

**COLORADO RIVER RECOVERY PROGRAM
FY-2016 SCOPE OF WORK**

Project No.: 127

Colorado pikeminnow population estimates - Colorado River

Reclamation Agreement number: R13PG40018

Reclamation Agreement term: June 3, 2013 – Sep. 30, 2017

Lead Agency: U.S. Fish and Wildlife Service
Colorado River Fishery Project

Submitted by: Darek Elverud, Fish Biologist
Dale Ryden, Project Leader
Address: 445 West Gunnison Ave. Suite 140
Grand Junction, CO 81501
Phone: (970) 628-7203
FAX: (970) 628-7217
E-Mail: darek_elverud@fws.gov
dale_ryden@fws.gov

Date: April 23, 2015

Category:

- Ongoing
 Ongoing-revised project
 Requested new project
 Unsolicited proposal

Expected Funding Source:

- Annual funds
 Capital funds
 Other (explain)

- I. Title of Proposal: Monitoring the Colorado pikeminnow population in the mainstem Colorado River via periodic population estimates.
- II. Relationship to RIPRAP:
Colorado River Action Plan: Colorado River Mainstem,
V. Monitor populations and habitat and conduct research to support recovery actions.
V.A. Conduct research to acquire life history information and enhance scientific techniques required to complete recovery actions.

III. Study Background/Rationale and Hypotheses:

The currently-accepted standard for monitoring populations of Colorado River endangered fishes is to periodically develop population estimates using closed-model capture-recapture methods. Such estimates provide information on population status (abundance), and when repeated periodically over an extended period can also provide information on population trends. Such estimates have been made for the Colorado River population of Colorado pikeminnow for nine years: 1992-1994, 1998-2000, 2003-2005, and 2008-2010 (see Osmundson and Burnham 1998, Osmundson 2002, Osmundson and White 2014). Recovery

goals for Colorado pikeminnow require that three annual population estimates be conducted from 2013-2015 (Program Director's Office 2002). During the first two 3-year efforts, time, manpower and funding limitations allowed only a minimal sampling regime in the Colorado River. This consisted of three passes, or capture efforts, through the upper reach (upstream of Westwater Canyon) and two through the lower reach (downstream of Westwater Canyon) each year. This was largely accomplished with one 2-person crew. In addition, data from annual ISMP electrofishing surveys were also included which provided part of one of the passes in each reach. Without this help, the two-person crew would not have been able to complete the sampling regime. Even with this assistance, estimates were considered generally inadequate based on wide confidence intervals, low probability of capture (p), and high coefficients of variation (CV). Pollock et al. (1982) suggests a good 'rule-of-thumb' is to achieve a CV of 20% or less. During 1991-1994 and 1998-2000, annual CV for pikeminnow >450 mm TL ranged from 15.4% to 45.5% in the upper study reach, and from 39.2% to 64.4% in the lower study reach. Annual ISMP electrofishing surveys have since been discontinued; hence, future field efforts will need to be much greater to make estimates more precise and make up for the shortfall left from discontinuing ISMP. To improve estimates, a target of four passes in the lower reach (Cisco, UT to the Colorado/Green River confluence) and five passes in the upper reach (upstream of Westwater Canyon to Government Highline Dam) was adopted for the Colorado River. In addition, increased effort per pass also improves precision of estimates. In the past, trammel-netting backwaters yielded many more pikeminnow per day of effort than did electrofishing shorelines. However, at any one time, there may be many pikeminnow that are not in the backwaters; hence, our current capture strategy includes a combination of electrofishing shorelines and trammel-netting backwaters. This expanded effort is intended to increase capture probabilities and decrease coefficients of variation, resulting in greater precision of the point estimates. This sampling regimen was employed during 2003-2005 and 2008-2010. The overall mean CV of the twelve annual combined-reach estimates for fish > 450 mm TL was 16.8% (Osmundson and White 2014). During the most recent three-year effort (2008–2010), the mean CV was 13.2%, the best (lowest) of any of the four multi-year efforts (first three years: 25%; second three years, 14.3%; third three years, 15.2%). However, the best single year was 2005, with a CV of 9.4%. The current regimen of increased effort and number of annual passes is scheduled to be continued in 2018-2020.

