

San Juan River Specimen Curation, Data Integration, and Synthesis
Museum of Southwestern Biology Fiscal Year 2017 Scope of Work

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Background

Collections Curation and Data Archives -- Personnel with the Division of Fishes, Museum of Southwestern Biology (MSB), at the University of New Mexico (UNM) are responsible for the curation of collections of fishes taken by principle investigators with the San Juan River Basin Recovery Implementation Program (SJRIP). Since 1991, the MSB Division of Fishes has been the permanent repository for large numbers of voucher specimens and associated data collected by SJRIP researchers. The numbers of specimen processed each year have fluctuated depending on the availability of these collections after the field season. For example, larval and juvenile San Juan River fishes (approximately 200,000) collected in the early 1990s by the Utah Division of Wildlife Resources were not completely processed by MSB staff until 2001. Specimens of San Juan River fishes, taken by the New Mexico Department of Game and Fish during the 1991-99 secondary channel surveys, were not received by the MSB until 2007 and are still being incorporated into the MSB collections. Other factors such as annual variability of sampling conditions and changes in sampling techniques have affected numbers of specimens processed by MSB staff. For example, between 2001 and 2002 drift net sampling for larval Colorado Pikeminnow and razorback sucker was eliminated in favor of larval seine sampling. Given the variability in number of fishes to process, the San Juan River Biology Committee has recommended that the annual budget for the San Juan River specimen curation and larval fish identification reflect an “average” year of sample processing. The SJRIP Biology Committee recognizes that some years would require more effort from MSB staff than budgeted, while other years might not require the same high level of activity. A relatively stable budget would allow for uninterrupted processing of new collections and yet be sufficient to cover the ongoing work of processing backlogged SJRIP collections due to circumstances previously discussed.

To date, 44,255 lots or 1,530,729 fish specimens have been collected (1987-2015) by the San Juan River research group and these specimens have been processed, cataloged, and archived at the Museum of Southwestern Biology, Division of Fishes. A total of 19,540 San Juan River collection sites have been entered into the MSB database and georeferenced; all locality and habitat information has been captured using original field notes and data sheets. Over 25,000 pages of original San Juan River field notes and data sheets have been digitally captured, cleaned, and saved in both tiff and pdf

formats for the electronic archives; the original field notes and data sheets are permanently stored in acid-free document boxes for long-term conservation.

Incoming specimen collections are removed from WhirlPaks®, cleaned of debris, placed in known concentrations of fixative (either 5% buffered formalin, 10 % buffered formalin, or 95% ethanol), and organized on the accession shelves by MSB staff. Collections are later sorted and identified by the principal SJRIP investigators. Specimen collections are assigned an accession number (tracking number) and all associated documentation, like permits and field notes, are filed under that same number. Processing collections of fish specimens (adults and larvae) requires fluid transfers from formalin fixative to ethanol preservative (typically), sending out specimens for species verification as required, counting the number of individuals in each collection, recording the standard lengths for the largest and smallest specimen in each collection, entering all locality and specimen data into an electronic catalog, digital capture of field notes and data sheets, and labeling and filing vials and jars of cataloged San Juan River specimens into the permanent MSB collections. The basic principles for accessioning specimens of fishes in the MSB are standard for most museums of natural history (e.g., Smithsonian Institution, Carnegie Museum, and University of Michigan Museum of Zoology). Species identifications and locality/collection data are verified as necessary prior to incorporation into the MSB catalog. This step is very important for SJRIP researchers to ensure that any misleading information is not incorporated into subsequent reports on San Juan River fish species, particularly for larval Colorado Pikeminnow (*Ptychocheilus lucius*) and Razorback Sucker (*Xyrauchen texanus*) studies. For purposes of permitting, the MSB provides with field and species data in museum report format. This information includes species identification, catalog number (MSB number), number of specimens and size range per lot.

