across reaches and rivers. The goal of using different gear types is to maximize capture probability on each pass.

Investigators will proceed downriver, sampling all available Colorado pikeminnow concentration habitat on each pass. Information recorded at each Colorado pikeminnow capture location will be major habitat type (e.g., main channel pool, main channel eddy, backwater, flooded tributary mouth), a specific capture and release location identified by a GPS unit, and fish total length and mass. Each fish will be scanned for the presence of a PIT tag, making sure to follow standard Program protocols to ensure detection of tags with new and old frequencies. The fish will be tagged if it has not been previously marked, and the tag number recorded. The importance of back-up PIT tag scanners of both frequencies and adequate tagging supplies is critical to the success of this project. Scanning and tagging of all fish will reduce bias and result in the most accurate and precise abundance estimates possible. Tagged fish will be released in recovered condition at the point of capture.

After a single marking occasion is completed for the reach, they will proceed back to the upstream terminus and begin the second sampling occasion. A sufficient amount of time (e.g., 5-10 days) should elapse between the start of consecutive sampling occasions to allow for sufficient mixing of marked and unmarked fish. In the appropriate reaches, an *ISMP*-like sampling pass may be conducted within a primary sampling occasion to add to that data set.

*Assumptions of closed population abundance estimators*.—Fulfilling the assumptions underlying any abundance estimation model is a critical first step in the planning of a large field study. We have evaluated the assumptions of closed population abundance estimators in a previous study and feel confident that these assumptions can be met again (Bestgen et al. 2005). The first assumption, that of constant N during short-term annual sampling, can be assumed because the size of the study area dictates that the only point of emigration/immigration from the population of interest would be to or from the lower Green River. The likelihood of movement is much reduced at that time of year because fish occupy small and stable home ranges. Lack of movement during that time period will also reduce movement of fish within the main study area from sampled reaches to areas that may receive little or no sampling effort such as canyons. Limiting the target group of fish to sub-adult and adult pikeminnow and limiting sampling to a relatively short time period in spring prior to migration, eliminates the possibility of additions to the population through recruitment. This fulfills the assumption of demographic closure.

The second assumption of equal probability of capture of individuals is unlikely to be met except in all but the most restricted conditions. However, techniques can be employed to reduce effects of heterogeneity among capture probabilities of individuals (e.g. size effects). Variation among capture probabilities among reaches and years can be reduced by explicitly modeling time effects. We also utilized total length as a covariate in previous analyses to account for a proportion of capture heterogeneity due to fish size differences (Bestgen et al. (2005). Previous studies have shown that behavior effects such as avoidance of capture gear are not generally important (Bestgen et al 2005). An exception may be for Colorado pikeminnow 800-mm TL or larger, which had very low recapture rates among years. The low number of those fish in samples suggested that bias of abundance estimates due to presumed behavior effects of those larger fish should be low. A separate study may be necessary to fully understand if those behavior effects are important, or if low recapture rates of large Colorado pikeminnow are due to other factors.

Another assumption is of accurate recognition of marked and unmarked animals. To ensure that this assumption is fulfilled, investigators need to make sure tag detection equipment is in good operating order, carefully scan each fish with old and new types of tag scanners, and make sure tags are detectable prior to insertion. This requires that the tagging protocol be diligently followed.

*Study duration*.—The robust design requires at least two years of data collection in order for a survival estimate to be calculated, but the addition of more years will increase the number of estimates possible, and their accuracy and precision. Although survival estimation is not a main goal of this study, such estimates are useful for other purposes related to determining recovery goals and for comparison with survival rates of Colorado pikeminnow in other systems or periods (Osmundson and Burnham 1998, Bestgen et al. 2005). A minimum of three years of data will also yield three separate abundance estimates for pikeminnow in the study area, and will provide a consistency check for estimates among years.

