Museum of Southwestern Biology
2015 San Juan River Specimen Curation and Data Synthesis and Integration

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Award R13AP40007

1 October 2014 to 30 September 2015

2015 SAN JUAN RIVER SPECIMEN CURATION AND DATA SYNTHESIS AND INTEGRATION FOR SAN JUAN RIVER RECOVERY IMPLEMENTATION PROGRAM (SJRRIP)

DIVISION OF FISHES
MUSEUM OF SOUTHWESTERN BIOLOGY
UNIVERSITY OF NEW MEXICO

Award R13AP40007

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DRAFT REPORT

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and

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Table of Contents

List of Tables and Figures

Page

INTRODUCTION SJRRIP SPECIMEN CURATION

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), field notes, and habitat photographs taken for the San Juan River Recovery Implementation Program (SJRRIP). Genetic samples, derived from these research activities, are also archived in the MSB in -80C freezers and 95% ethanol.

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 specimen and lot counts are not yet cataloged into the MSB database but in process.)

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) and data capture (Chapman, 2005). 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 19 years, MSB staff has maintained professional contacts with various experts in the field of museum "best practices" for both larval and adult fish specimen preservation as well as loans of comparative material for positive identification of San Juan River Basin species. These experts include Darrel E. Snyder, Larval Fish Lab, Colorado State University; David L. Smith, Division of Fishes, Natural History Museum, Smithsonian Institution; Karsten E. Hartel, Museum of Comparative Zoology, Harvard; Douglas W. Nelson, Museum of Zoology, University of Michigan.

METHODS USED FOR SJRRIP SPECIMEN CURATION

"Processing" San Juan River specimens of fishes and associated data refers to 1) following a formal accession protocol of documenting specimen conditions, filing permits, field notes, and other paperwork for SJRRIP collections received by the MSB; 2) cleaning the samples and transferring the collections through various concentrations of fluid preservatives for long-term storage; 3) separating the collections by species, measuring and counting the specimens; 4) verifying specimen identifications; 5) electronic capture of locality and habitat data and specimen data; 6) georeferencing the collection sites; 7) digital capture of original field notes for electronic archives; 8) cataloging and labeling specimen collections; and 9) filing the specimens and original field notes in the MSB permanent archives.

All incoming collections are removed from field containers (usually Whirl-Paks®) and "field formalin" (an approximated measurement of formaldehyde 1 part to river water 9 parts), cleaned by separating specimens from river debris, and transferring the collections 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. Currently, many

collections of fish larvae are fixed and maintained in 95% ethanol for otolith extraction and analysis. Some examples of the larval fishes may remain in 5% buffered formalin as a final preservative because morphological features are maintained better than in 70% ethanol, which causes some shrinkage. (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. As necessary, specimens that cannot be identified by SJRRIP researchers are sent on loan to Mr. Snyder for species verification. He provides a detailed description of larval characters for all collections verified or identified. This report is filed in the MSB files and made 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, 95% 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 (Bentley, 2004). The cataloged and labeled collections are then filed in the permanent archives, organized by 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 numbers so they can be 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 past 20 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.

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 are cataloged and entered by the MSB staff in an electronic catalog (Appendix III. NTop.db). 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 (Appendix III. NBottom.db).

Students are trained to enter locality data received in various field note formats; required to do a "QC" or quality-control check of data before submitting to the Collections Manager; and consult with the Collections Manager regarding ambiguous localities 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. For the past 8 years, San Juan River localities have been georeferenced, using GEOLocate© Version 3.0 software, a package developed specifically for natural history collection data. There are 38,905 locality records in the MSB database. Of these records, 19,540 records are San Juan River localities (1940-2014). All MSB specimen records are now completely edited, verified, georeferenced (NSF funding 2012-2014), and available on FishNet2, a portal for fish collections' data. These data can be searched and downloaded to three file types: .txt, .csv, and .kml. The site provides mapping capability to either plot records found in a search or to draw a search polygon. The records all have decimal latitude and longitude assigned to them so that they can be used in ArcView, a geographic information system (GIS) software for visualizing, managing, creating, and analyzing geographic data. http://fishnet2.net/aboutFishNet.html

In the next year, the MSB Division of Fishes database will transfer to Arctos, a comprehensive collection management information system, utilizing the Texas Advanced Computing Center servers for storage. http://arctosdb.org/

Data for released fishes (Appendix III. RNTop.db) are entered into a third, primary table labeled, "RNTOP." The field structure is similar to NTOP except there are no catalog numbers; data are mostly observational.

MSB Division of Fishes undergraduate student employees scan all San Juan River field notes received with specimens and "clean" digital images (Photoshop CS3) for the permanent electronic files. These images are saved in two formats: TIFF and PDF and archived in the Division server, Dell PowerEdge T110 II. PDF files of all original field notes and habitat pictures (JPEG files) are linked to individual specimen and locality records in the MSB database for viewing. That is, when researchers and staff open a locality or specimen record in the MSB database they can also view a PDF of the original field notes or JPG files of habitat and fish photographs, as well as associated spreadsheets with project information. As of 2015, student Curatorial Assistants have digitally captured over 25,000 pages (tifs) of San Juan River field notes and data sheets, received from American Southwestern Ichthyological Researchers, LLC, New Mexico Department of Game and Fish, Utah Department of Wildlife Resources, US Bureau of Reclamation, and (in past years) MSB field crews. (See Appendix IV for field note formats.)

The San Juan River database and all associated digital files of field notes and photographs are also backed up on a local Western Digital® ShareSpace 4TB network storage system, a Dell PowerEdge T110 II, and offsite private FTP site set up by the University of New Mexico Zimmerman Library Digital Data Management, Curation, and Archiving Department.

MUSEUM FACILITIES PROVIDED FOR SJRRIP SPECIMEN CURATION

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 fishes (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 wet pipe sprinkler system, floor drains with holding tank for large spills, and controlled room access (alarmed to UNM 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.
In 2014, upgrades were made to the HVAC system to control temperature and air flow. A new smoke alarm system was also installed.

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

Processing San Juan River collections has been greatly facilitated by having two fume hoods with large processing sinks and eleven workstations with point exhaust or fume collectors in the specimen preparation labs (Figure 3). Many of the 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 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 throughout the building thereby aiding in data transfer between staff and researchers.

Durable, high quality supplies and materials are necessary to successfully preserve and curate San Juan River specimens. These supplies include glass jars, either Le Parfait captive lid jars with custom made Buna-N rubber gaskets or Paragon flint glass jars with polypropylene caps and stainless steel "cadaver" tanks with nylon gaskets that are chemical resistant. All specimen containers, used by the MSB, are considered standard and acceptable for long-term preservation of fluid preserved collections (Cato, 2001). Forty percent of the total MSB fish collection is maintained in glass jars, the smallest being 8 ounce Paragon flint glass to the largest, the 3-liter Le Parfait glass jar with captive lid. Five percent of the collection is stored in gasketed, stainless steel tanks (18 and 35 gallon capacity) used for oversized fish specimens. About fifty-five percent of the collections are maintained in borosilicate (nonreactive) glass vials that are stored in 3-liter Le Parfait jars (i.e., a vial jar system) filled with either 5% buffered formalin, 70% ethanol, or 95% ethanol.

