

2010 San Juan River Specimen Curation
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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March 2011
DRAFT

2010 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

SUBMITTED BY:
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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 (completed in 2000) has further facilitated research by providing better access to specimens and ensuring long-term preservation of the collections for future investigations. Note that collections listed in Appendix I without counts for specimens and lots are not yet cataloged into the MSB database.

In our efforts to maintain the San Juan River collections and field data in optimal conditions, the MSB Division of Fishes follows a “best practices” guide for the conservation of museum collections (Cato, 2001). We adhere to recommendations for preservation of fish collections and data by following those of 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 17 years, MSB staff have maintained professional contacts with various experts in the field of “best practices” for both larval and adult fish specimen preservation. These experts include Darrel E. Snyder, Colorado State University; David L. Smith, Natural History Museum, Smithsonian Institution; Karsten E. Hartel, Museum of Comparative Zoology, Harvard.

METHODS

“Processing” San Juan River specimens of fishes and associated data refers to formally accessioning (hard files created for permits, field notes, and other paperwork) collections received from the field crews; cleaning the samples and transferring the collections through various concentrations of fluid preservatives (formalin and ethanol); separating the collections by species, measuring and counting the specimens; verifying specimen identifications; electronic capture of locality and habitat data and specimen data; digital capture of original field notes; and cataloging and labeling specimen collections; georeferencing the collection sites; and filing the specimens and original field notes in the MSB archives.

All incoming collections are removed from field containers (usually Whirl-Paks®) and field formalin (estimated with river water), cleaned by separating specimens from river debris, and transferred to either 5% buffered formalin for larvae (Markle, 1984) or 10% buffered formalin for adult specimens for complete fixing of tissues. 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. Some examples of the larval fishes may remain in 5% buffered formalin as a final preservative because it has been found to maintain some morphological features better than ethanol. (D.E. Snyder, pers. comm.) Each lot of fish

specimens is counted 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 as a MSB loan to Mr. Snyder for species verification. A detailed description by Mr. Snyder of verified specimens is filed in the accession hard files and these accounts are readily available to SJRRIP researchers.

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

Genetic collections and collections for otolith extractions consist of San Juan River fish larvae fixed and preserved in 95% ethanol or frozen in -80°C ultracold freezer. Fin clips from suspected hybrid catostomids (*Xyrauchen texanus* x *Catostomus* spp) are preserved in 95% ethanol for later analysis. Genetic examples are assigned a specimen number and cross referenced with formalin fixed vouchers (if available). Specimens fixed and maintained in 95% ethanol for otolith extraction are cataloged and filed accordingly.

Processing rates for incoming San Juan River specimens have been variable over the years depending on several issues like the lapse of time between the actual field collection and when the collection is received by MSB staff; 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. In the summer of 2007, the complete 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 (1993-2004), which are (2009-11) being removed from moving boxes, curated, and organized for incorporation into the MSB collections.

The second part of the MSB specimen processing protocol is data entry, data and file organization and management. There are three primary MS Access data tables (Appendix III): specimen data, locality/collection data, and released fishes data or a total of 134 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 specimen data (Table 1) are cataloged and entered by the MSB staff in an electronic catalog or table labeled "NTOP." These data relate to the physical deposition of the specimens, their identification, size class, and abundance.

San Juan River locality data are captured in 85 possible fields or a table labeled "NBOTTOM" (Table 2). Students are trained to efficiently and correctly enter locality data received in various

formats; required do a “QC” or quality-control check of data before submitting to the Collections Manager; and consult with the Collections Manager regarding ambiguous or errors in original locality data. Final checks of all locality data entries and verifications are the responsibility of the MSB Collections Manager (Chapman, 2005). Delays in entry of locality data occur only when field data are inaccurately or poorly recorded on original field/data sheets; when handwriting is illegible; when MSB staff must verify “in house” terminology; when field data are recorded in unknown (to us) codes or abbreviated terms; and when locality information is ambiguous. In these cases, MSB personnel must contact field crews for clarification prior to data entry.

Once locality data are entered, San Juan River localities are georeferenced, using GEOLocate© Version 3.0 software, a package developed specifically for natural history collection data. In the MSB’s effort to georeferenced all of its catalog collections, there are now 17,973 MSB locality records (out of 34,142 total) georeferenced in the database. Of these, 5,059 records are San Juan River localities (1940-2010). The collections from these localities can be mapped using ArcView, a geographic information system (GIS) software for visualizing, managing, creating, and analyzing geographic data.

Data for released fishes are entered into a third, primary table labeled, “RNTOP (Table 3).” The field structure is similar to Ntop except there is no catalog number; this table is linked to the collection catalog (Ntop) if voucher collections exist.