IV. Study Goals, Objectives, End Product:

Goal

Our goal is to provide three annual whole-river estimates of population abundance for Colorado pikeminnow ≥ 250 mm TL and for Colorado pikeminnow ≥ 450 mm TL in the Colorado River mainstem, with coefficients of variation of 20% or less.

Objectives

1. Capture and mark juvenile (< 400 mm TL), sub-adult (400-450 mm TL) and adult (> 450 mm TL) Colorado pikeminnow throughout the river for a three-year period, attempting to complete five passes through the upper reach (upstream of Westwater Canyon) and four through the lower reach (downstream of Westwater Canyon) each year.
2. Develop a population estimate from mark-recapture data.
3. Assess recruitment trends by analyzing length-frequency histograms and estimating abundance of individuals 400-450 mm TL.
4. Also, reduce centrarchid and walleye abundance in the study area by removing those encountered during field sampling so as to help meet objectives of Project 126 (bass removal).
5. Capture razorback sucker and bonytail opportunistically for assessment of their populations. Development of abundance estimates for razorback sucker using mark-recapture data collected here will be covered under a separate scope of work.

End Product

Provide a final report on study findings. A draft report for the 2013-2015 sampling period will be ready for peer review on August 30, 2016. A draft final report will be ready for approval consideration October 31, 2016. Report to be finalized December 31, 2016.

A draft report for the 2018-2020 sampling period will be ready for peer review on August 30, 2021. A draft final report will be ready for approval consideration October 31, 2021. Report to be finalized December 31, 2021.

V. Study Area:

The Colorado River will be sampled from Government Highline Dam (RM 194.4) downstream to the confluence with the Green River (RM 0.0), excluding Westwater Canyon (12 miles: rm 112-124), from early-April to late-June, 2018-2020. In addition, the lower 2.3 miles of the Gunnison River downstream of Redlands Diversion Dam will also be sampled, as fish utilizing this reach are generally part of the Colorado River population. Hence, a total of 179 miles will be sampled. The rationale for omitting Westwater Canyon is that sampling there requires specialized whitewater expertise, is time consuming, and, based on past experience, will yield very few pikeminnow (captures have averaged about one per year over nine years despite intensive sampling associated with other studies [unpublished Recovery Program database data]).

VI. Study Methods/Approach:

Juvenile, sub-adult and adult Colorado pikeminnow will be captured from throughout the Colorado River study area. In each of two sub-reaches (upstream and downstream of Westwater Canyon), there will be two crews working concurrently: one 2-person crew will

electrofishing shorelines while another two-person crew will trammel-net flooded backwaters. During low water periods, only electrofishing sampling will be deployed. There will therefore be a total of four 2-person crews working simultaneously at any one time (eight individuals). Additional individuals will be required to run shuttles, clean nets and maintain equipment. An additional person will also be needed to pilot a baggage boat when sampling in Canyonlands is conducted. In some reaches, where backwaters are scarce, both shorelines will be electrofished, either concurrently or on separate days. In reaches where shoreline electrofishing supplements backwater netting, the electrofishing crew will sample both shorelines, targeting what the driver believes to be the best habitats. No electrofishing will occur in backwaters; and electrofishing boats that get out ahead of netting crews will steer clear of backwater mouths to avoid scaring fish from these areas. Concurrent crews working in the same reach will embark at the same location but will be prepared to operate and work up fish independently. The technique, or combination of techniques, that most effectively samples the pikeminnow population varies by reach, and some flexibility will be required to modify sampling protocols as reach and flow conditions vary. All fish will be measured for total length (mm), weighed with an electronic balance (nearest gram) and checked for the presence of a PIT-tag. If a PIT tag is not present the fish will be marked with one.

