Section 6 (Texas Traditional) Report Review

Form emailed to FWS S6 coordinator (mm/dd/yyyy): 10/23/2012

TPWD signature date on report: 9/25/2012

Project Title: Surveys for Texas Hornshell Populations in Texas

Final or Interim Report? Interim

Grant #: TX E-132-R-2

Reviewer Station: Clearlake ESFO

Lead station concurs with the following comments: Yes

Interim Report (check one):

- ☒ Acceptable (no comments)
- ☐ Needs revision prior to final report (see comments below)
- ☐ Incomplete (see comments below)

Final Report (check one):

- ☐ Acceptable (no comments)
- ☐ Needs revision (see comments below)
- ☐ Incomplete (see comments below)

Comments: No comments or concerns with document.

INTERIM REPORT

As Required by

THE ENDANGERED SPECIES PROGRAM

TEXAS

Grant No. TX E-132-R-2

Endangered and Threatened Species Conservation

Survey of Texas Hornshell Populations in Texas

Prepared by:

Drs. Lyubov Burlakova and Alexander Karatayev

Carter Smith
Executive Director

Clay Brewer, Acting
Division Director, Wildlife

25 September 2012

INTERIM REPORT

STATE: ____Texas_____ **GRANT NUMBER:** ___E – 132-R-2____

GRANT TITLE: Survey of Texas Hornshell Populations in Texas, Yr 2&3

REPORTING PERIOD: ____1 Oct 11 to 30 Sep 12

OBJECTIVE(S):

To assess the current distribution of *P. popeii* in Texas; evaluate long-term changes in distribution range; locate and describe existing populations, and determine species' habitat requirements.

Segment Objectives:

1. Assess the current distribution of *Popenaias popeii* in Texas;
2. Evaluate long-term changes in distribution range;
3. Locate and describe existing populations, and (4) determine species' habitat requirements.

Significant Deviation: None.

Summary Of Progress: Please see Attachment A.

Location: Travis and Hays County, TX

Cost: ___Costs were not available at time of this report.__

Prepared by: _Craig Farquhar_____ **Date:** _25 September 2012

Approved by: _____ **Date:**___25 September 2012
C. Craig Farquhar

ATTACHMENT A

TEXAS PARKS AND WILDLIFE DEPARTMENT

TRADITIONAL SECTION 6

Joint Project with New Mexico Department of Game and Fish

PERFORMANCE REPORT - INTERIM

State: Texas **Project Number:** 419446

Project Title: "Survey of Texas Hornshell Populations in Texas"

Time period: February 3 - August 31, 2012

Full Contract Period: 3 February 2012 **To:** 31 August 2013

Principal Investigators: Lyubov E. Burlakova, Alexander Y. Karatayev

This joint Section 6 project is collaboration between the U.S. Fish and Wildlife Service (USFWS), Texas Parks and Wildlife Department (TPWD), Buffalo State College (BSC) and New Mexico Department of Game and Fish (NMDGF). It is coordinated between PIs Lyubov Burlakova and Alexander Karatayev (BSC), agency biologists Brian Lang (NMDGF) and Marsha May (TPWD).

1. Program Narrative Objectives:

1. Assess the current distribution of *Popenaias popeii* in Texas;
2. Evaluate long-term changes in distribution range;
3. Locate and describe existing populations, and (4) determine species' habitat requirements.

2. Problem and Need

The Rio Grande/Rio Bravo River is one of the longest rivers in North America. In the state of Texas the Rio Grande forms the border between the United States and Mexico and has been intensively used by both countries during the last century (Dahm et al., 2005; Wong et al., 2007). Due to water over-extraction for the increasing irrigation and domestic consumption, the riverbed between El Paso and Presidio frequently lies dry, and since 2001 the river often fails to reach the Gulf of Mexico (Edwards and Contreras-Balderas, 1991; Contreras-Balderas et al., 2002; Dahm et al., 2005; Wong et al., 2007; Douglas, 2009). Many additional factors contributed to the recent status of the Rio Grande, including persistent drought, increase in border population, and declines in the water quantity and quality (Dahm et al., 2005; Wong et al., 2007; Douglas, 2009).

