

2008 San Juan River Specimen Curation
at the Division of Fishes,
Museum of Southwestern Biology,
University of New Mexico



Submitted to
The
San Juan River Basin
Recovery Implementation Program

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1 June 2009

2008 SAN JUAN RIVER SPECIMEN CURATION

AT THE
DIVISION OF FISHES
MUSEUM OF SOUTHWESTERN BIOLOGY
UNIVERSITY OF NEW MEXICO

SUBMITTED TO
SAN JUAN RIVER BASIN RECOVERY
IMPLEMENTATION PROGRAM

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INTRODUCTION

Since 1987, the Museum of Southwestern Biology (MSB), Division of Fishes at the University of New Mexico (UNM), Albuquerque has served as the primary repository for collections of fishes (eggs, larvae, and adults) and field notes taken for the San Juan River Recovery Implementation Program (SJRRIP). Photographs of habitat and genetic materials derived from these research activities are also archived in the MSB.

San Juan River fish specimens, maintained at the MSB, represent a physical record of the presence/absence of those species in the drainage (Appendix I). Often referred to as “voucher collections,” these fish specimens are preserved so that they will remain in good condition, in perpetuity. Housing the San Juan River collections (and all other fish collections) in a new museum facility (2000) has greatly facilitated research by providing better access to these specimens as well as ensuring long-term preservation.

As with all collections of fishes, the San Juan River collections and field data will be maintained in optimal conditions ensuring that they are available to future generations of researchers and ichthyologists. To this end, the MSB Division of Fishes follows a “best practices” guide for the conservation of museum collections (Cato, 2001) as set forth by professional groups like the American Society of Ichthyologists and Herpetologists (Fink, et al., 1979), the Society for the Preservation of Natural History Collections, the American Fisheries Society, and the American Association of Museums. For the past 16 years, MSB staff have been in contact with various experts in the field of “best practices” for larval and adult fish specimen preservation. These experts include Darrel E. Snyder, Colorado State University; David L. Smith, Natural History Museum, Smithsonian Institution; Karsten Hartel, Museum of Comparative Zoology, Harvard.

METHODS

“Processing” San Juan River specimens of fishes refers to receiving these collections and field notes from the field crews (“accessioning”), cleaning and transferring the collections through various concentrations of fluid preservatives (formalin and ethanol), separating the collections by species and verifying identifications, electronic capture of locality, collection, and specimen data, digital capture of original field notes, and cataloging, labeling, and filing collections.

Incoming collections, received from the field crews, are removed from field containers and field formalin, cleaned by separating specimens from river debris, and transferred to either 10% or 5% buffered (Markle, 1984) formalin (depending on the life stages of the specimens) for a complete fixing of tissues in a known solution. As these collections are sorted and identified to species, they are transferred through two concentrations of ethanol (35%, 50%) and into a final preservative of 70% ethanol. (By request of the researchers, some of the larval fishes may remain in 5% buffered formalin as the final preservative.) Each lot of fish specimens is enumerated and measured (smallest and the largest in the series). Prior to fully incorporating SJRRIP collections into the MSB cataloged collections, the specimens are examined and identified by qualified personnel

(mostly SJRRIP researchers). SJRRIP personnel working in the MSB have trained with Darrel E. Snyder, Colorado State University (CSU) Larval Fish Lab Laboratory (LFL) who is a nationally recognized expert in the identification of native larval fishes of the Southwestern U.S. Specimens that cannot be identified by SJRRIP researchers are sent by the MSB Division of Fishes as a loan to Mr. Snyder for species verification. A detailed description of those verified specimens is submitted to the MSB by Mr. Snyder, thereby documenting relevant characters that were used to determine the species. These accounts are readily available to SJRRIP researchers.

Once the specimen and locality data are entered, the collections are cataloged (each lot assigned a unique museum number), transferred to final preservative (70% ethanol and /or 5% buffered formalin), and labeled with permanent jar labels produced on a Datamax DMX-I-4308 thermal transfer printer using polyspun plastic label paper. The labels are permanent in ethanol, formalin, and isopropanol. The cataloged and labeled specimens are then filed on shelves in the permanent collections, organized under family, genus, species, and drainage.

Genetic collections consist of San Juan River catostomid larvae fixed and preserved in 95% ethanol and fin clips from suspected hybrid catostomids (*Xyrauchen texanus* x *Catostomus* spp) or frozen in -80°C freezers. These examples for DNA isolation and analysis are assigned a specimen number and linked to the formalin fixed vouchers (if available) in the main collection (for species verification). Frozen or ethanol fixed fish specimens cannot be used in any study involving morphological analysis because the specimen is dehydrated and shrunken.

Processing rates for incoming San Juan River specimens have been variable over the years depending on three factors: when the collections were received by MSB staff and if the collection was received in stages or at the same time; the amount of debris in the samples, which can hamper detection of fish larvae and eggs; and the amount of material collected via a particular collection method. For example, when passive drift nets were used, collections normally required intensive cleaning, which sometimes took up to four days to remove larval fishes (size an average of 4.00 to 13.00 mm standard length) from a single one-gallon bag of debris. (If these labor intensive collections were then received late in the year or in various stages the processing time was further delayed.) In the summer of 2007, the transfer of the New Mexico Department of Game and Fish (NMDGF) collections to the MSB Division of Fishes took place. This transfer included all of the older NMDGF San Juan River collections and now, with the collections on site, the MSB is in a better position to incorporate these San Juan River collections more rapidly.

