Population Monitoring Work Group Meeting

April 16, 2019

Meeting Materials:

Meeting Agenda

Meeting Minutes

Draft Characterization Summary of Rio Grande Silvery Minnow Population Monitoring Data Collect Using Regular Gear Under Reclamation and Middle Rio Grande Endangered Species Collaborative Program Support During February 1993 to October 2017 [draft]

Consolidation of Mesohabitat Types for the Middle Rio Grande [draft, not included]

Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

Population Monitoring Work Group (PMWG)

April 16, 2019
9:00 PM – 12:00 PM

WEST Offices
8500 Menaul Blvd NE; 3rd Floor

Call-In Information: 712-451-0011; Code 141544#

Meeting Agenda

9:00 – 9:10	**Welcome, Introductions, and Agenda Review** • **Decision**: Approval of April 16, 2019 meeting agenda	*Dave Wegner*
9:10 – 9:25	**Review of December 12, 2018 PMWG Meeting** • Review Action Items • Updates to meeting minutes • **Decision**: Approval of March 14, 2019 meeting minutes	*Dave Wegner*
9:25 – 9:45	**Options for Roles of PMWG and other Workgroups** Integration into an Adaptive Management Plan process	*Dave Wegner*
9:45-9:50	**USGS Agreement Update**	*Grace Haggerty*
9:50-10:10	**Presentation: Characterization of the RGSM Population Monitoring Data by Mike Marcus**	*Mike Marcus*
10:10 – 11:10	**Presentation: Consolidation of Mesohabitat Types for the MRG by Rich Valdez** □ Read-aheads: ○ Consolidation of Mesohabitat Types for the MRG Report	*Rich Valdez*
11:10 – 11:50	**Model Support Efforts by the PMWG** • What type of models need to be developed, refined, or utilized? • What actions can the PMWG take now to support existing modeling efforts? • Are there existing datasets that should be distributed to	*Facilitated Discussion*

those conducting modeling?

11:50 - 12:00 **Summary and Next Steps** *Dave Wegner*

- Next meeting date?

12:00 **Adjourn**

Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

Population Monitoring Work Group (PMWG)
Meeting Minutes

April 16, 2019, 9:00 AM – 12:00 PM
Location: WEST Inc., 8500 Menaul Blvd NE

Decisions:

- ✓ The April 16, 2019 PMWG meeting agenda was approved.
- ✓ The March 14, 2019 meeting minutes were approved with no changes.

Action Items:

WHO	ACTION ITEM
Rich Valdez	Share table of parameters for different models with Charles Yackulic, U.S. Geological Survey, for feedback on what would be useful for models
Rich Valdez	Send data to Ara Winter, Bosque Ecosystem Monitoring Program, to run through Random Forests Statistics to check validity of categories in mesohabitats

Next Meeting: June 19, 2019, 9 am – 12 pm

Meeting Minutes

Welcome, Introductions, and Agenda Review

Dave Wegner, Science Coordinator for Western EcoSystems Technology, Inc. (WEST), opened the meeting, outlined the agenda, and asked for updates.

- ➢ **Decision**: Approval of April 16, 2019 meeting agenda

Review of December 12, 2018 PMWG Meeting

- There were no changes to meeting minutes
- Action items from the previous meeting were reviewed
- Dave W. addressed developments in Adaptive Management that relate to the PMWG
  - o Every program needs to articulate how it fits with Adaptive Management, such as analyzing information or presenting and receiving feedback regarding how goals are being met
- ➢ **Decision:** Approval of March 14, 2019 meeting minutes

Options for Roles of PMWG and other Workgroups

Dave W. initiated a discussion on whether PMWG should change its name to reflect increased functionalities; most felt that a name change was not necessary. There were some concerns regarding the frequency or infrequency of meetings. Opportunities to utilize ad hoc committees or to structure PMWG meetings differently were also discussed.

U.S. Geological Survey (USGS) Agreement Update

Grace Haggerty, New Mexico Interstate Stream Commission (NMISC), gave an update on interactions with Charles Yackulic, USGS, regarding modeling and funding.

- Any funding not requested by May 15th will go to the next fiscal year, however there is a plan to request a budget through June of 2020. The government shutdown hindered progress. Providing necessary data to Charles Y. without delay will be paramount.
- Rich V. stressed the importance of having a model support team to provide parameters for models in advance (e.g., following examples from other programs, demographic information on species could be assimilated). A table of parameters for five different models with assumptions included was presented by Ashley Tanner, WEST.
- Rich V. suggested sharing the table with Charles Y. for feedback

    - **Action Item:** Rich Valdez will share the table of parameters for different models with Charles Yackulic, U.S. Geological Survey (USGS), for feedback on what would be useful for models

Presentation: Characterization of the Rio Grande Silvery Minnow (RGSM) Population Monitoring Data by Mike Marcus

Mike M. presented a series of plots and tables compiled from the RGSM population monitoring data. A discussion followed.

- Thomas Archdeacon, U.S. Fish & Wildlife Service (USFWS), suggested including effort per site to study trends over time and to ask American Southwest Ichthyological Researchers (ASIR) about data for dry sites.
- Rich V. suggested checking quarterly reports, although they do not include dry sites.
- Ashley T, agreed the database needs to be updated to include the 2018 data.
- Rich V. explained that the distribution of CPUE sampling was scattered temporally prior to 2002, making it difficult to find patterns in the early years.
- There were also questions about how river miles were being recorded or represented for the twenty sampling sites.

Presentation: Consolidation of Mesohabitat Types for the Middle Rio Grande by Rich Valdez

Rich V. explained the need for consolidation of mesohabitat types was driven by the fact that the existing 28 mesohabitat types are cumbersome when applied to models. Per discussion with Charles Y., lumping mesohabitats into roughly three categories would be ideal.

- Joel Lusk, U.S. Fish & Wildlife Service (USFWS), inquired which season was chosen for inundation, as it makes a difference with fish.
- It was suggested that swimming criteria/performance could be applied to habitat in the river.
- Rich V. and Joel L. agreed that the mesohabitat type ‘shoreline’ is too important to cut.

- ASIR has a 5-category system, but some of the groupings could be problematic (e.g., flats grouped within runs). Ashley T. noted that while ASIR reports contained five categories, many different types were distinguished in field collection.
- Rich V. recommended presenting the 3-category and 5-category options to Charles Y.
- Ara Winter, Bosque Ecosystem Monitoring Program (BEMP), recommended applying Random Forest, a machine algorithm that checks the validity of assigned categories [of CPUE in this case].
- Thomas A. suggested the effect of spring runoff be removed.
- Eric Gonzales, U.S. Bureau of Reclamation (Reclamation), suggested CPUE be categorized as high/medium/low.
- Shay Howlin, WEST, suggested the lumping of categories would be a topic to discuss with Charles Y.
- Rich V. described three options for guiding categorizations:
    - CPUE surface area
    - Application of density by mesohabitat type with flow in river
    - Use of hydraulic function to look at velocities and depths in the river, disregarding mesohabitats
- Rich V. commented that the third option, also used by Joel L., would necessitate understanding of river flow, geomorphology, and fish abundance relationships

    - **Action Item:** Send data to Ara Winter, BEMP, to utilize Random Forests to check validity of categories in mesohabitats

Model Support Efforts by the PMWG

- Dave W. started the discussion on Model Support Efforts revolving around the following questions:
    - What types of models need to be developed, refined, or utilized?
    - What actions can the PMWG take now to support existing modeling efforts?
    - Are there existing datasets that should be distributed to those conducting modeling?
- Rich V. invited participants to take some time to identify the most important model parameters needed
- Mike M. invited additional input from the PMWG regarding development of SOW #20 (Evaluate and Quantify in-Channel Habitat Diversity and Utilization for All Life Stages of RGSM)
- Ashley T. elaborated on SOW #20.The study would develop a model of RGSM habitat in the river utilizing expected depths and velocities at different flows. There are at least 7-8 publications with info for RGSM selection with regard to depth, velocity, and substrate.
- Joel L. suggested there should eventually be a recruitment/growth/age model for local data.
- Ara W. recommended GitHub (for WEST) as a repository to keep models transparent.
- Rich V. suggested the use of models for predicting the risk of extinction utilizing a stock assessment centerpiece and imposing certain environmental variables such as flow and temperature. Other species could be included.

Summary and Next Steps

- Next meeting: June 19, 2019

Meeting Participants

Participant	Organization
Thomas Archdeacon	U.S. Fish & Wildlife Service
Dave Campbell	U.S. Fish & Wildlife Service
Nate Caswell	NM Department of Game & Fish, Conservation Office
Lynette Giesen	U.S. Army Corps of Engineers
Eric Gonzales	U.S. Bureau of Reclamation
Grace Haggerty	New Mexico Interstate Stream Commission
Monika (Mo) Hobbs	Albuquerque Bernalillo County Water Utility Authority
Joel Lusk	U.S. Fish & Wildlife Service
Mike Marcus	Assessment Payers Association of the Middle Rio Grande Conservancy District
Anne Marken	Middle Rio Grande Conservancy District
Kate Mendoza	Albuquerque Bernalillo County Water Utility Authority
Rich Valdez	SWCA Environmental Consultants
Ara Winter	Bosque Ecosystem Monitoring Program
Steve Zipper	SWCA Environmental Consultants
Janet Armstead	Western EcoSystems Technology, Inc.
Shay Howlin	Western EcoSystems Technology, Inc.
Ashley Tanner	Western EcoSystems Technology, Inc.
David Wegner	Western EcoSystems Technology, Inc.