Data Integration and Synthesis—Since its inception in 1992, the San Juan River Basin Recovery Implementation Program (SJRRIP) has been instrumental in managing and restoring native fish populations in the San Juan River Basin. During this time, numerous studies have been implemented with the collective goal of characterizing biotic and abiotic components of the environment that are thought to influence endangered fish populations. Information from these studies has been used to identify and implement appropriate management strategies. Most of these long-term projects focused on relationships between habitats and flow, flow mimicry and native/nonnative fish population dynamics, nonnative fish removal, native-nonnative fish interactions, and augmentation of endangered fish populations. While data collected from these projects have helped navigate management decisions over the course of the Program, most data analyses are limited to individual projects. Limited effort has been directed toward integrating and synthesizing information across studies (e.g., larval, small-bodied, and adult fish datasets). Data accumulated over the past two decades are considerable and are a valuable and an indispensable source of information for determining future management options and opportunities. Consequently, making this information accessible and usable is essential for assessing the current status of native and endangered fish populations, informing and guiding management actions, and evaluating the Program's progress toward achieving recovery and minimizing limiting factors as required by the Program Section 7 Principles.

The U.S. Fish and Wildlife Service's Program Office is the clearinghouse for all Program data. The Program Office is responsible for compiling, integrating, and synthesizing all monitoring data, as necessary, to meet its obligations defined in the Program Document and Long Range Plan. In 2010,

the Program Office proposed adding a senior Recovery Science Biologist to the Program Office to better accomplish data integration and synthesis to assess progress toward recovery and facilitate adaptive management decision-making. The Coordination Committee approved the proposal but for various reasons, the Service has been unable to hire another staff member and does not anticipate this will occur anytime soon. Existing Program Office staff has taken on some of this work but the need for additional data integration and synthesis still exists. Additionally, the information developed will help inform important relationships for integration into the San Juan Population Model being developed by the Southern Ute Indian Tribe and Miller Ecological Consultants for Programs use.

Previously, Nathan R Franssen, Ph.D., served as postdoctoral research associate to synthesize, analyze, and integrate relevant elements of this immense database in conjunction with the Program Office biologist. The work required strong quantitative, writing, and research skills, addressing questions without other time commitments or demands. Products/results from the research have been presented to both the Program's Biology and Coordination Committees, as well as interested public, and submitted to scientific journals for peer review and publication. Dr. Franssen collaborated closely with those responsible for directing relevant studies (e.g., adult monitoring, nonnative fish removal, and native fish reproduction) and key researchers associated with the Program, identifying critical questions for integration and analysis (especially early in the process). In August of 2015, Dr. Franssen left the University of New Mexico to continue this work with the US Fish and Wildlife Service, Office of Ecological Services' SJRRIP

To replace Dr. Franssen, we have identified an outstanding candidate to take on tasks associated with San Juan River data integration and synthesis outlined below. Dr. Scott Clark received his Ph.D. in May 2016 from Professor Jacob Schafer's Fish Ecology Laboratory at the University of Southern Mississippi. For his Ph.D. dissertation work, Dr. Clark studied fish movement dynamics using PIT-tag methods and other survey techniques, and has considerable experience with statistical modeling and integration of PIT-tag data with other ecological survey data (see attached curriculum vitae). He has five peer-reviewed scientific papers either published or in press, and has demonstrated his ability to produce high-quality scientific reports and publications. Dr. Clark will work especially closely with Franssen and Durst in the USFWS Ecological Services (ES) Office, and be available to collaborate broadly with other researchers in the San Juan River Program to integrate and synthesize key datasets with special attention to broader program goals. With Dr. Clark housed at UNM, he will have access to a broad variety of academic researchers interested in theory and practice of remote sensing data and integration, UNM Library resources, and access to data and archives held in the Museum of Southwestern Biology. He is also located in close proximity to the ES field office to facilitate collaboration. Despite the change in personnel, the overarching goal of data integration and synthesis remains the same: to provide a data-driven and scientifically sound approach to making recommendations regarding flow management, recovery criteria for endangered species, and measurements of Program success.

One graduate student research assistant (RA) will be dedicated to assisting the PI and Research Scientist with data synthesis and integration tasks including management and assistance with experimental, field, and fish data taken from the SJR Program and Upper Colorado River Basin. This effort will help to understand the wider distribution of native fishes in order to support the San Juan River Restoration Implementation Program and associated collections maintained by MSB Division of

Fishes. See note in budget summary. The RA will also work with the Curation team on an as-needed basis to provide specimen identification services.