Typically, vial jar collections contain fish larvae and eggs. 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 an important source of funding for acquiring these some of these supplies.

The MSB operating budget (i.e., permanent funds from New Mexico State funding) has purchased 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 cost for a 55-gallon drum of 95% ethanol (technical grade) can vary each year but on an average costs $500 a drum. (MSB Division of Fishes typically uses 8 to 10 drums of ethanol per year for specimen preservation.) Funding received from the US Bureau of Reclamation has been crucial for purchasing preservation chemicals and other supplies for optimal curation of San Juan River specimen collections.

Figure 3. MSB fish specimen preparation lab

Figure 4. MSB Research lab for fish identification and analyses

For 2015, permanent staff at the MSB Division of Fishes are Curator of Fishes (0.33 FTE) and Collections Manager (1.0 FTE). Funded under USBR Grant Agreement R13AP40007, the Graduate Student Research Assistant (1.0 FTE), charged with collecting and identifying larval fishes from the Upper Colorado River Basin; Curatorial Assistant (0.76 FTE), charged with processing, cataloging, and integrating all San Juan River fish specimens and records; two undergraduate curatorial assistants (0.38 FTE) to assist in museum lab; Curator of Fishes (0.08 FTE) summer salary; and a Postdoctoral (1.0 FTE) position for data synthesis and integration.

Primary contributors (past and present) 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 UT (UDWR), US Bureau of Reclamation, Durango CO (USBR), and US Fish and Wildlife Service, Grand Junction CO.

RESULTS FOR SJRRIP SPECIMEN CURATION

To date, 44,255 lots or 1,530,729 specimens collected by the San Juan River research group have been processed, cataloged, and archived at the Museum of Southwestern Biology, Division of Fishes (Figures 5 and 6). There are 19,540 unique San Juan River collection sites georeferenced and available in ArcView. Over 25,000 pages of San Juan River field notes and data sheets have been digitally captured, cleaned, and saved in tif 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.

REFERENCES FOR SJRRIP SPECIMEN CURATION

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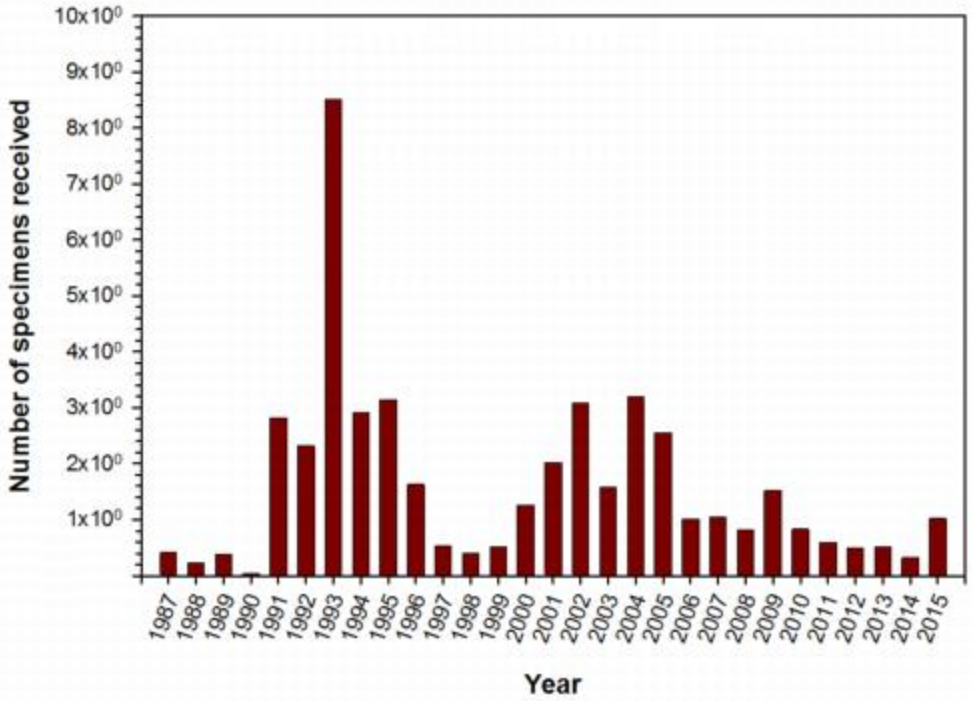


Figure 5. Number of specimens received by MSB from the San Juan River Recovery Implementation Program, 1987-2015.

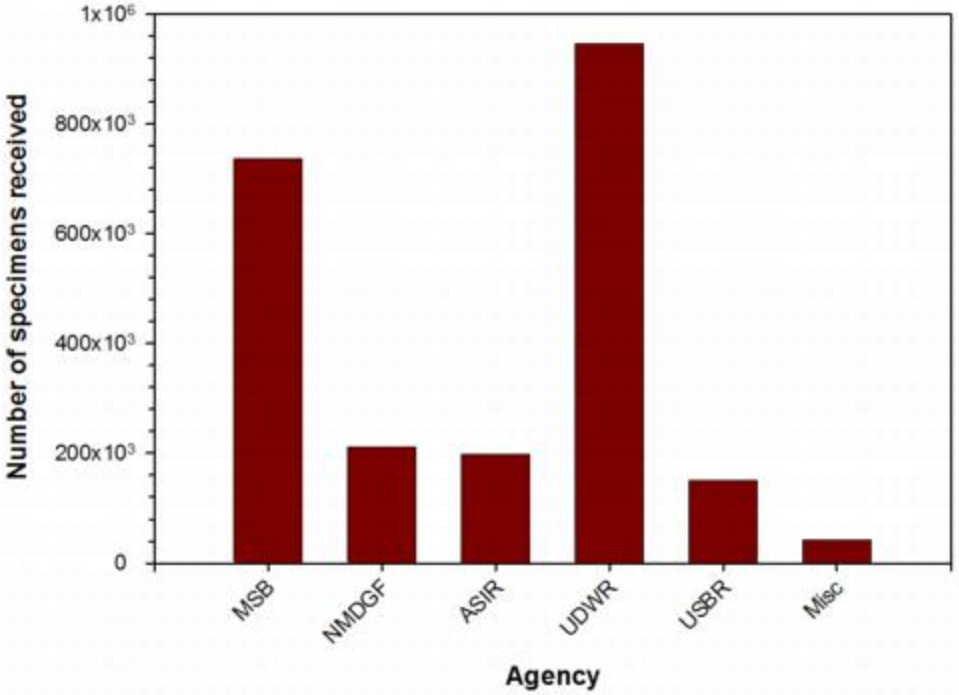


Figure 6. Number of specimens MSB received from the San Juan River Recovery Implementation Program by agency between 1987 – 2015.