The Rio Grande is a globally important river for freshwater biodiversity, supporting

numerous endemic fish, birds, and molluscs (Grommbridge and Jenkins, 1998; Revenga et al., 1998; Johnson, 1999; Revenga et al., 2000; Karatayev et al., 2012). Many of these species have already become extinct; others are facing a sharp decrease in their population density or range fragmentation. As a result, the Rio Grande is considered the most endangered river system in the North American continent and one of the world's top 10 rivers at risk (Wong et al., 2007).

Freshwater bivalves in the order Unionoida are considered to be one of the most endangered groups of animals in North America (Bogan, 1993; Lydeard et al., 2004) with over 76% of the North American Unionidae and Margaritiferidae presumed extinct, threatened, endangered, or deemed of special concern (Williams et al., 1993). Unionid bivalves of the Rio Grande drainage represent a unique assemblage and are distinct from the rest of Texas (Neck, 1982; Neck and Metcalf, 1988; Burlakova et al., 2011a; Burlakova et al., 2011b; Karatayev et al., 2012). The first data on unionid bivalves of Rio Grande and its tributaries were published at the turn of the 19th century (Singley, 1893; Simpson, 1900; Simpson, 1914). In the second half of the 20th century numerous studies conducted on the Rio Grande system were summarized by Johnson (1999), who provided a detailed description of historical records and current distribution of all 15 species of unionids reported from this system. Extensive surveys done by Texas Parks and Wildlife Department in 1998-2001 failed to recover any live endemic unionid species from the Rio Grande and Howells (2001) suggested that a sharp decrease in their populations may have put them on the edge of extinction.

Popenaias popeii, Texas hornshell, is a regional endemic known from the Rio Grande drainage in Texas (Singley, 1893; Taylor, 1967; Neck, 1987), Black River in New Mexico (Lang, 2001; Carman, 2007), and several Mexican tributaries of the Rio Grande (Simpson, 1914; Johnson, 1999; Strenth *et al.*, 2004). Strecker (1931) reported that *P. popeii* "seems to be rather scarce", Stansbery (1971) listed this species as "rare and endangered", and Neck (1984) included it in his list of restricted and declining species of Texas. Nature Serve ranks the Texas hornshell as critically imperiled across its range (NatureServe, 2009). This species has been recently added to the state's list of threatened species (Texas Register 35, 2010), and is currently considered a candidate for listing (priority 8) under the federal Endangered Species Act.

In Texas, live *P. popeii* were reported from Las Moras Creek (Taylor, 1967), Devils River (Singley, 1893; Neck, 1984), Pecos River (Metcalf, 1982) and from two distinct areas in Rio Grande (Metcalf, 1982; Neck and Metcalf, 1988). Only two dead shells of *P. popeii* were reported in Texas outside the Rio Grande Drainage in the South Concho and Llano rivers (Strenth *et al.*, 2004). There is no evidence that these records represent living population of *P. popeii.* Extensive surveys along 48 km of Las Moras Creek in 1971, 1973, and 1975 yielded no living *P. popeii* (Murray, 1975). This population is believed to be extirpated due to the removal of aquatic vegetation, the paving of a portion of the spring and the chlorination in conjunction with the use of the spring headwater as a swimming pool (Murray, 1975; Howells *et al.*, 1996). Pecos River sites were flooded by Amistad Reservoir and *P. popeii* was extirpated. In Devils River *P. popeii* survived much longer and "localized concentrations of living specimens" were reported from the Devil's River, Val Verde County, by Neck (1984). No live *P. popeii* were found in the Rio Grande since mid-1970s (Howells, 2001). In 2008 during our state-wide survey of freshwater molluscs in Texas funded by the State Wildlife Grant Program (Burlakova and Kararayev, 2010), we found live *P. popeii* in the Rio Grande at two sites: Terrell County (n = 1) and Webb County (n = 9). A total of seven live mussels was found in the Devils River (Val Verde County) from 2001 to 2011. During the first year of this current project, in 2011, we

discovered a large population of *P. popeii* in the La Bota area (Laredo, Webb Co) that may contain up to 8,700 mussels.

