ZUNI BLUEHEAD SUCKER MONITORING AND CONSERVATION EFFORTS 2011 and 2012

Zuni bluehead sucker, Rio Nutria, August 2012
Photo by N. Luna

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New Mexico Department of Game and Fish, Santa Fe, New Mexico
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SUMMARY

Zuni bluehead sucker *Catostomus discobolus yarrowi* historically occurred in the Zuni River and its tributaries. The New Mexico Department of Game and Fish (NMDGF), U.S. Fish and Wildlife Service (USFWS), Zuni Fish and Wildlife Department (ZDFW), and U.S. Forest Service (USFS) irregularly studied these populations from the 1970s-early 2000s, providing presence/absence and life history information. The species was listed in 1975 as endangered in New Mexico by authority of the Wildlife Conservation Act (WCA); in 1995, the WCA was amended directing NMDGF to write recovery plans for state endangered species. In 2004, NMDGF completed and began implementing the *Zuni Bluehead Sucker Recovery Plan* (Carman 2004). Long-term monitoring, an aspect of the recovery plan, has been conducted over the past nine years, with the assistance of USFWS, ZDFW, USFS, The Nature Conservancy (TNC), New Mexico Environment Department, the Silva Family, and Albuquerque BioPark (BioPark).

Habitat and fish population monitoring was completed at four sites in the upper Río Nutría drainage in both 2011 and 2012; persistence of Zuni bluehead sucker was confirmed in both years at Agua Remora, Tampico Springs, Tampico Draw, and Río Nutría. Larval (<29 mm total length) and young-of-year suckers (<100 mm total length) were documented at all sites where population monitoring occurred. This is the third consecutive year larvae have been observed at Agua Remora. Since 2010, the Pueblo of Zuni prohibited electrofishing within their lands. Visual surveys were authorized and conducted at long-term monitoring sites on the Río Nutría, within the Pueblo of Zuni, in 2011 and 2012. Fish were visually observed at the long-term monitoring sites in 2010 but not in 2011 or 2012. In 2012, Zuni bluehead sucker were observed in reaches upstream of the long-term monitoring sites in the Río Nutría within the Pueblo of Zuni. In previous years, several sites were surveyed in historically occupied habitats in the Zuni River and Río Pescado. Zuni bluehead sucker has not been found in these rivers since the mid-1990s and these sites have not been sampled since 2009. Sites within the Navajo Nation, which were previously known or thought to be occupied by suckers that are thought to have genetics markers associated with the Zuni bluehead sucker, were surveyed in 2012; suckers were collected at ten or fourteen sites sampled. The Río Nutría from the USGS gauge to the confluence with Tampico Draw continues to have the best habitat for Zuni bluehead sucker.

Various agencies and entities continued to implement conservation activities in 2011 and 2012. Refuge populations of Agua Remora and Tampico Springs were retained at the BioPark and fish voluntarily spawned in both years. The USFS continued efforts to restore habitat at Agua Remora. From late 2010 to 2012, NMDGF, USFWS, USFS, TNC, ZDFW, and the Silva Family were involved in supporting and planning two forest restoration projects within the Zuni Mountain Watershed. These forest restoration projects are intended to reduce the threat of stand replacing fire and potentially increasing surface water within Zuni bluehead sucker habitat. In January 2013, the State Court of Appeals remanded *Zuni Indian Tribe v. McKinley Board of Commissioners*, et. al., 2013-NMCA-31496 to the State District Court. This court case argues that the Tampico Springs Ranch subdivision and its associated wells were not fully analyzed for it possible surface water depletion and groundwater draw down impacts on the Rio Nutria, where Zuni bluehead sucker is most abundant. On 25 January 2013, the USFWS proposed listing the Zuni bluehead sucker as endangered with critical habitat.

AREA OVERVIEW

In 2004, as part of the initiation of long-term monitoring, required by the *Zuni Bluehead Sucker Recovery Plan,* three primary areas of Zuni bluehead sucker historical occurrence were identified using historical records, previous sampling, discussions with local landowners, and reconnaissance surveys. These areas are: 1) the upper watershed isolated spring habitats, including Agua Remora and Tampico Springs, 2) the middle watershed canyon-bound habitats, 3) Río Nutría and Tampico Draw, and 4) the lower watershed mainstem habitats, including the Rio Pescado and Zuni River (

Figure **1**). Zuni bluehead sucker no longer occur or suitable habitat is lacking in the lower watershed mainstem habitats. A summary of the habitats historically and currently occupied follows.

Isolated Spring Habitats

Zuni bluehead sucker distribution extends to headwater springs in the Zuni Mountains near the continental divide. These habitats are intermittent and currently isolated from downstream reaches and each other. The confirmed extant populations occur in perennial habitats in the Agua Remora and Tampico Springs on USFS and private lands, respectively. Agua Remora, where sampled, is a series of semi-isolated, permanently watered pools occupied by Zuni bluehead sucker, and until 2012, occupied by green sunfish *Lepomis cyanellus*. Access is through private land on which USFS has an easement. Tampico Springs is on private property and is a series of semi-isolated pools occupied only by Zuni bluehead sucker. Access to this site has been granted since 2007.

Canyon-Bound Habitats

Canyon-bound reaches of the Río Nutría are the current stronghold of Zuni bluehead sucker. TNC primarily owns the upper reach and the middle and lower reaches are within the Pueblo of Zuni. Habitat quality and extent varies in response to precipitation, beaver activity, and upstream land-use. Water is primarily perennial and three sites in this area have been monitored annually since 2004: Tampico Draw (TNC), Río Nutría below the confluence with Tampico Draw (TNC), and Río Nutría in the box canyon (Zuni Pueblo). Since 2006, wetted habitat has been irregularly present in the Río Nutría immediately above the confluence with Tampico Draw and is sampled for fish when water is present. In 2008, NMDGF and TNC completed purchase of areas of the upper Río Nutría, where Zuni bluehead sucker occurred regularly in the 1990s. Habitat was seasonally dry in 2009-2011 and not visited in 2012. While Tampico Draw near its confluence with Río Nutría is perennial and occupied by Zuni bluehead sucker, upper reaches are interrupted and Zuni bluehead sucker has not been documented in this stretch. The Río Nutría in the box canyon, within the Pueblo of Zuni, was intermittently dry in 2011 and 2012. Nonnative northern crayfish *Orconectes virilis* and fathead minnow *Pimephales promelas* are present in the Río Nutría, with abundance of each increasing downstream. Speckled dace *Rhinichthys osculus* was historically present but has been absent in recent years.

Mainstem Habitats

Mainstem habitats in the lower watershed occur solely on Zuni Pueblo. The Río Nutría below the box canyon meanders through a willow wetland and a series of impoundments. One site at the uppermost part of this section, just below the mouth of the box canyon near a USGS gage, was monitored until electrofishing was prohibited in 2010. The most recent documentation of Zuni bluehead sucker at this site was in 2005. Northern crayfish and fathead minnow were common and beaver activity high at this site. In the past several years, ZDFW conducted beaver and dam removal. The USGS gage in this area (USGS 09386900 Río Nutría near Ramah, NM) is currently located where beaver activity is high and readings since 2005 may not reflect streamflow accurately when flow is low.

The Río Pescado, which flows primarily through Zuni Pueblo, historically held populations of Zuni bluehead sucker. From 2004 to2009, several sites were sampled, but neither Zuni bluehead

sucker nor suitable habitat was found. Ríos Pescado and Nutría join above BIA Rte 4 to form the Zuni River, which historically had populations of Zuni bluehead sucker. Habitat was degraded and few areas of perennial flow existed, when sites were sampled from 2004 to 2009. Perennial water mostly occurred below Black Rock Reservoir. While perennial waters existed in some areas of the Río Pescado and Zuni River, suitable habitat was lacking and nonnative predators such as green sunfish, largemouth bass *Micropterus salmoides*, rainbow trout *Oncorhynchus mykiss*, channel catfish *Ictalurus punctatus* and northern pike *Esox lucius* dominated (Carman 2004). These habitats have not been monitored in any manner since 2009.

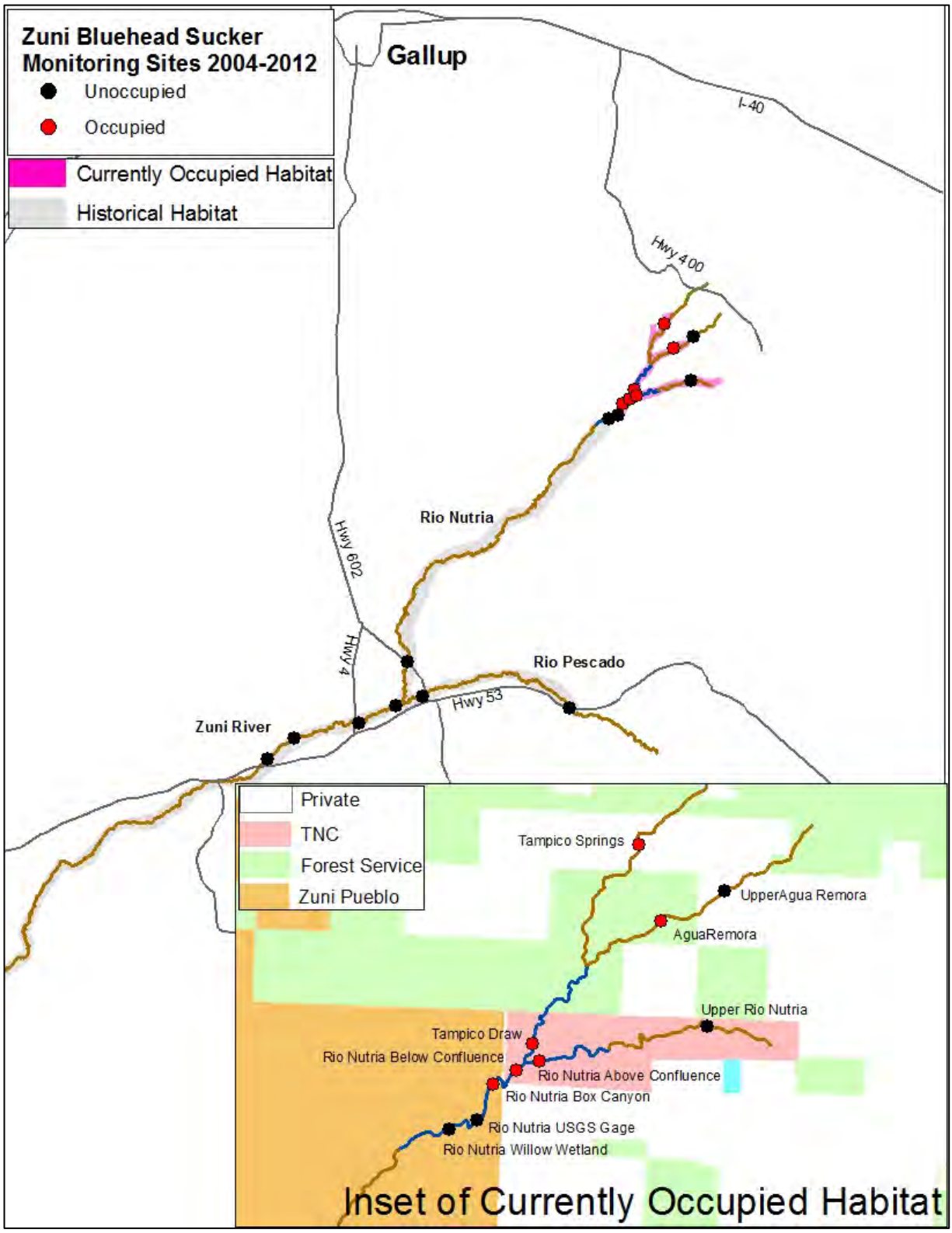
ANNUAL MONITORING

Evaluation Methods

Fish collection using electrofishing units and habitat evaluation methods follow those commonly used by NMDGF for monitoring endangered fish species. These fish collection methods have been shown to be most effective and least intrusive for collecting benthic species. When used properly, potentially harmful effects of electrofishing are significantly reduced and mortality is minimal. Additionally, electrofishing is less disruptive to benthos, which is vital for species that feed and live on the substrate. In the Zuni River and its tributaries, other fish capture methods such as seining are ineffective because of instream obstructions (e.g., boulders and debris) and habitat depth (water depth >1.5 m). Since methods have been similar across time, catch per unit effort (CPUE) data can be compared and used to determine Zuni bluehead population trends.