For concurrent bass removal efforts, all centrarchids will be measured and removed from the river as well as other non-native predators that may be encountered such as northern pike and walleye. These will be frozen, and either transferred to Colorado Parks and Wildlife or deposited in the county landfill. Data will be turned over to the Principle Investigator for Project 126a (centrarchid removal) for inclusion in their analysis.

The Principal Investigator will train crew members, act as overall crew leader and actively participate in data collection efforts. One higher-grade technician, certified for electrofishing, will be present in each reach, and will function as a sub-reach crew leader. Although the duration of the annual data collection effort is anticipated to be 11-12 weeks, additional time will be required prior to field sampling to ready equipment and train new crew members in motor boat operation and field techniques specific to this project.

The Principal Investigator will work closely with a biostatistician familiar with running program MARK or other appropriate mark-recapture programs that develop estimates of population abundance and rates of survival. Size structure of the population will be analyzed and compared against earlier data (1991-1994, 1998-2000, 2003-2005, 2008-2010, 2013-2015) to determine recent trends in recruitment frequency, identification of strong year-classes, etc. Average body condition will also be monitored as a means to assess fish health.

VII. Task Description and Schedule

Description

- Task 1. Capture and PIT tag Colorado pikeminnow (early April-late June)
- Task 2. Input and analyze data
- Task 3. Write annual reports
- Task 4. Prepare final report

Schedule

Task 1: 2018, 2019, 2020
Task 2: 2018, 2019, 2020
Task 3: 2018, 2019, 2020
Task 4: 2016

VIII. FY-2016 Work (reporting year following three years of field work in 2013, 2014, 2015)

Deliverables/Due Dates:

Annual report due 12/2016
Draft final report for peer review due 08/30/2016
Draft final report for Biology Committee approval 10/31/2016
Draft finalized 12/31/2016

Budget:

(Based on projected FY-2016 costs)

Labor

Tasks 2 & 3.

Data Input, Analysis, Management & Presentation; Report Writing; Office
& Administrative Support (Federal Salary + Benefits)

1. CRFP – Grand Junction Labor (Federal Salary + Benefits)

Administrative Officer (GS-9) – 1 person for 120 hrs

(15 days) at \$44.72/hr

\$ 5,366

Project Leader (GS-14) – 1 person for 40 hrs

(5 days) at \$83.42/hr

\$ 3,337

Fish Biologist (GS-11) – 1 person for 1,080 hrs

(135 days) at \$49.36/hr

\$ 53,309

2. Colorado State University Labor

Bio-Statistician – 1 person for 40 hrs (5 days)

at \$130/hr

\$ 5,200

Sub Total \$ 67,212

Travel and Per Diem (Based on Published FY-2015 Federal Per Diem Rates)

Tasks 2 & 3.

Lodging

4 nights in hotel in Fort Collins, CO at \$84/night

\$ 336

1 person X 1 trip X 5 days to meet with bio-statistician

Per Diem

5 days per diem at hotel rate for Fort Collins, CO = \$56/day

\$ 280

1 person X 1 trip X 5 days to meet with bio-statistician

Sub Total \$ 616

Equipment and Supplies

Tasks 1, 4, and 5.

Office supplies, toner cartridges, printer paper, mailing costs, etc.

Sub Total \$ 500

FY-2016 Total \$ 68,328

FY-2017 Work (off year -- no field work or reporting)

Deliverables/Due Dates: None

Budget: Off year -- no work \$ 0

FY-2018 Work (first year of three total years of field work)

Deliverables/Due Dates: Annual Report due 11/2018

Budget:
(Based on projected FY-2018 costs)

Labor

Tasks 1, 4, and 5.

Field Sampling

1. CRFP - Grand Junction Labor (Federal Salary + Benefits)

Fish Biologist (GS-11) – 1 person for 560 hrs (70 days) at \$52.37/hr \$ 29,327

Bio Tech Crew Leader (GS-7) – 1 person for 560 hrs (70 days) at \$35.75/hr \$ 20,020
+ 80 hrs overtime at \$53.62/hr \$ 4,290

Biological Technicians (GS-5) – 7 people for 480 hrs (60 days) each at \$20.69/hr \$ 88,973
+ 80 hrs overtime each (560 hrs) at \$31.04/hr \$ 22,243

Sub Total \$164,898

Task 2 & 3.