2. Methods

To assess the current distribution of unionids assemblages of the Rio Grande system within Texas we surveyed the Rio Grande in April 2012 at 33 sites in Webb County, over 70 river kilometers above and app. 50 river km below La Bota (Laredo). The survey was done using an airboat (owner Mr. S. Barclay), the only type of motorboats capable to efficiently navigate the river during low water levels when surveys are effective (Photo 1).

Photo 1. Airboat survey of freshwater mussels in the Rio Grande River. Lower picture, left to right: D. Barclay, S. Barclay, A. Karatayev, and T. Miller.

Our collaborator Tom Miller (Laredo Community College) assisted us in sampling, and obtained permission to sample on private land, and Mr. Don Barclay and Dr. Thomas Vaughan (Texas International A&M University in Laredo) helped us during the survey. This survey was designed to estimate the population of Texas hornshell (*Popenaias popeii*). We used time searches (at all sites), and area and quadrat searches at 10 sites. In addition, we sampled the Devils River at 27 sites from Bakers Crossing to Dolan Falls (Val Verde County). The work was carried out with an appropriate Scientific Research Permit issued by the Texas Parks and Wildlife Department.

Sampling was completed via hand collection of both live and dead mussels, by wading in low water and by snorkeling or diving. Reconnaissance sampling (timed searches) was used on some sites to reveal the presence of mussels and species diversity (Strayer *et al.*, 1997; Vaughn *et al.*, 1997) and mark-and-recapture-census was used in the La Bota Ranch site in Laredo. All mussels collected (live and dead) were taxonomically identified, counted, and measured with calipers to the nearest mm. After measurements, live mussels were carefully bedded into the sediment from which they were taken. Shell condition of dead mussels was recorded for each specimen.

A mark-and-recapture-census initiated in March 2011 was continued at the La Bota Ranch site in Northern Laredo located ca. 1.4 river miles north of the "World Trade Bridge" using methods described by Lang (2001), Villella et al. (2004), and Karatayev et al. (2012) in April 12-14, 2012. The access to the site was gained from the US Border Patrol boat ramp. Following recommendations by Villella *et al*. (2004), we sampled three consecutive days to estimate capture probabilities using closed population models. All mussels present (new captures, and recaptures) were measured (shell length, width, height (± 0.1 mm)), and wet-weighed. First-time captured individuals were marked with unique numbers assigned by embedding oval (4 x 10 mm) Floy laminated flex tags in Super Glue Gel along the valve hinge posterior to the umbo. Specimens were identified using published taxonomic keys and descriptions (Howells *et al.*, 1996; Johnson, 1998). We deposited voucher specimens into the Great Lakes Center Invertebrate Collection at Buffalo State College, Buffalo, NY. Each specimen was labeled with a unique number and cataloged in a database with the following information: specimen number, name of person who collected and identified the specimen, date of collection, and detailed site information.

3. Results and Benefits

In April 2012, together with Thomas Miller (Environmental Science Center, Laredo Community College), Dr. Thomas Vaughan (Texas International A&M University in Laredo), Trey Nobles and Harlan Nichols (Texas State University, San Marcos), we sampled the Devils River at 27 sites from Bakers Crossing to Dolan Falls (Photo 2). Kevin Stubbs and Phil Douglas (Expedition Outfitters) helped us with trip logistics and provided access to the sampling sites. We found 4 live *P. popeii* during 24.5-person hours of search effort, including one juvenile mussel (29.7 mm), and took swabs from each of the mussels for genetic analysis (samples were sent to our collaborators, D. J. Berg and K. Inoue, Miami University, Oxford, OH). However, due to the low density of mussels, quantitative methods to estimate population density or population size were not applied. Therefore our 2011-2012 surveys covered almost the whole stretch of Devils River from Bakers crossing to the upper part of the reservoir and confirmed that a very small Texas horhshell population has survived in the Devils River, and it is reproducing.