Fish collection began at the downstream boundary of the site and proceeded upstream until all available mesohabitats (pool, riffle, and run) were sampled. Sampling effort per mesohabitat (area sampled and elapsed time electrofishing) was recorded. Fish were collected using a battery-powered backpack electrofisher set to appropriate levels for sucker collection based on local conductivity. Two netters immediately removed stunned fish and placed them in aerated buckets until completion of the pass. Native fish were identified, enumerated, measured (length and mass), sex determined when possible, and released at the approximate point of capture. Non-native fishes were preserved for identification and accession to University of New Mexico Museum of Southwestern Biology or removed.

Figure 1. Zuni bluehead sucker monitoring and survey sites, 2004 through 2012, with inset of upper watershed sites. Blue areas indicate perennial watercourses, brown intermittent or ephemeral.



Quantitative habitat measurements were completed at each fish collection site to determine availability of Zuni bluehead sucker habitat. Water depth and velocity were measured and recorded at randomly selected points within each sampled mesohabitat. Substrata was visually characterized (e.g., sand, cobble, bedrock) at each depth/velocity measurement point. Presence of silt over base substratum was also recorded at each depth/velocity point, as well as information on cover and vegetation. Water quality parameters (water temperature, dissolved oxygen, pH, conductivity, and salinity) were measured at each site. Qualitative site descriptions were recorded, including riparian vegetation descriptions, stream size, and weather observations. Location data, including GPS points, were recorded for all sites. The HOBO data loggers deployed in 2009 and 2010 were not re-deployed in 2011 or 2012, as it was determined that this method did not track the presence and temperature of water accurately.

Monitoring for Zuni Bluehead sucker occurred in late August or early September 2004-2012. In 2011 and 2012, population monitoring occurred at four sites: Tampico Springs, Agua Remora, Tampico Draw and the Río Nutría below the confluence with Tampico Draw (

Figure **1**). In 2011, the Río Nutría above the confluence with Tampico Draw was wet and population and habitat monitoring occurred at this site. This site was dry in 2012. The upper Río Nutría (TNC) was visited in 2011 but not in 2012. Habitat data was collected at the USGS gage on the Rio Nutria and in the box canyon, within Zuni Pueblo in 2011 (

Figure **1**). No habitat data was collected within Zuni Pueblo in 2012.

Habitat Monitoring Results

Occupied isolated spring habitats (Tampico Springs and Agua Remora) in the upper areas of the watershed are quite different from the occupied canyon-bound habitats. Spring habitats are small (~1-2 m x 10 m), spring-fed semi-connected pools in grassy meadows (Figures 2-4). Water in these areas is tannic and slow moving and substrate is largely silt overlaying boulder. Habitat conditions at Tampico Springs were similar to those observed in prior years (

Figure 2 and Table 1). Deep silt continues to be present in the lower pool at Agua Remora (Figure 3 and Table 1). An intermittent connection between the lowest two pools appeared in 2010 and persisted through 2012 (Figure 3-4).

In 2011 and 2012, the best habitat for Zuni bluehead sucker, defined as clean, hard substrate with flowing water, was found in the Río Nutría downstream from the confluence with Tampico Draw to the most upstream monitoring site on Zuni Pueblo (Table 1 and Figure 4). In previous years, this extended to the canyon mouth, just above the USGS gage. In 2011 and 2012, the Río Nutría, below the Rio Nutria Box Canyon site, was intermittent, sediment had built up and the habitat appears to be degraded (Figure 4). Water levels in the Río Nutría, below its confluence with Tampico Draw, were similar to observations made since 2006 yet lower than observations between 2004-2005 (Table 1).

Habitat in Tampico Draw above the confluence with the Río Nutría and in the isolated headwaters appears marginal with some continual flowing water over patchily silted or debris-laden substrate. There is also an abundance of filamentous algae which may indicate high nitrogen input from upstream sources. Water levels in Tampico Draw, above the confluence with Río Nutría, were at the lowest levels since monitoring began in 2004 (Table 1). Prior to 2010, habitat directly above the confluence with the Río Nutría was degraded, due to dams created by beavers but spring flows in 2010 appeared to have washed out these dams creating suitable habitat. This habitat has persisted through 2012.

In 2011, visual survey of the upper Río Nutría habitat, on property purchased by NMDGF in partnership with TNC, was conducted. A few wetted pools over bedrock were present and appear to be intermittently wetted (Figure 6). The area was wet in the spring of 2009, dry in August 2009 and partially wetted August 2010. This site was not visited in 2012.

Although the Río Nutría in the box canyon has been intermittent in the past two years, a single photo point indicates 2011 water levels were similar to those seen in 2004, 2008, and 2010 (Figure 7) during survey periods. In 2012, water levels were not measured in currently or historically occupied sites on Zuni Pueblo nor were photographs taken. In the Río Nutría at the USGS gage, habitat is degraded with deep water and heavy silt (Table 1). Habitat quality has not been determined on the lower mainstem habitats located on Zuni Pueblo since 2009 at which time they were considered degraded (Table 1).

Habitats are currently designated under the New Mexico Water Quality Standards (State of New Mexico Standards for Interstate and Intrastate Surface Waters, 20.6.4 NMAC as amended through February 16, 2006) as follows: Río Nutría (from Tampico Draw confluence to headwaters) intermittent (WQS 20.6.4.98); Río Nutría (Zuni Pueblo boundary to Tampico Draw confluence) perennial (WQS 20.6.4.99); Tampico Draw (Río Nutría confluence to headwaters) perennial (WQS 20.6.4.99). In 2004, NMED completed water quality and chemistry analyses in the Zuni River watershed. The report showed one exceedence of New Mexico Water Quality Standards criteria within Zuni bluehead sucker occupied habitat, dissolved oxygen levels were 2.93 mg/L in the Río Nutría above Tampico Draw, below the 6.0 mg/L standard for coldwater aquatic life. The complete NMED report is available at: ftp://ftp.nmenv.state.nm.us/www/swqb/MAS/Surveys/ZuniSurveySummary2004.pdf

The Final 2010 Standards, from the 2009 Triennial Review of the Water Quality Standards for Interstate and Intrastate Surface Waters, 20.6.4 NMAC, designated the Río Nutría as a coolwater system changing the dissolved oxygen criteria to 5.0 mg/L or more, temperature 25°C (77°F) or less, and pH between 6.6 to 9.0 criteria:
http://www.nmcpr.state.nm.us/nmac/parts/title20/20.006.0004.htm
Measurement of water chemistry during 2011 and 2012 monitoring for Zuni bluehead sucker in occupied habitat did not show any exceedence of New Mexico Water Quality Standards criteria (Table 2).

Figure 2. Tampico Springs (Top: 2007. Bottom; 2012. Photos by M. Silva and E. Gilbert)

Figure 3. Agua Remora (Left: Larval fish salvage from drying lower pool August 2007. Right: New channel between middle and upper pools, May 2010. Bottom: Middle pool August 2012. Photos A. James and E. Gilbert)

Table 1. Attributes of habitats sampled in the Zuni River watershed, 2004 through 2012. Current Class is based on average of cubic feet per second measurements: Minimal ≤0.04 cfs; Moderate > 0.04 cfs. The term "vegetation" is inclusive of submergent, emergent and overhanging vegetation. Shading indicates sites where Zuni bluehead sucker has not been recently verified. An asterisk indicates site was dry. Dashed lines indicate an error occurred in data collection.

Site and Land Ownership	Year	Macro-habitats Sampled	Dominant Mesohabitat Type(s)	Average Depth (m)	Dominant Current Class	Dominate Substrate	Secondary Substrate	Dominant Cover
Tampico Springs, Private Property	2007	2	Pool	0.64	Minimal	Silt	Cobble	Boulder
	2008	2	Pool	0.47	Minimal	Silt	Sand	Vegetation
	2009	2	Pool	0.24	Minimal	Silt	Cobble	Vegetation
	2010	2	Pool	0.25	Minimal	Silt	Gravel	Vegetation
	2011	2	Pool	0.34	Minimal	Silt	Sand	Vegetation
	2012	2	Pool	---	Minimal	Silt	Sand	Vegetation
Agua Remora, USFS	2005	2	Pool	1.75	Minimal	Cobble	Boulder	Vegetation
	2006	3	Pool	0.62	Minimal	Silt	Boulder	Algae
	2007	3	Pool	0.56	Minimal	Silt	Boulder	Vegetation
	2008	2	Pool	0.28	Minimal	Silt	Boulder	None
	2009	3	Pool	0.28	Minimal	Silt	Boulder	Woody Debris
	2010	2	Pool	0.45	Minimal	Silt	Boulder	Vegetation
	2011	4	Pool	0.33	Minimal	Silt	Cobble	Vegetation
	2012	4	Pool	---	Minimal	Silt	Sand	Vegetation
Tampico Draw above confluence with the Rio Nutria, TNC	2004	2	Pool	0.56	Minimal	Bedrock	Silt	None
	2005	2	Pool	0.58	Moderate	Gravel	Silt	Boulder
	2006	1	Pool	0.52	Minimal	Bedrock	Silt	Vegetation
	2007	3	Pool	0.21	Minimal	Silt	Bedrock	Vegetation
	2008	2	Pool	0.24	Minimal	Silt	Bedrock	None
	2009	2	Pool	0.43	Minimal	Silt	Silt	None
	2010	2	Pool	0.20	Minimal	Bedrock	Silt	Boulder
	2011	2	Pool	---	Minimal	Bedrock	Silt	Filamentous Algae
	2012	1	Pool	0.17	Minimal	Bedrock	Silt	Filamentous Algae

Table 1. Continued

Site and Land Ownership	Year	Macro-habitats Sampled	Dominant Mesohabitat Type(s)	Average Depth (m)	Dominant Current Class	Dominate Substrate	Secondary Substrate	Dominant Cover
Río Nutría above confluence with Tampico Draw, TNC	2006	1	Pool	----	Minimal	Cobble	Bedrock	None
	2007	1	Pool	0.29	Minimal	Bedrock	Silt	Boulder
	2008	1	Pool	0.42	Minimal	Bedrock	Gravel	Boulder
	2009*							
	2010*							
	2011	1	Pool	---	---	---	---	None
	2012*							
Río Nutría below confluence with Tampico Draw, TNC	2004	2	Pool	0.68	Minimal/Moderate	Bedrock	Silt	Filamentous algae
	2005	2	Pool	0.69	Minimal/Moderate	Bedrock	Silt	Boulder
	2006	3	Pool	0.35	Minimal	Bedrock	Boulder	Boulder
	2007	3	Pool	0.23	Minimal	Bedrock	Silt	Boulder
	2008	3	Pool	0.17	Minimal	Bedrock	Silt	Boulder
	2009	2	Pool	0.24	Minimal	Bedrock	Silt	Boulder
	2010	3	Pool	0.24	Minimal	Bedrock	Silt	Boulder
	2011	3	Pool	0.31	Minimal	Bedrock	Silt	Boulder
	2012	3	Pool	0.26	Minimal	Bedrock	Silt	Boulder
Río Nutría in box canyon, Zuni	2004	4	Pool	0.35	Minimal	Clay	Bedrock	Willow
	2005	3	Pool	1.34	Moderate	Gravel	Boulder	None
	2006	3	Pool	0.42	Minimal	Gravel	Silt	Boulder
	2007	3	Pool	0.39	Minimal	Bedrock	Silt	Boulder
	2008	2	Pool	0.60	Minimal	Bedrock	Gravel	Boulder
	2009	2	Pool	0.24	Minimal	Gravel	Boulder	Boulder
	2010	2	Pool	0.68	Minimal	Silt	Boulder	Boulder
	2011	2	Pool	0.67	Minimal	Silt	Boulder	Boulder