Appendix I. SJRRIP Specimens Received by MSB Division of Fishes

MSB ACC	Project Name	Source/ Principle	Lots	Spec'ns
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	19824
Unacc 1988	SJR 1988 Secondary Channel Survey	NMDGF, D.L. Propst	274	11614
Unacc 1988	SJR 1988 Species Record: *Ptychocheilus lucius*	UDWR, B. Roberts	1	1
Unacc 1989	SJR 1989 Animas & San Juan R.	MSB, S.P. Platania	194	11051
Unacc 1989	SJR 1989 Secondary Channel Survey	NMDGF, D.L. Propst	57	7624
Unacc 1990	SJR 1990 Secondary Channel Survey	NMDGF, D.L. Propst	146	1589
Unacc 1991	SJR 1991 Drift Net at NM RM 119.7	UDWR	61	2475
Unacc 1991	SJR 1991 Fishes Early Life History	UDWR	3422	120077
Unacc 1991	SJR 1991 Secondary Channel Survey	NMDGF, D.L. Propst	114	1323
Unacc 1991	SJR 1991 Fishes Early Life History	USBR, K. Lashmett	76	17245
Unacc 1991	SJR 1991 Species Record: *Ptychocheilus lucius*	USFWS, F.K. Pfeifer	1	1
Unacc 1992	SJR 1992 NM RM 119.7 & UT RM 53	UDWR, C. Wethington	361	1137
Unacc 1992	SJR 1992 Fishes Early Life History	UDWR	3189	93489
Unacc 1992	SJR 1992 Fishes Early Life History	USBR, K. Lashmett	122	18214
Unacc 1992	SJR 1992 Secondary Channel Survey	NMDGF, D.L. Propst	161	2000
Unacc 1992	SJR 1992 Upper Reach	MSB, S.P. Platania	17	262
Unnacc 1993	SJR 1993 Secondary Channel Survey	NMDGF, D.L. Propst	503	17177
	Formal museum accessioning started in 1993			
ACC1993-II:2	SJR 1991-1993 Fishes Young of Year Survey	USBR, K. Lashmett	652	73557
ACC1993-II:22	SJR 1991 Fishes Early Life History Seine Coll'ns	UDWR, M.J. Buntjer	3780	122536
ACC1993-III:31	SJR 1992 Fishes Early Life History Seine Coll'ns	UDWR, M.J. Buntjer	3550	94626
ACC1993-VIII:23	SJR 1993 Fishes Early Life History Seine Coll'ns	UDWR, M.J. Buntjer	2889	117448
ACC1993-X:25	SJR 1993 Species Record:Ctenopharyngodon idella	USFWS, J.E. Brooks	1	1
ACC1994-VIII:26	SJR 1994 Light Trap Coll'ns: Lake Powell	NPS-AZ, S. Dodson	58	26889
ACC1994-X:10	SJR 1994 Drift Net & Seine Coll'ns Surveys	USBR/UDWR	2476	106486
ACC1994-X:10	SJR 1994 Secondary Channel Survey	NMDGF, D.L. Propst	229	11954

Appendix I. SJRRIP Specimens Received by MSB Division of Fishes, cont.

MSB ACC	Project Name	Source/ Principle	Lots	Spec'ns
ACC1995-VI:4	SJR 1995 Fishes Early Life History Seine Coll'ns	UDWR, T. Chart	998	46310
ACC1995-VI:4	SJR 1995 Larval Fish Drift Net Coll'ns	MSB, S.P. Platania	722	5163
ACC1995-VI:4	SJR 1995 Secondary Channel Coll'ns	NMDGF, D.L. Propst	899	53613
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	431	21779
ACC1996-VII:1	SJR 1996 Larval Colorado Pikeminnow Drift Net Survey	MSB, S.P. Platania	240	1265
ACC1996-VII:1	SJR 1996 Early Life History Seine Coll'ns	UDWR, T. Chart	826	58296
ACC1997-VII:9	SJR 1997 Larval Colorado Pikeminnow Drift Net Survey	MSB, S.P. Platania	337	2144
ACC1997-VII:9	SJR 1997 Early Life History Seine Coll'ns	UDWR, T. Chart	347	14972
ACC1997-VII:9	SJR 1997 Secondary Channel Survey	NMDGF, D.L. Propst	624	8956
ACC1997-IV:1	SJR 1997 Razorback Sucker Light Trap Survey	MSB, S.P. Platania	63	296
ACC1998-VII:5	SJR 1998 Early Life History Seine Coll'ns	UDWR, T. Chart		
ACC1998-VII:5	SJR 1998 Larval Colorado Pikeminnow Drift Net Survey	MSB, S.P. Platania	523	2457
ACC1998-IV:22	SJR 1998 Larval Razorback Sucker Light Trap Survey	MSB, S.P. Platania	391	13610
ACC1998-VII:31	SJR 1998 Rates of Drift Transport-Incidental Coll'ns	MSB, S.P. Platania		
ACC1998-XI:2	SJR 1998 Secondary Channel Survey	NMDGF, D.L. Propst	504	4257
ACC1999-IV:9	SJR 1999 Larval Razorback Sucker Seine Survey	MSB, S.P. Platania	351	20339
ACC1999-VI:22	SJR 1999 Rates of Drift Transport-Incidental Coll'ns	MSB, S.P. Platania		
ACC1999-VI:23	SJR 1999 Early Life History Seine Coll'ns	UDWR, 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	264	4773

Appendix I. SJRRIP Specimens Received by MSB Division of Fishes, cont.

MSB ACC	Project	Source/ Principle	Lots	Spec'ns
ACC2000-IV:4	SJR 2000 Larval Razorback Sucker Drift Net Survey	MSB, S.P. Platania	506	11382
ACC2000-VI:8	SJR 2000 Drift Transport Study-Incidental Coll'ns	MSB, S.P. Platania		
ACC2000-VII:3	SJR 2000 Secondary Channel & Red Shiner Study	NMDGF, D.L. Propst	1319	27714
ACC2000-VII:3	SJR 2000 Fishes Early Life History Seine Collections	UDWR, S. Meismer	592	21589
ACC2000-VII:3	SJR 2000 Larval Colorado Pikeminnow Drift Net	MSB, S.P. Platania	327	2138
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	95598
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	4873
ACC2002-IV:22	SJR 2002 Larval Razorback sucker Survey	MSB, W.H. Brandenburg	679	56266
ACC2002-IV:22	SJR 2002 Live Larval Razorback suckers Interim Facility	MSB, T.F. Turner		
ACC2002-VII:2	SJR 2002 Species record: *Dorosoma cepedianum*	USGS, G. Mueller	1	1
ACC2002-VII:8	SJR 2002 Larval Colorado Pikeminnow Survey	MSB, M.A. Farrington	377	90541
ACC2002-VII:8	SJR 2002 Small Bodied Fish Study	NMDGF, D.L. Propst	95	7511
ACC2003-II:26	SJR 2003 Hybrid Catostomid Coll'ns	USFWS, D. Ryden	1	1
ACC2003-IV:24	SJR 2003 Larval Razorback Sucker Survey	MSB, W.H. Brandenburg	571	40184
ACC2003-VII:10	SJR 2003 Larval Colorado Pikeminnow Survey	MSB, M.A. Farrington	831	34157
ACC2003-X:19	SJR 2003 Small Bodied Fish Study	NMDGF, D.L. Propst	250	4654
ACC2004-IV:19	SJR 2004 Larval Razorback sucker Survey	MSB, W.H. Brandenburg	541	14538
ACC2004-VII:23	SJR 2004 Larval Pikeminnow Survey	MSB, M.A. Farrington	662	145532
*ACC2004-X:5	SJR 2004 Hogback Diversion Canal	MSB, S.P. Platania	222	1545
ACC2005-I:13	SJR 2004 Small Bodied Fish Study	NMDGF, D.L. Propst	346	17409
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	19163
ACC2005-VII:13	SJR 2005 Larval Colorado Pikeminnow Survey	MSB, M.A. Farrington	791	89513
ACC2005-VIII:16	SJR 2005 Hogback Diversion Canal	MSB, S.P. Platania		

Appendix I. SJRRIP Specimens Received by MSB Division of Fishes, cont.