The second part of the MSB specimen processing protocol is data entry, data organization, and data management. There are three primary MS Access data tables (Appendix III Tables 1, 2, and 3): specimen data, released fishes data, and locality/collection data or a total of 127 possible fields in which to organize San Juan River data (Walsh and Meador, 1998). Data capture and data management (Chapman, 2005) for San Juan River specimens is accomplished by UNM student employees

(undergraduate and graduate) and the MSB Collections Manager. San Juan River locality data are captured using spreadsheet format (Excel) with MSB table (MS Access Nbottom) field structure (79 possible fields). Students are trained to enter data and do a preliminary “QC” or checking of data; decisions regarding ambiguous or erroneous locality data are made in consultation with the Collections Manager. The responsibility of doing a final “QC” of locality data entries and verification of ambiguous localities is that of the MSB Collections Manager (Chapman, 2005). San Juan River specimen data (MSB catalog number, identification, count, measure, and deposition) are entered by the MSB Collections Manager in the MSB catalog (MS Access Ntop table-48 possible fields). (Appendix II.) Released fishes data are entered into a third primary table, RNTOP. The fields are similar to NTOP except there is no catalog number, but the data for released fishes is linked to the catalog if specimen collections exist.

As with specimen processing, data entry can be considerably slowed down depending on how field data are organized on original field sheets, legibility of handwriting, and the use of “in house” terminology or encoded data that requires the MSB personnel to contact field crews for clarification.

Ancillary to data entry, the student curatorial assistants also scan and “clean” digital images of all San Juan River field notes received with specimens. These images are saved in three formats: tif, jpg, and pdf and maintained in the museum computer catalog. PDF files of all original field notes and habitat pictures (as jpg files) are hyperlinked to individual specimen and locality records in the MSB Division of Fishes database. This allows researchers to view all original field data, habitat and specimen photographs, spreadsheets with project-related information, and so forth. The San Juan River database, along with the whole MSB fishes database, is backed up on an external hard drive (DuoPro SimpleTech, 1 terabyte). Currently, the student Curatorial Assistants are digitally capturing all of the San Juan River larval drift net data sheets received from the Utah Department of Wildlife Resources (and others) from 1991 to 2000.

MUSEUM FACILITIES

In 2000, the MSB Division of Fishes moved into a renovated museum facility across from the UNM Department of Biology. This afforded more space and improved facilities for collection archives and specimen processing. The MSB collections of fish specimens (47% are from the San Juan River) now occupy 1,858 linear meters of shelving, which includes growth space (Figure 1). The shelving units are mobile, “compacted shelving,” which eliminate unused aisle space and increase shelf space (Figure 2).

The fluid collection archive room is maintained at a temperature of 18°C and lighting is kept to a minimum by illuminating only a few sections of shelves at any one time. Otherwise, the room is kept dark. Four-hour fire walls, overhead emergency sprinkler system, floor drains with holding tank for large spills, and controlled room access (alarmed to Campus Police during off hours) are all part of the improvements in the new facility for maintaining the fish collections (and all MSB fluid-preserved collections) in optimal, secure conditions.



Figure 1. MSB Division of Fishes collections



Figure 2. MSB Division of Fishes compactor storage shelves, jar and tank collections

Processing San Juan River collections has been greatly facilitated by having two fume hoods with sinks and eleven workstations with point exhaust or fume collectors in the specimen preparation labs (Figure 3). Typically, San Juan River collections are initially processed in 5% buffered formalin, making it necessary to have good ventilation. (The old facility did not provide such ventilation and collections could not be safely or efficiently processed under those conditions.) These new preparation and research labs also have ample room for working with specimen jars, as well as multiple workstations for both staff and student employees (Figure 4). Barrels of chemicals are easily accessible in a new flammable storage room and distilled water points of use are placed throughout the lab area. Wireless high speed internet access is available through out the building thereby aiding in data transfer between staff and researchers.

Supplies and materials necessary to successfully preserve and curate San Juan River specimens include glass jars, either Le Parfait captive lid jars with custom made Buna-N rubber gaskets or Paragon flint glass jars with polypropylene caps with polyethylene foam liners and stainless steel cadaver tanks with nylon gaskets that hold up to ethanol and formalin. All container products used by the MSB are used by most large fish collections for long-term preservation of collections in ethanol.