Table 1. Continued

Site and Land Ownership	Year	Macro-habitats Sampled	Dominant Mesohabitat Type(s)	Average Depth (m)	Dominant Current Class	Dominate Substrate	Secondary Substrate	Dominant Cover
Río Nutría at USGS gage, Zuni	2004	2	Pool	0.39	Moderate	Clay	Gravel	Debris
	2005	2	Pool	1.46	Minimal	Gravel	Silt	Vegetation
	2006	2	Pool	0.41	Minimal	Silt	Gravel	Vegetation
	2007	2	Pool	0.52	Minimal	Silt	Gravel	Vegetation
	2008	3	Slow Run	0.53	Minimal	Gravel	Silt	Vegetation
	2009	2	Slow Run	0.59	Minimal	Silt	Gravel	Vegetation
	2010	2	Slow Run	0.53	Minimal	Silt	Sand	Vegetation
	2011	2	Pool	0.53	Minimal	Silt	Silt	Vegetation
Río Nutría willow wetland, Zuni	2004	-----	Slow Run	-----	Minimal	Silt		Willow
Río Pescado at Hwy 53, Zuni	2004	9	Slow Run	1.00	Minimal	Clay	Silt	Vegetation
	2009	2	Slow Run	0.51	Minimal	Silt	Cobble	
Río Pescado at Hwy 602, Zuni	2006	1	Slow Run	----	Minimal	Silt	Silt	Boulder
	2009*							
Zuni River at confluence, Zuni	2008	1	Pool	1.00	Minimal	Silt	Gravel	
	2009	1	Pool	1.00	Minimal	Silt		
Zuni River at BIA Route 4, Zuni	2006	1	Pool	0.50	Minimal	Silt	Boulder	Boulder
	2007	1	Pool	---	Minimal	Silt	Boulder	
	2008	2	Pool	0.33	Minimal	Silt	Boulder	Boulder
	2009*							
Zuni River below Black Rock, Zuni	2004	2	Wetland Pool	0.34	Minimal/Moderate	Silt	Boulder	Woody
	2007	1	Wetland Pool	---	Minimal	Silt		Vegetation
Zuni River Black Rock - Eustace, Zuni	2006	2	Slow Run	0.63	Minimal	Silt	Concrete	Vegetation
	2008	3	Slow Run	0.06	Minimal	Bedrock	Silt	Vegetation

Figure 4. Río Nutría (Top: Suitable habitat just below confluence with Tampico Draw 2012. Bottom Left and Right: Río Nutría below upper most permanent monitoring sites on Zuni land 2011)

Figure 5. Tampico Draw. (Top Left: degraded habitat with beaver dams in 2007. Top Right: suitable habitat where beaver dams washed out by high water flows in 2010. Bottom: persistence of suitable habitat in 2012. Photos: M. Schumann, A. James, and E. Gilbert)

Figure 6. Upper Río Nutría on the TNC Río Nutría Preserve. Photos by A. James.

Figure 7. The largest pool in the Río Nutría box canyon area, 2004-2010, showing changes in water levels. Photos: A. James, USFWS.

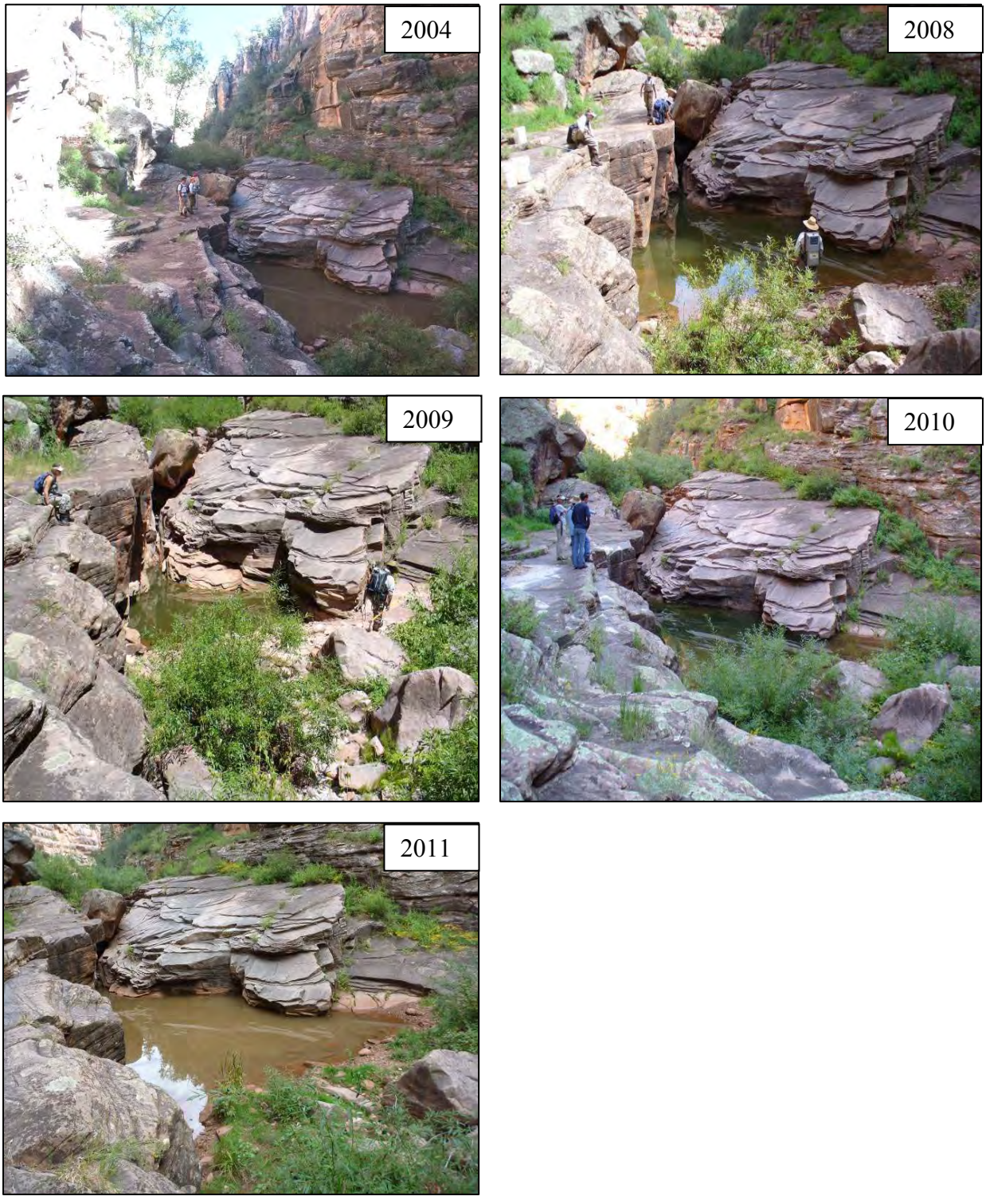


Table 2. Water chemistry variables collected by NMDGF in the Zuni River watershed 2004-2012. Dashed lines indicate that an error occurred in data collection. Shading indicates sites where Zuni bluehead sucker has not been recently verified. An asterisk indicates site was dry.

Site and Land Ownership	Date	Temperature (°C)	Salinity (ppt)	pH	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)	Conductivity (mS)	Specific Conductivity
Tampico Springs, Private Propterty	19-Aug-07	17.0	0.2	7.0	5.7	59	418	494
	25-Aug-08	16.2	0.2	8.0	6.1	62	347	418
	19-Aug-09	15.8	0.2	8.2	10.0	99	401	486
	22-Aug-10	15.9	0.2	----	5.8	48	294	343
	30-Aug-11	16.6	---	7.8	3.8	39.4	---	---
	20-Aug-12	16.5	0.2	---	6.7	65.4	386	454
Agua Remora, Forest Service,	24-Aug-05	12.9	0.3	7.6	----	----	403	525
	30-Aug-06	12.6	0.3	7.4	9.3	88	438	574
	19-Aug-07	19.4	0.3	---	8.4	90	519	582
	25-Aug-08	13.0	0.2	7.4	5.9	56	368	477
	19-Aug-09	15.3	0.3	8.1	7.6	77	470	497
	22-Aug-10	18.3	0.2	----	10.5	110	431	474
	30-Aug-11	16.7	---	8.2	6.8	70	---	---
	20-Aug-12	17.8	0.2	---	6.9	75	342	449
Tampico Draw above Rio Nutria confluence, TNC	14-Sep-04	14.9	----	8.1	12.1	157	----	----
	23-Aug-05	15.8	0.3	8.1	----	----	531	643
	31-Aug-06	14.8	0.3	8.2	8.6	86	530	667
	28-Aug-08	21.3	0.3	8.0	9.5	107	577	621
	19-Aug-09	9.9	0.3	8.2	8.1	72	476	665
	23-Aug-10	18.1	0.3	----	13.2	144	521	603
	20-Aug-12	12.8	0.3	---	6.5	62	411	537
Río Nutría above Tampico Draw confluence, TNC	31-Aug-06	15.8	0.1	8.1	7.1	71	243	294
	28-Aug-08	15	0.2	8	9.5	95	308	381
	2009*							
	2010*							
	31-Aug-11	15	---	8	4.3	43	---	---
	2012*							

Table 2. Continued

Site and Land Ownership	Date	Temperature (°C)	Salinity (ppt)	pH	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)	Conductivity (mS)	Specific Conductivity
Río Nutría below Tampico Draw confluence, TNC	23-Aug-05	15.4	0.3	8.4	----	----	496	607
	31-Aug-06	15.5	0.3	8.7	10.2	102	504	615
	28-Aug-08	14.6	0.3	8.0	11.3	103	464	579
	19-Aug-09	10.7	0.3	8.4	8.5	77	443	608
	23-Aug-10	20.4	0.3	----	12.4	154	531	580
	31-Aug-11	17.0	---	8.3	8.3	86	---	---
	20-Aug-12	12.8	0.3	---	6.5	62	412	537
Río Nutría in box canyon, Zuni	15-Sep-04	17.6	0.3	----	6.6	70	405	504
	22-Aug-05	19.7	0.2	8.4	----	----	347	386
	29-Aug-06	13.8	0.2	9.4	8.7	84	241	306
	21-Aug-07	16.2	0.2	7.7	9.6	98	320	384
	27-Aug-08	17.2	0.2	8.2	8.3	87	315	370
	19-Aug-09	18.1	0.2	8.8	12.4	131	370	422
	30-Sep-11	12.1	---	7.8	6.8	64	---	---
Río Nutría at USGS gage, Zuni	15-Sep-04	13.7	0.3	----	3.8	36	489	625
	22-Aug-05	13.7	0.3	7.4	----	----	506	643
	29-Aug-06	13.9	0.2	8.4	1.8	18	306	388
	21-Aug-07	14.5	0.3	6.6	4.7	47	468	584
	27-Aug-08	14.9	0.3	7.6	2.5	24	472	578
	18-Aug-09	12.8	0.3	7.7	5.0	48	458	600
	30-Sep-11	12.1	---	7.8	6.8	64	---	---
Río Pescado at Hwy 53, Zuni	13-Sep-04	17.7	0.2	----	3.1	----	400	465
	18-Aug-09	9.7	0.3	8.0	9.6	67	373	526
Río Pescado at Hwy 602, Zuni	29-Aug-06	17.8	0.2	8.4	5.9	62	316	366
	2009*							366
Zuni River at confluence, Zuni	26-Aug-08	22.3	0.2	8.4	10.0	115	401	420
	17-Aug-09	22.3	0.5	8.8	9.6	110	1040	1097
Zuni River at BIA Rte 4, Zuni	29-Aug-06	18.2	0.1	8.8	5.3	58	204	235
	26-Aug-08	19.7	0.2	8.3	9.4	104	296	330
	2009*							
Zuni River below Black Rock, Runi	20-Aug-07	21.0	0.5	6.3	9.4	106	866	938
Zuni River between Black Rock & Eustace, Zuni	28-Aug-06	20.3	0.5	8.8	2.9	32	855	941
	26-Aug-08	16.3	0.5	7.9	11.3	116	771	925