Study Area

The object of this project is to process and organize specimens of fishes collected for the San Juan River Recovery Implementation Program (San Juan River and Upper Colorado River Basin), capture all field information into an electronic catalog, and incorporate the SJRIP collections into a phylogenetic system within the museum archives for easy access. All of these activities take place in the Division of Fishes, Museum of Southwestern Biology, on the University of New Mexico campus in Albuquerque NM. The work and collaboration to synthesize, analyze, and integrate relevant elements of this large database has moved to the USFWS SJRRIP Program Office in Albuquerque and continues to be presented at researchers' meetings held in the Four Corners area, Colorado or New Mexico.

The MSB Division of Fishes has three offices with a total of six computer workstations for data entry, data management, and data analysis; a fully equipped laboratory for preparation of fish specimens, and approximately 1,858 linear meters of compacted shelving for storage of cataloged collections. On average, five UNM students and staff (three undergraduate, one graduate student, and part-time staff curatorial assistant) process and curate SJRRIP collections. One postdoctoral research associate position is currently open and will be responsible for SJRRIP data synthesis and integration, meeting the research goals of the SJRRIP Program.

Curation and Collections Care Objectives

1. Provide a secure and organized repository for San Juan River fish collections, field notes, and associated data thereby facilitating access to these resources by SJRIP researchers.
2. Insure that all SJRIP species identifications and associated data are verified and correctly represented in the MSB electronic catalog; report discrepancies to SJRIP principal investigators.
3. Georeference collection sites for SJRIP collections; maintain license for ArcView and make collection data available to SJRIP researchers in that format, as required.

Curation and Collections Care Methods

Tasks to be completed under this project are processing and curation of fish specimens and all data from the San Juan River Basin Recovery Implementation Program synthesized and integrated in the form of reports to the Committee and peer review publications. Specimen collections are deposited with the MSB Division of Fishes by SJRIP principal investigators.

Upon receipt of newly collected San Juan River specimens, MSB staff transfer these collections from formalin fixative into stages of 35%, 50%, and 70% concentrations of ethanol. Exceptions to this protocol are made per request of PI, as in the case of using 95% ethanol for genetic or otolith studies.

Fish specimens are removed from field containers and cleaned (debris removed) and placed into museum quality jars during the fluid transfers. Principle investigators sort, identify, count and measure each lot (discrete collection) once the collections are transferred to ethanol. MSB staff catalog, label, and file the specimens once the principle investigators have completed their work. SJRIP collections are organized in the permanent archives by drainage (San Juan River) and taxa. These archives are in a room that is controlled for temperature (18° Celsius) and light (complete darkness to low light levels). All data associated with the specimens are entered and organized in the electronic MSB Division of Fishes database (MS Access 2010) and georeferenced (GeoLocate Ver. 3). All original field notes and data sheets are digitally captured and archived in acid-free document boxes for permanent storage.

Products

SJRIP and Upper Colorado River Basin fishes and associated data will be curated in the Division of Fishes, Museum of Southwestern Biology (MSB), at the University of New Mexico. Collection sites will be georeferenced and available in ArcView format. Original field notes will be digitized and archived by the MSB Division of Fishes and collection data electronically stored in a permanent MSB database program. Species verifications and corrections and digital copies (PDF) of their field notes will be made available to SJRIP principle investigators. A draft report of the 2015 San Juan River and upper Colorado River Basin specimen curation, larval fish sampling and identification, and data integration activities will be prepared and distributed by 31 March 2016 to the San Juan River Biology Committee for review. Upon receipt of written comments, that report will be finalized and disseminated to members of the San Juan River Coordination Committee by 1 August 2016.

Data Integration Tasks and Objectives

Tasks outlined below will be coordinated with USFWS SJRRIP office, notably Nathan Franssen and Scott Durst. The University of New Mexico will fill a Research Scientist III position with a new PhD-level researcher that will report to coPI Turner. This researcher will be tasked with the following items in the 2016-2017 work plan:

Task 1. PIT tag data collection, synthesis, and integration

Collect and collate PIT tag data from both passive (antenna) and active (capture) sources and upload to The Species Tagging, Research, and Monitoring System, an online database. PIT tag data will be analyzed and summarized to calculate demographic parameters, assess recapture frequencies, investigate movement patterns, and determine habitat use. Additional hypotheses and questions may be identified that can be addressed with PIT tag data. A major focus is to relate PIT-tag data to more traditional survey methods using detailed statistical evaluation of both data types, where comparable. Another component of the work will involve experimental evaluations using remote antennae and other scanners and stationary and boat-mounted wagon wheel receivers deployed during electrofishing surveys and other key survey events.

