



The Mexican Blindcat Project new discoveries and future efforts

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ZARA
ENVIRONMENTAL LLC

- Background and History
- Survey Efforts
- Distribution
- Threats and Protection
- *Prietella* in Texas
- Amistad NRA Project
- Zoo Efforts
- eDNA
- Future Research Efforts



Prietella Background

- Obligate stygobite (eyeless and depigmented)
- One of 4 stygobitic Ictalurid species (in 3 genera) endemic to North American karst aquifers that feed rivers from San Antonio (Texas, USA) to Río Pánuco (Tamaulipas, México)
- First collected in 1952 and described by Carranza (1954).
- Sporadic survey efforts over the past four decades have resulted in significant expansion of known range.
- 12 known localities in Coahuila (Hendrickson et al., 2001)
- Occurs in caves and wells in the Rio Bravo drainage but not abundant. Deep caves with intermittent streams.
- Listed as federally endangered in both México and USA



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PUBLICACION MENSUAL DEL
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MEXICO, D. F.
PUBLICADO: 15 DE DICIEMBRE DE 1954

PUBLICADO CON LA AYUDA ECONOMICA DEL INSTITUTO NACIONAL DE LA INVESTIGACION CIENTIFICA DE MEXICO
REGISTRADA COMO ARTICULO DE 24. CLASE EN LA ADMINISTRACION DE CORREOS DE MEXICO, D. F., CON FECHA 24 DE OCTUBRE DE 1946

Comunicaciones originales

DESCRIPCION DEL PRIMER BAGRE ANOFTALMO Y DEPIGMENTADO ENCONTRADO EN AGUAS MEXICANAS¹

(Pisc., Ameiur.)

Durante los últimos días del mes de agosto de 1954, el Dr. Cándido Bolívar y Pieltain, del Instituto Politécnico Nacional, y el autor de este trabajo, tuvieron la oportunidad de visitar varios pozos y socavones, tanto naturales como artificiales de la región cársica de Múzquiz, estado de Coahuila, colectando, en uno de ellos, una extensa serie de un bagre carente de ojos y depigmentado, que al estudiarlo demostró ser una forma genérica nueva para la ciencia.