Fish Collections

During 2011 and 2012 monitoring, Zuni bluehead sucker was present at all four sites sampled with electrofishing; Tampico Springs, Agua Remora, Tampico Draw and Río Nutría below the confluence with Tampico Draw (Figure 8). Zuni bluehead sucker was not found in the Río Nutría above the confluence with Tampico Draw despite being wetted in 2011. This site was dry in 2012 and thus not sampled. No fish has been observed in the upper Río Nutría since stocking occurred in July 2009 and pools dried later in August. Visual surveys occurred at this site in 2010 and 2011 but not in 2012. The presence of Zuni bluehead sucker was not confirmed in 2011 or 2012 during visual surveys in the Rio Nutria from the box canyon downstream, though fathead minnow were observed in 2011. Zuni bluehead sucker was not observed at the Río Nutría USGS gage site during visual observations in 2011; no Zuni bluehead sucker has been captured at this site since 2005 (electrofishing sampling conducted from 2004-2009). Speckled dace was not captured during monitoring in 2011 or 2012. Northern crayfish was observed during visual surveys in the Río Nutría upstream of the USGS gage in 2011, but not in 2012. This is the first year since 2005 that green sunfish was not collected at Agua Remora. This is also the fourth consecutive year that young-of-year Zuni bluehead sucker was captured at Agua Remora during annual monitoring. Sites in the lower watershed mainstem habitats, were not visited in either 2011 or 2012 (Figure 8).

The majority of Zuni bluehead suckers caught in 2011 and 2012 appeared in good physical condition, with spawning coloration (red lateral stripe) noted on some males at all sites. A total of 212 Zuni bluehead suckers ranging from young-of-the-year to 215 mm TL adults were caught in 2011 (Table 4). In 2012, 775 individuals were captured. They ranged in size from young-of-the-year to 419 mm TL (Table 4). Black spot, caused by the common fish parasitic fluke *Uvulifer*, was found on Zuni bluehead suckers in Agua Remora, but not noted in other populations in 2011and 2012. Tampico Spring fish continue to show facial deformities (Table 3). In most years the percentage of deformities was <5.5% with the exception of 2008 when deformities were at a high (12.1%). No fish were observed expressing milt in August 2011 or 2012.

Young-of-year Zuni bluehead suckers were found in the Río Nutría, Tampico Draw, Tampico Springs, and for the third and fourth consecutive year, in Agua Remora. Until 2009, young-of-year had not been collected in Agua Remora. A third pool in Agua Remora, which had been fishless prior to 2011, was found to hold Zuni bluehead sucker in 2012.

Review of Zuni bluehead sucker population status, for proposed listing as either threatened or endangered with critical habitat, began in 2012. Part of the process of the status review was updating all information regarding species status. Thus, USFWS, NMDGF, and Navajo Nation Department of Fish and Wildlife sampled sites on the Navajo Nation, which were previously known or thought to be occupied by Zuni bluehead sucker. In 2012, Zuni bluehead sucker was collected at ten of fourteen sites sampled on the Navajo Nation.

Population Trends

Although Zuni bluehead sucker sampling has been conducted irregularly since 1990, sampling methods were similar across years making comparisons of several population variables possible.

Herein, number of fish per second electrofishing elapsed time (CPUE) and length-frequency histograms are the metrics used to characterize population trends (Figures 10-14).

With the exception of Tampico Springs, CPUE in 2012 was highest among all years at each site sampled (Figure 9). Catch rates in the Río Nutría below its confluence with Tampico Draw was high but similar to 2009 and 2005. A decreasing trend in CPUE was observed at Tampico Springs since 2008 but this trend reversed in 2012.

Length-frequency histograms for Zuni bluehead sucker populations in Agua Remora indicate a shift in the size structure (Figure 10). From 2005 through 2008, no Zuni bluehead sucker < 120 mm TL was captured in the Agua Remora. Green sunfish removal efforts were initiated in 2007 (see Nonnative Species Control Efforts, page 28). From 2009 to 2012, young-of-year were present and juveniles outnumbered adults.

Comparison of length-frequency data from 1994 with 2007-2010 from Tampico Springs indicate that larger individuals (>105 mm TL) declined; only three fish >105 mm TL were collected from 2007-2010 (
Figure **11**). However, data collected at Tampico Springs in the 1990s indicated fish <100 mm TL had late maturing and mature ova (Propst et al. 2001), and were capable of reproduction at this size. During 2007-2012 collections, fish at Tampico Springs with adult characteristics (spawning coloration, gravid females) were observed as small as 57 mm TL. Larvae and the occurrence of multiple, if compressed, size classes were observed indicating that spawning and recruitment continues to occur in Tampico Springs. Collections in 2011-2012 resulted in the capture of a few larger sized fish (
Figure **11**).

Although there have been minor shifts in the length-class frequency distribution, Zuni bluehead sucker in the Rio Nutria below the confluence with Tampico Draw and in Tampico Draw continue to be comprised of multiple size classes (Figure 12Figure 13). The presence of small fish (<50 mm TL), presumably larvae and young-of-year, indicate that the species successfully reproduced in the Río Nutría and Tampioc Draw in 2011 and 2012. The collection of adults at both sites indicate that recruitment also occurred in these area.

Table 3. Incidence of facial deformities at Tampico Springs

Year	Deformity Ratio (deformed/total captured)	Deformity Percentage
2007	3/77	3.8
2008	8/66	12.1
2009	2/48	4.1
2010	0/54	0.0
2011	2/36	5.5
2012	4/109	3.7

Figure 8. Fish assemblage by site in the Zuni River watershed, 2004-2012. No Survey = NS

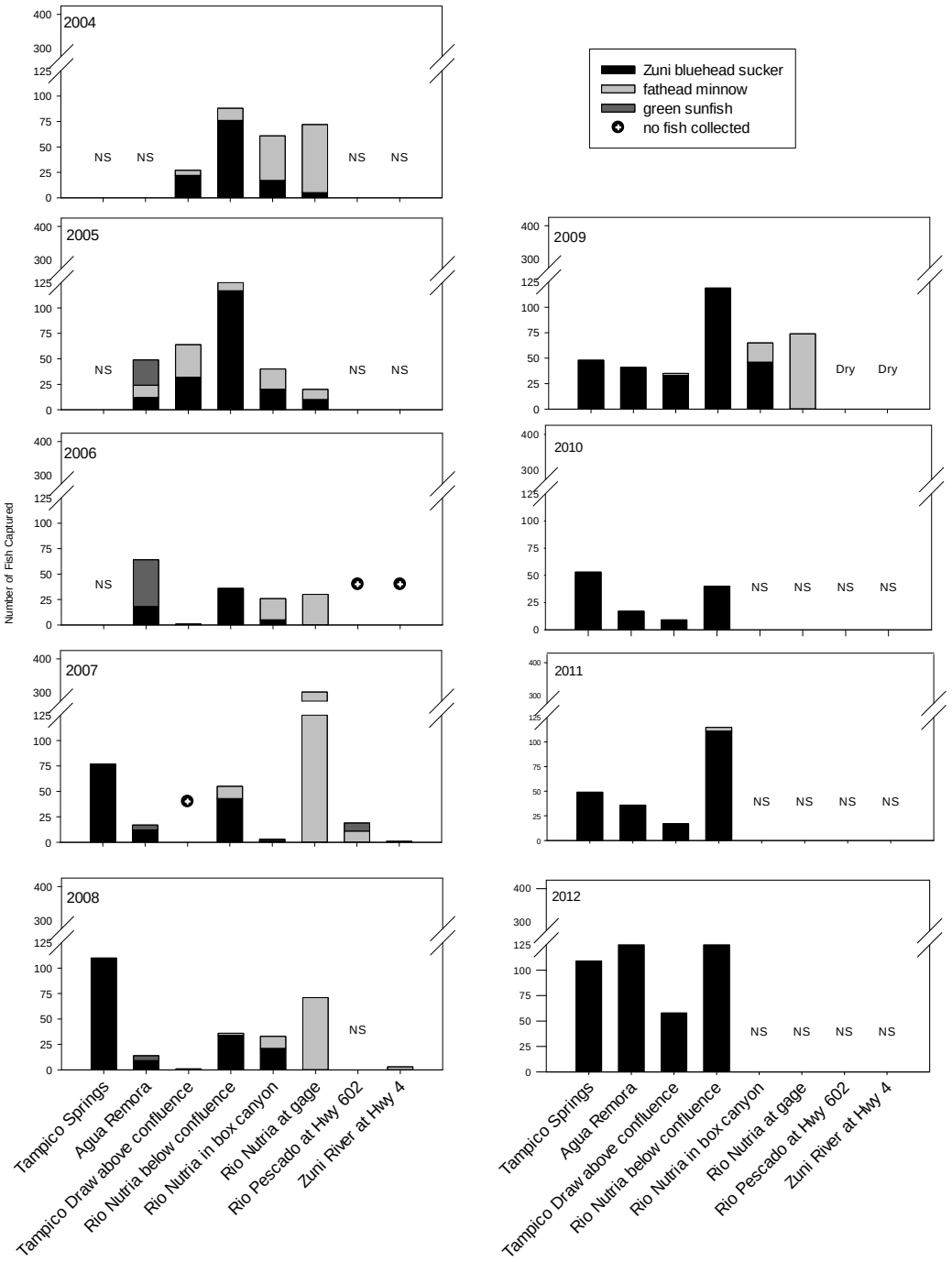


Table 4. Number of fish collected in the Zuni River watershed, 2011 and 2012. Range of Zuni bluehead sucker total length (mm) in parentheses. Visual survey conducted in Río Nutría box canyon.

2011 Sites	Effort (Shocking Seconds)	Zuni Bluehead Sucker	Fathead Minnow	Green Sunfish	Plains Killifish	Crayfish
Tampico Springs	462	49 (yoy-147)				
Agua Remora	958	35 (yoy-215)		1		
Tampico Draw above Rio Nutria Confluence	---	17 (yoy-125)				
Río Nutría below Tampico Draw Confluence	1190	111 (yoy-183)	4			
Río Nutría in box canyon	Visual Survey	Not Observed	Present			
Río Nutría at USGS gage	Visual Survey	Not Observed	Not observed			
Río Pescado at Hwy 53	No Survey					
Zuni River at confluence	No Survey					
Totals						

2012 Sites	Effort (Shocking Seconds)	Zuni Bluehead Sucker	Fathead Minnow	Green Sunfish	Plains Killifish	Crayfish
Tampico Springs	518	109 (yoy-124)				
Agua Remora	479	163 (yoy-190)				
Tampico Draw above Rio Nutria Confluence	374	58 (yoy-205)				
Río Nutría below Tampico Draw Confluence	1640	236 (yoy-187)	1			
Río Nutría in box canyon	Visual Survey	Not Observed at Permanent Sites; Observed Upstream	Present			
Río Nutría at USGS gage	No Survey					
Río Pescado at Hwy 53	No Survey					
Zuni River at confluence	No Survey					
Totals						

Figure 9. Catch per unit effort in the Zuni River Watershed, 1991-2012. No sampling conducted in waters within Zuni Pueblo in 2010-2012(highlighted in gray).