MSB ACC	Project	Source/ Principle	Lots	Spec'ns
ACC2005-X:19	SJR 2005 Small Bodied Fish Study	NMDGF, D.L. Propst	124	1364
ACC2006-IV:19	SJR 2006 Larval Razorback Sucker Survey	MSB, W.H. Brandenburg	591	25080
ACC2006-VII:17	SJR 2006 Larval Colorado Pikeminnow Survey	MSB, M.A. Farrington	667	25444
ACC2007-IV:16	SJR 2007 Larval Razorback Sucker Survey	ASIR, W.H. Brandenburg	425	21886
ACC2007-VII:23	SJR 2007 Larval Colorado Pikeminnow Survey	ASIR, M.A. Farrington	352	30942
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	23318
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	16964
ACC2009-IV:13	SJR 2009 Larval Razorback Sucker Survey	ASIR, W.H. Brandenburg	377	5663
ACC2009-VII:27	SJR 2009 Colorado Pikeminnow Survey	ASIR, M.A. Farrington	549	66489
ACC2009-XII:8	SJR 2009 Small Bodied Fishes Survey	NMDGF, D.L. Propst	74	3924
ACC2010-III:25	SJR 2010 Larval Razorback Sucker Survey	ASIR, W.H. Brandenburg	566	12646
ACC2010-VII:19	SJR 2010 Larval Colorado Pikeminnow Survey	ASIR, M.A. Farrington	663	28624
ACC2010-XI:16	SJR 2010 Small Bodied Fishes Survey	NMDGF, A.M. Monie	13	186
ACC2011-IV:19	SJR 2011 Larval Razorback Sucker Survey	ASIR, W.H. Brandenburg	373	10550
ACC2011-VII:18	SJR 2011 Larval Colorado Pikeminnow Survey	ASIR, M.A. Farrington	490	17704
*ACC2011-VIII:26	Lake Powell 2011-2015 Razorback Sucker Survey	USFWS, B. Hines	1725	46,171
ACC2011-IX:14	SJR 2011 Small Bodied Fishes Survey	NMDGF, A.M. Monie & E.I. Gilbert	36	400
ACC2012-II:29	Survey of Dirty Devil River, UT	ASIR, S.P. Platania	36	174
ACC2012-IV:16	SJR 2012 Larval Fishes Survey	ASIR W.H. Brandenburg & M.A. Farrington	883	26852
ACC2012-X:4	SJR 2012 Small Bodied Fishes Survey	NMDGF A.M. Monie & E.I. Gilbert	17	170
ACC2013-IV:15	SJR 2013 Larval Fishes Survey	ASIR W.H. Brandenburg & M.A. Farrington	964	25938
ACC2013-IX:17	SJR 2013 Small Bodied Fishes Survey	NMDGF E.I. Gilbert	20	160
ACC2014-IV:21	SJR 2014 Larval Fishes Survey	ASIR, W.H. Brandenburg & M.A. Farrington	710	14,806
ACC2014-IV:28	SJR Native Fish Stable Isotope Study	MSB, N.R. Franssen & NMDGF, E.I. Gilbert	9	9
ACC2014-IX:15	SJR Small Bodied Fishes	NMDGF, E.I. Gilbert	55	825

MSB ACC	SJRRIP Project	Source	Lots	Spec'ns
ACC2015-IV:20	SJR 2015 Larval Fishes Survey	ASIR, W.H. Brandenburg & M.A. Farrington	560	17,819
ACC2015-VI:5	SJR Ecosystems Restoration Initiative	NMDGF, M.P. Zeigler	7	18
ACC2015-IX:21	SJR Catostomid Spawning Periodicity	KSU N. Cathcart	48	576
ACC2015-XI:18	SJR 2015 Small-Bodied Fishes Survey	NMDGF, M.P. Zeigler	48	240

* Open Accession –possible short term project or continuous

Appendix II. MSB Protocol for SJRRIP Specimen and Specimen Data Curation

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.

Appendix II. continued MSB Protocol for SJRRIP Specimen and Specimen Data Curation

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.

7. Specimen data and all associated digital files of field notes and photographs are backed up and archived on a local Western Digital® ShareSpace 4TB network storage system, a Dell PowerEdge T110 II, and offsite private FTP site set up by the University of New Mexico Zimmerman Library Digital Data Management, Curation, and Archiving Department.

Appendix III. MSB Data Tables: NTop.db Specimen Data		
Field Name	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 Freezer
Storage_Secondary	Text	70% EtOH, 95% EtOH, 50% ISOH, 5% & 10% Formalin, -80C Freezer
Storage_Tertiary	Text	70% EtOH, 95% EtOH, 50% ISOH, 5% & 10% Formalin, -80C Freezer
Specimen_Prep	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 Standard or Total Length
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