DRAFT

Characterization Summary of Rio Grande Silvery Minnow Population Monitoring Data Collect Using Regular Gear under USBR and MRGESCP Support during February 1993 to October 2017

Mike Marcus - 15 April 2019

1. Introduction

1.1. The following provides a basic introduction to aid understanding the characteristics and distribution of age-0+ RGSM collected during ASIR's population monitoring using "regular gear."

1.2. This summary uses only basic Excel data sorting and summary techniques to produce both pivot-table and histogram plots, enabling simplifying views of relationships across the included data.

1.3. This database summary is based on the "AllSppPopMon_1993_2017" Excel dataset shown to be created by WEST (Ashley Tanner) on 10/10/2018.

1.4. This dataset includes monitoring/sampling data results for all fish species collected in "hauls" using "regular" and "larval" gear types, sampling location descriptions including river mile (RM) and mesohabitat (Habitat) types where fish were collected, haul areas (m^2) for each collection, standard lengths for specific RGSM collected or length summaries for groups of RGSM collected, and more.

1.5. River Mile locations (RM_Start) sampled range from RM 57.7 to 210.1

1.5.1. Some RM entries show impossibly high resolution, perhaps artifacts due to computation of sampling locations that likely should have been cleaned up during QA/QC.

1.5.2. The following table provides general RM guidance and location descriptions for the up/downstream reach boundaries with a few key localities for sampling locations included in the database.

	Angostura/Albuquerque Reach
210.1	Rio Grande, just downstream of Angostura Diversion Dam, Algodones.
183.4	Rio Grande, at Central Avenue bridge crossing (US HWY 66), Albuquerque.
178.3	Rio Grande, at Rio Bravo Blvd. Bridge crossing (NM State HWY 500) crossing, Albuquerque.
172.7	Rio Grande, at US Interstate HWY I-25 bridge crossing, Albuquerque.
	Isleta Reach
165.3	Rio Grande, ca. 4.2 mi downstream of Isleta Diversion Dam, Isleta Pueblo.
116.8	Rio Grande, ca. 0.6 miles upstream of San Acacia Diversion Dam, San Acacia
	San Acacia Reach
116.2	Rio Grande, directly below San Acacia Diversion Dam, San Acacia.
79.1	Rio Grande, directly east of Bosque del Apache National Wildlife Refuge Headquarters.
68.6	Rio Grande, at San Marcial Railroad Bridge, San Marcial.
57.7	Rio Grande, ca. 16.2 mi downstream of the southern boundary of Bosque del Apache NWR, San Marcial.

1.6. **Attachment 1** lists all sampling localities with their descriptions.

1.7. **Attachment 2** lists the column names with descriptors included in the RGSM population monitoring database.

1.8. **Attachment 3** lists the mesohabitat codes and descriptors included in the RGSM population data. This attachment includes the original mesohabitat types provided by ASIR and the simplification of this list produced by WEST.

2. Dataset Inconsistencies

2.1. Attachment 1 reveals that some river miles for some sampling localities and descriptors for some river mile sampling localities have changed slightly over time, as reflected in the database. This summary uses the sampling locations based on the river mile presented in the database, without modification. This makes data summaries based on RM inconsistent.

2.2. During the collection period 1993-February 2002, all RGSM collected from a site across all hauls and all mesohabitats were compiled and recorded in Haul 1 and in whatever mesohabitat that Haul 1 happened to occur for that sampling time. As such, collection data from this period can only be summarized on a site-specific basis, not by haul or by mesohabitat. Starting in March 2002 and until the present, all collection data were recorded for each haul and mesohabitat where RGSM where actually collected.

2.3. Summarizing the collection data for RGSM is additionally complicated by the fact that RGMS data from most single hauls having >1 to an inconsistent few RGSM are distributed over multiple rows, presented using one fish per row, to facilitate entry of age, standard length and measures and marking information for individual RGSM collected. For hauls with inconsistent larger collections the RGSM data may be presented (1) in a single row with the length data summarized; (2) in multiple rows by RGSM age groups with length data summarized for each; and/or (3) in single rows holding a subset of individual RGSM age and length data and then, for the balance of the RGSM catch from that haul, another row added for the estimated remaining haul collection numbers. Some variations of these alternatives also occur. This complicates data summaries because the sampling effort ("Effort m^2") for each haul is entered repeatedly in each row for each RGSM in the haul. This makes computing RGSM catch per unit effort (CPUE) by haul and habitat sampled directly from the dataset impossible without undergoing a complicated data sort and summary efforts to sum the RGSM counts in rows for each haul and pairing that total count with only a single Effort m^2 value for sampling effort. (Others members of the Population Monitoring Work Group have been re-computing by-haul CPUE estimates for past monitoring efforts. The following summary does not include CPUE computations.)

2.4. Recent RGSM monitoring most often includes collections targeting 20 hauls collected from various mesohabitats within 20 sampling localities (400 sampling hauls) for seven multiday month intervals (2800 hauls annually). The number hauls have varied due to environmental conditions resulting in some, mostly minor, inconsistencies in the data, particularly for numbers of mesohabitat types sampled and for dry sites encountered.

3. Data Summary Approach

3.1. For this summary, the database was sorted partly and extracted to allow the development of possible data summaries based on subsets of sampling data for RGSM collected using regular gear for the entire 1993-2017 period, the period 1993-February 2002, the period March 2002-2017, and for the decade 2008-2017. The last provides a focus on the most recent RGSM collections.

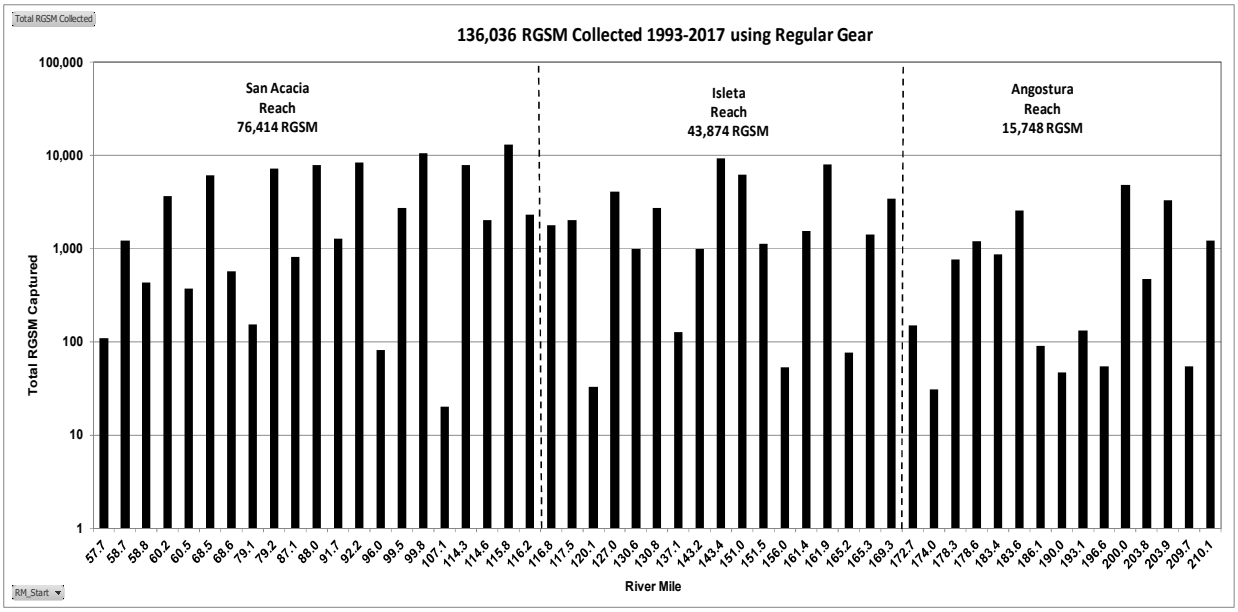
3.2. Fortunately, the total RGSM collected by each single haul for the period 3/2002-2017can be summarized directly by pairing sampling date with haul number, mesohabitat, and/or RM/sampling location using, for example, Excel pivot tables and histograms, which have been used for the following summary.

3.3. The database subsets for RGMS from regular gear collections for the four periods described above were first summarized in their entirety without correction for haul groupings. Then the complete data subsets for both periods were further summarized with appropriate consideration of the haul groupings. The following summary points include information for the entire 1993-2017, 1993-2/2002, 3/2002-2017, and 2008-2017 data subsets, including 0-catch hauls for RGSM.