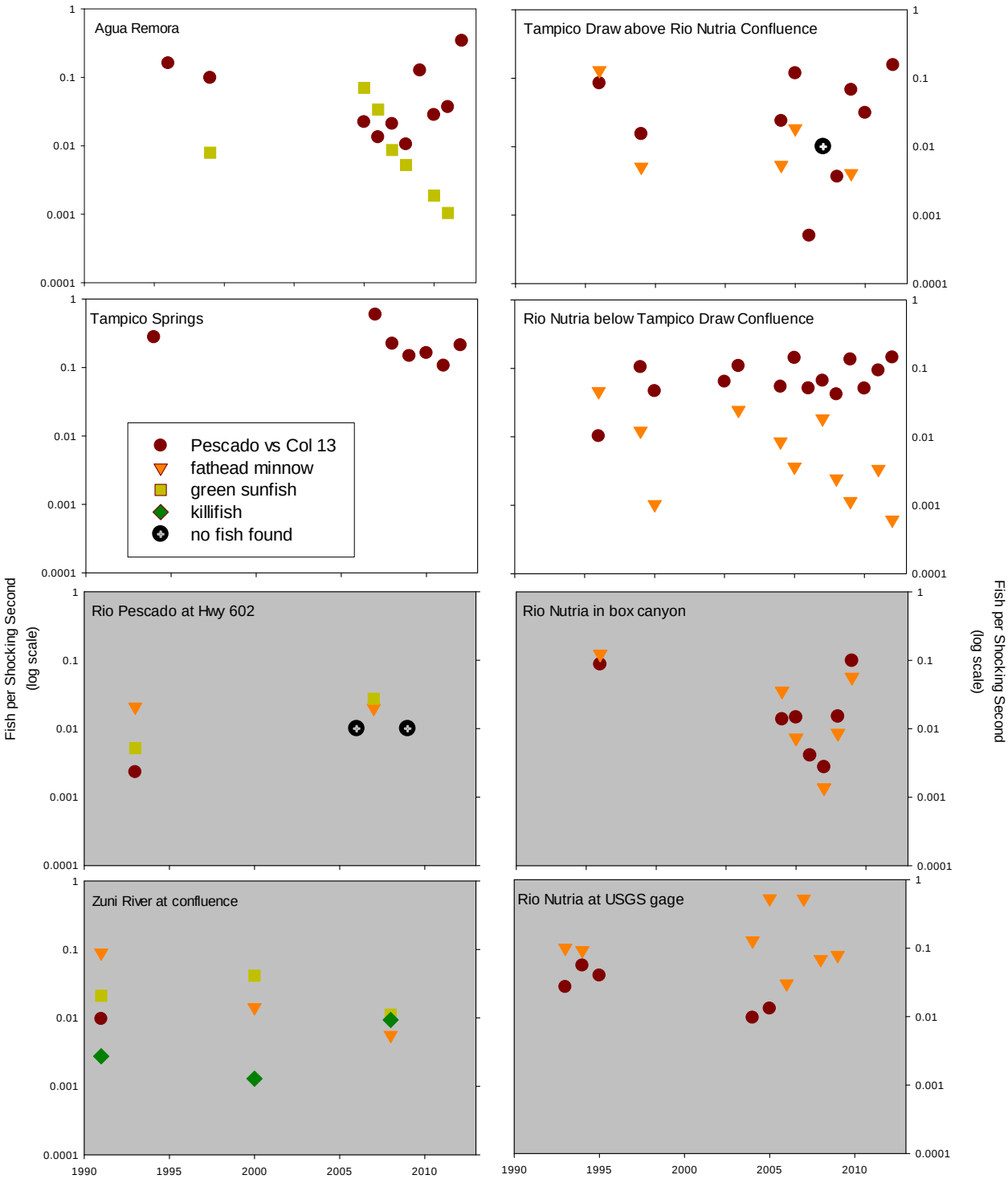


Figure 10. Length-frequency of Zuni bluehead sucker collected from headwater springs, Agua Remora, 1991, 1994 and 2005 – 2012.

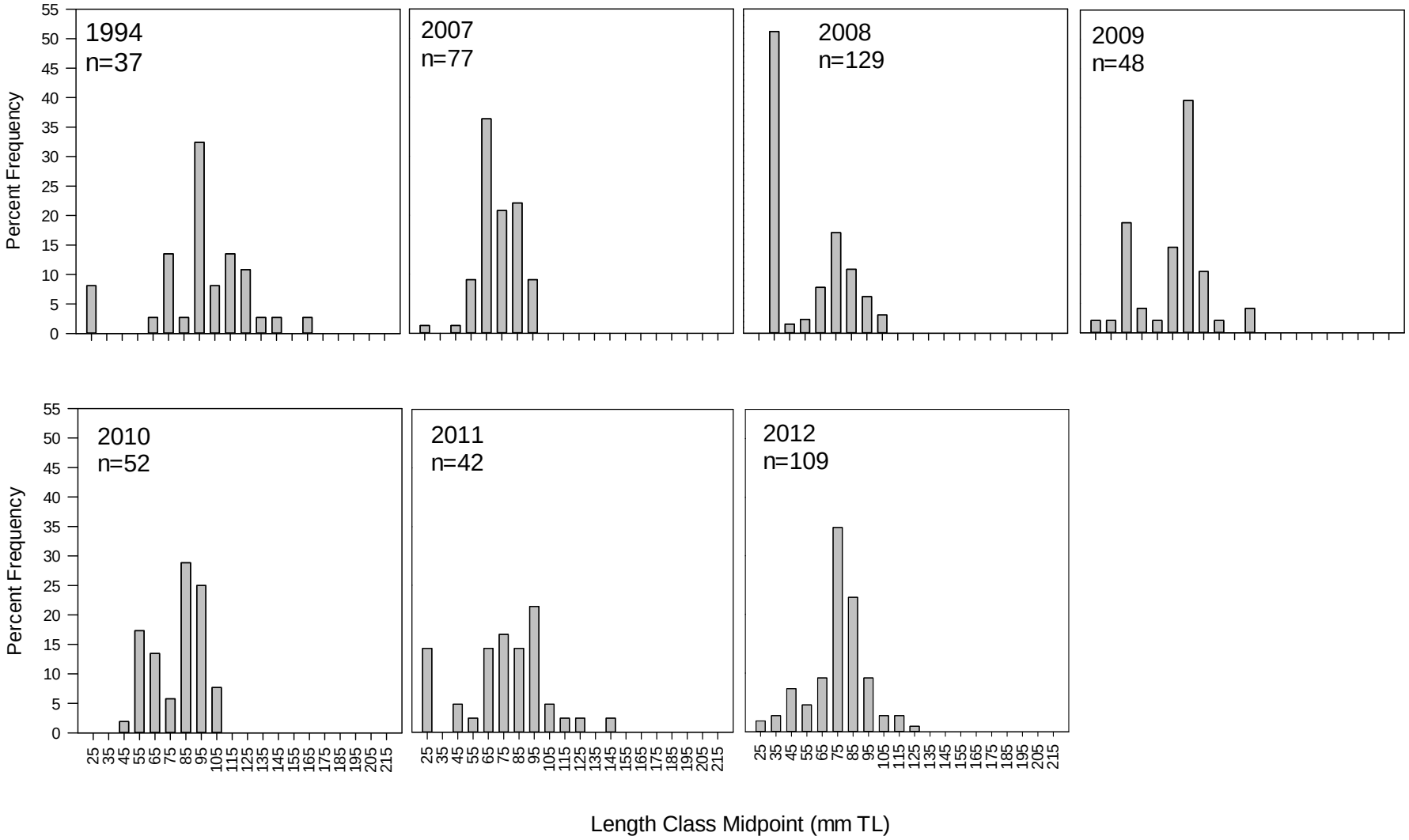


Figure 11. Length-frequency of Zuni bluehead sucker collected from headwater springs, Tampico Springs, 1994 and 2007-2012.

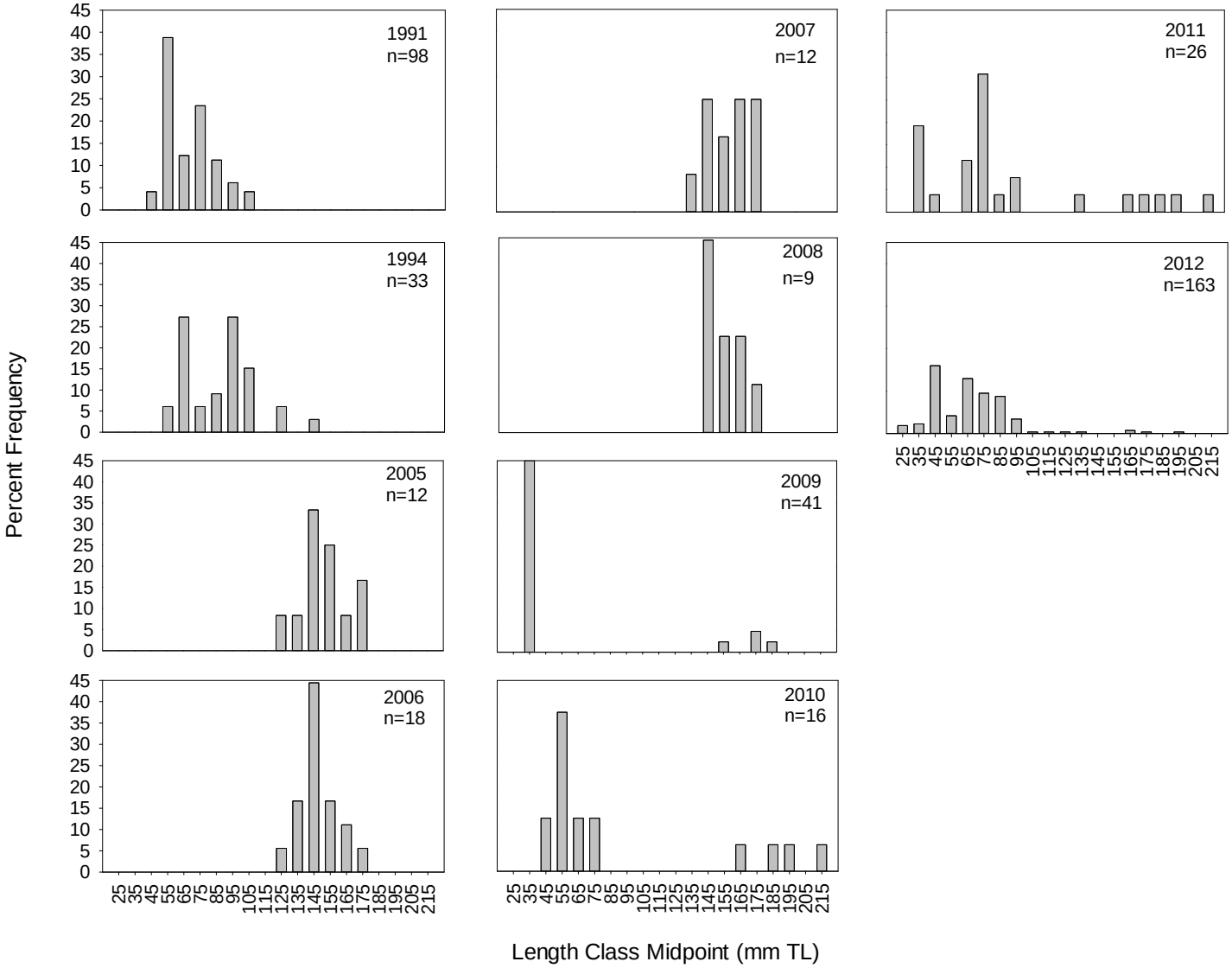


Figure 12. Length-frequency of Zuni bluehead sucker collected from Rio Nutria, 2000 - 2012.