Refinement of models and interpretation of PIT tag datasets will allow for a means to assess populations, as the target species move through the downlisting process and beyond. It may be

possible to develop remote sensing capabilities using stationary PIT tag arrays to automatically deliver population information to managers in the future, providing invaluable long-term monitoring data. In order to realize these exciting possibilities, serious attention to modeling, analysis, and comparison of PIT-tag scan data needs to be undertaken now.

Task 2. Evaluation of growth, movement and condition of Razorback Sucker (*Xyrauchen texanus*)

Investigate seasonal movement and growth of razorback sucker using methodology developed in Durst & Franssen (2014). Statistically compare growth and movement data to other databases in Upper and Lower Colorado. Evaluate variation in growth rates and possibilities for resources as a limiting factor to razorback sucker recruitment in the San Juan River.

Task 3. Age-specific survival of Colorado Pikeminnow (*Ptychocheilus lucius*)

Investigate age-specific survivorship of Colorado pikeminnow using the program MARK to evaluate potential demographic bottlenecks to recruitment, possible sources of mortality, and age-specific resource limitation.

Task 4. Investigate long-term dynamics of aquatic habitat in response to variation in flow

Determining the effects of flow on aquatic habitat in the San Juan River will inform how future managed releases from Navajo Dam are conducted. Past efforts investigating the effects of flow on habitat have been confounded by variation in habitat by flow at the time of mapping. Assessing the effect of antecedent flow on habitat would shed light on an important management action that has largely been conducted without any evaluation of its effects.

Products

Manuscripts, suitable for peer reviewed publication, will be prepared in collaboration with appropriate Program personnel, the Biology Committee, and researchers for each commonly agreed upon investigation. This model has proven to be very productive, producing six peer-reviewed papers since 2012, and many more in the pipeline.

Budget Fiscal Year 2017

1 October 2016 to 30 September 2017

| BUDGET ITEM DESCRIPTION | COMPUTATION | | RECIPIENT FUNDING | OTHER FUNDING | RECLAMATION FUNDING | TOTAL COST |
|---|------------------|----------|----------------------|------------------|------------------------|---------------------|
| | \$/Unit and Unit | Quantity | | | | |
| SALARIES AND WAGES --Position title x hourly wage/salary x est. hours for assisted activity. Describe this information for each position. | | | | | | |
| UNM Professional Staff | \$13.39/HR | 1582 HRS | | | \$21,190.00 | \$21,190.00 |
| UNM Student Assistants (2) | \$12.36/HR | 780 HRS | | | \$ 9,641.00 | \$ 9,641.00 |
| UNM Post-Doctoral Associate | \$21.43/HR | 2080 HRS | | | \$44,585.00 | \$44,585.00 |
| UNM Graduate Student RA | \$9.93/HR | 2080 HRS | | | \$20,658.00 | \$20,658.00 |
| UNM Faculty Summer Salary | \$61.99/HR | 161 HRS | | | \$ 9,980.00 | \$ 9,980.00 |
| FRINGE BENEFITS – Explain the type of fringe benefits and how applied to various categories of personnel. | | | | | | |
| UNM Staff and Faculty | 35.30% | 1 EA | | | \$7,480.00 | \$7,480.00 |
| UNM Undergraduate | 1% | 2 EA | | | \$ 96.00 | \$ 96.00 |
| UNM Post-Doctoral | 26.20% | 1 EA | | | \$11,681.00 | \$11,681.00 |
| UNM Graduate Student | 1% | 1 EA | | | \$ 207.00 | \$ 207.00 |
| UNM Summer Faculty | 22.0% | 1 EA | | | \$ 2,196.00 | \$ 2,196.00 |
| TRAVEL —dates; location of travel; method of travel x estimated cost; who will travel | | | | | | |
| Four SJRRIP Meetings | \$1,500/traveler | 4 EA/YR | | | \$6,000.00 | \$6,000.00 |
| EQUIPMENT —Leased Equipment use rate + hourly wage/salary x est. hours for assisted activity—Describe equipment to be purchased, unit price, # of units for all equipment to be purchased or leased for assisted activity: Do not list contractor supplied equipment here. | | | | | | |
| | | | | | | |
| SUPPLIES/MATERIALS --Describe all major types of supplies/materials, unit price, # of units, etc., to be used on this assisted activity. | | | | | | |
| Chemical Preservatives | \$204.00 | 12 MOS | | | \$2,448.00 | \$2,448.00 |
| | | | | | | |
| CONTRACTUAL/ CONSTRUCTION —Explain any contracts or sub-Agreements that will be awarded, why needed. Explain contractor qualifications and how the contractor will be selected. | | | | | | |
| | | | | | | |
| OTHER –List any other cost elements necessary for your project; such as extra reporting, or contingencies in a construction contract. | | | | | | |
| UNM Graduate Student Tuition | \$666.08 | 12 MOS | | | \$ 7,933.00 | \$ 7,933.00 |
| UNM Graduate Student Health | \$156.33 | 12 MOS | | | \$ 1,876.00 | \$ 1,876.00 |
| TOTAL DIRECT COSTS-- | | | | | \$145,971.00 | \$145,971.00 |
| INDIRECT COSTS – 17.5% | | | | | | |
| | | | | | \$25,545.00 | \$25,545.00 |
| TOTAL PROJECT/ACTIVITY COSTS FY17 | | | | | \$171,516.00 | \$171,516.00 |