Forty percent of the total MSB fish collection is maintained in glass jars, the smallest being the Paragon flint glass 8 ounce jars to the largest, the Le Parfait three liter captive lid jars. Five percent of the collection is stored in stainless steel cadaver tanks (18 and 35 gallon capacity) used for oversized fish specimens. About fifty five percent of the collections are maintained in borosilicate glass vials contained in 3 liter Le Parfait jars (i.e., a vial jar system). These are typically the small collections or individuals and there are significant collections of delicate fish eggs and larvae, mostly from the San Juan River, archived in this manner. Annual purchases of glassware, formaldehyde, buffering chemicals, and ethanol have averaged from \$3,000 to \$6,000 per year. San Juan River research funding has been the primary source for acquiring these supplies. Since 2000, the MSB operating budget (i.e., permanent funds from New Mexico State funding or from previous National Science Foundation grants) has helped purchase jars, tanks, and preservation fluids. Due to increased freight charges, many of the supplies have become more costly. Glass jars, vials, cotton plugs, gaskets and caps on average cost \$2,100 to \$4,000 per year. Currently, one 55 gallon barrel of 37% formaldehyde costs \$480, double the price from last year (2007). The annual cost for formalin buffering chemicals is \$840, and about twelve barrels of 95% ethanol are required to preserve all incoming fish specimens, the majority being from the San Juan River. The current cost of one 55 gallon barrel of ethanol is \$500 or \$4,500 for 2008. The US Bureau of Reclamation funding for materials and supplies has been crucial for the MSB to completely and professionally curate these collections from the San Juan River as other funds in the MSB budget are required to meet other obligations.

Permanent staff at the MSB Division of Fishes includes a 0.33 FTE Curator of Fishes and 1.0 FTE Collections Manager. Temporary student employees include one 0.5 FTE Graduate Student RA and three 0.125 FTE undergraduate student employees. These



Figure 3. Specimen preparation lab with fume hoods, distilled water, and large sinks



Figure 4. Separate lab and research room for fish identification.

positions are sponsored by either the UNM Federal Work Study program or the U.S. Bureau of Reclamation contract 05-FG-40-2411 for curation of SJRRIP collections. Over the past 16 years, a total of \$102,315 in San Juan River research funding has paid for graduate and undergraduate student salaries and 10 years (1992-2000) of salary for the Collections Manager position. UNM students are trained in museum specimen preservation and documentation, field work and specimen collecting, identification of fishes from the American Southwest, and data organization and management. To date, eight former student employees, hired to work on San Juan River fishes (museum, lab, and fieldwork), have gone on to pursue careers in aquatic biology, freshwater and marine fishes, arthropod systematics, mammal studies, and genetics lab work. Many other former student employees have pursued advanced degrees in the medical fields and computer technology.

RESULTS

To date, 92,694 lots or 1,860,881 specimens collected by the San Juan River research group have been processed and archived at the Museum of Southwestern Biology, Division of Fishes (Figure 5). Approximately 14,725 field notes with locality data have been entered. Of these handwritten field notes (about 8,655 pages) have been digitally captured and the original hardcopies archived in acid free boxes for long-term storage.

Primary contributors of San Juan River specimens have been American Southwest Ichthyological Research, Albuquerque NM (ASIR), Museum of Southwestern Biology, Albuquerque NM (MSB), the New Mexico Department of Game and Fish, Santa Fe (NMDGF), Utah Department of Wildlife Resources, Moab CO (UDWR), US Bureau of Reclamation, Durango CO (USBR), US Fish and Wildlife Service, Grand Junction CO and Albuquerque NM (USFWS) (Figure 6).

ACKNOWLEDGEMENTS

We thank the San Juan River Biology Committee for their approval of 2008 funding through the San Juan River Basin Recovery Implementation Program and Michael Berry and Karen McWilliams of the U.S. Bureau of Reclamation, Salt Lake City, for their administration of Award # 05-FG-40-2411. Numerous individuals have given their time and invaluable assistance in our efforts to curate the San Juan River specimens. We thank Steven P. Platania for his ongoing curatorial guidance and advice on this project, Cynthia Rivera, Alicia M. Hodson, Chanel S. Jim, and Kaitlin M. Hulsbos for their diligence in processing and incorporating the San Juan River specimens and data into the MSB fish collections and W. Howard Brandenburg, Michael A. Farrington, and Trevor J. Krabbenhoft for specimen identifications and extensive support in both the lab and the museum.

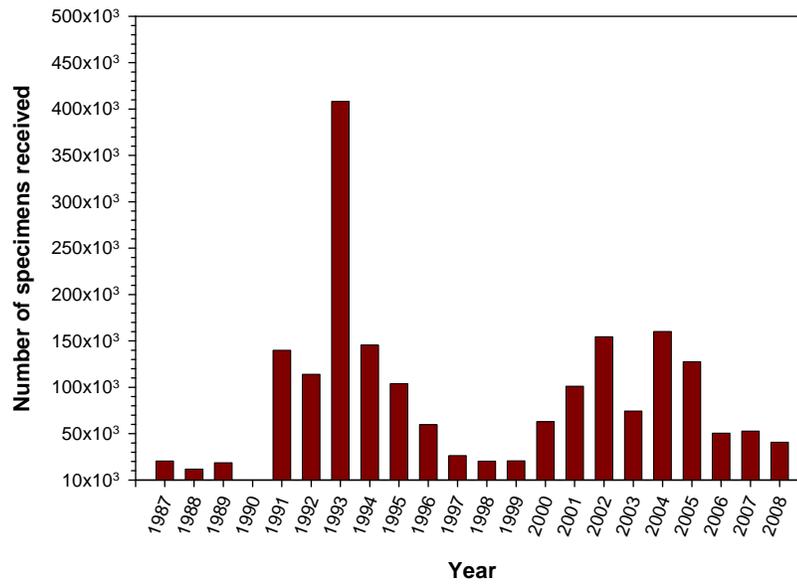


Figure 5. Number of specimens MSB received from the San Juan River Recovery Implementation Program by year 1987 – 2008.