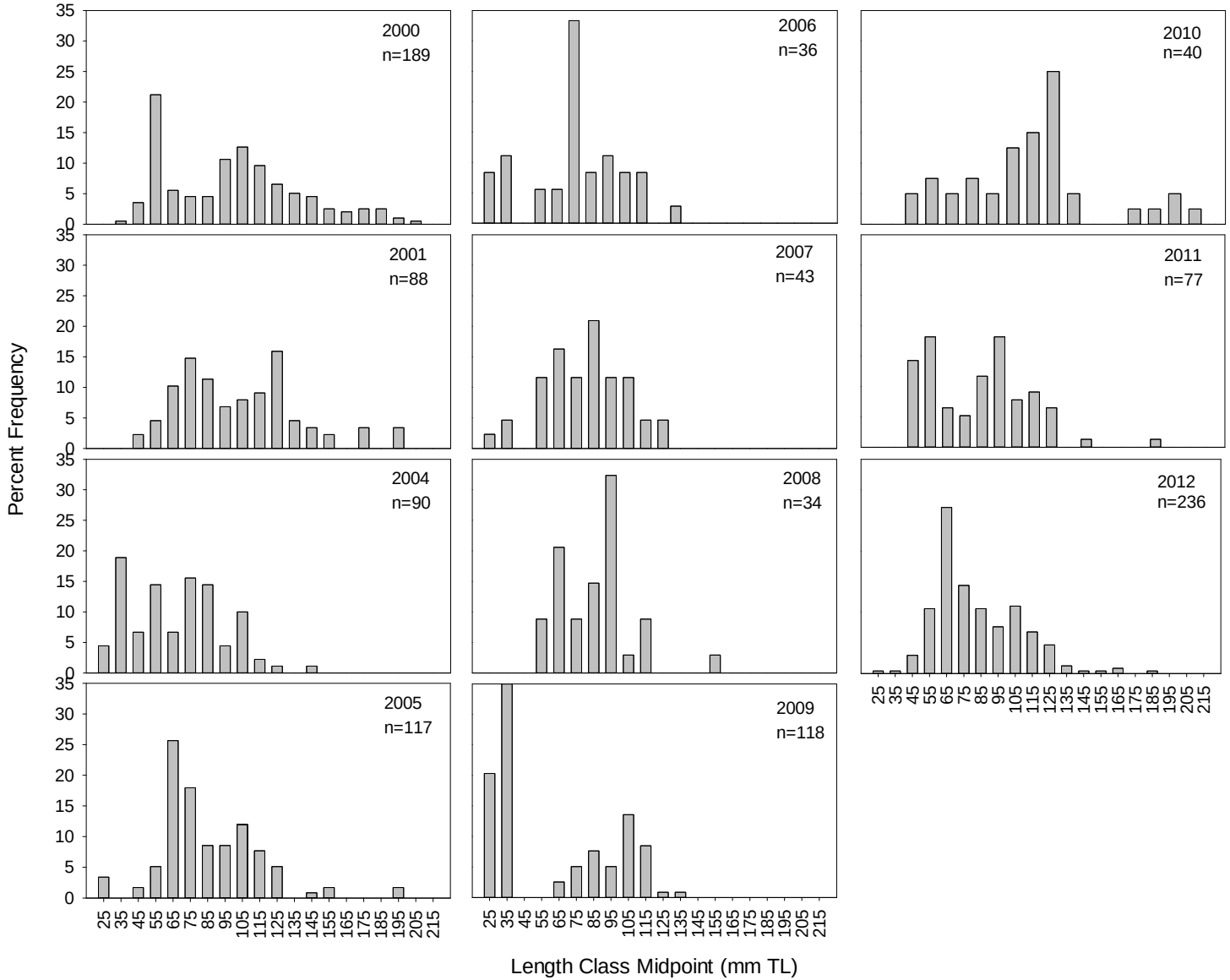
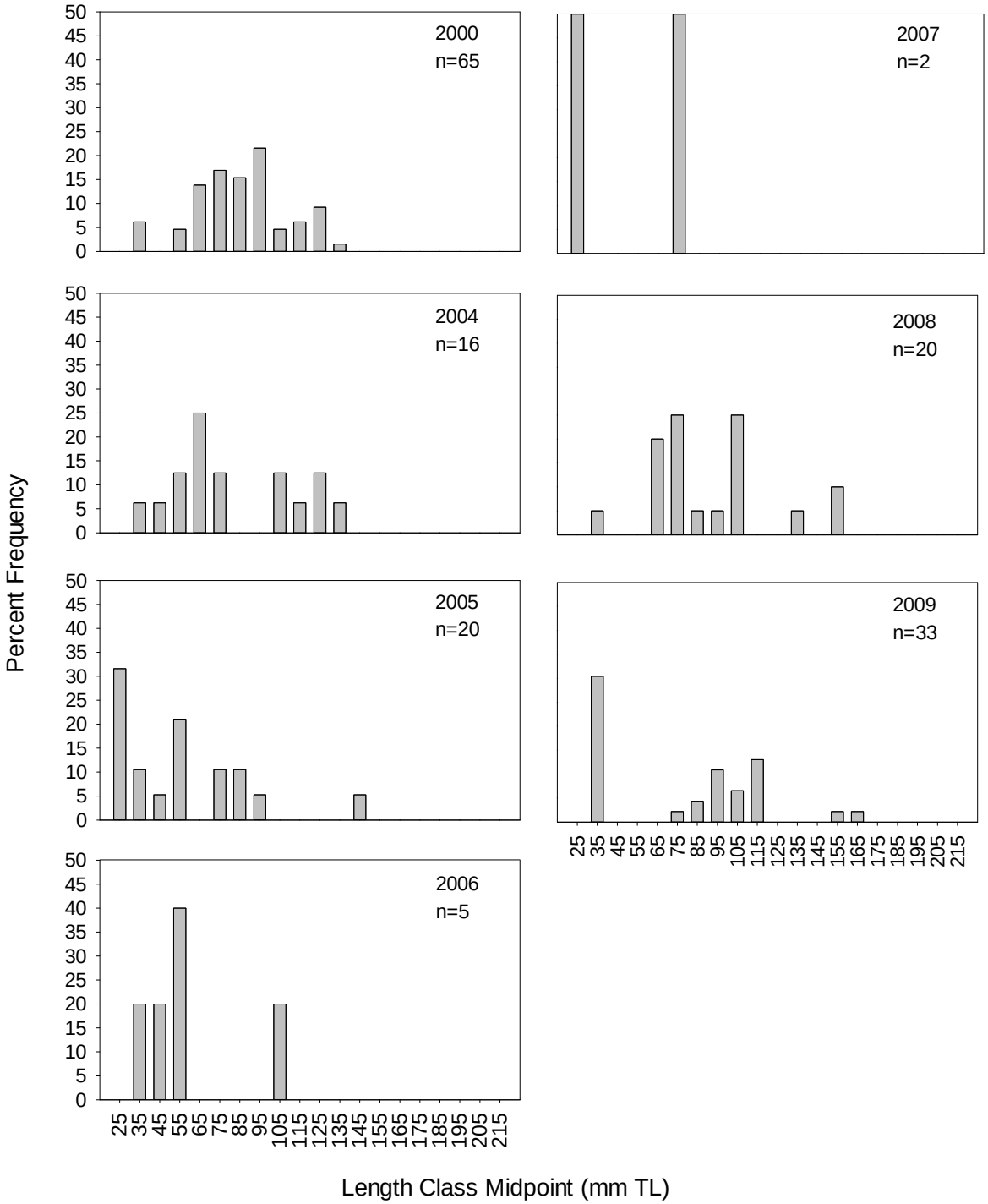


Figure 13. Length-frequency of Zuni bluehead sucker collected from Río Nutría box canyon, 2000 and 2004-2009. Surveys were not conducted at monitoring sites 2010-2012.



NONNATIVE SPECIES CONTROL EFFORTS

Nonnative crayfish *Orconectes virilis* was reported and confirmed in the Río Nutría at the USGS gage in 2004. From 2004-2010, northern crayfish has been found approximately 100 m further upstream. It has not been collected at any other sites regularly monitored for Zuni bluehead sucker. In years when monitoring occurred in historical downstream habitats, crayfish was common. The presence of this species was confirmed during visual surveys of the Rio Nutria near the USGS in 2011.

Although rare or absent in the 1990s, green sunfish was more common than Zuni bluehead sucker in Agua Remora between 2005 and 2006 (Figure 9). The lack of small (< 125 mm TL) Zuni bluehead sucker in the Agua Remora suggested green sunfish may be preying upon young Zuni bluehead sucker and limiting recruitment (Figure 10). Piscivory by green sunfish has been implicated in the decline of several native southwestern species (Marsh and Langhorst 1988, Fausch and Bramblett 1991, Dudley and Matter 2000). Efforts to document piscivory of green sunfish at Agua Remora did not did not reveal predation on Zuni bluehead sucker which could be due to rapid digestion (Carmen 2006).

Directed efforts to remove green sunfish from Agua Remora pools began in 2007 and resulted in the removal of over 80 green sunfish in 2007 and two in 2008 via angling (lower and middle pools). No green sunfish was captured in 2009 by angling or during monitoring efforts, although one green sunfish was visually observed in the middle pool. Each year, during 2010 and 2011 annual monitoring activities, one sunfish was captured in the middle pool and removed. In 2012, no green sunfish was captured at Agua Remora. Since monitoring began at Agua Remora, the greatest number of Zuni bluehead sucker collected in the middle pool was ten (year 2006). In all other years, the greatest number of fish captured in this pool was four. Fish were never < 120 mm TL. In 2012, 26 Zuni bluehead sucker were collected in this pool ranging from 59-174 mm TL. Zuni bluehead sucker was also observed and captured in a small pool just upstream of the middle pool. This is the first time fish have been observed in this pool. Larvae have now been captured in four consecutive years at Agua Remora during annual monitoring.

In previous annual monitoring efforts, nonnative fathead minnow numerically dominated the fish catch in the lower sections of the Río Nutría canyon. Fathead minnow may negatively affect Zuni bluehead sucker and was removed when found. While no monitoring was conducted in Río Nutría below the box canyon, fathead minnow was captured in the Río Nutría just below the confluence with Tampico Draw and thus continue to persist in the system.

GENETIC INVESTIGATIONS

While no genetic investigations were begun or continued by NMDGF between 2011 and 2012, prior genetic investigations of bluehead sucker indicate various complex evolutionary histories and genetic divergence between isolated populations. Genetic analysis of suckers collected in the Lower Colorado River indicated mountain sucker Catostomus platyrhynchus (subgenus *Pantosteus*) of the Little Colorado River basin (LCR) share genetic material from *Catostomus plebeius,* consistent with the distinctiveness and hypothesized hybrid origin of Zuni bluehead

sucker (T. Dowling, pers.comm). Genetic samples collected from Zuni bluehead sucker populations, particularly those in the headwater spring habitats of the Zuni watershed indicated that these populations had low allelic diversity (Turner and Wilson 2009). Headwater fish in the Rio Nutria while distinctly different from the isolated spring population exhibited very few alleles/haplotypes that are of *C. plebius* origin (Turner and Wilson 2009)

CAPTIVE REARING INVESTIGATIONS

Husbandry of Zuni bluehead sucker is an unknown science and given the fish's extremely limited distribution and the magnitude of threats to its persistence in the wild, captive holding may be a necessary recovery action. In 2007, NMDGF contracted the Albuquerque BioPark to investigate rearing and holding practices for imperiled aquatic species in the state, including Zuni bluehead sucker. Priorities included collection of fish from the Agua Remora and Tampico Springs as these are the most remote and isolated Zuni bluehead sucker populations. Larval, juvenile, and adult fish were collected in 2007, 2008 and 2010 (

Table 5). The following update was obtained from the Albuquerque BioPark annual report submitted in July 2012.

Tampico Springs

During annual monitoring in 2007, 19 adult Zuni bluehead sucker were collected from Tampico Springs (ABP07-016 and SMC07-011). In 2008, approximately 10 adults and 20 juveniles were collected from Tampico Springs (ABP08-017). In the spring of 2009, a filtered, clear water, low flow, and variable-depth raceway system was designed to provide suitable habitat for the fish. The system contained a variety of substrates including concrete, flagstone, pea gravel, and river rock. Plankton and algae were the main food source. Approximately 43 adult Tampico Springs fish were transferred to this new system. Razorback sucker pellets were provided as a supplement to algae. Ground pellets were provided in areas younger, smaller fish frequented. Shortly after entering the new system, the Tampico Springs fish spawned naturally. Approximately 50 larval were observed on 6 May 2009. On 11 November 2009, 18 juveniles were observed (

Table 5).