*Other considerations for FY 2008*.—This sampling design does not include canyon reaches because fish are presumed rare in those habitats during the non-spawning period (Bestgen et al. 2005). Another consideration in the decision not to intensively sample canyon reaches is the high level of logistics and effort needed to accomplish such sampling. We will use

ancillary data collected in those reaches, such as was done from 2000 to 2003, to evaluate that this consideration still holds (Bestgen et al. 2005).

Program Mark will be used to estimate abundance and survival estimates for Colorado pikeminnow in the study area. Program Mark is an omnibus data analysis program that allows exploration of a number of closed and open sampling design estimators for calculating estimates of abundance and survival. The robust design specifically incorporates closed model abundance estimation techniques, while survival is estimated from variants of the Jolly-Seber model.

## VII. Task Description and Schedule (FY-2008)

Because of the complexity and short duration of the sampling design, and the need to use five relatively autonomous units to complete this work, we will continue to use a Standard Operating Procedure for field personnel to ensure a consistent sampling approach and timely completion of tasks. We will also have frequent conference calls with team members and field crews to discuss issues and problems. This will also provide an opportunity for each group to report on progress in completing tasks. The Larval Fish Laboratory will be responsible for routine coordination of the study. The Program Directors office will assist in resolution of problems related to timely completion of tasks.

Task 1. Feb.-March. Order and prepare equipment. This task relates to objectives 1 and 2.

Task 2. April. Scout locations, final equipment preparation. This task relates to objectives 1, 2, and 3. Several river reaches are relatively remote or on private property and will require reconnaissance to acquire permission and find boat launch and take-out sites.

Task 3. Apr.-June. 3-pass sampling. Relates to objectives 1-3.

Task 4. Jan.-Sept. Sampling team coordination, data entry, and analysis. Relates to 4 objectives 1-4.

Task 5. December. Begin to write Recovery Program final summary report for data collected in 2006-2008, and prepare data analysis for Colorado River pikeminnow data analysis. Relates to objectives 3 and 4.

Task Description and Schedule (FY-2009)

Task 1. Jan.-Sept. Sampling team coordination, data entry, and analysis, including razorback sucker data.

Task 2. November. Write Recovery Program final summary report.

VIII. FY-2008-2009 Work

- Deliverables/Due Dates. Project summary report November 2008 and 2009.
-

| Group/Agency | Reach | Costs per year FY-08 | FY-09 |
|---|---|---|---|
| Larval Fish Laboratory | Yampa River | 87,959 | 38623 |
| Utah Division of Wildlife Resources, Vernal | middle Green River | 53,073 | 5,137 |
| U. S. Fish and Wildlidfe Service, Vernal | White River | 54500 | 7505 |
| U. S. Fish and Wildlidfe Service, Vernal | Desolatio-Gray Canyon, Green River | 67885 | 0 |
| Utah Division of Wildlife Resources, Moab | lower Green River | 118520 | 5000 |
| | total | 381,937 | 56265 |

**Budget by reach:**

**Larval Fish Laboratory, sampling and data analysis**

Larval Fish Laboratory: Budget includes data analysis costs for Principal investigator. Budget presented assumes that ½ of field-related expenses associated with Colorado pikeminnow abundance estimation will be covered under project 125, pike and smallmouth bass removal in the middle Yampa River and under CDOW sampling. Additional funds are to be used to attempt five or six full passes (at present three complete passes and sampling in concentration areas three more times will be completed under existing CDOW and CSU projects) for the Yampa River to improve precision of abundance estimates. Cost savings over a combined budget for middle and lower Green River projects pro-rated from 2003 to 2006 ($75,200 in 2003, $82,173 projected in 2006, 2006 actual = $55210) represent $26,963. Some funds are also for razorback sucker data analysis in 2008. Fringe benefits are 20.8% of the total amount of salaries. LFL overhead rate is 15% and is charged to all items except equipment in excess of $5,000. Fringe on salary and overhead are figured into costs for LFL items. Costs for Colorado River pikeminnow data analysis ($12,000) are included in Task 4.