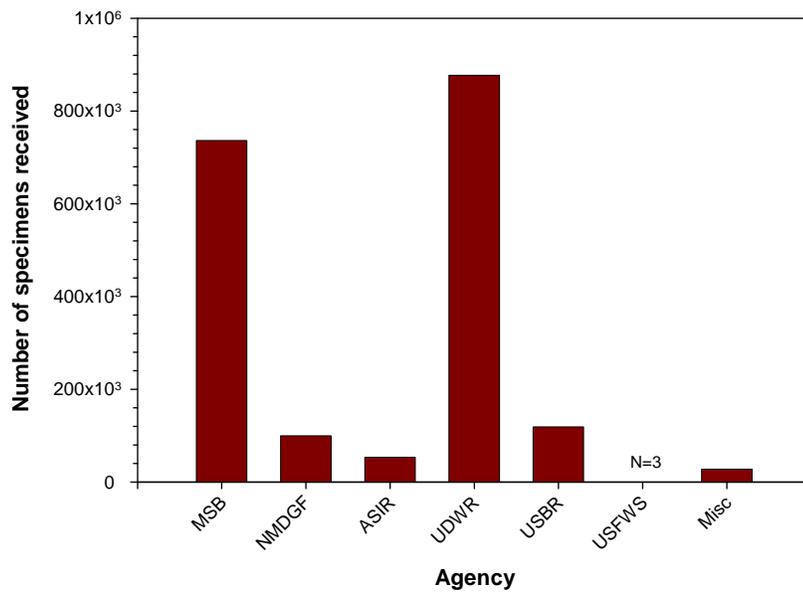


Figure 6. Number of specimens MSB received from the San Juan River Recovery Implementation Program by agency between 1987 – 2008.

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Appendix I. San Juan River specimens deposited in MSB Division of Fishes cataloged collections

MSB ACC	Project Name	Source	Principle	Lots	Specs
Unacc 1987	SJR 1987 Post Larval Age 0 Colorado pikeminnow monitoring	UDWR	C.W. Meyer	58	638
Unacc 1987	SJR 1987 Upper Reach	MSB	S.P. Platania	224	19,824
Unacc 1988	SJR 1988 Secondary Channel Survey	NMDGF	D.L. Propst	274	11,614
Unacc 1988	SJR 1988 Species Record: <i>Ptychocheilus lucius</i>	UDWR	B. Roberts	1	1
Unacc 1989	SJR 1989 Animas River and San Juan River	MSB	S.P. Platania	194	11,051
Unacc 1989	SJR 1989 Secondary Channel Survey	NMDGF	D.L. Propst	57	7,624
Unacc 1990	SJR 1990 Secondary Channel Survey	NMDGF	D.L. Propst		
Unacc 1991	SJR 1991 Drift Net at NM RM 119.7 Four Corners and UT Mexican Hat	UDWR	Unknown	361	2475
Unacc 1991	SJR 1991 Fishes Early Life History Seine Collections	UDWR	Unknown	3422	120,077
Unacc 1991	SJR 1991 Secondary Channel Survey	NMDGF	D.L. Propst		
Unacc 1991	SJR 1991 Fishes Early Life History Seine Collections	USBR-Durango	K. Lashmett	76	17,245
Unacc 1991	SJR 1991 Species Record: <i>Ptychocheilus lucius</i>	USFWS	F.K. Pfeifer	1	1
Unacc 1992	SJR 1992 NM RM 119.7 and UT Mexican Hat Larval Drift Net Collections	UDWR	C. Wethington	361	1,137
Unacc 1992	SJR 1992 Fishes Early Life History Seine Collections	UDWR	Unknown	3189	93,489
Unacc 1992	SJR 1992 Fishes Early Life History Seine Collections	USBR-Durango	K. Lashmett	122	18,214
Unacc 1992	SJR 1992 Secondary Channel Survey	NMDGF	D.L. Propst	21	861
Unacc 1992	SJR 1992 Upper Reach	MSB	S.P. Platania	17	262
Unacc 1993	SJR 1993 Secondary Channel Survey	NMDGF	D.L. Propst		
ACC1993-II:2	SJR 1991-1993 Fishes Young of Year Survey	USBR-Durango	K. Lashmett	652	73,557
ACC1993-II:22	SJR 1991 Fishes Early Life History Seine Collections	UDWR-Moab	M.J. Buntjer	3780	122,536
ACC1993-III:31	SJR 1992 Fishes Early Life History Seine Collections	UDWR-Moab	M.J. Buntjer	3550	94,626
ACC1993-VIII:23	SJR 1993 Fishes Early Life History Seine Collections	UDWR-Moab	M.J. Buntjer	2889	117,448
ACC1993-X:25	SJR 1993 Species Record: <i>Ctenopharyngodon idella</i>	USFWS-NMFRO	J.E. Brooks	1	1
ACC1994-VIII:26	SJR 1994 Light Trap collections-Paiute Farms	NPS-Arizona	S. Dodson	58	26,889
ACC1994-X:10	SJR 1994 Drift Net and Seine Collections: Fishes Early Life History	UDWR-Moab USBR-Durango	T. Chart K. Lashmett	2,476	106,486
ACC1994-X:10	SJR 1994 Secondary Channel Survey	NMDGF	D.L. Propst	229	11,954