Agua Remora

In the spring of 2007, 27 larval from Agua Remora (ABP07-011 and SMC07-002) were collected. The fish were held indoors and failed to thrive. By the summer of 2009 only three fish remained. During annual monitoring in 2010, fish were collected from Agua Remora. Ten age-1 fish were assigned lot ABP10-011 and 36 larvae were assigned lot ABP10-010. Young-of-year fish were fed brine, ground flake and ground pellets and were provided structures with algae for supplemental grazing. Juvenile fish were fed larger pellets and also provided algae covered structures for grazing. The juvenile fish were observed grazing on the algae often. Adults were fed small sucker pellets. While indoors, black plastic was wrapped around the tank walls because it appeared to reduce stressful behavior. Fish were held in indoor systems until October 2011 when they were moved to an outdoor raceway, a similar but separate system from the Tampico Springs population. The two surviving fish collected from Agua Remora in 2007 (ABP07-011) were placed outdoors in this system as well. Fish were moved outdoors because previous populations of suckers collected in 2007 and 2008 that were housed indoors did not thrive.

Combined Agua Remora and Tampico Springs populations

In 2011, NMDGF approved a plan to combine the Tampico Springs and Agua Remora populations into the same system (B14) based on a genetics study (Turner and Wilson 2009). The Agua Remora fish were tagged with a yellow, visible implant elastomer (VIE) on the inner, right pectoral fin to distinguish them from the Tampico Springs population. Standard and total lengths were recorded for all Agua Remora fish when tagged. In 2012, offspring were tagged with a VIE tag in a different location using a different color. Each year offspring will be tagged in a different location so each generation can be identified.

ABP12-005

All Zuni bluehead sucker produced in 2012 were assigned lot APB12-005, and are prodigy of ABP07-011, ABP07-016, ABP08-017, ABP09-001, ABP10-010 and ABP10-011 (

Table 5). Four larval, ~10 mm TL were observed in the center of the raceways system in April 2012. Fish were likely less than two weeks old. Zooplankton density was evaluated to be low in the system so fish were fed 470mL of Artemia, four times a day to supplement their diet. A fine mesh screen cover was installed on the pump intake to diffuse water pressure and prevent larval from being pulled into pump. In May, ~100 larval <10mm TL were observed. An underwater camera was used to search for eggs. Spawning behavior and eggs were not observed. Water temperature was 19.9°C. Within one week, these fish had doubled in size, ~20 mm TL. Larval fish were offered 1L of Artemia five times a day. Observations of fish eating were made daily. Fish were observed swimming mid-column, feeding on zooplankton and Artemia. They remained free-swimming in the upper half of the 2ft deep system and never observed to be occupying the floor of the tank during the first month. In June 2012, juvenile fish were observed periodically grazing on algae off the bottom of the system. They were offered ground pellets and observed eating them. The fish were offered daphnia and fed on it enthusiastically. By the end of June, the fish spilt their time between swimming mid-column and grazing on the bottom of the system.

Spawning behavior

Spawning behavior was observed on 18 May 2012. Water temperature was 20.0°C. BioPark staff observed one female swimming around depressed gravel. She was flanked on all sides by up to ten males that were smaller than her and exhibiting bright red coloration. At one point two males lined up on each side of her and the three shimmied their tails quickly over a depressed gravel bed, approximately one foot deep. The female continued to swim with males surrounding her for about an hour. A video recorder was set up to record the behavior. Only one female expressed this behavior. Other females were at least two meters away and behaving normally.

Videography was reviewed for observation of egg deposition but was not noticed. Small aquarium nets were used to disturb gravel and collect eggs but no eggs were found. Other sections of the system were searched for eggs through the following week but none were found. No larval fish were observed after the18 May 2012 spawning activity.

Mortalities

Eleven Zuni bluehead sucker mortalities occurred in 2011-2012. Fish were preserved in 5% formalin and a fin clips were preserved in ethanol. Specimens were accessioned to the Museum of Southwestern Biology at University of New Mexico.

Table 5. Zuni bluehead sucker lots at the Albuquerque BioPark as of July 2012.

Lot Designation	Origin	Collection Date	Collection Lifestage	Collection Number
ABP07-101/SMC07-003	Tampico Springs	3 Jul 2007	Larvae	18
ABP07-016/SMC07-011	Tampico Springs	19 Aug 2007	Adults	19
ABP08-010/SMC08-004	Tampico Springs	28 Jun 2008	Larvae	21
ABP08-017/SMC08-009	Tampico Springs	25 Aug 2008	Juveniles/Adults	20/10
ABP09-001	Offspring (Tampico Springs)	May 2008	Larvae	50
ABP07-011/SMC07-002	Agua Remora	2 Jul 2007	Larvae	27
ABP08-015/SMC08-008	Agua Remora	25 Aug 2008	Adults	5
ABP10-010/SMC10-010	Agua Remora	22 Aug 2010	Juveniles	36
ABP11-010/SMC10-010	Agua Remora	22 Aug 2010	Adults	8
ABP12-005	Offspring (Combined)	22 Apr 2012	Larvae	4

RESTORATION OF HISTORICAL POPULATIONS AND HABITAT AND ESTABLISHMENT OF REFUGE POPULATIONS

In 2008, NMDGF and TNC completed the purchase of land in the upper Río Nutría, including the stream segments that were believed to be perennial and where a life history study was completed in the early 1990s(Propst et al. 2001). When the site was visited in August 2005, the stream was wetted, but Zuni bluehead sucker was not observed. Restoration of a population to this area was a priority action identified in 2008. Transfer of fish from the Río Nutría below the confluence with Tampico Draw occurred in June 2009. At that time wetted habitat was reduced from that noted in the spring of that year. During annual monitoring 2009-2011 disconnected pools were present. These observations, coupled with the data from the 2010 HOBO temperature logger, indicate that this stretch of the upper Río Nutría may be seasonally intermittent. In 2010 and 2011, the wetted pools harbored a large number of bullfrog tadpoles. No fish have been observed at this site since they were transferred in 2009. This site was not visited in 2012.

COLLABORATIVE HABITAT PROTECTION AND RESTORATION

In 2003, the USFS began the process to grant an easement to McKinley County for access across FR 191 and 191D and reassignment of an existing easement across private lands. The terms of the easement allows McKinley County to upgrade FR 191D and take over the maintenance of FR 191 and FR 191D for a proposed subdivision. At that time the proposed subdivision was Southern Cross Ranch, LLC and later became Tampico Springs Ranch Subdivision. In 2007, NMDGF appealed a Finding of No Significant Impact, for this action, citing a lack of analysis on the "potential direct, indirect and cumulative impacts to the Zuni Bluehead Sucker of the proposed Tampico Springs Ranch Subdivision" (Thompson, 2007e). An Environmental Assessment resulted and an Environmental Impacts Statement (EIS) was developed. NMDGF contested implementation of the EIS's Proposed Action (Wunder 2008 and 2010). The Record of Decision implementing the Proposed Action was published in April 2011: http://a123.g.akamai.net/7/123/11558/abc123/forestservic.download.akamai.com/11558/www/nepa/50531_FSPLT2_052742.pdf. The granting of the easement allowed McKinley County to

upgrade FR 191D to a County Class B-2 (all-weather road). Upgrades began in 2011 and have continued through 2012.

Mitigation for wildlife and fish, in the EIS Record of Decision for the McKinley County FR 191 and 191D easement, included setting up and maintaining water monitoring wells in Zuni bluehead sucker habitat within the Rio Nutria watershed. This mitigation was included as three competing hydrologic reports did not confer on the impacts development of Tampico Spring Ranch Subdivision and groundwater draw down from associated wells would have on surface and groundwater in Zuni bluehead sucker habitat (MJDDarrconsult, Inc. 2007 commissioned by Tampico Springs, LLC., Glorieta Geoscience, Inc. 2007 commissioned by Zuni Tribe, and Congdon 2009 commissioned by Cibola National Forest).

NMDGF received a report in early 2013 from Cibola National Forest on regional spring surveys in the Cibola National Forest (Paffet and Crossey 2011). This survey was conducted by a senior at the University of New Mexico and included springs from three different regions (Bear, Sandia and Zuni Mountains). The Zuni Mountains study was subdivided into the Rio Nutria and Ojo Caliente groups. Four of eight springs identified as existing in the Rio Nutria group were surveyed; these all occur on Cibola National Forest. Surveys included measurement of water quality and collection of water samples. Stable isotopes, from water samples, were supposed to allow geochemical modeling and identification of the sources and mixing of water in springs. Comparisons of water chemistries between springs in the Rio Nutria group were not accomplished as only one of the four springs (Agua Remora) surveyed was discharging water during the study.

The EIS Record of Decision also indicated that NMDGF and the USFS would work in cooperation to set up and maintain water monitoring wells. Due to personnel changes at NMDGF it is not currently understood if NMDGF participated in the development of this study. It is also not currently understood if this study was conducted as part of the mitigation to understand how potential groundwater pumping from the Tampico Spring Ranch Subdivision would impact the surface and groundwater available to Zuni bluehead sucker.

Isolated Spring Habitats

According to a local landowner, the pools at Agua Remora were dug out by USFS in the 1970s. While this has not been confirmed in files, given the location and dimensions of the pools, it seems likely such digging occurred. Discussions began with the USFS in 2009 about potential methods to protect or enhance the Agua Remora habitat. In 2010, USFS proposed to protect and enhance the Agua Remora habitat in future years by pool restoration, installation of sediment control structures throughout the watershed, removal of cattails and excessive woody debris, and repair of fencing. In 2010, USFS personnel, volunteers from the Albuquerque Wildlife Federation and NMDGF repaired the fencing around the three pools. During a visit in July 2012, holes in the fence were observed and trespass cows were present within the meadow. By August 2012, cattle were removed from the area.

The upper pool at Agua Remora was heavily laden with woody debris and found fishless in 2005. Efforts to introduce fish from lower pools were successful from 2006-2007 but extensive

debris made sampling impossible from 2008-2010. Sampling in this pool, in 2011, did not produce any collection of Zuni bluehead sucker. Water quality data collected at three pools in the Agua Remora throughout day and night in July 2007 indicated dissolved oxygen was similar in the upper and lower pools (20-65% saturation), with the highest values occurring in the middle pool (45-80% saturation). In 2011, dissolved oxygen in the upper pool and middle pool was 33.2% and 69.9%, respectively. In 2012, USFS personnel removed all woody debris from the upper pool and installed a solar aerator (Figure 14).

It is likely that fluctuations in the extent and location of spring habitats is natural in the upper watershed area. Reports were received of remnant spring habitats with Zuni bluehead sucker throughout the upper watershed area. These areas likely represent refuges for the species, which grow and lessen with changing hydrologic conditions. Given the increased pressure on water resources in the upper watershed, documentation of spring locations and groundwater levels and movement is a priority.

Figure 14. Upper pool at Agua Remora (Left: before debris removal. Right: during debris removal)

Support from local landowners in conservation of Zuni bluehead sucker is central to recovery of the species. Forest management on private lands in the upper watershed is ongoing, utilizing a variety of state and federal resources. Working with the Natural Resources Conservation Service and New Mexico State Forestry, a private landowner is restoring forested areas including selective harvesting of timber and installation of wildlife friendly fencing.