Photo 2. Texas hornshell survey in the Devils River, Texas, in April 2012. Upper picture, left to right: Harlan Nichols and Trey Nobles (Texas State University, San Marcos), Phil Douglas and Kevin Stubbs (Expedition Outfitters), Thomas Miller (Environmental Science Center, Laredo Community College), Thomas Vaughan (Texas International A&M University in Laredo), and Lyubov Burlakova (photo: Alexander Karatayev). Lower: Texas hornshell found in the Devils River.

In April 12-14, 2012 we continued our population study at the mark-and-recapture site in the Rio Grande River in La Bota. We conducted three closed-population censuses over a 3-day period, spending 120 man hours at the site (Photo 3). We tagged 432 *P. popeii* in addition to 297 mussels marked in 2011. The recovery rate was 12.6% (25 mussels tagged in 2011 of 198 total mussels found) on the first day, 16% (32 mussels tagged in 2011 and 2012 of 200 total mussels found) on the second day, and was 45.2% (75 of 166 mussels found) on the third day. The average recovery rate (24.6%) was almost three times higher than in 2011 (9.1%). Shell lengths of *P. popeii* varied from 30.2 to 84.2 mm. The estimation of Texas hornshell population size at the mark-and-recapture site in La Bota is currently in progress.

Photo 3. Texas hornshell population study at the mark-and-recapture site in La Bota, April 12-14, 2012. Participants: Thomas Miller and his students (Environmental Science Center, Laredo Community College), Thomas Vaughan and his students (Texas International A&M University in Laredo), Alexander Karatayev and Lyubov Burlakova. Lower right: tagged mussels found underneath one rock.

On April 15-18, 2012 using an airboat, we surveyed 33 sites on the 120 km streach of the Rio Grande above and below Laredo. During this survey we found an additional 348 live Texas

hornshell. Because we identified suitable substrate for Texas hornshell, it was easy to find and map mussel beds (Photo 4). Texas hornshell was most commonly found in crevices under flat boulders resting on the bedrock, similar to the preferred habitat for this species found in the Black River (low-flow refuges characterized by aggregations of mussels under large boulders of limestone conglomerates, where clay seams provide stable substrata for mussels in low-velocity microhabitats, Lang (2010)). Mussels were found on all 13 sites with suitable substrate in 70 km stretch of Rio Grande above Laredo, and at 2 sites in Laredo upstream from the North Laredo Wastewater Plant. The estimation of Texas hornshell population size upstream from Laredo is currently in progress.

Photo 4. Suitable habitat for Texas hornshell in the Rio Grande above Laredo (Webb County).

No live *P. popeii* or *Truncilla cognata* were found in the 50 km stretch of river below the North Laredo and Nuevo Laredo sewage treatment plants inspite of abundance of suitable substrates. The reasons for the lack of mussels could be the contamination of water or sediments that prevent mollusc reintroduction from upstream sites. Special studies are needed to understand why native molluscs are no longer found below Laredo (e.g. testing of water and sediment quality, degree of organic enrichment, presence of host fish) and to determine the feasibility of reintroduction.

Popenaias popeii typically broods mature, infective larvae in Black River (New Mexico) from May through June (Smith et al. 2003). On May 23, June 19 and July 26, 2012, our collaborator Tom Miller and his students sampled fishes in La Bota site using seines and nets.

The most abundant species of fish collected were shiners, including blacktail and red shiners, inland silverside, and minnow (Table 1).