Larval Fish Laboratory, FY2008

Tasks 1 and 2, Prepare sampling equipment, literature work, site visit

| Item | | | Cost |
|---|---|---|---|
| Labor | Units | Cost/unit | |
| Principal investigator (d) | 8 | 450 | $3,600 |
| Biologist (d) | 5 | 310 | $1,550 |
| Senior technician (d) | 7 | 190 | $1,330 |
| Technician (d) | 7 | 145 | $1,015 |
| | | subtotal | $7,495 |

Travel

| | | | | |
|---|---|---|---|---|
| Per diem (d) | 4 | 30 | | $120 |
| Mileage (miles) | 750 | 0.4 | | $300 |
| | | | subtotal | $420 |
| | | | Total | $7,915 |

Task 3, complete 3 sampling passes, 10d ea, represents 1/2 the costs, other 1/2 covered by project 125, pike and bass removal in the middle Yampa River

| Item | | | | Cost |
|---|---|---|---|---|
| Labor | Units | Cost/unit | | |
| Principal investigator (d) | 10 | 450 | | $4,500 |
| Biologist (d) | 15 | 310 | | $4,650 |
| Senior technician (d) | 15 | 190 | | $2,850 |
| Technician (d) | 60 | 145 | | $8,700 |
| | | | subtotal | $20,700 |
| Travel | | | | |
| Per diem (d) | 100 | 20 | | $2,000 |
| Mileage (miles) | 3600 | 0.4 | | $1,440 |
| | | | subtotal | $3,440 |
| Supplies | | | | |
| gas | 450 | 2.25 | | $1,013 |
| oil | 20 | 2.5 | | $50 |
| motor repair | 2 | 300 | | $600 |
| nets, seines, pens | 9 | 52 | | $468 |
| preservative | 1 | 33 | | 33 |
| misc camp gear | 1 | 400 | | 400 |
| Misc sampling gear | 1 | 400 | | 400 |
| | | | subtotal | $2,964 |
| | | | Total | $27,104 |

Task 4, data entry and analysis

| Item | | | | Cost |
|---|---|---|---|---|
| Labor | Units | Cost/unit | | |
| Principal investigator (d) | 65.23 | 450 | | $29,350 |
| Biologist (d) | 25 | 310 | | $7,750 |
| Senior technician (d) | 38 | 190 | | $7,220 |
| Technician (d) | 7 | 145 | | $1,015 |
| | | | subtotal | $45,335 |

Task 5, annual report preparation

| Item | | | | Cost |
|---|---|---|---|---|
| Labor | Units | Cost/unit | | |
| Principal investigator (d) | 10 | 450 | | $4,500 |
| Biologist (d) | 3 | 310 | | $930 |
| Senior technician (d) | 5 | 190 | | $950 |
| Technician (d) | 5 | 145 | | $725 |
| | | | subtotal | $7,105 |
| Travel | | | | |
| Meeting | 1 | 500 | | $500 |
| | | | subtotal | $500 |
| | | | Total | $7,605 |
| | | | Total tasks 1-5 | $87,959 |

Larval Fish Laboratory, FY2009

Task 1, data entry and analysis

| Item | | | | Cost |
|---|---|---|---|---|
| Labor | Units | Cost/unit | | |
| Principal investigator (d) | 25 | 450 | | $11,250 |
| Biologist (d) | 7 | 319 | | $2,233 |
| Senior technician (d) | 20 | 190 | | $3,800 |
| Technician (d) | 15 | 145 | | $2,175 |
| software, computer | 1 | 1500 | | $1,500 |
| | | | subtotal | $20,958 |