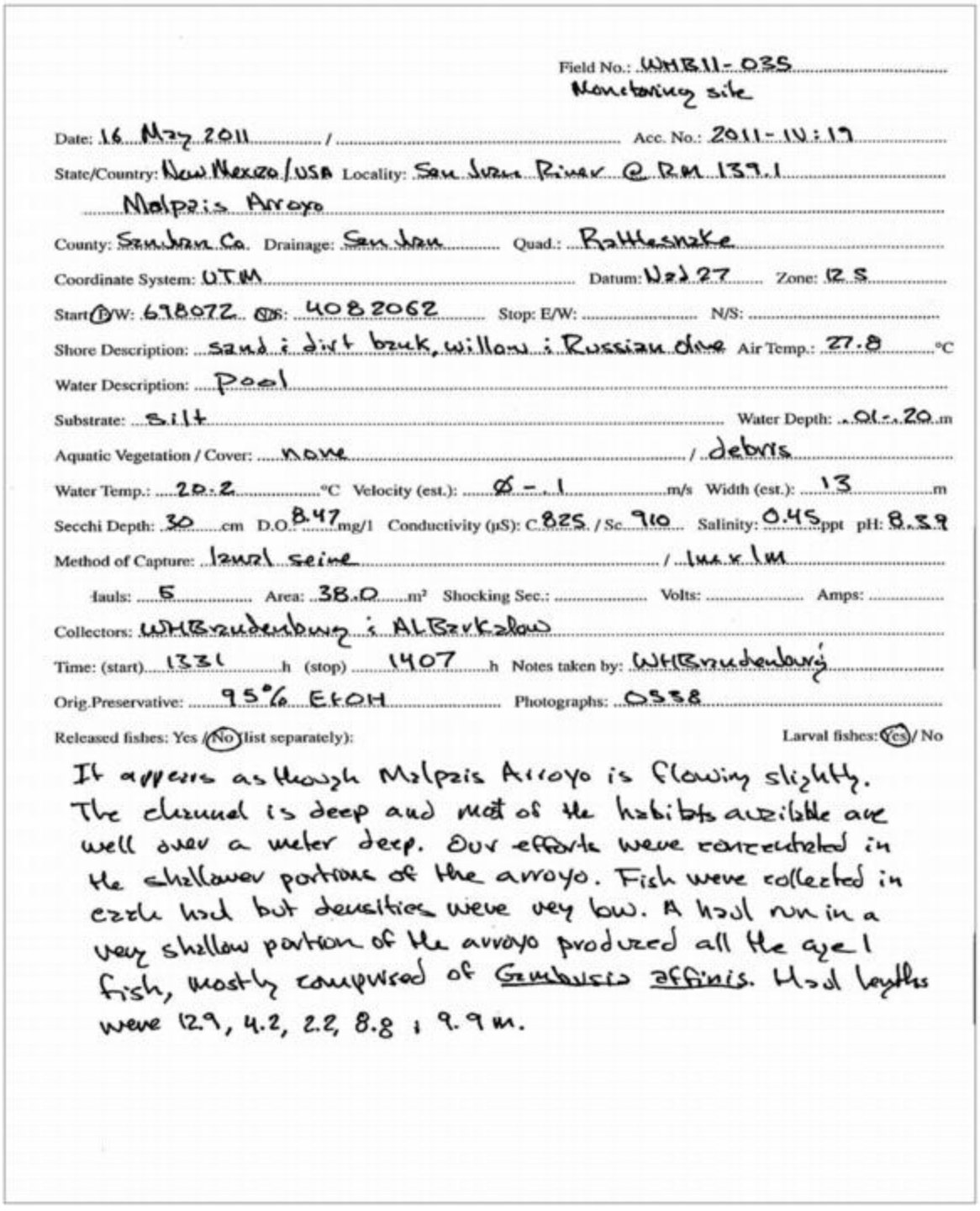
Appendix III. MSB Data Tables: NBottom.db Locality Data		
Field Name	Type	Metadata
Station	Text	Indexed field. Key. Field number-unique
Continent	Text	Also Ocean
Country	Text	Also Island
Drainage	Text	MSB defined drainages
State	Text	Also Province
County	Text	Also District
Original_Locality	Text	Locality descriptor verbatim by collector
Locality	Text	Edited "Original Locality" by Collections Manager
Designation_Locality	Text	State land, private land, national park, etc.
LatDec	Number	Latitude decimal degrees
LongDec	Number	Longitude decimal degrees
CoordConfidence	Number	Site within meters
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
Datum	Text	NAD27, NAD83 or WGS1984
Gear_Depth_Min	Number	Placement of collecting gear-minimum meters
Gear_Depth_Max	Number	Placement of collecting gear-maximum meters
Water_Depth_Min	Number	Depth of water at coll'n site-minimum meters
Water_Depth_Max	Number	Depth of water at coll'n site-maximum meters
Secchi_Depth	Number	Water Visibility at coll'n site-meters
Gear	Text	Type of collecting gear
Time_From	Date/Time	Military time start/single value
Time_To	Date/Time	Military time end
Project	Text	Name of project/purpose for collecting event
Collector	Text	Initials first name, full last name-all collectors. E.g. A.M. Snyder
Associated Field Nos	Text	Field numbers for data recorded at same collecting event
DateColl_From	Date/Time	dd/MON/yyyy e.g. 4 JAN 2013 start effort
DateColl_To	Date/Time	dd/MON/yyyy e.g. 4 JAN 2013 end effort
Remarks	Text	255 character space for comments re: collecting effort
Photograph Number	Text	Number assigned by collector to photo
RM_Start	Number	River mile starting point
RM_Stop	Number	River mile ending point
Township	Text	US BLM system E.g. T34
Range	Text	US BLM system E.g. R14
Section	Text	US BLM system Sec01 NW

Appendix III. MSB Data Tables: NBottom.db Locality Data, continued

Field Name	Type	Metadata
USGS Quadrangle	Text	Topo map name
USGS HUC Values	Number	USGS Hydrologic Unit Map number
Width_Min	Number	Waterbody width-minimum meters
Width_Max	Number	Waterbody width-maximum meters
Salinity_Min	Number	Water salinity-minimum ppt
Salinity_Max	Number	Water salinity-maximum ppt
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	Water temperature-minimum Celsius
Temp_Max	Number	Water temperature-maximum Celsius
Water_Descriptor	Text	Riffle, main channel, backwater, pool, etc.
Current_Min	Number	Water current-minimum meters/seconds
Current_Max	Number	Water current-maximum meters/seconds
Vegetation	Text	Aquatic vegetation and descriptors
Air_Temp_Min	Number	Ambient air temperature-minimum Celsius
Air_Temp_Max	Number	Ambient air temperature-maximum Celsius
Bottom_Substrate	Text	Substrate descriptor at collection site
Shore Description	Text	Descriptor of shoreline at site of collection
Min_Gear_Distance	Number	Placement of collecting gear from shoreline
Max_Gear_Distance	Number	Placement of collecting gear from shoreline
Effort	Number	Seine effort calculation
DO_Min	Number	Dissolved oxygen mg/l minimum
DO_Max	Number	Dissolved oxygen mg/l maximum
Conductivity_True	Number	Water Conductivity-true µS
Conductivity_Specific	Number	Water Conductivity-specific Sc
pH_Min	Number	pH minimum
pH_Max	Number	pH maximum
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)

Appendix III. MSB Data Tables: RNTop.db Observation/Released Collections of Fishes		
Field Name	Type	Metadata
ID1	Number	ACCESS Index field
R Catnum	Text	Contains "RELEASED"
Genus	Text	Genus-Field ID
Species	Text	Species-Field ID
Subspecies	Text	Subspecies-Field ID
Station	Text	Field No.-Unique
Spec	Number	Number of fishes released
Origno	Text	MSB catalog number of same species vouchers from same field no.
NK	Text	Tissue No./Genetic Sample
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	Standard or Total Length
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. Examples of SJRRIP Field Notes.



Field No.: WMB11-035
Monitoring site

Date: 16 May 2011 / Acc. No.: 2011-IV:17

State/Country: New Mexico / USA Locality: San Juan River @ RM 139.1
Malpais Arroyo

County: San Juan Co. Drainage: San Juan Quad.: Rattlesnake

Coordinate System: UTM Datum: Nad 27 Zone: 12 S

Start (E)W: 678072 (N)S: 4082062 Stop: E/W: N/S:

Shore Description: sand : dirt bank, willow : Russian olive Air Temp.: 27.8 °C

Water Description: Pool

Substrate: silt Water Depth: .01-.20 m

Aquatic Vegetation / Cover: none / debris

Water Temp.: 20.2 °C Velocity (est.): 0 - .1 m/s Width (est.): 13 m

Secchi Depth: 30 cm D.O. 8.47 mg/l Conductivity (µS): C 825 / Sc. 910 Salinity: 0.45 ppt pH: 8.59

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

Hauls: 5 Area: 38.0 m² Shocking Sec.: Volts: Amps:

Collectors: WHBrudenburg : ALBurkhalow

Time: (start) 1331 h (stop) 1407 h Notes taken by: WHBrudenburg

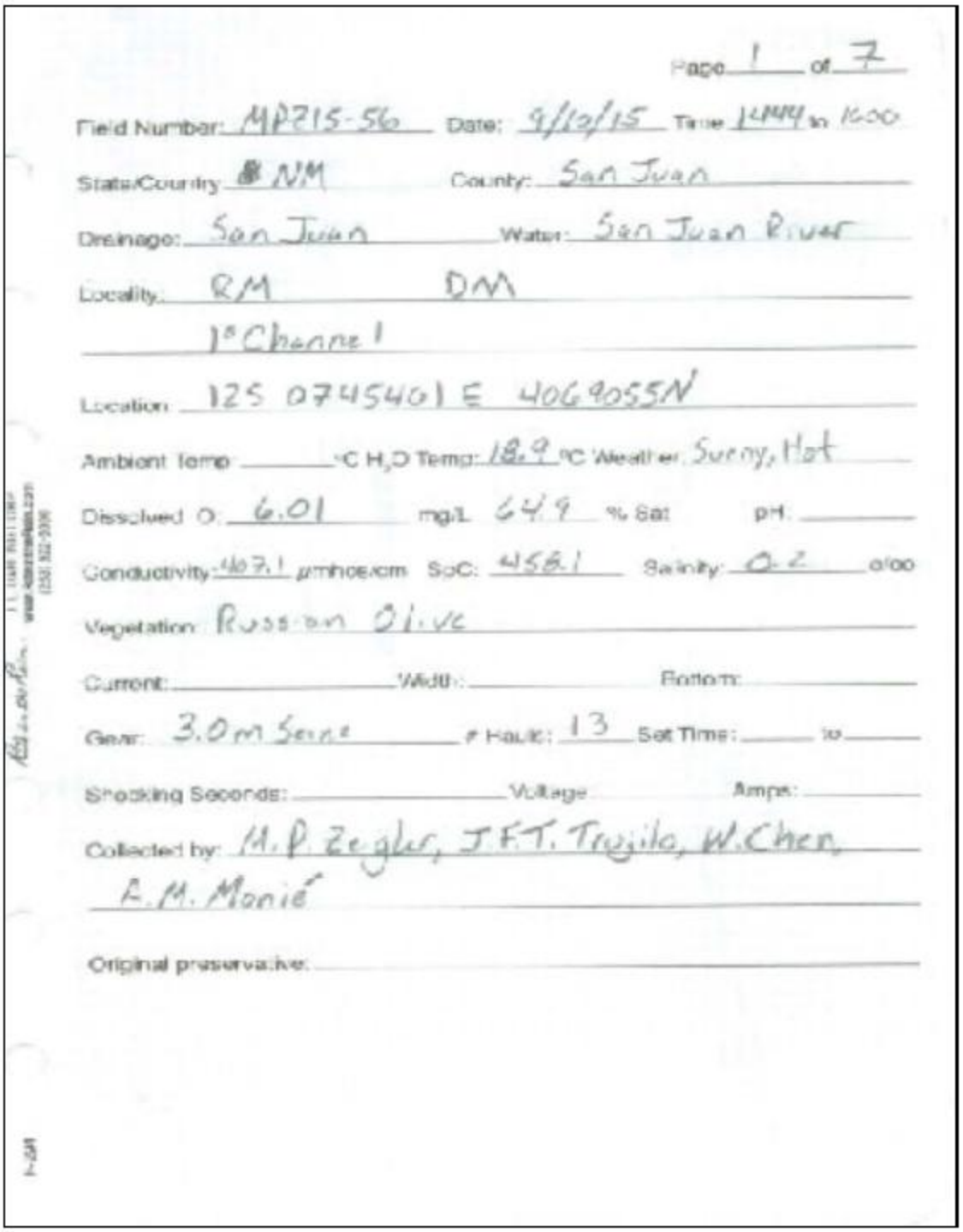
Orig. Preservative: 95% EtOH Photographs: 0338

Released fishes: Yes / (No) list separately): Larval fishes: (Yes) / No

It appears as though Malpais Arroyo is flowing slightly. The channel is deep and most of the habitats available are well over a meter deep. Our efforts were concentrated in the shallower portions of the arroyo. Fish were collected in each haul but densities were very low. A haul run in a very shallow portion of the arroyo produced all the age 1 fish, mostly comprised of Gambusia affinis. Haul lengths were 12.9, 4.2, 2.2, 8.8 & 9.9 m.

American Southwest Ichthyological Researchers (ASIR)

Appendix IV. Examples of SJRRIP Field Notes, cont.



Page 1 of 7

Field Number: MP715-56 Date: 9/10/15 Time: 1444 to 1600

State/Country: NM County: San Juan

Drainage: San Juan Water: San Juan River

Locality: RM DM

1° Channel

Location: 12S 0745401 E 4069055N

Ambient temp °C H$_2$O Temp: 18.9 °C Weather: Sunny, Hot

Dissolved O: 6.01 mg/L 64.9 % Sat pH:

Conductivity: 467.1 µmhos/cm SpC: 458.1 Salinity: 0.2 o/oo

Vegetation: Russian Olive

Current: Width: Bottom:

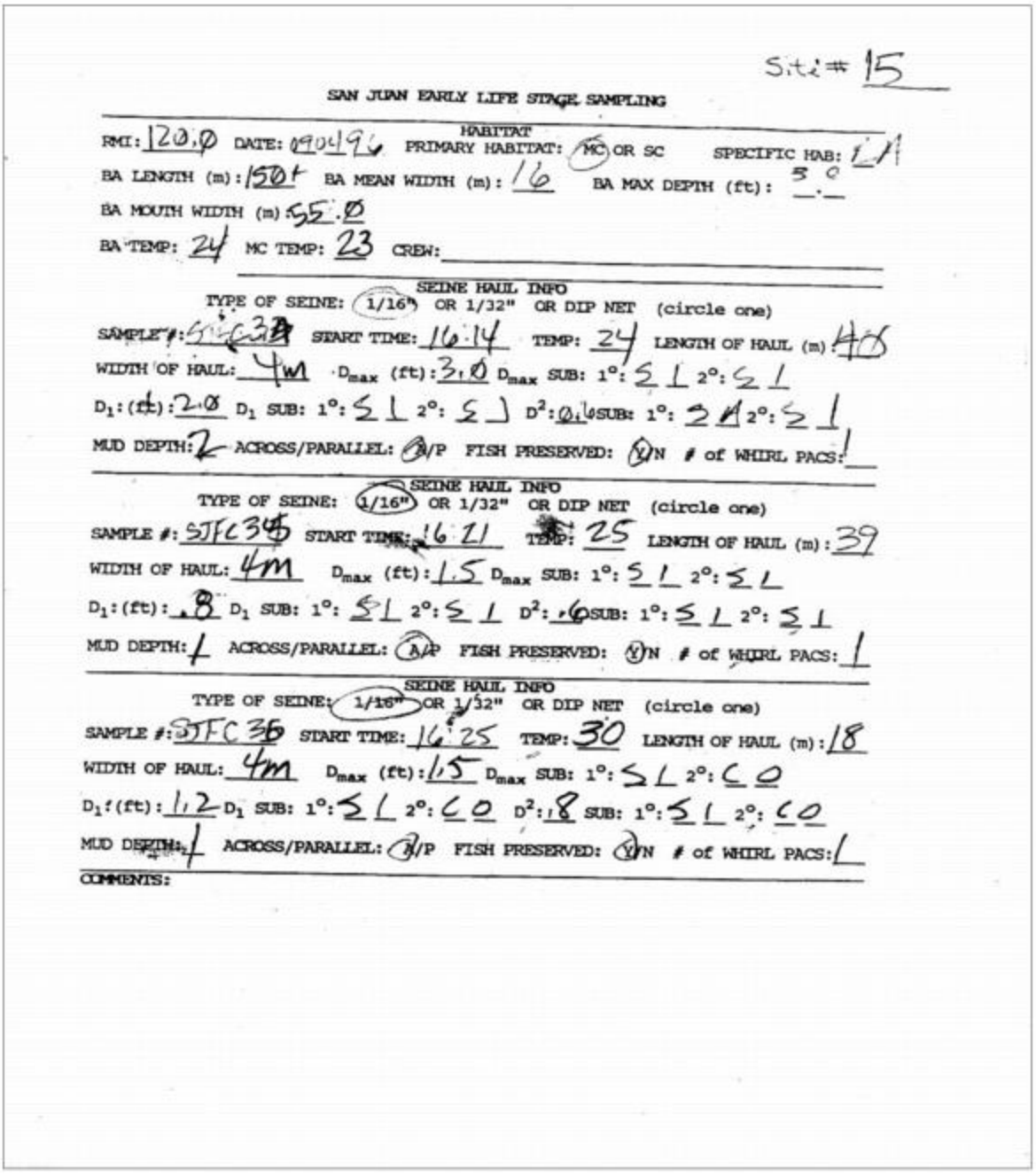
Gear: 3.0m Seine # Hauls: 13 Set Time: to