Two additional forest health restoration efforts began in late 2010 and were approved in 2011. The Zuni Mountain Collaborative Forest Landscape Restoration Program (CFLRP – administered through the Forest Guild) was allocated of $7.6 million and will leverage an

additional $6.7 million non-federal funds to treat 56,000 acres of Cibola National Forest. The Rio Puerco Collaborative Forest Restoration Program (CFRP –administered through the Turkey Wildlife Federation) was allocated ~$400,000 to assist in the planning process to treat these acres. NMDGF formally supported both proposals, specifically because restoration has the potential to benefit Zuni bluehead sucker by reducing the likelihood of forest fires and potentially increasing amount of surface water in the watershed. Additional information on the CFLRP can be accessed on the web: http://allaboutwatersheds.org/groups/zuni_mtns_cflrp

Canyon Bound Habitats

Tampico Draw and upper Río Nutría currently represent the stronghold of Zuni bluehead sucker. The habitat, canyon-bound cascading pools over exposed bedrock, is preferred habitat for the species. Flushing spring and monsoon flows are necessary to mobilize and transport silt from occupied habitats. Summary data available from the USGS gage on the Río Nutría (#09386900) indicate that large flood events, usually occurring in the early spring (snowmelt) and mid-summer (monsoon), show that discharge has not been >400 cfs since the late 1990s (Figure 15 and 17). These high volume events are important in maintaining the clean, hard substrate habitat where Zuni bluehead sucker are most commonly found.

Beaver numbers have increased in the upper Río Nutría since the early 1990s, when the species was restored to Pueblo of Zuni. Loss of wetted habitat in the Río Pescado and Zuni River has led to an increased density of beaver in the Río Nutría. In prior years this lead to near-complete impoundment of the Río Nutría below the mouth of the canyon and presence of dams throughout the canyon into Tampico Draw and upper Río Nutría. Beaver control efforts were undertaken by ZDFW from 2007-2010 with a total removal of 22 beavers. In 2011 and 2012, no beavers were removed by Pueblo of Zuni. Rather, beaver dams were lowered or taken out at the Río Nutría near the USGS gage. While, beaver activity has been inhibited, and less silt and pooling was observed at the Río Nutría near the USGS gage, habitat for Zuni bluehead sucker may still not be suitable as flushing flows have not removed deep silt.

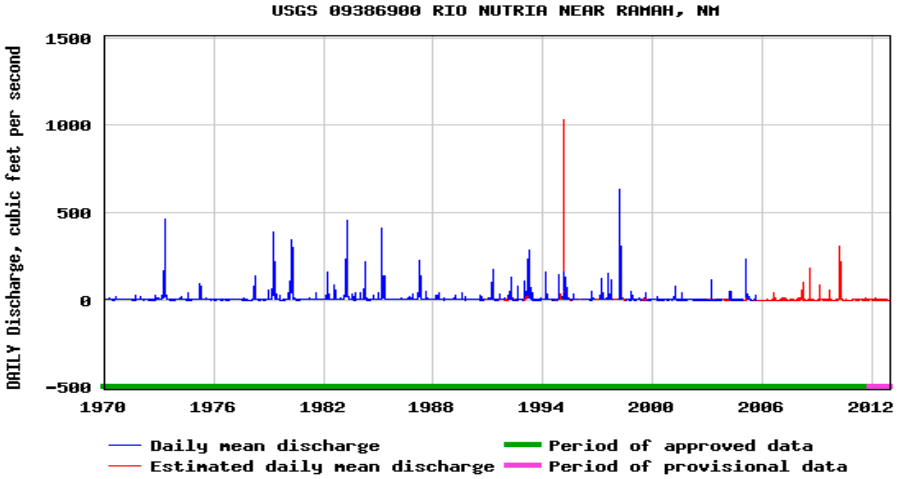
Mainstem Habitat

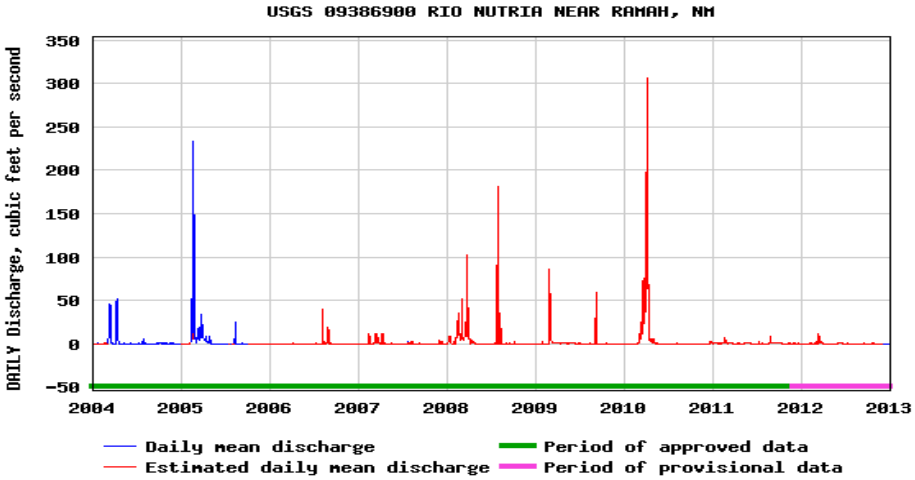
No surveys were conducted in these habitats in 2011 and 2012 to determine presence of fish or potential changes in habitat.

OUTREACH AND EDUCATION

In 2012, a joint presentation on Zuni bluehead sucker was given by ZDFW and NMDGF at the Native American Fish and Wildlife Conference.

Figure 15. Daily mean discharge (1970-2012; 2004-2012; 2011-2012) in the Río Nutría, from the USGS gaging station #09386900, Río Nutría at the bottom of the box canyon. Data were accessed and graphed on 30 January 2013 at http://waterdata.usgs.gov/nwis/uv?09386900. Note changes in scale for daily mean discharge.





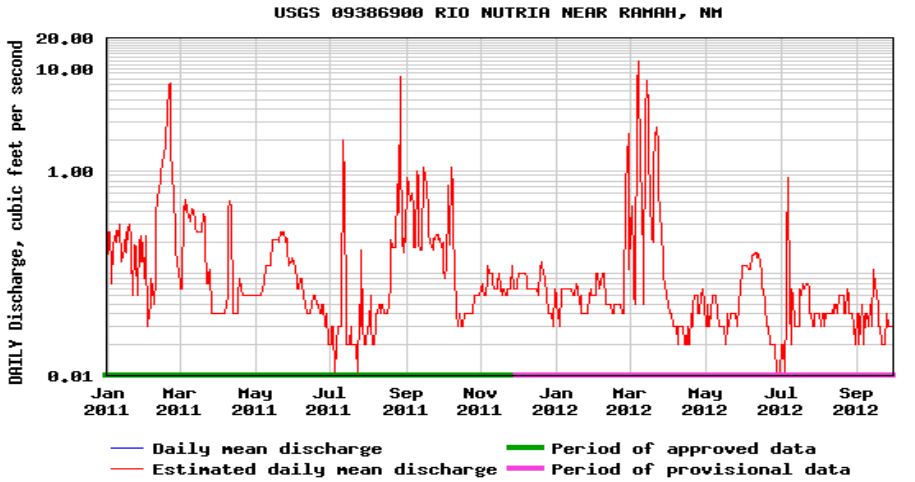
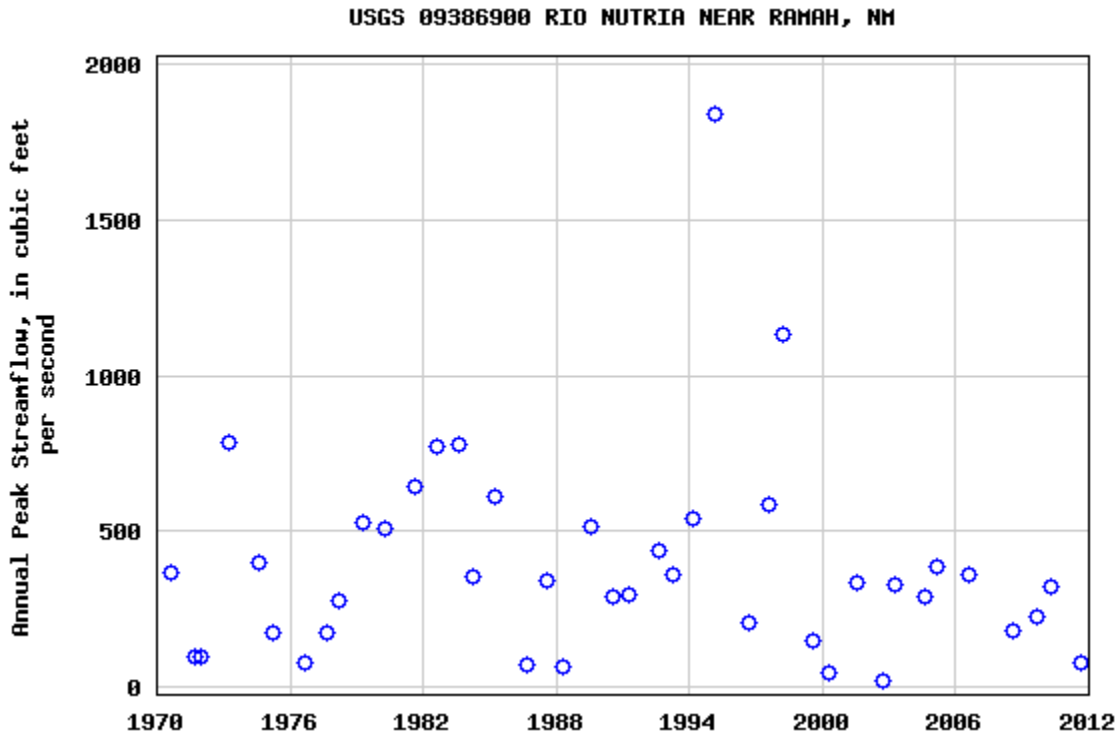


Figure 16. Annual peak spring flow (1970-2012) in the Río Nutría, from the USGS gaging station #09386900, Río Nutría at the bottom of the box canyon. Data were accessed and graphed on 30 January 2013 at http://waterdata.usgs.gov/nwis/uv?09386900.



2012 RECOMMENTATION OF MANAGEMENT TO BE CONTINUED OR INITIATED

- Cooperative efforts to monitor and manage Zuni bluehead sucker should continue between tribal, state, and federal partners.

- Formalize cooperation among the Pueblo of Zuni, USFS, TNC, USFWS, NMDGF, and private landowners to include use of electrofishing as a survey method and access for monitoring and management purposes

- Cooperators should work to ensure that consideration for Zuni bluehead sucker recovery is included in all projects in the watershed. Partnerships with local, state, and federal agencies such as McKinley County, NRCS, Zuni Mountains CLRFP, and Rio Puerco CRFP should be sought and/or continued.

- Funding should be sought for both large multi-jurisdictional and small private projects, including through State Landowner Incentive and Tribal Landowner Incentive programs. Potential projects include:
  - Installation of ground and surface water quantity meters, such as piezometers, to better understand groundwater in occupied and historical habitat
  - Additional or relocation of USGS gage on the Río Nutría to better reflect low flows
  - Installation of surface water quality meters in key habitats to monitor dissolved oxygen and temperature
  - Physical rehabilitation/improvement of the Agua Remora
  - Sediment transport abatement in the upper watershed, including forest restoration and sediment traps in ephemeral watercourses
  - Restoration of flow and removal of sediment in historical habitat in the upper Río Pescado

- Surveys for additional perennial water in historical range should be reinitiated.

- Continuation of conservation genetic research to guide management decisions regarding captive holding, movement of Zuni bluehead suckers in natural habitat, and determination of occupied habitat.
  - Determine if some fish held at BioPark should be introduced into Tampico Springs to reduce potential bottlenecking

- Continuation of rearing investigations to assist in maintenance of a refuge population. This includes collections of additional fish from all populations.

- Remove or relocate beaver in the Río Nutría at the USGS gage to lessen the impacts of stream impoundment in currently occupied Zuni bluehead sucker habitat where siltation is a concern. Investigate the feasibility of beaver relocation to areas historically occupied by Zuni bluehead sucker in the Rio Pescado and Zuni River. Beaver dams may enhance water retention in the watershed and expand Zuni bluehead sucker habitat.

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