Task 2, annual report preparation

| Item | | | Cost |
|---|---|---|---|
| Labor | Units | Cost/unit | |
| Principal investigator (d) | 25 | 450 | $11,250 |
| Biologist (d) | 10 | 319 | $3,190 |
| Senior technician (d) | 10 | 190 | $1,900 |
| Technician (d) | 5 | 145 | $725 |

| | | | | |
|---|---|---|---|---|
| | | | subtotal | $17,065 |
| Travel | | | | |
| Meeting | 1 | 600 | | $600 |
| | | | subtotal | $600 |
| | | | Total | $17,665 |
| | | | Total tasks 1-5 | $38,623 |

**Middle Green River, Utah Division of Wildlife Resources, Vernal**

**FY 2008**

Task 1. Literature research, order and Prepare equipment.

| FY08 Task 1 | | |
|---|---|---|
| Labor- | Work days | Cost |
| Project Leader (449/day) | 1 | $449 |
| Biologist (349/day) | 4 | $1,396 |
| Technician (200/day) | 5 | $1000 |
| FY08 Task 1 Subtotal | | $2,845 |

Task 2. Scout locations, final equipment preparation.

| FY08 Task 2 | | |
|---|---|---|
| Labor- | Work days | Cost |
| Project Leader (449/day) | 4 | $1,796 |
| Biologist (349/day) | 4 | $1,396 |
| Technician (200/day) | 4 | $800 |
| Travel | | |
| Vehicle ($42/day; mileage and rent) [a] | 4 | $168 |
| Equipment (maintenance or replacement)[b] | | $1,000 |
| FY08 Task 2 Subtotal | | $5,160 |

[a] Calculated as average miles traveled per day * cost per mile + daily rental fee = 75 * $0.35 + $15 = $41.25/day.

[b] Includes repair or replacement of outboard motor lower units, electrofishing, and trammel net repair and replacement.

Task 3. 3-pass sampling.

| FY08 Task 3 | | |
|---|---|---|
| Labor- | Work days | Cost |
| Project Leader (449/day) | 10 | $4,490 |
| Biologist (349/day) | 40 | $13,960 |
| Technician (200/day) | 80 | $16,000 |
| Travel | | |
| Vehicle ($42/day; mileage and rent)[a] | 20 | $840 |
| Equipment (maintenance or replacement)[b] | | $1,000 |
| FY08 Task 3 Subtotal | | $36,290 |

[a] Calculated as average miles traveled per day * cost per mile + daily rental fee = 75 * $0.35 + $15 = $41.25/day.
[b] Includes repair or replacement of outboard motor lower units, electrofishing, and trammel net repair and replacement.

Task. 4 Sampling team coordination, data entry and analysis.

| FY08 Task 4 | | |
|---|---|---|
| Labor- | Work days | Cost |
| Project Leader (449/day) | 5 | $2,245 |
| Biologist (349/day) | 3 | $1,047 |
| Technician (200/day) | | $0 |
| FY08 Task 4 Subtotal | | $3,292 |

Task 5. Write Recovery Program summary report.

| FY08 Task 5 | | |
|---|---|---|
| Labor- | Work days | Cost |
| Project Leader (449/day) | 6 | $2,694 |
| Biologist (349/day) | 8 | $2,792 |

| | | |
|---|---|---|
| Technician (200/day) | | $0 |
| FY08 Task 5 Subtotal | | $5,486 |

| | |
|---|---|
| **FY 2008 Total** | $53,073 |

**FY 2009**

Task 1. Final data preparation and Recovery Program summary report review.

| FY09 Task 5 | | |
|---|---|---|
| Labor- | Work days | Cost |
| Project Leader (449/day) | 6 | $2,694 |
| Biologist (349/day) | 7 | $2,443 |
| Technician (200/day) | | $0 |
| FY08 Task 5 Subtotal | | $5,137 |