FY 2017 Budget Summary

2017 Grand Total Curation of SJRRIP Specimen Collections \$49,393

2017 Grand Total Data Synthesis and Integration for SJRRIP Program \$87,469

2017 Grand Total Upper Colorado Basin Graduate Student RA \$34,654 (This portion is not being funded by the SJRRIP.)

REFERENCES

- Bentley, A.C. 2004. Thermal transfer printers-applications in wet collections. Society for the Preservation of Natural History Collections Newsletter Vol. 18 (2):1-17
- Cato, P. S. 2001. Best practices-what does that imply? Society for the Preservation of Natural History Collection Newsletter Vol. 15 (1):1-11 http://www.spnhc.org/media/assets/cato_BP.pdf
- Chapman, A. D. 2005. Principles of Data Quality, Version 1.0. Report for the Global Biodiversity Information Facility, Copenhagen.
- _____ 2005. Principles and Methods of Data Cleaning – Primary Species and Species Occurrence Data, Version 1.0. Report for the Global Biodiversity Information Facility, Copenhagen.
- Durst, S. L., and N. R. Franssen. 2014. Movement and growth of juvenile Colorado pikeminnows in the San Juan River, Colorado, New Mexico, and Utah. TAFS 143: 519-527.
- Fink, W.L., K.E. Hartel, W.G. Saul, E.M. Koon, and E.O. Wiley. 1979. A Report on Current Supplies and Practices Used in Curation of Ichthyological Collections. American Society of Ichthyologists and Herpetologists, Ichthyological Collection Committee.
- Gido, K. B. and D. L. Propst. 2012. Long-term dynamics of native and nonnative fishes in the San Juan River, New Mexico and Utah, under a partially managed flow regime. TAFS 141:645-659.
- Malaro, M.C. 1985. A legal primer on managing museum collections. Smithsonian Institution Press 351pp
- Markle, D. F. 1984. Phosphate buffered formalin for long term preservation of formalin fixed ichthyoplankton. Copeia 1984 (2): 525-528
- Propst, D. L. and K. B. Gido. 2004. Responses of native and nonnative fishes to natural flow regime mimicry in the San Juan River. TAFS 133:922-931,
- Rios, N.E. and H.L. Bart, Jr. 2008. GEOLocate© Georeferencing software, Version 3.0 Tulane University Museum of Natural History, Belle Chase LA. <http://www.museum.tulane.edu/geolocate/default.aspx>
- Snyder, D.E. and R.T. Muth. 2004. Catostomid fish larvae and early juveniles of the upper Colorado River Basin-Morphological descriptions, comparisons, and computer-interactive key. Colorado Division of Wildlife Tech. Pub. No. 42. 110 pp + CD interactive key.
- Walsh, S.J. and M.R. Meador. 1998. Guidelines for quality assurance and quality control of fish taxonomic data collected as part of the national water-quality assessment program. U.S. Geological Survey Water-Resources Investigations Report 98-4239.

2008. Scientific Collections: Mission-Critical Infrastructure for Federal Science Agencies. A Report of the Interagency Working Group on Scientific Collections (IWGSC) ISBN 978-0-9819500-0-6 <http://www.whitehouse.gov/sites/default/files/sci-collections-report-2009-rev2.pdf>