3.4. RGSM numbers by single sampling periods at the localities are not summarized here.

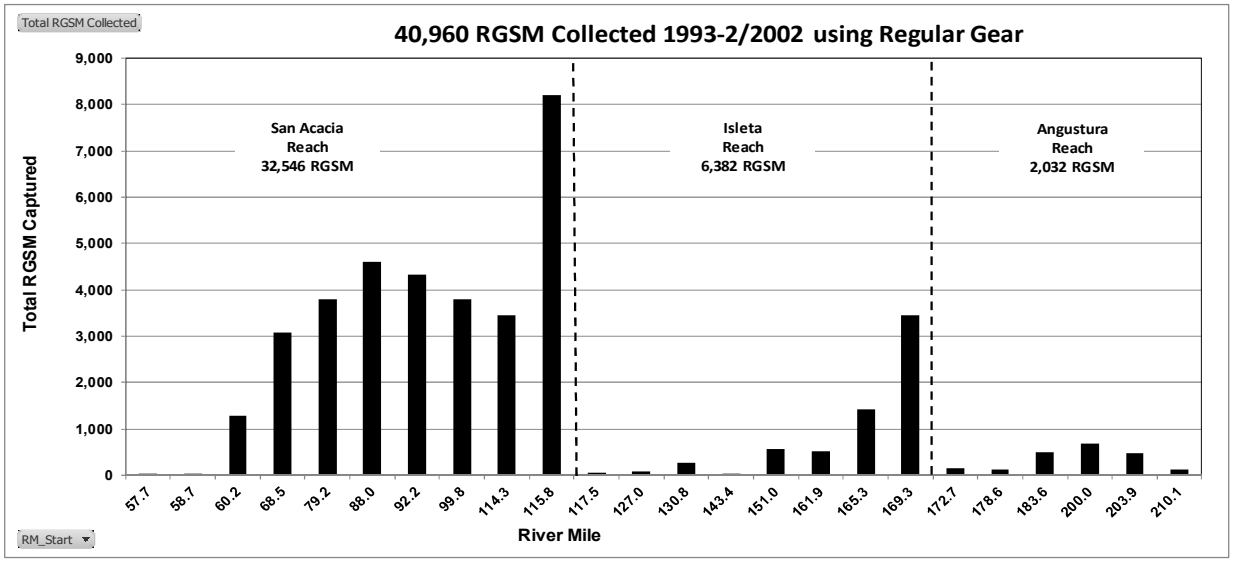
4. General Data Characteristics by River Mile

4.1. The 1993-2017 data subset for RGSM collections using regular gear includes 85,955 rows, including individual hauls, hauls with multiple row groupings, including hauls showing 0 RGSM captures. Sample area includes a total of 2,407,030 m^2 (inflated for multiple rows with single haul entries). In total these data shows the collection of 136,036 RGSM from 27 different mesohabitats.



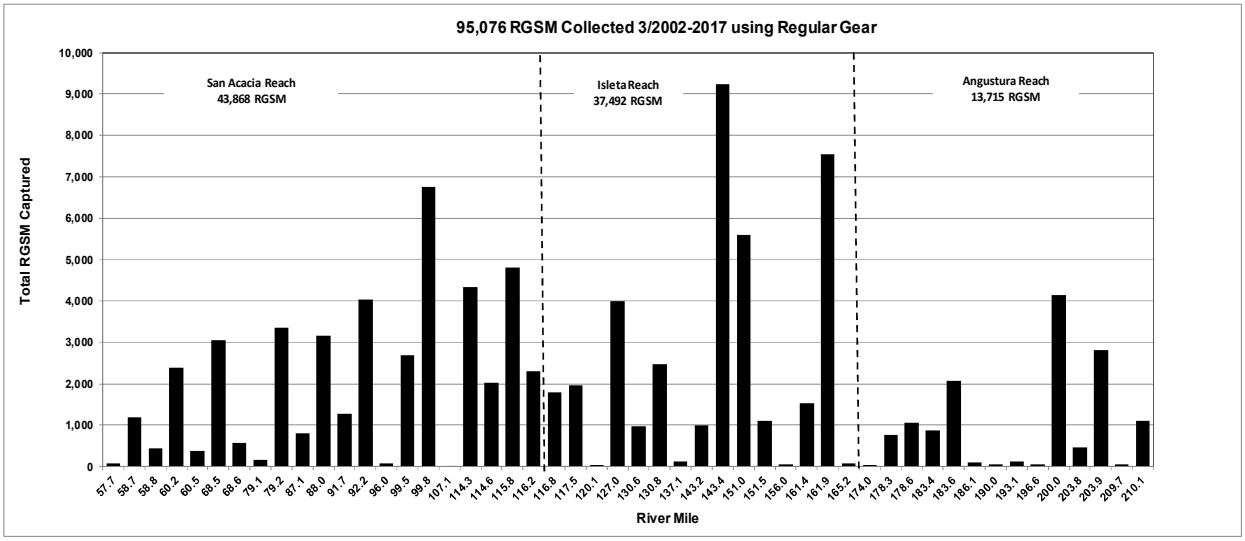
4.2. This subset of the database include 76,414 RGSM collected from the San Acacia Reach, 43,847 collected from the Isleta Reach, and 15,748 collected from the Angostura Reach. The data did not show any marked distribution within or across the reaches.

4.3. The 1993-Feb2002 data subset for RGSM collections using regular gear includes 37,161 rows (this included both individual hauls, hauls with multiple row groupings, and hauls showing 0 RGSM captures) totaling 1,025,348 m2 (inflated for multiple rows with single haul entries). In total these data shows the collection of 40,960 RGSM from 27 different mesohabitats.



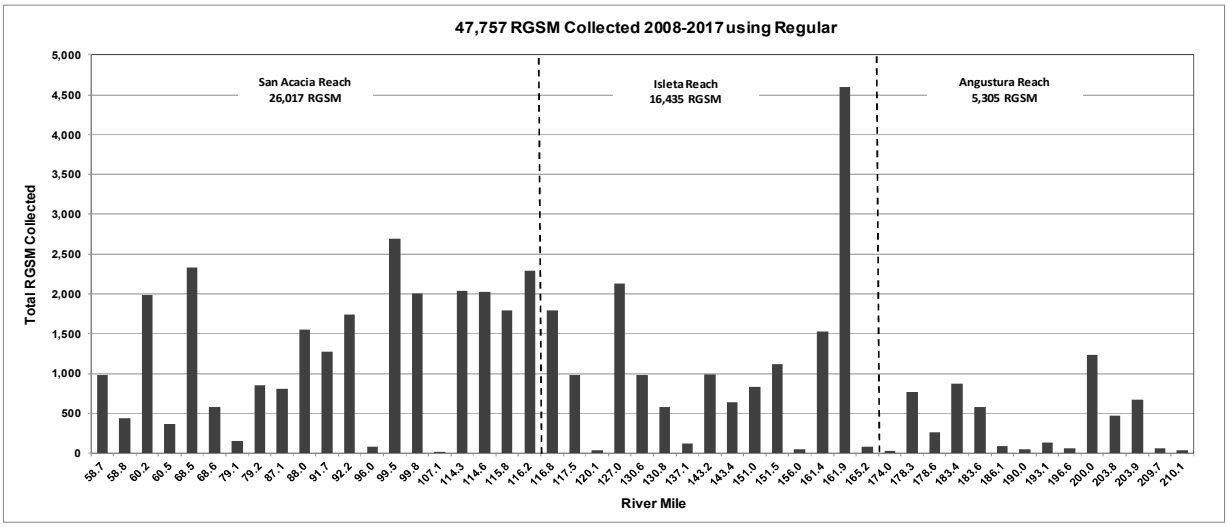
4.4. This subset of the database include 32,546 RGSM collected from the San Acacia Reach, 6,382 collected from the Isleta Reach, and 2,032 collected from the Angostura Reach. Of particular interest, the data showed markedly greater numbers of RGSM at the most upstream collection localities in both the San Acacia and Isleta Reaches.

4.5. The March 2002-2017 data subset for RGSM collections using regular gear includes 37,161 rows (this included both individual hauls, hauls with multiple row groupings, and hauls showing 0 RGSM captures) totaling 1,025,348 m2 (inflated for multiple rows with single haul entries). In total these data shows the collection of 40,960 RGSM from 27 different mesohabitats.



4.6. This subset of the database include 43,868 RGSM collected from the San Acacia Reach, 37,492 collected from the Isleta Reach, and 13,715 collected from the Angostura Reach. The data show a trend of increased numbers through the upstream portion of the reaches.

4.7. The data subset for 2008-2017 includes 32,455 rows (this includes individual hauls and haul groupings) totaling 882,741 m2 (inflated for haul groupings) that reports collecting 47,757 RGSM from 22 different mesohabitats. There are also 9,095 rows showing 0-catch hauls for RGSM.