| | |
|---|---|
| **FY 2009 Total** | $5,137 |

**White River, U. S. Fish and Wildlife Service, Vernal**

SOW 128b (White River) FY2008

| Task Activity | Cost |
|---|---|
| Tasks 1-3 | |
| Labor | |
| GS-11 Biologist trip prep ($36.67/hr x 8 hrs/day x 6 day) | $1,760 |
| GS-8 Fisheries Tech ($28.29/hr x 8 hrs/day x 6 days) | $1,358 |
| 2 GS-5 Techs trip prep ($20.56/hr x 8 hrs/day x 6 days) | $1,974 |
| Taylor Draw Dam to Rangely river bridge | |
| GS-11 Biologist ($36.67/hr x 8 hrs/day x 1 day/trip x 3 trips) + ($55.00/hr x 2 hrs OT x 1 day/trip x 3 trips) | $1,210 |
| GS-8 Fisheries Tech ($28.29/hr x 8 hrs/day x 1 day/trip x 3 trips) + ($42.44/hr x 2 hrs OT/day x 1 day/trip x 3 trips) | $934 |
| 2 GS-5 Tech ($20.56/hr x 8 hrs/day x 1 day/trip x 3 trips) + ($30.84/hr x 2 hrs OT/day x 1 day/trip x 3 trips) | $1,357 |
| Rangely river bridge to Stateline | |
| GS-11 Biologist ($36.67/hr x 8 hrs/day x 2 days/trip x 3 trips) + ($55.00/hr x 2 hrs OT x 2 days/trip x 3 trips) | $2,420 |
| GS-8 Fisheries Tech ($28.29/hr x 8 hrs/day x 2 days/trip x 3 trips) + ($42.44/hr x 2 hrs OT/day x 2 days/trip x 3 trips) | $1,867 |

| | |
|---|---|
| 2 GS-5 Tech ($20.56/hr x 8 hrs/day x 2 days/trip x 3 trips) + ($30.84/hr x 2 hrs OT/day x 2 days/trip x 3 trips) | $2,714 |
| Stateline to Ignacio Bridge | |
| GS-11 Biologist ($36.67/hr x 8 hrs/day x 1 day/trip x 3 trips) + ($55.00/hr x 2 hrs OT x 1 day/trip x 3 trips) | $1,210 |
| GS-8 Fisheries Tech ($28.29/hr x 8 hrs/day x 1 day/trip x 3 trips) + ($42.44/hr x 2 hrs OT/day x 1 day/trip x 3 trips) | $934 |
| 2 GS-5 Tech ($20.56/hr x 8 hrs/day x 1 day/trip x 3 trips) + ($30.84/hr x 2 hrs OT/day x 1 day/trip x 3 trips) | $1,357 |
| Ignacio Bridge to Enron | |
| GS-11 Biologist ($36.67/hr x 8 hrs/day x 2 days/trip x 3 trips) + ($55.00/hr x 2 hrs OT x 2 days/trip x 3 trips) | $2,420 |
| GS-8 Fisheries Tech ($28.29/hr x 8 hrs/day x 2 days/trip x 3 trips) + ($42.44/hr x 2 hrs OT/day x 2 days/trip x 3 trips) | $1,867 |
| 2 GS-5 Tech ($20.56/hr x 8 hrs/day x 2 days/trip x 3 trips) + ($30.84/hr x 2 hrs OT/day x 2 days/trip x 3 trips) | $2,714 |
| Enron to White River mounth | |
| GS-11 Biologist ($36.67/hr x 8 hrs/day x 2 days/trip x 3 trips) + ($55.00/hr x 2 hrs OT x 2 days/trip x 3 trips) | $2,420 |
| GS-8 Fisheries Tech ($28.29/hr x 8 hrs/day x 2 days/trip x 3 trips) + ($42.44/hr x 2 hrs OT/day x 2 days/trip x 3 trips) | $1,867 |
| 2 GS-5 Tech ($20.56/hr x 8 hrs/day x 2 days/trip x 3 trips) + ($30.84/hr x 2 hrs OT/day x 2 days/trip x 3 trips) | $2,714 |