Appendix I. San Juan River specimens deposited in MSB Division of Fishes cataloged collections

MSB ACC	Project Name	Source	Principle	Lots	Specs
ACC1995-VI:4	SJR 1995 Fishes Early Life History Seine Collections	UDWR-Moab	T. Chart	998	46,310
ACC1995-VI:4	SJR 1995 Larval Fish Drift Net Collections	MSB	S.P. Platania	722	5,163
ACC1995-VI:4	SJR 1995 Secondary Channel Collections	NMDGF	D.L. Propst		
ACC1995-XII:18	SJR 1995 Eggs and Larvae for identification	E.R.I.	T. Gilson	119	769
ACC1996-II:7	SJR 1996 Secondary Channel Survey	NMDGF	D.L. Propst		
ACC1996-VII:1	SJR 1996 Larval Colorado Pikeminnow Drift Net Survey	MSB	S.P. Platania	240	1,265
ACC1996-VII:1	SJR 1996 Early Life History Seine Collections	UDWR-Moab	T. Chart	826	58,296
ACC1997-VII:9	SJR 1997 Larval Colorado Pikeminnow Drift Net Survey	MSB	S.P. Platania	337	2,144
ACC1997-VII:9	SJR 1997 Early Life History Seine Collections	UDWR-Moab	T. Chart	347	14,972
ACC1997-VII:9	SJR 1997 Secondary Channel Survey	NMDGF	D.L. Propst	624	8,956
ACC1997-IV:1	SJR 1997 Razorback Sucker Light Trap Survey	MSB	S.P. Propst	63	296
ACC1998-VII:5	SJR 1998 Early Life History Seine Collections	UDWR-Moab	T. Chart		
ACC1998-VII:5	SJR 1998 Larval Colorado Pikeminnow Drift Net Survey	MSB	S.P. Platania	523	2,457
ACC1998-IV:22	SJR 1998 Larval Razorback Sucker Light Trap Survey	MSB	S.P. Platania	391	13,610
ACC1998-VII:31	SJR 1998 Rates of Drift Transport Study-Incidental Coll'ns	MSB	S.P. Platania		
ACC1998-XI:2	SJR 1998 Secondary Channel Survey	NMDGF	D.L. Propst	504	4,257
ACC1999-IV:9	SJR 1999 Larval Razorback Sucker Seine Survey	MSB	S.P. Platania	351	20,339
ACC1999-VI:22	SJR 1999 Rates of Drift Transport Study-Incidental Coll'ns	MSB	S.P. Platania		
ACC1999-VI:23	SJR 1999 Early Life History Seine Collections	USWR-Moab	T. Chart		
ACC1999-VI:23	SJR 1999 Larval Colorado Pikeminnow MEC Survey	MSB	S.P. Platania	180	363
ACC1999-VI:23	SJR 1999 Secondary Channel Survey	NMDGF	D.L. Propst		

Appendix I. San Juan River specimens deposited in MSB Division of Fishes cataloged collections