Permitting; Coordination; Data Input, Analysis, Management & Presentation;

Report Writing; Office & Administrative Support (Federal Salary + Benefits)

1. CRFP – Grand Junction Labor (Federal Salary + Benefits)

Administrative Officer (GS-9) – 1 person for 320 hrs (40 days) at \$47.44/hr \$ 15,181

Project Leader (GS-14) – 1 person for 96 hrs (12 days) at \$88.50/hr \$ 8,496

Fish Biologist (GS-11) – 1 person for 600 hrs (75 days) at \$52.37/hr \$ 31,422

2. Colorado State University Labor

Bio-Statistician – 1 person for 16 hrs (2 days) at

\$135/hr

\$ 2,160

Sub Total \$ 57,259

Travel and Per Diem (Based on published FY-2015 Federal Per Diem Rates with a 3% annual increase)

Tasks 1, 4, and 5.

Lodging and Hotel per diem

32 nights in hotel in Moab, UT at \$114/night \$ 3,648

4 people x 2 nights/trip X 4 passes

Per Diem

48 days per diem at hotel rate for Moab, UT = \$61/day \$ 2,928
= 4 people X 3 days/trip X 4 passes (48 man days)

204 days per diem at camp rate = \$28/day \$ 5,712

Loma – Westwater Ranger Station = 5 people

X 2 days/trip X 4 passes (40 man days)

Cisco – Dewey Bridge = 4 people X 2 days/trip

X 4 passes (32 man days)

Dewey Bridge to Moab “Daily Take-Out” = 4 people

X 2 days/trip X 4 passes (32 man days)

Potash boat ramp to Green River confluence and

back = 5 people X 5 days/trip X 4 passes

(100 man days)

Sub Total \$ 12,288

Equipment and Supplies

Tasks 1, 4, and 5.

Vehicle Maintenance & Gasoline (@ \$387/month lease = \$12.91 per day based on 30 days in an “average” month + \$0.35/mile)

Vehicle Costs

7 vehicles for 3 months each at \$387/month \$ 8,127

1,420 miles/month X 3 months (4,260 total miles/vehicle)

X 7 vehicles (29,820 total miles for all 7 trucks)

X \$0.35/mile \$ 10,437

Boat and generator gasoline

420 gallons at \$4.00/gallon for 91 octane \$ 1,680

Equipment Maintenance, Repair, and Replacement \$ 5,000

Exact use of the money in this line item will vary from year to year depending on what equipment needs to be maintained, repaired, or replaced, but use of these funds for a “typical” field season for one study would include the following:

Spark plugs for generators – 5 at \$7 each = \$35

Synthetic oil for generators - 11 quarts at \$7 each = \$77

Generator repair/tune-up - 5 hrs @ \$75/hr = \$375

Hip boots – 2 pair at \$50/pair = \$100

Breathable chest waders - 2 pair @ \$125/pair = \$250

Stearns Type III life jackets – 3 @ \$70 each = \$210

Electrical Gloves - 3 pairs @ \$65/pair = \$195

Dura-Frame electrofishing dip nets – 2 @ \$300 each = \$600

Raft trailer maintenance

Signal light pigtail adapters – 2 @ \$30 each = \$60

Repair raft frame

Aluminum welding – 3 hours @ \$150/hr = \$450

Raft repair kits

Raft glue (urethane/hypalon) – Four 4-oz. cans
@ \$22.50/can = \$90

NRS raft patch material – 5 feet @ \$37/ft = \$185

Acetone – 1 gallons @ \$17.50/gallon = \$17.50

Toluene – 1 gallon @ \$17.50/gallon = \$17.50

Replace any missing NRS HD-brand tie-down straps,
each boat needs:

Ten 2-ft straps @ \$4.20 each = \$42

Five 3-ft straps @ \$4.30 each = \$21.50

Ten 4-ft straps @ \$4.70 each = \$47

Five 6-ft straps @ \$5.05 each = \$25.25

Five 9-ft straps @ \$5.7 each = \$28.50

Five 12-ft straps @ \$6.15 each = \$30.75

Replace any missing D-style carabiners, each boat needs:

10 @ \$7.50 each = \$75

Mesh rig bag – 1 @ \$50 each = \$50

Yeti 125-quart coolers – 1 @ \$500 each = \$500

Rafting oars, oar blades, and oar rowing sleeves

Carlisle 10-foot oar shafts – 2 @ \$90 each = \$180

Carlisle Oars blades – 4 @ \$65 each = \$260

Oar sleeves – 4 @ \$12 each = \$48

5-gallon plastic gasoline jerry cans – 5 @ \$20 each = \$100

River bags

NRS 3.8 heavy-duty Bill's Bag – 2 @ \$100 each = \$200

Clavey (green 7 X 17) dry bag – 3 @ \$22 each = \$66

Clavey (blue 10 X 24) dry bag) – 4 @ \$26 each = \$104

20 lb. propane tanks – 3 @ \$20 each = \$60

Ohaus electronic scales – repair sensors, replace missing
rubber “feet” for pans, replace old battery packs for
five scales @ \$100 per scale = \$500

Other potential uses for these same funds could include replacing
replacing hand tools (ratchet and sockets, screw drivers, vise grips,
pliers, Allen wrenches, crescent wrenches, hammer, etc.), WD-40,
bailing wire, duct tape, electrical supplies (12 and 14 gage wire for
the boats, junction boxes, extra male & female plugs, wire nuts,
fuses, Ohm meter, electrical tape), batteries (C, AA and AAA),
camp stoves, lanterns, lantern mantles, small “pony” propane
bottles for lanterns, Gott 5-gallon water jugs, shovels, 5-gallon
buckets, cargo nets, fix chips or cracks in vehicle windshields,
bulbs, lenses, and wiring to fix trailer lights and pigtails,
new electrofishing spheres, wire rope for replacing electrofishing
“witches brooms,” 2-man dome tents, NRS Canyon Box for dry

storage, camping kitchen gear (roll-up camp tables, anodized dutch ovens, plates, bowls, cups, silverware), data books, Rite- In-The-Rain data sheets, pencils, repair/replace river maps, etc.

Sub-Total \$ 25,244

FY-2018 Total **\$259,689**

FY-2019 Work (first year of three total years of field work)

Deliverables/Due Dates: Annual Report due 11/2019

Budget:

(Based on projected FY-2019 costs)

Labor

Tasks 1, 4, and 5.

Field Sampling

1. CRFP - Grand Junction Labor (Federal Salary + Benefits)

Fish Biologist (GS-11) – 1 person for 560 hrs
(70 days) at \$53.94/hr \$ 30,206

Bio Tech Crew Leader (GS-7) – 1 person for 560 hrs
(70 days) at \$35.79/hr \$ 20,619
+ 80 hrs overtime at \$53.62/hr \$ 4,419

Biological Technicians (GS-5) – 7 people for 480 hrs
(60 days) each at \$27.27/hr \$ 91,627
+ 80 hrs overtime each (560 hrs) at \$40.91/hr \$ 22,910

Sub Total \$169,782

Task 2 & 3.

Permitting; Coordination; Data Input, Analysis, Management & Presentation; Report Writing; Office & Administrative Support (Federal Salary + Benefits)

1. CRFP – Grand Junction Labor (Federal Salary + Benefits)

Administrative Officer (GS-9) – 1 person for 320 hrs
(40 days) at \$47.44/hr \$ 15,635

Project Leader (GS-14) – 1 person for 96 hrs
(12 days) at \$88.50/hr \$ 8,751

Fish Biologist (GS-11) – 1 person for 600 hrs
(75 days) at \$52.37/hr \$ 32,364

2. Colorado State University Labor

Bio-Statistician – 1 person for 16 hrs (2 days) at
\$139/hr (assumed a 3% cost increase
over 2018 hourly rates) \$ 2,225

Sub Total \$ 58,976

Travel and Per Diem (Based on estimated 2018 Federal Per Diem Rates with a 3% annual increase)

Tasks 1, 4, and 5.