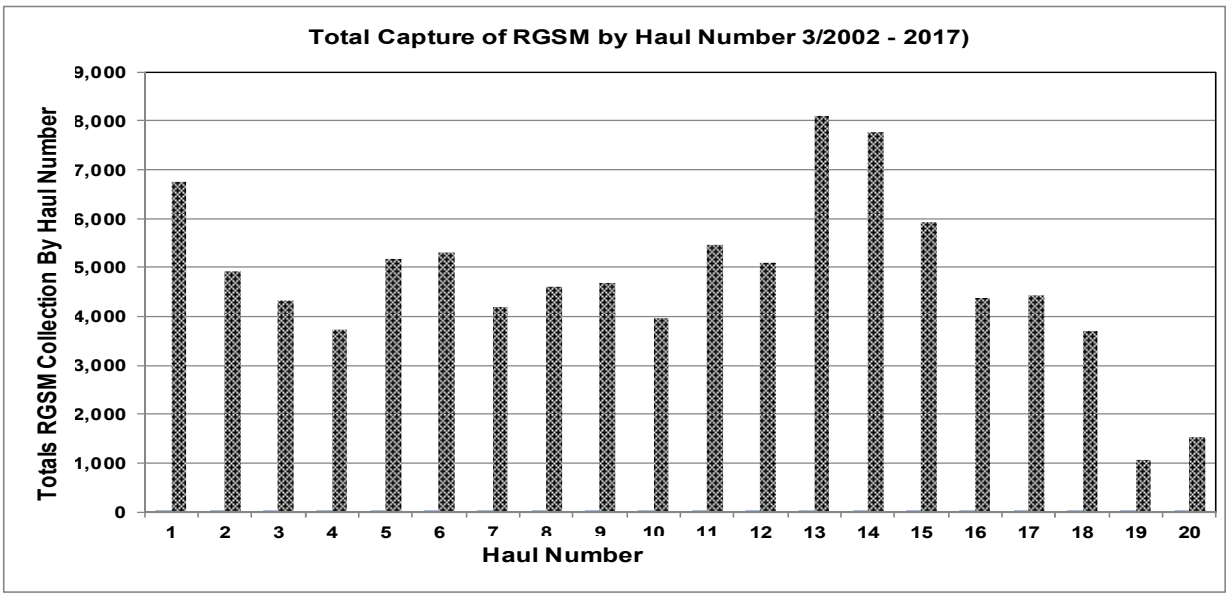


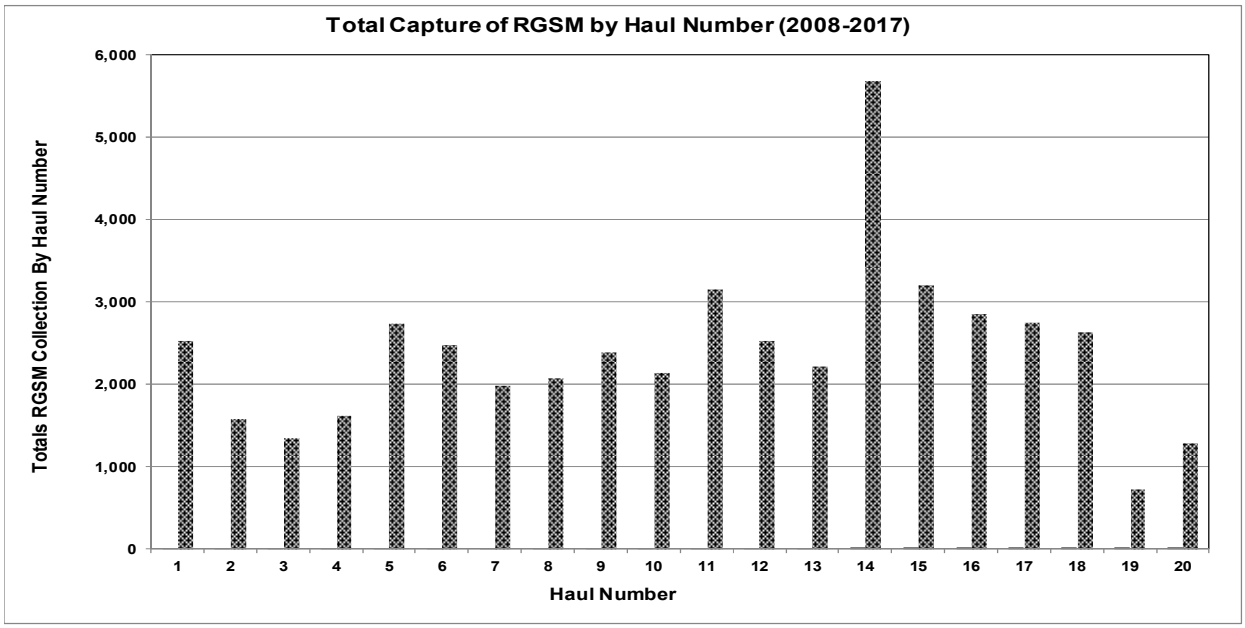
4.8. This subset of the database include 26,017 RGSM collected from the San Acacia Reach, 16,435 collected from the Isleta Reach, and 5.305 collected from the Angostura Reach. The data show a possible trend of increased numbers through the upstream portion of the reaches.

4.9. Some locals in the Isleta Reach appear to maintain very low collections rates, perhaps it would be appropriate to move those sampling location elsewhere, perhaps to the Angostura Reach.

5. **RGSM Collections by Haul Number**

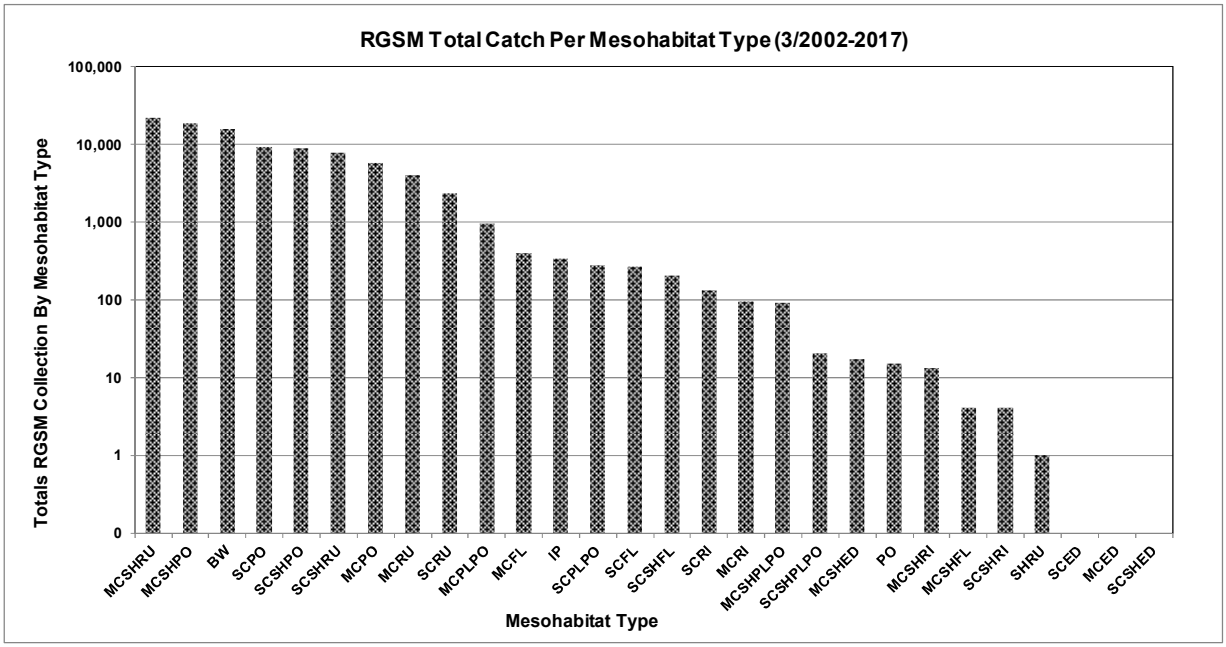
5.1. Excel pivot tables were used to sum the RGSM collected by haul number for the period March 2002 to 2017 and the decade 2008-2017. Neither summary indicated obvious bias in the collection of RGSM by haul number.