| | |
|---|---|
| Subtotal | $33,097 |

| | |
|---|---|
| Travel, Per Diem, Equipment | |
| Vernal to Taylor Draw Dam round trip | |
| (3 trucks/trip x 105 mi/truck x $0.405/mi x 3 trips) | $383 |
| Boat gas (6 gal gas/boat x $2.50/gal x 2 boats/day x 1 day/trip x 3 trips) | $90 |
| Boat oil (1 qt. Oil/boat x $2.75/qt x 2 boats/day x 1 day/trip x 3 trips) Taylor Draw Dam to Rangely | $17 |
| Vernal, Rangely to Stateline round trip | |
| (3 trucks/trip x 172 mi/truck x $0.405/mi x 3 trips) | $627 |
| Shuttle Drivers (3 drivers/trip x $60/driver x 3 trips) | $540 |
| Shuttle Driver Organizer (1 driver/trip x $10/driver x 3 trips) for trip organization | $30 |
| Boat gas (12 gal gas/boat x $2.50/gal x 2 boats/day x 2 days/trip x 3 trips) | $360 |
| Boat oil (2 qts. Oil/boat x $2.75/qt x 2 boats/day x 2 days/trip x 3 trips) | $66 |
| Per diem ( 4 people/day x $25/person x 2 days/trip x 3 trips) Rangely to Stateline | $600 |
| Vernal, Stateline to Ignacio Bridge round trip | |
| (3 trucks/trip x 106 mi/truck x $0.405/mi x 3 trips) | $386 |
| Shuttle Drivers (3 drivers/trip x $60/driver x 3 trips) | $540 |
| Shuttle Driver Organizer (1 driver/trip x $10/driver x 3 trips) | $30 |
| Boat gas (6 gal gas/boat x $2.50/gal x 3 boats/day x 1 day/trip x 3 trips) | $135 |
| Boat oil (1 qts. Oil/boat x $2.75/qt x 3 boats/day x 1 day/trip x 3 trips) | $25 |
| Vernal, Ignacio Bridge to Enron round trip | |
| (4 trucks/trip x 180 mi/truck x $0.405/mi x 3 trips) | $875 |
| Shuttle Drivers (4 drivers/trip x $60/driver x 3 trips) | $720 |
| Shuttle Driver Organizer (1 driver/trip x $10/driver x 3 trips) for trip organization | $30 |
| Boat gas (6 gal gas/boat x $2.50/gal x 3 boats/day x 2 days/trip x 3 trips) | $270 |
| Boat oil (1 qts. Oil/boat x $2.75/qt x 3 boats/day x 2 days/trip x 3 trips) | $50 |
| Per diem ( 5 people/day x $25/person x 2 days/trip x 3 trips) | $750 |
| Vernal, Enron to White River mouth | |
| (4 trucks/trip x 180 mi/truck x $0.405/mi x 3 trips) | $875 |
| Shuttle Drivers (4 drivers/trip x $60/driver x 3 trips) | $720 |

| | |
|---|---|
| Shuttle Driver Organizer (1 driver/trip x $10/driver x 3 trips) for trip organization | $30 |
| Boat gas (6 gal gas/boat x $2.50/gal x 3 boats/day x 2 days/trip x 3 trips) | $270 |
| Boat oil (1 qts. Oil/boat x $2.75/qt x 3 boats/day x 2 days/trip x 3 trips) | $50 |
| Per diem ( 5 people/day x $25/person x 2 days/trip x 3 trips) | $750 |
| | |
| Equipment and supplies (nets, electrofishing gear, maintenance and repairs, boat motors, etc.) | $4,679 |

| | |
|---|---|
| Subtotal | $13,898 |

Tasks 4-5

| | |
|---|---|
| Labor | |
| GS-11 Biologist trip prep ($36.67/hr x 8 hrs/day x 20 day) | $5,867 |
| GS-9 Admin. Assist. ($32.20/hr x 8 hrs/day x 5 day) | $1,288 |
| Supplies (paper, computer disks, copies, etc.) | $350 |