Lodging and Hotel per diem

32 nights in hotel in Moab, UT at \$117/night 4 people x 2 nights/trip X 4 passes	\$ 3,744
--	----------

Per Diem

48 days per diem at hotel rate for Moab, UT = \$63/day = 4 people X 3 days/trip X 4 passes (48 man days)	\$ 3,024
---	----------

204 days per diem at camp rate = \$28/day	\$ 5,712
---	----------

Loma – Westwater Ranger Station = 5 people
X 2 days/trip X 4 passes (40 man days)

Cisco – Dewey Bridge = 4 people X 2 days/trip
X 4 passes (32 man days)

Dewey Bridge to Moab “Daily Take-Out” = 4 people
X 2 days/trip X 4 passes (32 man days)

Potash boat ramp to Green River confluence and
back = 5 people X 5 days/trip X 4 passes
(100 man days)

Sub Total	\$ 12,480
-----------	-----------

Equipment and Supplies

Tasks 1, 4, and 5.

Vehicle Maintenance & Gasoline (@ \$399/month lease = \$13.30
per day based on 30 days in an “average” month + \$0.36/mile)

Vehicle Costs

7 vehicles for 3 months each at \$399/month	\$ 8,379
---	----------

1,420 miles/month X 3 months (4,260 total miles/vehicle)

X 7 vehicles (29,820 total miles for all 7 trucks)

X \$0.36/mile	\$ 10,735
---------------	-----------

Boat and generator gasoline

420 gallons at \$4.00/gallon for 91 octane	\$ 1,680
--	----------

Equipment Maintenance, Repair, and Replacement	\$ 5,150
--	----------

Exact use of the money in this line item will vary from year
to year depending on what equipment needs to be maintained,
repaired, or replaced. See FY-2018 budget for a list of individual items
falling within the category.

Sub-Total	<u>\$ 25,944</u>
------------------	------------------

FY-2019 Total	\$267,182
----------------------	------------------

FY-2020 Work (first year of three total years of field work)

Deliverables/Due Dates:

Annual Report due 11/2020

Budget:

(Based on projected FY-2020 costs)

Labor

Tasks 1, 4, and 5.

Field Sampling

1. CRFP - Grand Junction Labor (Federal Salary + Benefits)

Fish Biologist (GS-11) – 1 person for 560 hrs (70 days) at \$55.56/hr	\$ 31,114
Bio Tech Crew Leader (GS-7) – 1 person for 560 hrs (70 days) at \$37.93/hr + 80 hrs overtime at \$56.90/hr	\$ 21,241 \$ 4,552
Biological Technicians (GS-5) – 7 people for 480 hrs (60 days) each at \$28.09/hr + 80 hrs overtime each (560 hrs) at \$42.14/hr	\$ 94,382 <u>\$ 23,598</u>
Sub Total	\$174,887

Task 2 & 3.

Permitting; Coordination; Data Input, Analysis, Management & Presentation; Report Writing; Office & Administrative Support (Federal Salary + Benefits)

1. CRFP – Grand Junction Labor (Federal Salary + Benefits)

Administrative Officer (GS-9) – 1 person for 320 hrs (40 days) at \$50.33/hr	\$ 16,106
Project Leader (GS-14) – 1 person for 96 hrs (12 days) at \$93.90/hr	\$ 9,014
Fish Biologist (GS-11) – 1 person for 600 hrs (75 days) at \$55.56/hr	\$ 33,336

2. Colorado State University Labor

Bio-Statistician – 1 person for 16 hrs (2 days) at \$143/hr (assumed a 3% annual cost increase over 2018 hourly rates)	<u>\$ 2,292</u>
Sub Total	\$ 60,748

Travel and Per Diem (Based on published FY-2015 Federal Per Diem Rates with a 3% annual increase)

Tasks 1, 4, and 5.