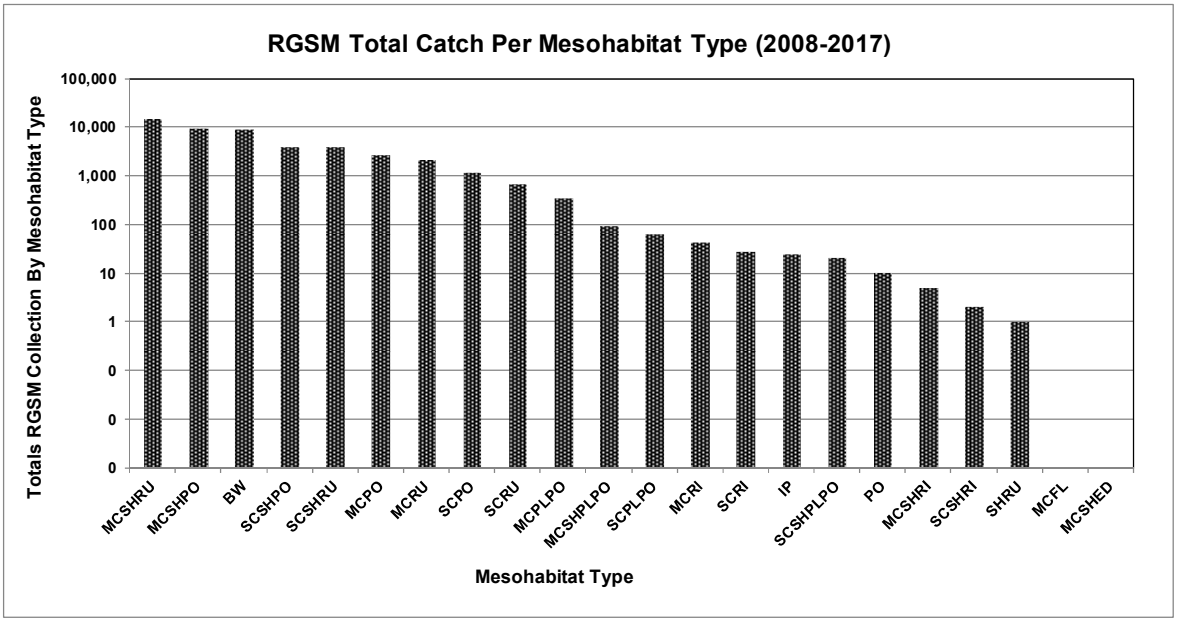




6. RGSM Collected by Mesohabitat Type

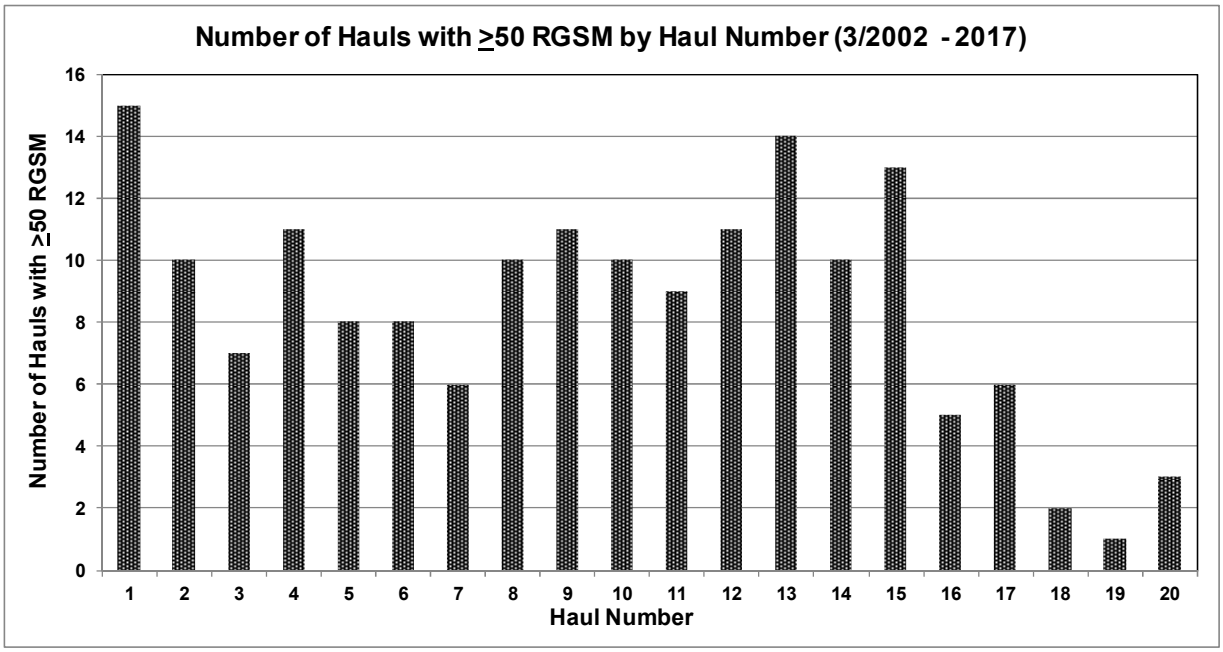
6.1. Excel pivot tables were used to sum the RGSM collected by mesohabitat type for the period March 2002 to 2017 and the decade 2008-2017. Distributions of RGSM collection numbers varied by more than 4 orders of magnitude across the habitat types, indicating that reducing the numbers of mesohabitat types sampled may be markedly reduced to those top 3-7 categories having the greatest numbers of RGSM collected without meaningful loss of information. More advanced analysis of these results are needed to refine this conclusion.



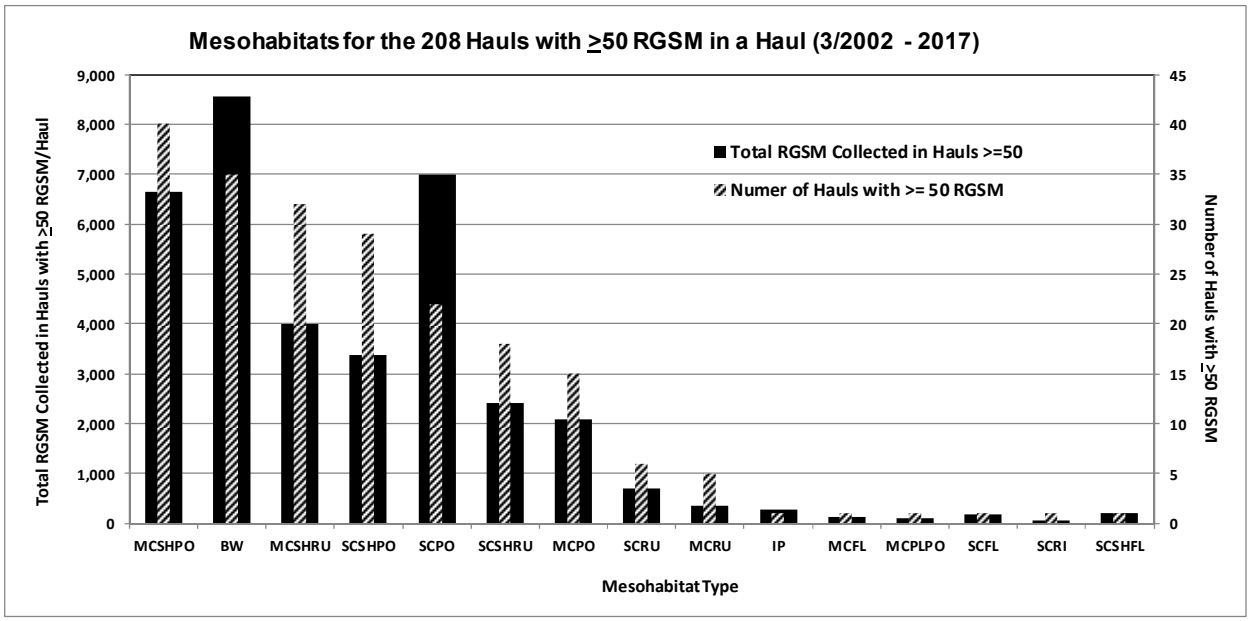


7. Haul Numbers and Mesohabitat with ≥50 RGSM

7.1. Collections with ≥50 RGSM show no particular pattern by Haul Number for the period March 2002-2017 for the first 15 hauls, subsequent hauls included fewer ≥50 RGSM collections.

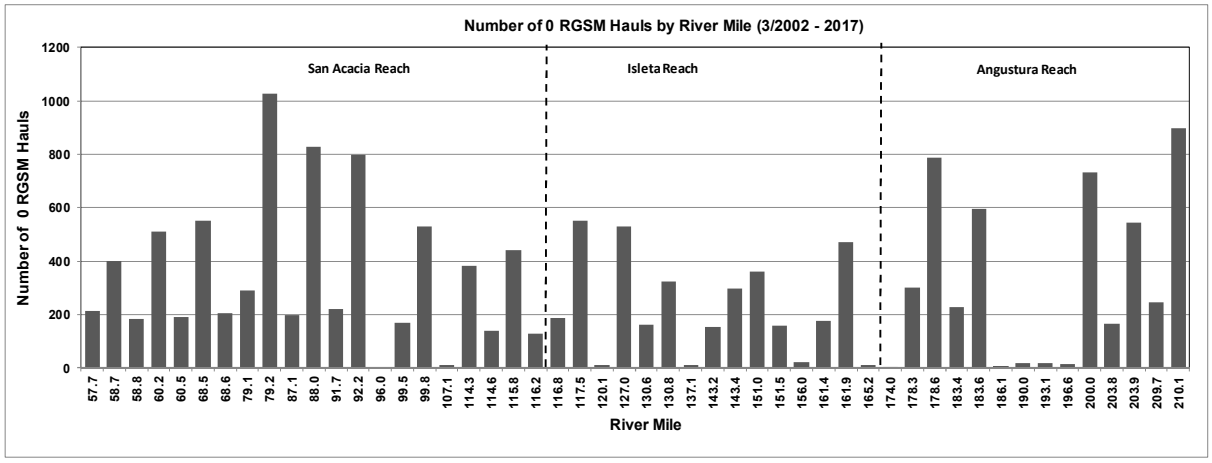


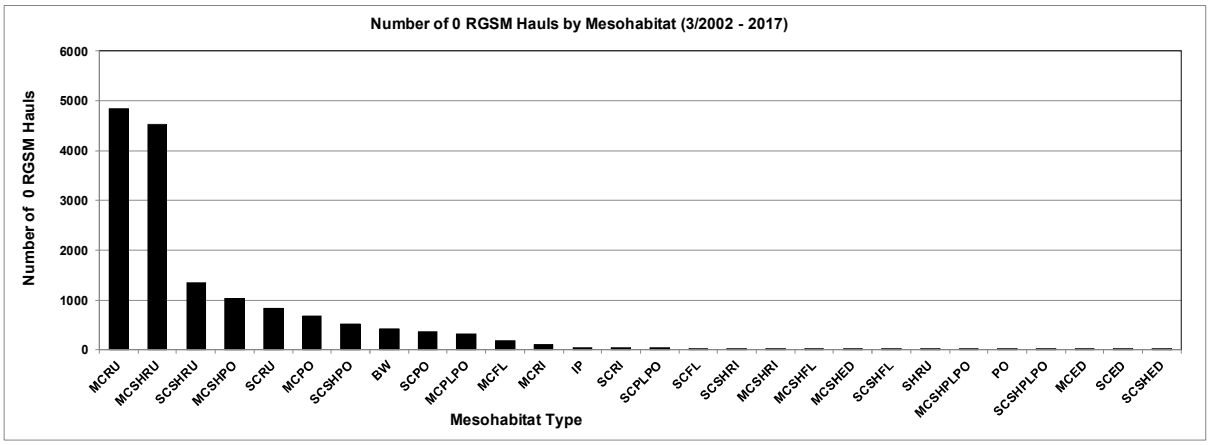
7.2. The greatest occurrence of hauls with ≥50 collections occur in MCSHPO (mid-channel shoreline pools) followed by BW (Backwater) mesohabitats, progressively fewer though other mesohabitat types. In contrast, the greatest number of RGSM in ≥50 hauls came from SCPO (side-channel pools) followed by BW.