| | |
|---|---|
| Subtotal | $7,505 |

| | |
|---|---|
| Total | $54,500 |

SOW 128b (White River) FY2009

Tasks 1-2

| | |
|---|---|
| Labor | |
| GS-11 Biologist trip prep ($36.67/hr x 8 hrs/day x 20 day) | $5,867 |
| GS-9 Admin. Assist. ($32.20/hr x 8 hrs/day x 5 day) | $1,288 |
| Supplies (paper, computer disks, copies, etc.) | $350 |

| | |
|---|---|
| Subtotal | $7,505 |

## Desolation-Gray Canyon, Green River, U. S. Fish and Wildlife Service, Vernal

SOW 128a FY2008 (Desolation-Gray Canyon)

| Task Activity | Cost |
|---|---|

Tasks 1-3

| | |
|---|---|
| Labor | |
| GS-11 Biologist trip prep ($38/hr x 8 hrs/day x 6 days) | $1,824 |
| GS-8 Fisheries Tech trip prep ($28.29/hr x 8 hrs/day x 6 days) | $1,358 |
| 3 GS-5 Techs trip prep ($20.56/hr x 8 hrs/day x 6 days) | $2,961 |
| White River confluence to Sandwash | |
| GS-11 Biologist ($38/hr x 8 hrs/day x 2 days/trip x 3 trips) + ($55.00/hr x 2 hrs OT x 2 days/trip x 3 trips) | $2,484 |
| GS-8 Fisheries Tech ($28.29/hr x 8 hrs/day x 2 days/trip x 3 trips) + ($42.44/hr x 2 hrs OT/day x 2 days/trip x 3 trips) | $1,867 |
| 3 GS-5 Tech ($20.56/hr x 8 hrs/day x 2 days/trip x 3 trips) + ($30.84/hr x 2 hrs OT/day x 2 days/trip x 3 trips) | $4,071 |
| Sandwash to Swaesys | |
| GS-11 Biologist ($38/hr x 8 hrs/day x 5 days/trip x 3 trips) + ($55.00/hr x 2 hrs OT x 5 days/trip x 3 trips) | $6,210 |

| | |
|---|---|
| GS-8 Fisheries Tech ($28.29/hr x 8 hrs/day x 5 days/trip x 3 trips) + ($42.44/hr x 2 hrs OT/day x 5 days/trip x 3 trips) | $4,668 |
| 3 GS-5 Tech ($20.56/hr x 8 hrs/day x 5 days/trip x 3 trips) + ($30.84/hr x 2 hrs OT/day x 5 days/trip x 3 trips) | $10,178 |

| | |
|---|---|
| Subtotal | $35,621 |

| Travel, Per Diem, Equipment | |
|---|---|
| (4 trucks/trip x 75 mi/truck x $0.405/mi x 3 trips) Vernal to Ouray round trip | $365 |
| Shuttle Drivers (4 drivers/trip x $60/driver x 3 trips) Vernal to Ouray round trip | $720 |
| Shuttle Driver Organizer (1 driver/trip x $10/driver x 3 trips) for trip organization Vernal to Ouray round trip | $30 |
| Boat gas (12 gal gas/boat x $2.50/gal x 3 boats/day x 2 days/trip x 3 trips) Ouray to Sandwash | $540 |
| Boat oil (2 qts. Oil/boat x $2.75/qt x 3 boats/day x 2 days/trip x 3 trips) Ouray to Sandwash | $99 |
| Per diem ( 5 people/day x $25/person x 2 days/trip x 3 trips) Ouray to Sandwash | $750 |
| (4 trucks/trip x 175 mi/truck x $0.405/mi x 3 trips) Vernal to Sandwash round trip | $851 |
| Shuttle Drivers (4 drivers/trip x $100/driver x 3 trips) Vernal to Sandwash round trip | $1,200 |
| Shuttle Driver Organizer (1 driver/trip x $10/driver x 3 trips) for trip organization Vernal to Sandwash round trip | $30 |
| Boat gas (6 gal gas/boat x $2.50/gal x 3 boats/day x 5 days/trip x 3 trips) Sandwash to Swaesys | $675 |
| Boat oil (1 qts. Oil/boat x $2.75/qt x 3 boats/day x 5 days/trip x 3 trips) Sandwash to Swaesys | $124 |
| Per diem ( 5 people/day x $25/person x 5 days/trip x 3 trips) Sandwash to Swaseys | $1,875 |
| (4 trucks/trip x 400 mi/truck x $0.405/mi x 3 trips) Vernal to Swaseys round trip | $1,944 |
| Shuttle Drivers (4 drivers/trip x $100/driver x 3 trips) Vernal to Swaseys round trip | $1,200 |
| Shuttle Driver Organizer (1 driver/trip x $10/driver x 3 trips) for trip organization Vernal to Swaesys | $30 |
| Equipment and supplies (nets, electrofishing gear, maintenance and repairs, boat motors, etc.) | $12,000 |