MSB ACC	Project Name	Source	Principle	Lots	Specs
ACC2000-IV:4	SJR 2000 Larval Razorback Sucker Drift Net Survey	MSB	S.P. Platania	506	11,382
ACC2000-VI:8	SJR 2000 Rates of Drift Transport Study-Incidental Coll'ns	MSB	S.P. Platania		
ACC2000-VII:3	SJR 2000 Secondary Channel Survey and Red Shiner Study	NMDGF	D.L. Propst	1319	27,714
ACC2000-VII:3	SJR 2000 Fishes Early Life History Seine Collections	UDWR-Moab	S. Meismer	592	21,589
ACC2000-VII:3	SJR 2000 Larval Colorado Pikeminnow Drift Net	MSB	S.P. Platania	327	2,138
ACC2001-III:28	SJR 2001 Live Larval Razorback Sucker Interim Facility	MSB	S.P. Platania	1	163
ACC2001-IV:17	SJR 2001 Larval Razorback Sucker Survey	MSB	S.P. Platania	604	95,598
ACC2001-VII:3	SJR 2001 Secondary Channel Survey	NMDGF	D.L. Propst	8	403
ACC2001-VII:3	SJR 2001 Larval Colorado Pikeminnow Drift Net Survey	MSB	S.P. Platania	307	4,873
ACC2002-IV:22	SJR 2002 Larval Razorback sucker Survey	MSB	W.H. Brandenburg	679	56,266
ACC2002-IV:22	SJR 2002 Live Larval Razorback suckers Interim Facility	MSB	T.F. Turner		
ACC2002-VII:2	SJR 2002 Species record: <i>Dorosoma cepedianum</i>	USGS-Denver	G. Mueller	1	1
ACC2002-VII:8	SJR 2002 Larval Colorado Pikeminnow Survey	MSB	M.A. Farrington	377	90,541
ACC2002-VII:8	SJR 2002 Small Bodied Fish Study	NMDGF	D.L. Propst	95	7511
ACC2003-II:26	SJR 2003 Hybrid Catostomid Collections	USFWS	D. Ryden	1	1
ACC2003-IV:24	SJR 2003 Larval Razorback Sucker Survey	MSB	W.H. Brandenburg	571	40,184
ACC2003-VII:10	SJR 2003 Larval Colorado Pikeminnow Survey	MSB	M.A. Farrington	831	34,157
ACC2003-X:19	SJR 2003 Small Bodied Fish Study	NMDGF	D.L. Propst		
ACC2004-IV:19	SJR 2004 Larval Razorback sucker Survey	MSB	W.H. Brandenburg	541	14,538
ACC2004-VII:23	SJR 2004 Larval Pikeminnow Survey	MSB	M.A. Farrington	662	145,532
ACC2004-X:5	SJR 2004 Hogback Diversion Canal	MSB	S.P. Platania		
ACC2005-I:13	SJR 2004 Small Bodied Fish Study	NMDGF	D.L. Propst	346	17,409
ACC2005-IV:6	SJR 2005 Hybrid Catostomid Collections	MSB	M.A. Farrington		
ACC2005-IV:18	SJR 2005 Larval Razorback sucker Survey	MSB	W.H. Brandenburg	502	19,163

Appendix I. San Juan River specimens deposited in MSB Division of Fishes cataloged collections

MSB ACC	Project Name	Source	Principle	Lots	Specs
ACC2005-VII:13	SJR 2005 Larval Colorado Pikeminnow Survey	MSB	M.A. Farrington	791	89,513
ACC2005-VIII:16	SJR 2005 Hogback Diversion Canal	MSB	S.P. Platania		
ACC2005-X:19	SJR 2005 Small Bodied Fish Study	NMDGF	D.L. Propst	124	1,364
ACC2006-IV:19	SJR 2006 Larval Razorback Sucker Survey	MSB	W.H. Brandenburg	591	25,080
ACC2006-VII:17	SJR 2006 Larval Colorado Pikeminnow Survey	MSB	M.A. Farrington	667	25,444
ACC2007-IV:16	SJR 2007 Larval Razorback Sucker Survey	ASIR	W.H. Brandenburg	425	21,886
ACC2007-VII:23	SJR 2007 Larval Colorado Pikeminnow Survey	ASIR	M.A. Farrington	352	30,942
ACC2007-X:14	SJR 2007 Small Bodied Fishes/Fall Monitoring	NMDGF	D.L. Propst	20	500
ACC2008-IV:14	SJR 2008 Larval Razorback Sucker Survey	ASIR	W.H. Brandenburg	339	23,318
ACC2008-VI:3	SJR 2008 Small Bodied Fishes/Fall Monitoring	NMDGF	D.L. Propst	6	504
ACC2008-VII:21	SJR 2008 Larval Colorado Pikeminnow Survey	ASIR	M.A. Farrington	666	16,964

Appendix II. MSB specimen and data processing

Specimen preservation protocol specific to San Juan River collections

1. San Juan River collections, received by MSB staff, are removed from WhirlPak sample bags and the “field formalin” (i.e., unbuffered formalin of unknown concentration) discarded. The specimens and debris are placed into glass jars with secure closures with new 5% or 10% buffered formalin for further fixing. This first step is completed within one to two days after receipt of the field collections.
2. The jars, containing unsorted collections, are arranged by field number on accession shelving in the museum archives (cool and dark environment). Original data sheets or field notes are organized and filed in the hardcopy accession files, which are maintained by MSB Collections Manager.
3. Student curatorial assistants remove jars from accession shelves in field number (field site) order, pour contents into tray with formalin (5% or 10%), and removed fish specimens from debris using insect forceps to handle delicate fish larvae. Eggs and larvae are collected into vials so that they are not damaged by labels or other larger specimens.
4. Cleaned samples are returned to accession shelves in any one of the following preservatives, depending on how long the specimens have been in formalin for tissue fixing: 5% buffered formalin, 10% buffered formalin, water or 35% ethanol for the initial rinse of formalin, or eggs and larvae are maintained in 5% buffered formalin for long-term archives.
5. As samples are being cleaned and transferred to 50% ethanol or into fresh 5% buffered formalin, MSB staff (trained in larval fish identification and San Juan River fishes) sort the collections to species. One field site collection is worked on at a time to avoid mixing collections from different localities. As each species is identified, the series is counted and the smallest and largest of the series measured in millimeters for standard length or total length (for larvae only). Species identifications and lengths are recorded on “catalog sheets.”
6. All field and specimen data are captured in an electronic catalog. Once completed, vial and jar labels are produced on a spun bound polyester tag medium via thermal transfer printing system (a permanent label). The student curatorial assistants insert these labels into vials and jars and file the newly labeled jars into the permanent, cataloged collection by taxa and drainage.