Museum staff also scan and “clean” digital images of all San Juan River field notes that are received with specimens. These images are saved in two formats: TIFF and PDF and maintained in the museum computer catalog. PDF files of all original field notes and habitat pictures (as JPEG files) are hyperlinked to individual specimen and locality records in the MSB database. When fully operational, these links will allow researchers to view all original field notes, photographs of habitat and live fishes, and spreadsheets with project-related information. As of 2010, student Curatorial Assistants have digitally captured 23,738 pages of San Juan River field notes and data sheets, received from American Southwestern Ichthyological Researchers, L.L.C., the New Mexico Department of Game and Fish, Utah Department of Wildlife Resources, US Bureau of Reclamation, and past years of MSB field crews.

The San Juan River database and digital files of field notes and photographs is backed up on aWestern Digital® ShareSpace 4TB network storage system.

<http://www.wdc.com/en/products/products.asp?driveid=501>

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.



Figure 1. MSB Division of Fishes archives

The MSB collections of fish specimens (47% from the San Juan River) now occupy 1,858 linear meters of shelving, which includes growth space (Figure 1). Shelving units are mobile or “compacted shelving” eliminating unused aisle space, which means more space for shelves (Figure 2).

The fluid collection 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 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). San Juan River collections are initially processed in 5% buffered formalin, making it necessary to have good ventilation. Barrels of chemicals are easily accessible in a new flammable storage room; distilled water points of use, compressed air and vacuum outlets are placed throughout the lab areas. These new preparation and research labs have ample room for working with specimen jars and lap top computers (electronic calipers); there are multiple workstations for researchers, staff, and student employees (Figure 4). 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 a primary source of funding for acquiring these supplies.

The MSB operating budget (i.e., permanent funds from New Mexico State funding) has purchases jars, tanks, and preservation fluids. Due to increased freight charges, inflation, and current economic conditions, many of the supplies have become very 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. The annual cost for formalin buffering chemicals is \$840, and \$500 for a 55 gallon barrel of 95% ethanol (technical grade). The MSB Division of Fishes typically uses 12 barrels of ethanol per year for conservation of the collections. Funding received from the US Bureau of Reclamation has been funding for materials and supplies has been crucial for the MSB to completely and professionally curate these collections from the San Juan River.



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



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

Permanent staff at the MSB Division of Fishes includes a 0.33 FTE Curator of Fishes and 1.0 FTE Collections Manager. Temporary employees include: 1.0 FTE for 2010-2011, and students: one 0.5 FTE Graduate Student RA and three 0.125 FTE undergraduate student employees. The temporary employee salaries are funded by the U.S. Bureau of Reclamation contract 05-FG-40-2411 and the graduate student RA salary by the UNM Biology Department. Over the past 17 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 biology, 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.