| | |
|---|---|
| Subtotal | $22,433 |

Tasks 4-5

| Labor | |
|---|---|
| GS-11 Biologist trip prep ($38/hr x 8 hrs/day x 21 days) | $6,323 |
| GS-9 Admin. Assist. ($32.20/hr x 8 hrs/day x 5 day) | $1,288 |
| Supplies (paper, computer disks, copies, etc.) | $2,220 |

| | |
|---|---|
| Subtotal | $9,831 |

| | |
|---|---|
| Total | $67,885 |

## No FY 09 budget, included under White River.

## lower Green River, Utah Division of Wildlife Resources, Moab

**FY2008 Work**:

Task 1-3. Three mark-recapture passes. Each pass is broken into two trips; from Green River to Mineral Bottom and from Mineral Bottom to the confluence with the Colorado River.

| | | | |
|---|---|---|---|
| Personnel: | | | |
| | Project Leader ($37.61/hr x 10hr/day x 27.85 total work days) | $ | 10,474 |
| | 2 Biologists ($29.24/hr x 10hr/day x 140 total work days) | $ | 40,936 |
| | 5 Technicians ($16.67/hr x 10hr/day x 300 total work days) | $ | 50,010 |
| | **Subtotal** | **$** | **101,420** |
| Travel / Per Diem: | | | |
| | Mileage: (5) trucks - 180 mi per pass @ $.42 per mi for 3 passes, $5/day/truck for 2 mos. | $ | 4,750 |
| | Gas (boats and generator) for 3 passes; | $ | 1,200 |
| | Per Diem: - 7 people @ $15 per day for 30 days; | $ | 3,150 |
| | **Subtotal** | **$** | **9,100** |
| Equipment / Supplies: | | | |
| | Equipment Repair and Replacement (maintain outboards, trailer repairs, generators, replace 2 Jon boats,) | $ | 6,000 |
| | Miscellaneous: camping equipment (tents, dry bags, stoves, cookware, chairs, tables, toilets, life jackets, dip nets, GPS units, scales) | $ | 2,000 |
| | **Subtotal** | **$** | **8,000** |
| **FY 08 TOTAL** | | **$** | **118,520** |

**FY2009 Work:**

Task 1-2. Final data reporting and report review.

| | | | |
|---|---|---|---|
| Personnel: | | | |
| | Project Leader ($37.61/hr x 10hr/day x 3 total work days) | $ | 1,128 |
| | Biologist ($29.24/hr x 10hr/day x 13.2 total work days) | $ | 3,872 |
| | **Subtotal** | **$** | **5,000** |

IX. Budget Summary

| | |
|---|---|
| FY-2008 | $381,937 |
| FY-2009 | $ 56,265 |
| Total: | $438,202 |

X. Reviewers: Dr. Richard Valdez, Dr. Paul Holden, Doug Osmundson

XI. References


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