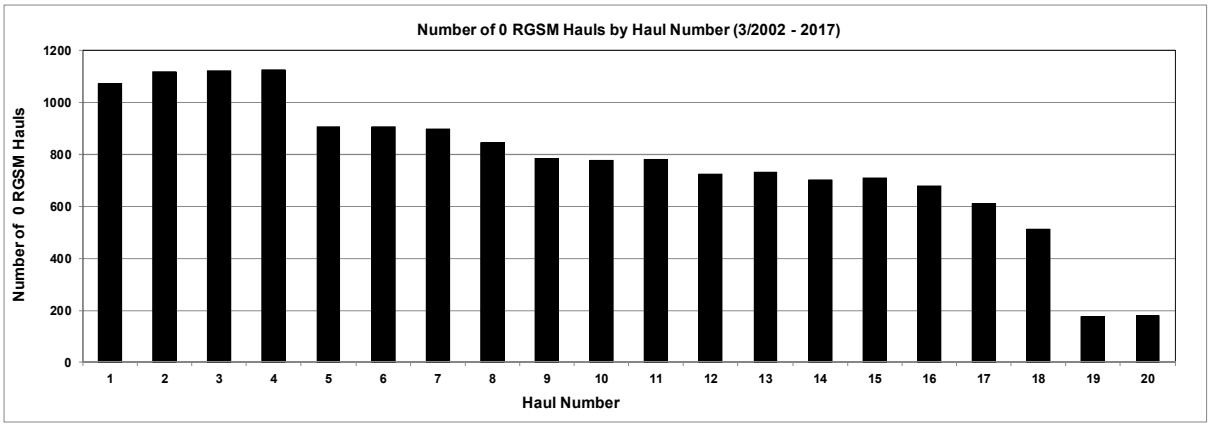


8. 0-RGSM Collections by River Mile, Haul Number and Mesohabitat

8.1. All three reaches had relatively high numbers and frequencies of 0-RGSM hauls during March 2002-2917, with no obvious longitudinal patterns occurring, with some site apparently regularly having RGSM collections. MCRU (mid-channel run) and MCSHRU (mid-channel shoreline run) were the two mesohabitats with the greatest numbers of 0-RGSM hauls. The total number of 0-RGSM hauls appeared to remain relative higher and consistent through the first four hauls then slowly decrease in generally progressive manner with subsequently hauls.







8.2. One of the difficulties with the 0-RGSM haul information in the dataset, as shown here is in places, although the "SumOfSPEC" column show 0-RGSM hauls, the "HybamaPresentRaw" column show RGSM to be present in the sample. This may indicate QA/QC errors.

9. Dry sites

9.1. The database shows only 4 rows of information for "dry" sites at RM 68.6 and 79.1 for two dates each. Whether this information was included in the computations of CPUE in the annual reports for these years is unknown. (Of note, the extracted database information in the insert below is not included in the Chart Set 2 and Table Set 2 summaries.)

RM_Start	Date Collected	Effort m^2	SumOfSPEC	Genus	Species	Gear
87.1	7/8/2014	0	0	Site Not Sampled	(Site Dry)	regular
87.1	10/5/2015	0	0	Site Not Sampled	(Site Dry)	regular
79.1	9/8/2014	0	0	Site Not Sampled	(Site Dry)	regular
79.1	9/5/2017		0	Site Not Sampled	(Site Dry)	

9.2. In addition, the data includes 43 sample date lacking habitat and collection information for RGSM. These are reasonable to assume are dry sites. Three years (2002, 2010, 2016) had only a single site and three others had 3-4 sampling times/sites listed (2008, 2011, 2013), whereas 2013, 2001, and 2012 had a higher frequency and distributions of such sites.

River Miles with dry-site sampling indicated

River Mile	Number	Locality
79.1 - 79.2	10	Rio Grande, east of Bosque del Apache NWR headquarters, San Antonio.
88	9	Rio Grande, just upstream of US HWY 380 bridge crossing, San Antonio.
92.2	11	Rio Grande, ca. 4.5 mi upstream of US HWY 380 bridge crossing, San Antonio.
99.8	4	Rio Grande, ca. 0.5 mi upstream of Socorro Low Flow Conveyance Channel (LFCC) bridge crossing, Socorro.
117.5	2	Rio Grande, ca. 1.2 mi upstream of San Acacia Diversion Dam, San Acacia.
161.9	8	Rio Grande, just upstream of NM State HWY 6 bridge crossing, Los Lunas.

43 Sample Dates and Site Locations with Blank Habitat (assumed dry) -- 2002-2027

Year	Date Collected	RM_Start
2002	7/18/2002	92.2
2003	6/23/2003	79.2
	7/28/2003	79.2
	7/28/2003	88.0
	7/29/2003	92.2
	7/29/2003	99.8
	7/30/2003	161.9
	8/18/2003	79.2
	8/18/2003	88.0
	8/19/2003	92.2
	8/19/2003	99.8
	8/20/2003	161.9
	9/25/2003	161.9
2004	6/22/2004	88.0
	9/20/2004	79.2
	9/21/2004	88.0
	9/21/2004	92.2
	9/21/2004	99.8
	9/23/2004	161.9
2008	5/13/2008	92.2
	5/14/2008	117.5
	6/10/2008	92.2
2010	9/7/2010	79.2
2011	7/13/2011	79.2
	7/13/2011	88.0
	7/13/2011	92.2
	9/26/2011	161.9
2012	8/1/2012	88.0
	8/1/2012	92.2
	8/2/2012	161.9
	9/4/2012	79.2
	9/4/2012	88.0
	9/4/2012	92.2
	9/6/2012	161.9
	10/1/2012	**79.2**
	10/1/2012	**88.0**
	10/2/2012	**92.2**
	10/2/2012	**99.8**
	10/3/2012	**161.9**
2013	7/1/2013	79.2
	7/1/2013	88.0
	7/1/2013	92.2
2016	8/1/2016	79.1

Attachment 1. River Mile Locality descriptions included in the RGSM monitoring database for RGSM collected with Regular Gear

River Mile	Site Location
57.7	Rio Grande, ca. 16.2 mi downstream of the southern boundary of Bosque del Apache NWR, San Marcial.
58.7	Rio Grande, ca. 10.0 mi downstream of San Marcial Railroad bridge crossing, San Marcial.
58.8	Rio Grande, ca. 10 mi downstream of the San Marcial railroad bridge crossing
58.8	Rio Grande, ca. 10.0 miles downstream of the San Marcial Railroad Bridge crossing, San Marcial.
60.2	Rio Grande, ca. 8.0 mi downstream of San Marcial Railroad bridge crossing, San Marcial.
60.5	Rio Grande, ca. 8 miles downstream of the San Marcial railroad bridge crossing
60.5	Rio Grande, ca. 8.0 miles downstream of the San Marcial Railroad Bridge crossing, San Marcial.
68.5	Rio Grande, just downstream of San Marcial Railroad bridge crossing, San Marcial.
68.6	Rio Grande, at San Marcial Railroad Bridge, San Marcial.
68.6	Rio Grande, downstream of the San Marcial railroad crossing, San Marcial.
79.1	Rio Grande, directly east of Bosque del Apache National Wildlife Refuge headquarters, San Antonio.
79.1	Rio Grande, directly east of Bosque del Apache National Wildlife Refuge Headquarters.
79.2	Rio Grande, east of Bosque del Apache NWR headquarters, San Antonio.
87.1	Rio Grande, at US HWY 380 bridge crossing, San Antonio.
87.1	Rio Grande, upstream of US Highway 380 bridge crossing, San Antonio.
88	Rio Grande, just upstream of US HWY 380 bridge crossing, San Antonio.
91.7	Rio Grande, ca. 4.0 miles upstream of U.S. 380 bridge crossing.
91.7	Rio Grande, ca. 4.0 miles upstream of US Highway 380 bridge crossing, San Antonio.
92.2	Rio Grande, ca. 4.5 mi upstream of US HWY 380 bridge crossing, San Antonio.
96	Rio Grande, ca. 7.9 miles upstream of US HWY 380 bridge crossing, San Antonio
99.5	Rio Grande, ca. 0.5 miles upstream of the Low Flow Conveyance Channel bridge, east and upstream of Socorro Wastewater Treatment Plant, Socorro.
99.5	Rio Grande, east of Socorro, 0.5 miles upstream of Socorro Low Flow Conveyance Channel bridge and east just upstream of Socorro Wastewater Treatment Plant, Socorro.