Table 1. Fish collected during 3 seining events in summer 2012 at La Bota site, Laredo.

Fish species	Common name	Individuals collected	Fish host (Levine et al. 2012)*	
			Lab	Field
Cyprinella sp.	shiner	125		
Menidia beryllina	inland silverside	104	U	
Cyprinella venusta	blacktail shiner	79		
Pimephales vigilax	bullhead minnow	77		
Cyprinella lutrensis	red shiner	68	Y	Y
Poecilia formosa	Amazon molly	53		
Dorosoma petenense	threadfin shad	43		
Dorosoma cepedianum	American gizzard shad	35		U
Oreochromis aureus	blue tilapia**	17		
Hypostomus plecostomus	suckermouth catfish**	11		
Lepomis macrochirus	bluegill	7	Y	Y
Lepomis megalotis	longear sunfish	5	Y	Y
Ictalurus punctatus	channel catfish**	3	Y	U
Cichlasoma cyanoguttatum	Rio Grande cichlid	1		
Moxostoma congestum	gray redhorse	1	Y	Y
Total		**629**		

**Y = yes, produced transformed juveniles, N = no juveniles produced, U = uncertain, glochidia encysted at the time of host death (laboratory) or cysts unclear (field).*

*** exotic*

Although laboratory studies described *P. popeii* as a host generalist (i.e., 31 fish species tested representing 11 families, 24 physiological host species identified; Lang 2001, 2004), Levine et al. (2012) found that in the wild *P. popeii* uses a much smaller subset of all potential hosts that occur in the Black River. Only half of the 20 fish species observed in the river were infested with glochidia (*Cyprinella lutrensis, Pimephales promelas, Carpiodes carpio, Cycleptus*

elongates, Moxostoma congestum, Ictalurus lupus, Gambusia affinis, Lepomis macrochirus, Lepomis megalotis, and *Micropterus punctulatus*). Of all naturally infested fishes *Carpiodes carpio, M. congestum,* and *C. lutrensis* represented 80% of all individual fishes infected and carried over 99% of glochidia: 84% of all glochidia recorded were attached to *C. carpio,* 12.9% to *M. congestum* and 2.5% to *C. lutrensis* (Levine et al., 2012). Small-bodied red shiners, *C. lutrensis,* constituted half of all fishes in this survey with cysts, while large-bodied catostomids (river carpsucker, *Carpiodes carpio,* and gray redhorse, *Moxostoma congestum*) and long-ear sunfish, *Lepomis megalotis,* each accounted for 10 percent of total observed infestations. Of large-bodied fishes, *Carpiodes carpio* and *C. elongatus* exhibited the highest prevalence of infestation (60%). Although *Moxostoma congestum* was infested at lower prevalence (10%), it represented the most frequently captured large-bodied fish (292 captures). *C. lutrensis,* small-bodied fish, was the only species infested consistently and exhibited the highest prevalence (30%) (Levine et al., 2012).

Only 4 fish species of all collected in the Rio Grande in summer 2012 were found suitable field hosts in the Black River (Levine et al., 2012, Table 1). Of these, only red shiners were abundant (Table 1). None of the fish collected in the La Bota area had been found infested with glochidia in the field. To test the possibility of overlooking glochidia in the field, we are planning to check some of the fish collected in the summer on the presence of glochidia in the lab under a microscope in the fall 2012. However, the lack of the glochidia may also indicate that either mussels in the Rio Grande reproduced in different season, or that ecological fish hosts are present in very low densities. We are planning to continue fish sampling in the fall and winter of 2012, and in spring and summer of 2013.

Current and Potential Threats

The Rio Grande is presently one of the most impacted rivers in the world, with both water-quantity and water-quality issues being the major concerns (Dahm *et al.*, 2005). We suggest that among various types of human activities on the Rio Grande Drainage the most destructive for unionid assemblages were impoundments, habitat degradation, salinization, pollution, and over extraction of water (Karatayev et al., 2012).