Appendix III. MSB specimen and data processing

Table 1. Specimen table field structure, MSB NTop.db

Field Name	Field Type	Metadata
Catnum	Number	MSB catalog number-unique numeric
Genus	Text	Genus-current designation
Species	Text	Species-current designation
Subspecies	Text	Subspecies-current designation
Station	Text	Field no. for locality data-unique alphanumeric
Spec	Number	Number of specimens in series
Origno	Text	Any other number related to specimen lot
NK	Text	Numbers associated with tissues derived from series
ID	Text	Author of current designation
Invoice	Text	Transaction number assigned to loan, gift derived from series
IDDate	Date/Time	Date when current specimen taxa designation made
ACC_No	Text	Accession number assigned to project-unique alphanumeric
Kind_Type	Text	Vial Jar or Tank specimen deposition
Calcld	Calcld	Alphanumeric assigned to Vial Jar
Other Kind_Type	Text	Special Collections, Type storage/deposition
Storage	Text	70% EtOH, 95% EtOH, 50% ISOH, 5% & 10% Formalin, -80C
Storage_Secondary	Text	70% EtOH, 95% EtOH, 50% ISOH, 5% & 10% Formalin, -80C
Storage_Tertiary	Text	70% EtOH, 95% EtOH, 50% ISOH, 5% & 10% Formalin, -80C
Specimen_Preparation	Text	Fin clip, tissue, blood sample, etc.
Size_From	Number	Minimal standard length of specimen in cataloged series
Size_To	Number	Maximum standard length of specimen in cataloged series
Measure	Text	SL or TL
Remarks	Text	Any comments related to specimen record
Last_Modified	Date/Time	Updated field-changes made to specimen record
Date_Created	Date/Time	Original date for specimen record entered in catalog
Inventory	Text	T or F specimen inventory
Invoice_Conditions	Text	Transaction conditions
Published	Text	Published: journal, year, vol., number, pages
Taxonomic_History	Text	Original descriptions
Voucher Collection	Text	Specimens designated as vouchers for genetic collections
Link_to_Specimen_Photo	Hyperlink	Linked to photos, data sheets, or other relevant files

Appendix III. MSB specimen and data processing

Table 2. Locality table field structure, MSB NBottom.db

Field Name	Field Type	Metadata
Station	Text	Indexed field. Key. Field number-unique
Continent	Text	Also Ocean
Country	Text	Also Island
Drainage	Text	MSB defined drainages
State	Text	Also Province
County	Text	Also District
Original_Locality	Text	Locality descriptor verbatim by collector
Locality	Text	Edited "Original Locality" by Collections Manager
LatDeg	Number	
LatMin	Number	
LatSec	Number	
LatHem	Text	
LongDeg	Number	
LongMin	Number	
LongSec	Number	
LongHem	Text	
LAT_DEC	Number	Latitude decimal degrees
LONG_DEC	Number	Longitude decimal degrees
UTM_Easting	Number	6 numbers start
UTM_Northing	Number	7 numbers start
UTM_Zone	Text	UTM zone start
UTM_Easting_Stop	Number	6 numbers stop
UTM_Northing_Stop	Number	7 numbers stop
UTM_Zone_Stop	Text	UTM Zone stop
Coordinate_Det	Text	GPS, Map, etc. by collector or data manager
Precision	Text	S=second, M=Minute, G=Quadrangle, U=Unmappable
Datum	Text	NAD27, NAD83 or WGS1984
Coordinate Confidence	Text	High-Medium-Low
Gear_Depth_Min	Number	
Gear_Depth_Max	Number	
Water_Depth_Min	Number	
Water_Depth_Max	Number	
Secchi_Depth	Number	
Secchi_Depth_Max	Number	
Gear	Text	
Time_From	Date/Time	Military time start/single value
Time_To	Date/Time	Military time end
Project	Text	
Collector	Text	
DateColl_From	Date/Time	
DateColl_To	Date/Time	
Remarks	Text	
Photograph Number	Text	
RM_Start	Number	River mile starting point
RM_Stop	Number	River mile ending point
Township	Text	