99.8	Rio Grande, ca. 0.5 mi upstream of Socorro Low Flow Conveyance Channel (LFCC) bridge crossing, Socorro.
107.1	Rio Grande, ca. 2.6 miles upstream of Pueblitos Rd. bridge crossing, Escondida
114.3	Rio Grande, ca. 1.5 mi downstream of San Acacia Diversion Dam, San Acacia.
114.6	Rio Grande, ca. 1.5 miles downstream of San Acacia Diversion Dam, San Acacia.
115.8	Rio Grande, just downstream of San Acacia Diversion Dam, San Acacia.
116.2	Rio Grande, directly below San Acacia Diversion Dam, San Acacia.
116.2	Rio Grande, downstream of San Acacia Diversion Dam, San Acacia.
116.8	Rio Grande, ca. 0.6 miles upstream of San Acacia Diversion Dam, San Acacia
116.8	Rio Grande, ca. 0.6 miles upstream of San Acacia Diversion Dam, San Acacia.
117.5	Rio Grande, ca. 1.2 mi upstream of San Acacia Diversion Dam, San Acacia.
120.1	Rio Grande, ca. 1.5 miles upstream of confluence with the Rio Salado, San Acacia
127	Rio Grande, ca. 3.5 miles downstream of the US HWY 60 bridge crossing, Bernardo.
127	Rio Grande, ca. 3.5 miles downstream of US Highway 60 bridge crossing, La Joya.
127	Rio Grande, ca. 3.7 mi downstream of US HWY 60 bridge crossing, Bernardo.
130.6	Rio Grande, at US HWY 60 bridge crossing, Bernardo.
130.6	Rio Grande, upstream of US Highway 60 bridge crossing, Bernardo.
130.8	Rio Grande, just upstream of US HWY 60 bridge crossing, Bernardo.
137.1	Rio Grande, ca. 6.3 miles upstream of U.S. Hwy. 60 bridge crossing, Bernardo
143.2	Rio Grande, ca. 2.2 miles upstream of NM State Highway 346 bridge crossing, Jarales.
143.2	Rio Grande, ca. 2.2 miles upstream of NM State HWY 346 bridge crossing, Jarales.
143.4	Rio Grande, ca. 2.2 mi upstream of NM State HWY 346 bridge crossing, Jarales.
151	Rio Grande, ca. 1.0 mi upstream of NM State HWY 309 bridge crossing, Belen.
151.5	Rio Grande, ca. 1.0 miles upstream of NM State Highway 309/6 bridge crossing, Belen.
151.5	Rio Grande, ca. 1.0 miles upstream of NM State HWY 309/6 bridge crossing, Belen.
156	Rio Grande, ca. 6.2 miles upstream of NM State Hwy. 309 bridge crossing, Belen
161.4	Rio Grande, at Los Lunas Bridge crossing (NM State HWY 49), Los Lunas.
161.4	Rio Grande, ca. 0.3 miles upstream of Los Lunas (NM State Highway 49) bridge crossing, Los Lunas.

161.9	Rio Grande, just upstream of NM State HWY 6 bridge crossing, Los Lunas.
165.2	Rio Grande, ca. 4.1 miles upstream of NM State Hwy. 6 bridge crossing, Los Lunas
165.3	Rio Grande, ca. 4.2 mi downstream of Isleta Diversion Dam, Isleta Pueblo.
169.3	Rio Grande, just downstream of Isleta Diversion Dam, Isleta Pueblo.
172.7	Rio Grande, at US Interstate HWY I-25 bridge crossing, Albuquerque.
174	Rio Grande, ca. 1.5 miles upstream of I-25 bridge crossing, Isleta
178.3	Rio Grande, at Rio Bravo Blvd. Bridge crossing (NM State HWY 500) crossing, Albuquerque.
178.3	Rio Grande, upstream of Rio Bravo Boulevard bridge crossing, Albuquerque.
178.6	Rio Grande, just upstream of Rio Bravo Blvd. bridge crossing (NM State HWY 500), Albuquerque.
183.4	Rio Grande, at Central Avenue bridge crossing (US HWY 66), Albuquerque.
183.4	Rio Grande, upstream of Central Avenue (US Highway 66) bridge crossing, Albuquerque
183.6	Rio Grande, just upstream of Central Ave. bridge crossing (US HWY 66), Albuquerque.
186.1	Rio Grande, ca. 1.1 miles upstream of I-40 bridge crossing, Albuquerque
190	Rio Grande, ca. 1.0 miles downstream of Paseo del Norte Blvd. (NM State Hwy. 423) bridge crossing Albuquerque
193.1	Rio Grande, ca. 1.1 miles upstream of Alameda Blvd. (NM State Hwy. 528) bridge crossing, Corrales
196.6	Rio Grande, ca. 4.4 miles upstream of Alameda Blvd. (NM State Hwy. 528) bridge crossing, Corrales
200	Rio Grande, ca. 4.0 mi downstream of US HWY 550 bridge crossing, Rio Rancho.
200	Rio Grande, ca. 4.0 miles downstream of US Highway 550 bridge crossing, east and upstream of Rio Rancho Wastewater Treatment Plant, Rio Rancho.
200	Rio Grande, ca. 4.0 miles downstream of US HWY 550 (formerly NM State HWY 44) bridge crossing, at Rio Rancho Wastewater Treatment Plant, Rio Rancho.
203.8	Rio Grande, at US HWY 550 (formerly NM State HWY 44) bridge crossing, Bernalillo.
203.8	Rio Grande, upstream of US Highway 550 bridge crossing, Bernalillo.
203.9	Rio Grande, just upstream of US HWY 550 bridge crossing, Bernalillo.
209.7	Rio Grande, directly below Angostura Diversion Dam, Algodones.
209.7	Rio Grande, downstream of Angostura Diversion Dam, Algodones.
210.1	Rio Grande, just downstream of Angostura Diversion Dam, Algodones.

Attachment 2. Column names with descriptors included in the RGSM population monitoring database

Column Name	Description
SiteID	Unique identification number created for each site (based on date/time when site was first sampled [i.e. higher numbers equal recently added sites])
DrainageRaw	Drainage where site is located (based on raw data)
StateRaw	State where site is located (based on raw data)
CountyRaw	County where site is located (based on raw data)
CountyFinal	County where site is located (based on verifying updated locality data with current maps)
ReachRaw	River reach (named after the damn at the top of each reach) where site is located (based on raw data)
QuadRaw	USGS topographic quadrangle map where site is located (based on raw data)
QuadFinal	USGS topographic quadrangle map where site is located (based on verifying updated locality data with current maps)
RMStartRaw	River mile at the starting point (upstream) of the site. This field also used when only a single entry exists (i.e. middle of site), (based on raw data)
RMStartFinal	River mile at the starting point (upstream) of the site. This field also used when only a single entry exists (i.e. middle of site), based on verifying updated locality data with current maps
RMStopRaw	River mile at the stopping point (downstream) of the site; not applicable for Reproductive Monitoring project (based on raw data)
RMStopFinal	River mile at the stopping point (downstream) of the site; not applicable for Reproductive Monitoring project (based on verifying updated locality data with cirrent maps)
LocalityRaw	Locality description of the site (based on raw data)
LocalityFinal	Locality description of the site (based on verifying updated locality data with current maps)
DatumRaw	North American Datum where the site is located (based on raw data)
DatumFinal	North American Datum where site is located (based on verifying updated locaility data with current maps)
ZoneRaw	UTM zone where site is located (based on raw data)
UTMEastingStartRaw	UTM easting coordinate at the starting point (upstream) of the site. This field also used when only a single entry exists (i.e. middle of site), based on raw data
UTMEastingStartFinal	UTM easting coordinate at the starting point (upstream) of the site. This field also used when only a single entry exists (i.e. middle of site), based on verifying updated locality data
UTMEastingStopRaw	UTM easting coordinate at the stopping point (downstream) of the site; not applicable for Reproductive Monitoring project (based on raw data)

UTMEastingStopFinal	UTM easting coordinate at the stopping point (downstream) of the site, not applicable for Reproductive Monitoring project (based on verifying updated locality data)
UTMNorthingStartRaw	UTM northing coordinate at the starting point (upstream) of the site. This field also used when only a single entry exists (i.e. middle of the site), based on raw data
UTMNorthingStartFinal	UTM northing coordinate at the starting point (upstream) of the site. This field also used when only a single entry point exists (i.e. middle of the site), based on verifying updated locality data
HabitatsPrimaryKey	Habitats Primary Key (numerical sequence for habitat-level data)
HaulNumberRaw	Sequence of samples taken at the site (based on raw data)
SamplesPrimaryKey	Samples primary key (numerical sequence for sample-level data)
FieldNumberRaw	Field number (person/site, year, number), based on raw data
ProjectRaw	Standardized names of research projects, based on raw data
SubprojectRaw	Standardized names of research subproject (standard, replacement, additional), based on raw
RepeatedSamplingNumberRaw	Data for the sequence of sampling (only applicable for population monitoring repeated sampling project), based on raw data
DateCollectedRaw	Date of collection, based on raw data
ReportingPeriodRaw	Data in yearmonth (YYYYMM) format corresponding to contracted sampling "year/month", based on raw data
ReportingYearRaw	Data in year (YYYY) format corresponding to contracted sampling "year", based on raw data
ReportingMonthCalc	No original description - WEST added description: Calculation derived from SQL code
UTMNorthingStopRaw	UTM northing coordinate at the stopping point (downstream) of the site; not applicable for Reproductive Monitoring project (based on raw data)
UTMNorthingStopFinal	UTM northing coordinate at the stopping point (downstream) of the site; not applicable for Reproductive Monitoring project (based on verifying updated locality data)
AirTemperatureMaxRaw	Air temperature (degrees Celsius; C). This field used for single entry (no range) or when the <(less than) symbol is used in the field notes (based on raw data)
WaterTemperatureMaxRaw	Maximum water temperature (degrees Celsius; C). This field used for a single entry (no range) or when the <(less than) symbol is used in the field notes (based on raw data)
SecchiDepthRaw	Secchi disk measurement of water transparency (cm), based on raw data
DORaw	Dissolved oxygen of water (milligrams per liter: mg/L). Extremely low or high values should be interpreted cautiously, based on raw data.
ConductivityRaw	Uncorrected conductivity of water (microsiemens; uS). Extremely low or high values should be interpreted cautiously. Based on raw data
SpecificConductanceRaw	Specific conductance, corrected for 25 C water (microsiemens; uS). Extremely low or high values should be interpreted cautiously. Based on raw data