Salinity concentrations in the Rio Grande are the result of both human activities and natural conditions. The naturally saline waters of the Pecos River are a major source of the salts that flow into Amistad Reservoir and continue downstream. Salinity may be the major factor causing local extirpation of *P. popeii* in the Pecos River and in the Rio Grande below the confluence with the Pecos River. Laboratory studies indicate that *P. popeii* show behavioral signs of physiological stress, followed by death, at a salinity of 7.0 ppt (Lang, 2001). This increased salinity may have precluded populations in the main stem of the Pecos River even prior to its impoundment. In July 2011 we surveyed four sites on the Pecos River in Pecos County, and found only one fragment of *P. popeii* valve (relatively recently dead) at Olson Road near Iraan.

Another reason of the local extinction of *P. popeii* in the Pecos system could be the construction of Amistad Reservoir that flooded the lower Pecos (Metcalf and Stern, 1976). Creation of Falcon Reservoir most likely decimated the lotic habitat of the bivalves in the lower Rio Grande (Neck and Metcalf, 1988). In southeastern New Mexico, the construction of impoundments (Lake MacMillan, Brantley and Avalon reservoirs) was one of the many factors responsible for extirpation of *P. popeii* from the Pecos River mainstem (Taylor, 1967). Any

future projects to construct a new dam, or to modify existing low-head dams and associated water diversion structures, both on the Black River or in the Rio Grande River in Laredo could potentially impact *P. popeii*. We would advise the U.S. Fish and Wildlife Service, Texas Parks and Wildlife Department, Texas Commission on Environmental Quality, and local authorities to be alerted to possible threats that could extirpate this significant population of *P. popeii* in Texas, including the only known habitat of another extremely rare endemic, *T. cognata*. The most important measures to preserve these remaining populations in the Rio Grande at La Bota would be to ensure a constant stream flow from reservoirs upstream, and to prevent any damming of the river at this and adjacent sites, as well as to prevent any other activity that can increase streambed sedimentation, and suspended sediment and nutrient loading in the Rio Grande.

Finally, during 2012' survey we identified another important threat that has extirpated the Texas hornshell populations below Laredo – water pollution from the North Laredo and Nuevo Laredo sewage treatment plants. The reasons for the lack of mussels could be the contamination of water or sediments that prevent mollusc reintroduction from upstream sites or/and potentially limit distribution of the hosts - resident native fish population.

4. Conclusions and Future Work

The goals of the joint Section 6 project between the New Mexico Department of Game and Fish and the Texas Parks and Wildlife Department are to determine the current distribution, document long-term changes in distribution range, locate existing population in need of protection, record habitat requirements of *P. popeii* in Texas, and establish sites for monitoring of these mussels in the future. We discovered the largest extant population of *P. popeii* in the lower Rio Grande River in Laredo, Texas ever reported from Texas, New Mexico or Mexico. A species database with abundance and habitat data will be provided to the TPWD' Texas Natural Diversity Database, making all data readily available for conservation, monitoring and decision making. *Popenaias popeii*'s preference for low-flow refugia in shallow water and undercut banks of both the Black River and Rio Grande River implies that this species is sensitive to habitat perturbations resulting from reduced stream discharge, large-volume pulse flows during seasonal rain events, habitat inundation, and water pollution. Our future studies in 2013will concentrate on surveys of current distribution, population monitoring, reproductive biology, including identification of local fish hosts, and genetic structure of *P. popeii*. The La Bota population of *P. popeii* in the Rio Grande will be monitored to: (1) continue mark-and-recapture studies of mussels tagged in 2011 and 2012; (2) document population status; and (3) assess habitat condition. As a result of this project we will suggest recommendations on sensitivity to disturbance and management options, and develop a common recovery plan and management options for *P. popeii* in the USA.