Shocking Seconds: Voltage: Amps:

Collected by: M.P. Zeigler, J.F.T. Trujillo, W. Chen, R.M. Monié

Original preservative:

Appendix IV. Examples of SJRRIP Field Notes, cont.



Site # 15

SAN JUAN EARLY LIFE STAGE SAMPLING

HABITAT

RMI: 120.0 DATE: 09049 PRIMARY HABITAT: (MC) OR SC SPECIFIC HAB: LA

BA LENGTH (m): 150+ BA MEAN WIDTH (m): 16 BA MAX DEPTH (ft): 5.0

BA MOUTH WIDTH (m): 55.0

BA TEMP: 24 MC TEMP: 23 CREW: _____

SEINE HAUL INFO

TYPE OF SEINE: (1/16") OR 1/32" OR DIP NET (circle one)

SAMPLE #: SJFC34 START TIME: 16.14 TEMP: 24 LENGTH OF HAUL (m): 46

WIDTH OF HAUL: 4M D_{max} (ft): 3.0 D_{max} SUB: 1°: ≤1 2°: ≤1

D_1: (ft): 2.0 D_1 SUB: 1°: ≤1 2°: ≤1 D^2: 0.6 SUB: 1°: 2 2°: ≤1

MUD DEPTH: 2 ACROSS/PARALLEL: (A)/P FISH PRESERVED: (Y)N # of WHIRL PACS: 1

SEINE HAUL INFO

TYPE OF SEINE: (1/16") OR 1/32" OR DIP NET (circle one)

SAMPLE #: SJFC35 START TIME: 16.21 TEMP: 25 LENGTH OF HAUL (m): 39

WIDTH OF HAUL: 4M D_{max} (ft): 1.5 D_{max} SUB: 1°: ≤1 2°: ≤1

D_1: (ft): .8 D_1 SUB: 1°: ≤1 2°: ≤1 D^2: .6 SUB: 1°: ≤1 2°: ≤1

MUD DEPTH: 1 ACROSS/PARALLEL: (A)/P FISH PRESERVED: (Y)N # of WHIRL PACS: 1

SEINE HAUL INFO

TYPE OF SEINE: (1/16") OR 1/32" OR DIP NET (circle one)

SAMPLE #: SJFC36 START TIME: 16.25 TEMP: 30 LENGTH OF HAUL (m): 18

WIDTH OF HAUL: 4M D_{max} (ft): 1.5 D_{max} SUB: 1°: ≤1 2°: ≤0

D_1: (ft): 1.2 D_1 SUB: 1°: ≤1 2°: ≤0 D^2: .8 SUB: 1°: ≤1 2°: ≤0

MUD DEPTH: 1 ACROSS/PARALLEL: (A)/P FISH PRESERVED: (Y)N # of WHIRL PACS: 1

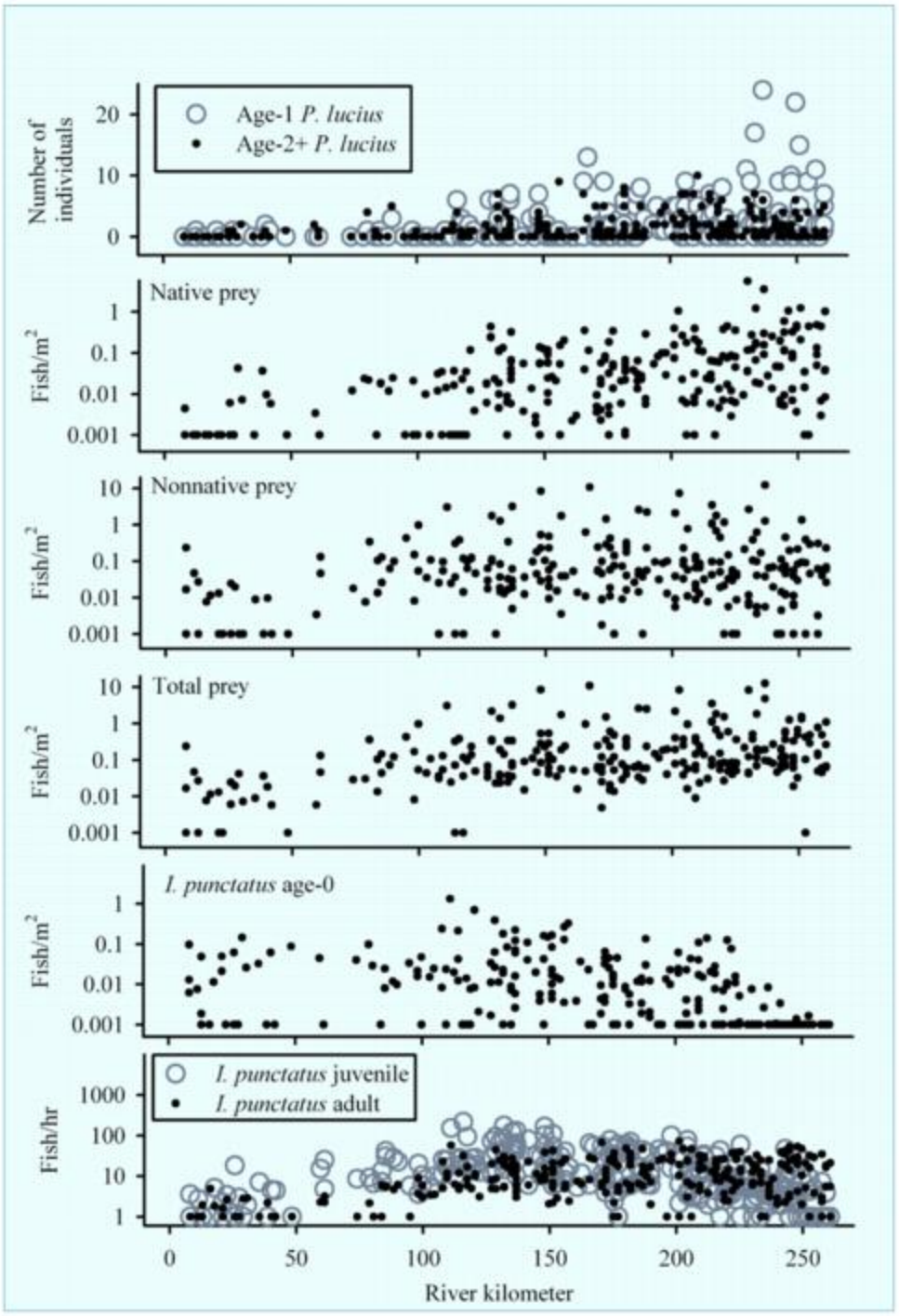
COMMENTS:

Utah Department of Wildlife Resources (UDWR)

San Juan River Restoration Implementation Program (SJRRIP)

Data Synthesis and Integration 2015

USBR AND MSB AGREEMENT R13AP40007



INTRODUCTION SAN JUAN RIVER DATA SYNTHESIS AND INTEGRATION.

Dr. Nathan R. Franssen has continued (FY15) to synthesize, analyze, and integrate relevant elements of the SJRRIP's immense database in conjunction with the Program Office biologist. As a postdoctoral research associate, Dr. Franssen possesses strong quantitative, writing, and research skills and is devoted to this project without other time commitments or academic demands. The results of Franssen's research will be presented to the Program's Biology and Coordination committees, interested public audiences, and to scientific journals for peer review and publication. Dr. Franssen will closely collaborate with those responsible for directing relevant studies (e.g., adult monitoring, nonnative fish removal, and native fish augmentation) and key researchers associated with the Program to identify critical questions for integration and analysis. Collaboration will continue with appropriate project leaders and researchers in analyzing data and drafting manuscripts detailing results of investigations. The overarching goal of these efforts will be 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 (or shortfalls).

Since October 2012, Dr. Franssen has led and collaborated in his efforts to synthesize and integrate San Juan River data, working with other SJRRIP investigators in both the office and field. These collaborators for FY14 have been Scott L. Durst (SJRRIP Program Office, Albuquerque), Dale W. Ryden (USFWS), Keith B. Gido, Ph.D. (Kansas State University), David L. Propst, Ph.D. (UNM), Eliza I. Gilbert (NMGF), and Vince Lamarra (Ecosystems Research Institute).

During FY15, issues and topics to address in SJRRIP data analysis have expanded and ongoing discussions with key Program personnel and Biology and Coordination Committees have identified additional studies beyond the FY14 scope of work. These are addressed in the FY15 Scope of Work, submitted to the Program office and the US Bureau of Reclamation.

METHODS USED IN SAN JUAN RIVER DATA SYNTHESIS AND INTEGRATION.

In FY15 Dr. Franssen worked with researchers in the SJRRIP Program Office, USFWS, Albuquerque and New Mexico Department of Game and Fish, Santa Fe to compile and analyze SJRRIP data for three projects that will help aid management activities aimed at recovering threatened San Juan River fishes:

- Survival and movement of stocked Razorback Sucker (*Xyrauchen texanus*)
- Predicted responses of a nonnative Channel Catfish (*Ictalurus punctatus*) to managed exploitation in a large southwestern river

Specific questions posed in each project necessitated the integration of several long-term SJRRIP datasets prior to analyses. These datasets were obtained from the SJRRIP Program Office and included data from: nonnative fish removal and large-bodied fish monitoring.

Appropriate statistical analyses were conducted for each project to test hypotheses, answer specific questions, or performed in a more exploratory manner. Specifics on methods used for each project can be found in the published manuscripts or in the draft manuscripts disseminated to the Biology Committee in FY15.

RESULTS AND FUTURE DIRECTIONS IN SAN JUAN RIVER DATA SYNTHESIS AND INTEGRATION

Two projects were completed in FY15. Below are the project citations with descriptions of the status of the projects and their major findings and conclusions:

Franssen, N.R. and S.L. Durst. Survival and movement of stocked Razorback Sucker (*Xyrauchen texanus*) in the San Juan River, NM and UT. *In revision.*

- This project quantified survival of stocked Razorback Sucker from different hatcheries, stocking sites on the river, and variation in stocking sizes.
- This manuscript was rejected from Transactions of the American Fisheries Society.
- This project spurred further research on effects of stocking locations and fish conditioning on survival. Two ongoing experiments, once completed will be incorporated into this revised manuscript and resubmitted.

Franssen, N.R., S.L. Durst, B. Duran, B. Hines, C.N. Cathcart, and J.E. Davis. Predicted responses of a nonnative Channel Catfish (*Ictalurus punctatus*) to managed exploitation in a large southwestern river.

- This project used fisheries stock assessment software to quantify predicted responses of the Channel Catfish population do differing levels of exploitation and minimum size limits.
- Results suggested current levels of exploitation would not crash the population; however, they will likely have a strong impact on the total amount of biomass in the river.
- Contrary to other investigations, we found the Channel Catfish population's size and biomass structure has decreased since the early 1990s, suggesting the nonnative removal program has affected the Channel Catfish population.

The results of San Juan River Restoration Implementation Program data integration and synthesis were presented at the following meetings:

- Franssen, N.R. December 3, 2014. Biology Committee Meeting. Durango, CO.
- Franssen, N.R. January 13, 2015. Annual Researchers Meeting, Moab, UT.
- Franssen, N.R. February 19, 2015. Biology Committee Meeting. Durango, CO.
- Franssen, N.R. May 12, 2015. Biology Committee Meeting. Durango, CO.
- Franssen, N.R. May 13, 2015. Biology/Coordination Committee Meeting. Durango, CO.

ACKNOWLEDGMENTS

We would like to thank the San Juan River Biology Committee for their approval of 2015 funding. We also thank Dr. Mark C. McKinstry, Grant Technical Representative, US Bureau of Reclamation, Salt Lake City, for administration of Award No. RA13AP40007.

Numerous individuals have given their time and invaluable assistance in our efforts to curate the San Juan River specimens and to synthesize, analyze, and integrate SJRRIP data used to provide scientifically sound recommendations in the areas of critical habitat restoration and recovery of endangered species.

We thank Steven P. Platania, MSB Associate Curator for his ongoing curatorial guidance in processing and archiving SJRRIP specimens. We are grateful to Maribel Solis, Kendra Brunet Lecomte, Larissa E Garcia, Shiloh Langwell, and Holly Hayes for their diligence in processing and incorporating San Juan River specimens, data, and documentation into the MSB archives. Finally, we thank W. Howard Brandenburg, Michael A. Farrington, and Adam L. Barkalow for specimen identifications and technical support in both the lab and the museum.