Appendix III. MSB specimen and data processing

Table 2. Locality table field structure, MSB NBottom.db continued

Field Name	Field Type	Metadata
Range	Text	
Section	Text	
USGS Quadrangle	Text	Topo map name
USGS HUC Values	Number	USGS Hydrologic Unit Map number
Width_Min	Number	
Width_Max	Number	
Salinity_Min	Number	
Salinity_Max	Number	
Last_Mod	Date/Time	Updated field-changes made to locality record in Nbottom.db
Date_Created	Date/Time	Original date locality record entered NBottom.db
Temp_Min	Number	
Temp_Max	Number	
Water_Descriptor	Text	Riffle, main channel, backwater, pool, etc.
Current_Min	Number	
Current_Max	Number	
Vegetation	Text	Aquatic vegetation
Air_Temp_Min	Number	
Air_Temp_Max	Number	
Bottom_Substrate	Text	
Shore Description	Text	
Min_Gear_Distance	Number	
Max_Gear_Distance	Number	
Effort	Number	Seine effort calculation
DO_Min	Number	
DO_Max	Number	
Conductivity_True	Number	
Conductivity_Specific	Number	
pH_Min	Number	
pH_Max	Number	
Shock_Seconds	Number	Electrofisher effort
Volts	Number	Electrofisher effort
Amps	Number	Electrofisher effort
Start_Flow	Number	Flow meter effort beginning value
End_Flow	Number	Flow meter effort ending value
Flow_Total	Number	Flow meter effort (End-Start)
Link_to_Photo	Hyperlink	Link to habitat photograph
Link_to_Field_Notes	Hyperlink	Link to pdf file of original field note

Appendix III. MSB specimen and data processing

Table 3. Released fishes table structure, MSB RNTop.db

ID1	Number	Index field-sequential numbers
R Catnum	Text	Contains "RELEASED"
Genus	Text	Genus-field identification
Species	Text	Genus
Subspecies	Text	Genus
Station	Text	Field No.-Unique
Spec	Number	Number of fishes released
Origno	Text	Any other no. related to corresponding specimen lot
NK	Text	Tissue No.
ID	Text	Author of field identification
ID Date	Date/Time	Date of field identification
ACC_No	Text	Accession no. of project-unique
Size_From	Number	Minimal standard length of released fishes
Size_To	Number	Maximum standard length of released fishes
Measure	Text	SL or TL
Remarks	Text	Additional information re: released fishes
Last_Mod	Date/Time	Updated field-changes made to specimen record
Date_Created	Date/Time	Original date for specimen record entered in catalog

Appendix IV. MSB specimen and data processing

Field No.: WHR07-064

Date: 14 June / 2007 Sample: Acc. No.: 2007-IV-16

State/Country: Utah USA Locality: San Juan River @ RM 11.5

County: San Juan Co. Drainage: San Juan Quad: Slickhorn canyon West

Coordinate System: N2d 27 N/S: 4128040 E/W: 565734 Zone: 12S

Shore Description: inundated phragmites, sandstone cliffs Air Temp.: 29 °C

Water Description: backwater

Substrate: Silt & organic matter Water Depth: 4.0 m

Aquatic Vegetation/Cover: inundated phragmites

Water Temp.: 20.6 °C Velocity (est.): 0 m/s Width (est.): 12 m

Secchi Depth: 23 cm D.O.: 5.22 mg/l Conductivity: 310.1/335.6 µS Salinity: 0.2 ppt pH: 8.42

Method of Capture: laval seine / 1m x 1m

No. Hauls: 7 Area: 29.4 m² Shocking Sec.: Volts: Amps:

Distance from Shore (est.): m Depth of Capture: 0.6 - .68 m

Collected by: WHR Brandenburg & MAF Arrington

Time: (start) 0837 h (stop) 0905 h Notes taken by: WHR Brandenburg

Orig. Preservative: 10% Formalin Photographs: 0116

Released fishes: Yes / No (list separately):

Water from the main channel backs up into the mouth of this a large canyon on river right. No bank is visible simply a path that meanders through tall stands of phragmites. Hauls did not produce lots of fish but low numbers of larval catostomids (and possibly cyprinids) were collected throughout the site. Catostomid larvae ranged from early life stages through juvenile. We spooked a flock of teal (blue wing) from this backwater when we approached. Haul lengths were 2.3 m, 3.4 m, 2.8 m, 5.0 m, 5.6 m, 5.1 m & 5.2 m

Figure 7. San Juan River field note, American Southwest Ichthyological Researchers

Appendix IV. MSB specimen and data processing

River: SJR Date: 11 JUL 00 Field Coll. No: JLP4542
 State: NM County: SAN JUAN River Mile(s): _____ to _____
 Time: 0850 to _____ Weather: SCATTERED Ambient Temp: _____
 Secondary Channel Type: DRIFT Crew: DE P. ALH

	<u>Below pool</u> <u>2^o Channel</u>	<u>pool above</u> <u>base</u>	<u>Main Channel</u>
Water Temp:	<u>25.3</u>	<u>24.1</u>	<u>34.0°</u>
Dissolved O ₂	<u>4.4</u>	<u>1.8</u>	<u>2.6</u>
Conductivity:		<u>11.64 milli</u>	<u>37.31 milli</u>
Salinity:		<u>6.8</u>	<u>19.8</u>
PHOTOS			

Pool @ base

Comments: Fish common - but few in large
pool @ base of site. Tadpoles common.
Several dead catfish in shallow pools
Tadpoles feeding on dead fish. H₂O
slightly lower than 6 jul 00. No
evidence of flow spike

THERMOGRAPH DOWNLOADED @
1030 HRS ON 11 JUL 00

Figure 8. Digitally captured field note. New Mexico Department of Game and Fish