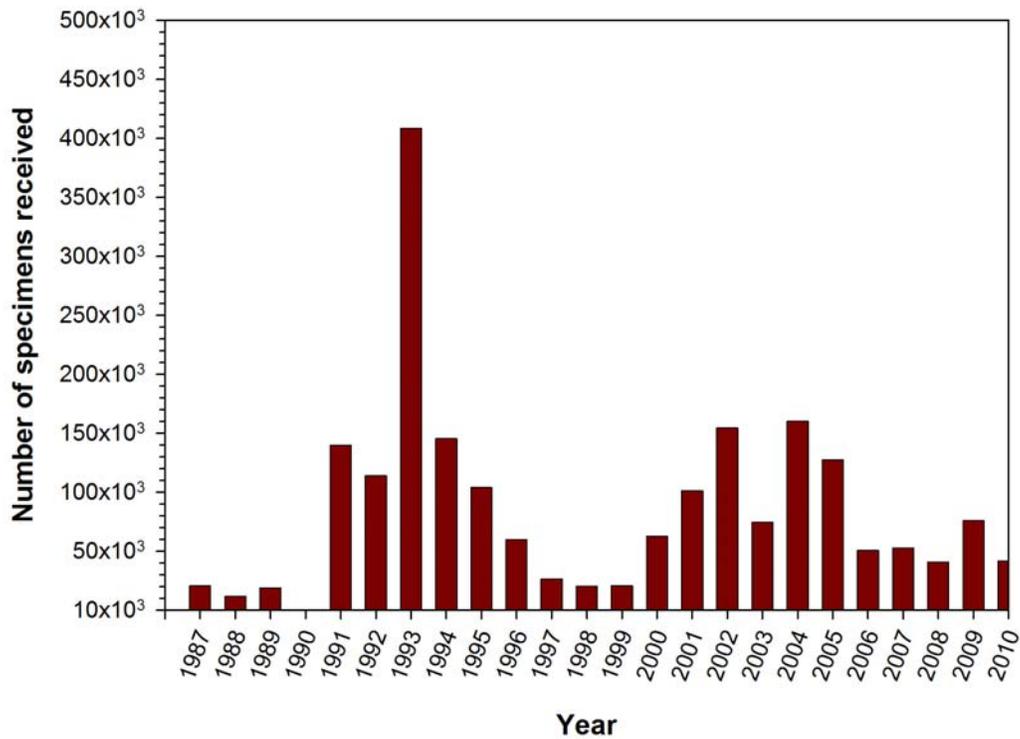
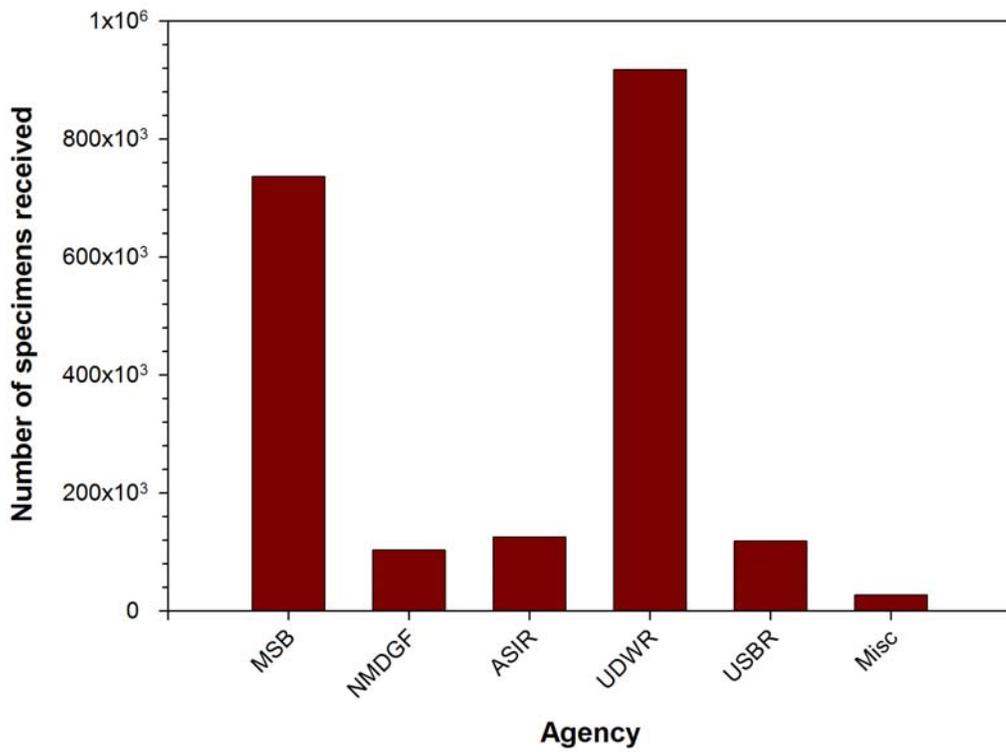
Primary contributors of San Juan River specimens have been American Southwest Ichthyological Research, Albuquerque NM (ASIR), Museum of Southwestern Biology, Albuquerque NM (MSB), the New Mexico Department of Game and Fish, Santa Fe (NMDGF), Utah Department of Wildlife Resources, Moab CO (UDWR), US Bureau of Reclamation, Durango CO (USBR), and US Fish and Wildlife Service, Grand Junction CO (Figure 5).

RESULTS

To date, 34,356 lots or 1,574,460 specimens collected by the San Juan River research group have been processed, cataloged, and archived at the Museum of Southwestern Biology, Division of Fishes (Figure 6). 5,059 San Juan River collection sites have been georeferenced and can be mapped in ArcView. Approximately 15,477 pages of field notes (locality data) and data sheets have been entered into the MSB database. 23,362 pages of San Juan River field notes and data sheets have been digitally captured, cleaned, and saved in tiff and pdf formats for electronic archiving; the original field notes and data sheets are stored in acid free document boxes for long-term conservation, available only by special request. (Figures 7, 8, and 9).