SalinityRaw	Salinity of water (parts per thousand; ppt). Extremely low or high values should be interpreted cautiously. Based on raw data.
pHRaw	pH of water. Extremely low or high values should be interpreted cautiously. Based on raw data.
CollectorRaw	Identity of collector(s), based on raw data.
CollectorFinal	Identity of collector(s), based on verifying the raw data for the correct names of all collectors
TimeFromRaw	Start time of collection. This field also used for a single entry. Based on raw data.
TimeToRaw	Stop time of collection. Based on raw data.
NotSampled	Not sampled (Fish Release [Mark Recapture], Not Feasible [e.g. fire danger], Not Safe [e.g. dangerous flooding], or Site Dry [verified by walking the length of the site]); [blank] = sampled
CombinedSample	Were fish combined across habitats for the sample (i.e. fish-level data not separated by haul)? (1 = Yes, [blank] = No)
MesohabitatRaw	Mesohabitat codes (based on raw data)
MesohabitatFinal	Mesohabitat codes (based on categorizing all raw mesohabitat data)
MesohabitatDescription	Mesohabitat descriptions
DebrisRaw	Where Y = presence of debris, 1 = minimal or loosely packed debris (i.e. grasses), 2 = small debris pile (i.e. ,1.0 m^2), 3 = medium pile (i.e., 1.0 to 2.0 m^2), and 4 = large pile (i.e., >2.0 m^2); [blank] = no debris. Based on raw data.
DebrisFinal	Where Y = presence of debris, 1 = minimal or loosely packed debris (i.e. grasses), 2 = small debris pile (i.e. ,1.0 m^2), 3=medium pile (i.e., 1.0 to 2.0 m^2), and 4=large pile (i.e., >2.0 m^2); [blank]=no debris. Based on categorizing all raw debris data
LengthRaw	Length of sampling effort (m); Not applicable for Reproductive Monitoring or Mark Recapture project (based on raw data)
LengthFinal	Length of sampling effort (m); Not applicable for Reproductive Monitoring or Mark Recapture project (based on verifying all raw text/numerical length data)
StartFlowmeterRaw	Start value of flowmeter for sample (General Oceanics, Inc. mechanical flowmeter); Only applicable for Reproductive Monitoring project (based on raw data)
StartFlowmeterFinal	Start value of flowmeter for sample (General Oceanics, Inc. mechanical flowmeter); Only applicable for Reproductive Monitoring project (based on raw data or estimated effort)
StopFlowmeterRaw	Stop value of flowmeter for sample (General Oceanics, Inc. mechanical flowmeter); only applicable for Reproductive Monitoring project (based on raw data)
StopFlowmeterFinal	Stop value of flowmeter for sample (General Oceanics, Inc. mechanical flowmeter); only applicable for Reproductive Monitoring project (based on raw data or estimated effort)
FlowmeterEstimated	Was the flowmeter value estimated (1=Yes, [blank]=No); Only applicable for Reproductive Monitoring project. (If true, effort was estimated based on other MECs during the same/similar period)

FlowmeterMalfunction	Did the flowmeter malfunction during sample? (1=Yes, [blank]=No); Only applicable for Reproductive Monitoring project. (If true, effort was estimated based on other MECs during the same/similar period)
SamplingEffortCalc	No original description - WEST added description: Calculation derived from SQL code
GearRaw	Where 'regular'=3/16 in. mesh (2.5 m wide sampling), 'larval'=1/16 in. mesh (1.0 m wide sampling), and 'MEC'=Moore Egg Collector (1/16 in. mesh [12 in. by 16 in. sampling area]), based on raw data.
ElectrofishingRaw	Were fish collected with an electrofisher? (1=Yes, [blank]=No), based on raw data.
ClosedRaw	Was the mesohabitat enclosed with nets during sampling (1=Yes, [blank]=No), based on raw data.
FishPresentRaw	Were fish collected in this haul? (1=Yes, [blank]=No); Only applicable for years when fish counts were not available by haul (based on raw data)
HybamaPresentRaw	Was Hybognathus amarus collected in this haul? (1=Yes, [blank]=No); Only applicable for years when fish counts were not available by haul (based on raw data)
SpeciesPrimaryKey	Species primary key (numerical sequence for species-level data)
DepletionNumberRaw	Depletion pass number; Only applicable for Population Estimation project (based on raw data)
SpeciesRaw	First three letters of genus and species (based on raw data)
NelsonNumber	Nelson number (phylogenic order for family of fishes)
Family	Scientific name for family of fishes
CommonFamily	Common name for family of fishes
GenusName	Genus name for fishes
SpeciesName	Species name for fishes
CommonName	Common name for fishes
NumberCollectedRaw	Number of all fishes collected (based on raw data)
NumberReleasedRaw	Number of all fishes released (based on raw data)
NumberLarvalRaw	Number of larval fish collected (based on raw data)
AgeClassesRaw	Age in years (1 January is birthday), as designated in the field; Not applicable for Reproductive Monitoring project (based on raw data)
AgeClass0Calc	No original description - WEST added description: Calculation derived from SQL code
AgeClass1Calc	No original description - WEST added description: Calculation derived from SQL code
AgeClass2Calc	No original description - WEST added description: Calculation derived from SQL code
AgeClassFinalCalc	No original description - WEST added description: Calculation derived from SQL code
LengthSLRaw	Standard length of an individual (mm); Zeroes indicate eggs (based on raw data)
LengthMinSLRaw	Minimum standard length of a group of individuals (mm), based on raw data.

LengthMaxSLRaw	Maximum standard length of a group of individuals (mm), based on raw data.
VIEColorRaw	Color of the VIE tag, if present; [blank]=no VIE; Not applicable for Reproductive Monitoring project (based on raw data)
VIEColorFinal	Color of the VIE tag, if present; [blank]=no VIE; Not applicable for Reproductive Monitoring project (based on verifying validity of all raw data, using USFWS stocking records)
VIELocationRaw	Anatomical location (left or right & anal or dorsal) of VIE tag, if present; [blank]=no VIE; Not applicable for Reproductive Monitoring project (based on raw data)
VIELocationFinal	Anatomical location (left or right & anal or dorsal) of VIE tag, if present; [blank]=no VIE; Not applicable for Reproductive Monitoring project (based on verifying validity of all raw data, using USFWS stocking records)

Attachment 2. Mesohabitat codes and descriptors included in the RGSM monitoring database.

ASIR Mesohabitat Descriptors		West Simplified Descriptors
BW	Backwater	BW
BW NS	Backwater	Not applicable (population estimation only)
FL	Flat	RU
IP	Isolated Pool	Not applicable (not suitable for density estimation)
MCED	Main Channel Eddy	SHPO
MCFL	Main Channel Flat	RU
MCPLPO	Main Channel Plunge Pool	PO
MCPO	Main Channel Pool	PO
MCRI	Main Channel Riffle	RU
MCRU	Main Channel Run	RU
MCSHED	Main Channel Shoreline Eddy	SHPO
MCSHFL	Main Channel Shoreline Flat	SHRU
MCSHPLPO	Main Channel Shoreline Plunge Pool	SHPO
MCSHPO	Main Channel Shoreline Pool	SHPO
MCSHRI	Main Channel Shoreline Riffle	SHRU
MCSHRU	Main Channel Shoreline Run	SHRU
PO	Pool	PO
PO NS	Pool	Not applicable (population estimation only)
RI	Riffle	RU
RU	Run	RU
RU NS	Run	Not applicable (population estimation only)
SCED	Side Channel Eddy	SHPO
SCFL	Side Channel Flat	RU
SCPLPO	Side Channel Plunge Pool	PO
SCPO	Side Channel Pool	PO
SCRI	Side Channel Riffle	RU
SCRU	Side Channel Run	RU
SCSHED	Side Channel Shoreline Eddy	SHPO
SCSHFL	Side Channel Shoreline Flat	SHRU
SCSHPLPO	Side Channel Shoreline Plunge Pool	SHPO
SCSHPO	Side Channel Shoreline Pool	SHPO
SCSHRI	Side Channel Shoreline Riffle	SHRU
SCSHRU	Side Channel Shoreline Run	SHRU
SHFL	Shoreline Flat	SHRU
SHPO	Shoreline Pool	SHPO
SHPO NS	Shoreline Pool	Not applicable (population estimation only)
SHRU	Shoreline Run	SHRU
SHRU NS	Shoreline Run	Not applicable (population estimation only)