5. Status

Popenaias popeii is listed in New Mexico as Endangered (NMAC 1996), in Texas as Threatened (Texas Register 35, 2010) and is a candidate for listing (priority 2) under the federal Endangered Species Act (Federal Register 2001). Live *P. popeii* have been reported and studied in New Mexico where it currently occupies approximately 12% of its historic range. It also has been reported from the Rio Grande below Big Bend National Park (Terrell Co.). A large (1382

live specimens recorded) extant population of *P. popeii* in the lower Rio Grande River in Laredo, Texas was found in 2011-2012. This population is by far the largest ever reported from Texas, New Mexico or Mexico, however it currently occupies only a small portion of its former distribution range and is limited by the Amistad Reservoir on the north, and by water pollution and Falcon Reservoir from the south. The most significant threats for this population are water pollution, impoundments, salinization, and over extraction of water.

6. Publications and Presentations.

***Peer-reviewed publications*.**

One paper has been published based on the results of this study:

Karatayev, A. Y., T. D. Miller, and L. E. Burlakova. 2012. Long-term changes in unionid assemblages in the Rio Grande, one of the World's top 10 rivers at risk. *Aquatic Conservation: Marine and Freshwater Ecosystems*. 22(2): 206-219.

***Presentations*.**

We presented 2 oral talks and one poster at international and local meetings:

(1) One oral presentation at the IV International Scientific Conference "Lake Ecosystems: Biological Processes, Anthropogenic Transformation, Water Quality", September 12-17, 2011, Minsk-Naroch, Belarus.
Burlakova, L. E., and A. Y. Karatayev. Biogeography and conservation of freshwater mussels (Bivalvia: Unionidae) in Texas.

(2) One oral presentations at the International Meeting on Biology and Conservation of Freshwater Bivalves in Braganca, Portugal (September, 4-7, 2012):

Karatayev, A., Miller, T, and L. Burlakova. Long-term changes in unionid assemblages in the Rio Grande, one of the World's top 10 Rivers at Risk. International Meeting on Biology and Conservation of Freshwater Bivalves, Braganca, Portugal, 4-7 September 2012.

(3) One poster at the 12th Annual 2011 Faculty and Staff Research and Creativity Fall Forum, Buffalo State College, October 2011.
Karatayev, A. Y., Miller, T. D., and L. E. Burlakova. Long-term changes in unionid assemblages in the Rio Grande, one of the World's top 10 rivers at risk.

Acknowledgements

This survey was funded by the U.S. Fish and Wildlife Service (US FWS), Texas Parks and Wildlife Department (TPWD), and New Mexico Department of Game and Fish (NMDGF) (Joint Traditional Section 6 Project to LEB, AYK, B. Lang (NMDGF) and M. May (TPWD)). We thank our collaborator, Thomas Miller and his students (Laredo Community College), Don and Steve Barclays, Dr. Thomas Vaughan and his students (Texas International A&M University in Laredo), Trey Nobles and Harlan Nichols (Texas State University, San Marcos), and Phil Douglas for their help in field surveys. The survey of the Devils River would not have been successful without assistance of Kevin Stubbs (Expedition Outfitters) who provided access to the

sampling sites and helped us with trip logistics, and we are very thankful to the Devils River' ranch owners (the Russell Family and Mike Luigs) for granting us access to their land. We thank B. Lang (NMDGF), D. J. Berg (Miami University, OH) and Marsha May (TPWD) for their help with this report and advice on fish surveys. LEB was also supported by the Research Foundation of SUNY. We are very grateful to Carol A. Darstein, Carol A. Julian, Lisa A. Gatti (Research Foundation of SUNY), Cathleen Nasca (Great Lakes Center) and other staff of the Research Foundation and Buffalo State College for their help during the entire course of this project.

Prepared by: Lyubov E. Burlakova **Approved by:** _____

Alexander Karatayev

Lyubov Burlakova, and Alexander Karatayev
BSC, Principal Investigators

Date: September 25, 2012

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