ACKNOWLEDGMENTS

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Figures 5 and 6. Number of Specimens received 1987-2010 by agency and by year

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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. Meisner	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
ACC2009-IV:13	SJR 2009 Larval Razorback Sucker Survey	ASIR	W.H. Brandenburg	377	5,663
ACC2009-VII:27	SJR 2009 Colorado Pikeminnow Survey	ASIR	M.A. Farrington	549	66,489
ACC2009-XII:8	SJR 2009 Small Bodied Fishes	NMDGF	D.L. Propst	74	3,924
ACC2010-III:25	SJR 2010 Larval Razorback Sucker Survey	ASIR	W.H. Brandenburg	566	12,646
ACC2010-VII:19	SJR 2010 Larval Colorado Pikeminnow Survey	ASIR	M.A. Farrington	663	28,624
ACC2010-XI:16	SJR 2010 Small Bodied Fishes	NMDGF	A.M. Monie	13	186

Appendix II. MSB specimen and data processing

San Juan River larval fish specimen processing protocol

1. San Juan River collections are removed from Whirl-Pak® sample bags within a week after receipt by MSB staff. All “field formalin” (i.e., unbuffered formalin of unknown concentration) discarded is discarded. The specimens and debris are transferred to glass jars and into new 5% buffered formalin for further fixing. Larval specimens fixed in 95% ethanol for genetics or otolith extraction are removed from Whirl-Pak sample bags, cleaned of debris and put into new 95% ethanol, which is the final preservative.
2. 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. Unprocessed collections in 5% buffered formalin are cleaned by student curatorial assistants by pour contents of one collection (larvae and debris) into a tray and removing larval fish specimens from debris using insect forceps. Unsorted fish 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: 5% buffered formalin or 95% ethanol. If the specimens in 5% formalin are to be transferred to 70% ethanol as the final preservative, then they are transferred from formalin to 35% ethanol for the initial rinse of formalin, then to 50% ethanol, and finally to 70% ethanol. Otherwise, larvae are maintained in 5% buffered formalin for long-term archives.
5. As samples are being sorted and identified they are transferred to fresh 5% buffered formalin. Again, 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 into an Excel spreadsheet using a notebook laptop.
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), MSB 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
Calcfld	Calcfld	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	
CoordConfidence	Text	High-Medium-Low
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
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. continued Locality table field structure, MSB NBottom.db

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)
Photo_file_name	Text	
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.: WHB07-064

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: Nad 87 @S: 4128040 @W: 565734 Zone: 12S

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

Water Description: backwater

Substrate: Silt & organic matter Water Depth: 40 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: 310.1/3356 µS Salinity: 0.2 ppt pH: 8.42

Method of Capture: brail 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: WHBrendenburg & MAFerrington

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

Orig. Preservative: 10% Formalin Photographs: 016

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 brail 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 2.3m, 3.4m, 2.8m, 5.0m, 5.6m, 5.1m & 5.2m

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

Appendix IV. MSB specimen and data processing

River: SAN JUAN Date: 5 OCT 09 Field Coll. No: DUP09-547
 State: UT County: SAN JUAN River Mile(s): 114.5 to _____
 Time: _____ to _____ Weather: OVERCAST Ambient Temp: _____
 Secondary Channel Type: _____ Crew: DUP, KB, YMA, SMC

	<u>2° Channel</u>	<u>Main Channel</u>
Water Temp:	<u>17.3</u>	<u>17.3</u>
Dissolved O ₂	<u>110%/11.45</u>	<u>98%/10.5</u>
Conductivity:	<u>384/507</u>	<u>384/507</u>
Salinity:	<u>0.2</u>	<u>0.2</u>
	<u>12 0672865</u>	<u>41100805</u>

Comments: 20 001 RIVER LEFT
LOW DIVERSITY
CLEAN - LITTLE SILT

Figure 8. Digitally captured San Juan River field note, New Mexico Dept. of Game and Fish

Appendix IV. MSB specimen and data processing

Acc 1993-IT:22

SAN JUAN ICHTHYOLOGICAL INVESTIGATIONS

Larval Fish Drift Study

Location: River mile 61 Date: 6-24-91
 Net Location: Mid River Net set from: 6:00am to 7:00am
 Distance from Shore: mid river Water Depth: 51'6" Substrate: sand
 Water Temperature: 17°C Ambient Temperature: 11°C
 Flow, Beginning: _____ End: _____ Total: _____
 Collection No.: W6-24-91 Weather: clear & calm Crew: CMW DJVM
 Comments: Large amounts of debris, large amounts of suspended sediments

Field Sorted: CMW DJVM Date: 6-25-91

1/2 gallon of debris, large amounts of aquatic insects, no larval fish at all
sorting time 8 hours combined. Do not know the reason for lack of fish.

x c

→ 95246
 → 31628

Figure 9 Digitally captured field data sheet San Juan River larval drift net surveys, Utah Dept. of Wildlife Resources