Lodging and Hotel per diem 32 nights in hotel in Moab, UT at \$121/night 4 people x 2 nights/trip X 4 passes	\$ 3,872
--	----------

Per Diem

48 days per diem at hotel rate for Moab, UT = \$65/day = 4 people X 3 days/trip X 4 passes (48 man days)	\$ 3,120
204 days per diem at camp rate = \$28/day Loma – Westwater Ranger Station = 5 people X 2 days/trip X 4 passes (40 man days) Cisco – Dewey Bridge = 4 people X 2 days/trip X 4 passes (32 man days) Dewey Bridge to Moab “Daily Take-Out” = 4 people X 2 days/trip X 4 passes (32 man days) Potash boat ramp to Green River confluence and back = 5 people X 5 days/trip X 4 passes (100 man days)	\$ 5,712
Sub Total	<u>\$ 12,704</u>

Equipment and Supplies

Tasks 1, 4, and 5.

Vehicle Maintenance & Gasoline (@ \$411/month lease = \$13.76 per day based on 30 days in an “average” month + \$0.37/mile)

Vehicle Costs

7 vehicles for 3 months each at \$411/month	\$ 8,631
1,420 miles/month X 3 months (4,260 total miles/vehicle)	
X 7 vehicles (29,820 total miles for all 7 trucks)	
X \$0.37/mile	\$ 11,033
Boat and generator gasoline	
420 gallons at \$4.00/gallon for 91 octane	\$ 1,680
Equipment Maintenance, Repair, and Replacement	\$ 5,305

Exact use of the money in this line item will vary from year to year depending on what equipment needs to be maintained, repaired, or replaced. See FY-2018 budget for a list of individual items falling within the category.

Sub-Total \$ 26,649

FY-2020 Total **\$ 274,988**

IX. Budget summary

FY-2016

USFWS-GJ	\$ 63,128
Bio-Statistician	<u>\$ 5,200</u>
2016 Total	\$ 68,328

FY-2017

USFWS-GJ	\$ 0
Bio-Statistician	<u>\$ 0</u>
2017 Total	\$ 0

FY-2018

USFWS-GJ	\$257,529
Bio-Statistician	<u>\$ 2,160</u>
2018 Total	\$259,689

FY-2019

USFWS-GJ	\$264,957
Bio-Statistician	<u>\$ 2,225</u>
2018 Total	\$267,182

FY-2020

USFWS-GJ	\$272,696
Bio-Statistician	<u>\$ 2,292</u>
2018 Total	\$274,988

5-Year Total = \$870,187

X. Reviewers: Recovery Program Staff and Biology Committee

XI. References

Osmundson, D. B. 2002. Population dynamics of Colorado pikeminnow in the upper Colorado River. Final Report. U. S. Fish and Wildlife Service, Grand Junction, Colorado.

Osmundson, D. B. 2009. Population status and trends of Colorado pikeminnow of the upper Colorado River, 1991-2005. Final Report. U. S. Fish and Wildlife Service, Grand Junction, Colorado.

Osmundson, D. B., and K. P. Burnham. 1998. Status and trends of the endangered Colorado squawfish in the upper Colorado River. Transactions of the American Fisheries Society 127:957-970.

Osmundson, D. B., and G. C. White. 2014. Population structure, abundance and recruitment of Colorado pikeminnow of the upper Colorado River, 1991–2010. Final Report. U. S. Fish and Wildlife Service, Grand Junction, Colorado.

Pollock, K. H., J. D. Nichols, C. Brownie, and J. E. Hines. 1990. Statistical inference for capture-recapture experiments. Wildlife Monographs 107.

Program Director's Office. 2002. Protocols for Colorado pikeminnow and humpback chub estimates. Draft Report. Upper Colorado River Endangered Fish Recovery Program, Lakewood, Colorado.