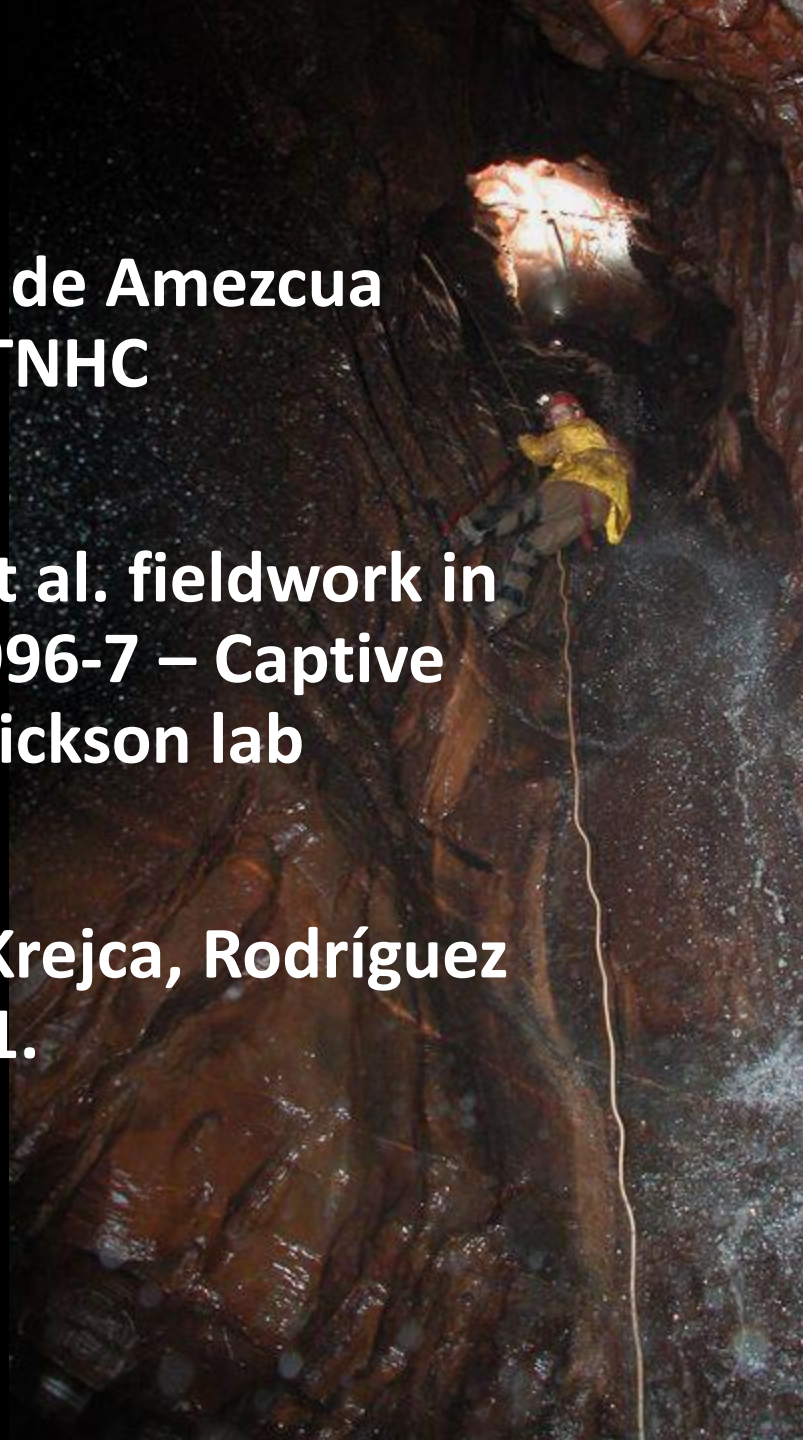
El hallazgo fué factible gracias a la generosidad del Lic. Carlos Prieto, quien patrocinó el viaje desde México y dió todas las facilidades necesarias al haber sido informado por su amigo, el Sr. Henry J. Sanford, Gerente de la Compañía Carbonífera de Sabinas, de la posible existencia de un pez ciego en las cercanías del poblado de Nueva Rosita, Coah. A ambas personas y al Ing. Salvador Garza Dávila, quien colaboró de un modo directo en la captura de

está situado al pie de la Sierra de Santa Rosa, a 260 m de altitud, en un lugar conocido localmente como "El Potrero de Doña Mariana", o simplemente "El Potrero", Municipio de Múzquiz, Coahuila (ver mapa). Es un pozo artificial de unos 3 m de diámetro, en el que el nivel freático se encuentra a escasos 2,5 m de la superficie. Está situado a unos 50 m del arroyo Salinas, afluente del río Sabinas. "El Potrero" tiene acceso por la carretera Rosita-Múzquiz. A 30 800 m de Rosita existe una brecha al lado izquierdo de la carretera que conduce en dirección W, después de 5 kilómetros, a la localidad típica.

El pozo abastece de agua potable a la población de Nueva Rosita en tiempos de escasez. El día que lo visitamos, el agua tenía una temperatura de 29°, pero fuimos informados que cuando se bombea hacia la población, la temperatura de la que fluye de las cavidades del subsuelo es algo mayor. Esto parece corroborarlo el hecho de que el agua que se estaba extrayendo de otro pozo situado a unos 30 m de distancia, tenía una temperatura de 30,5°. Según se nos informó, la temperatura del agua permanece constante dentro de ciertos límites.

- Carranza 1952 – 1 locality, 66 specimens in 2 days trapping
- 1961, 1969, 1984 – various single specimens from type locality
- 1986 – TCWC (A&M) – El Socavón, very near type locality – 1 specimen
- 1986 – TNHC (UT) – 1 specimen from Ojo Yermo, 48 km N of type locality

- 1992 – Sotano de Amezcuca specimens to TNHC
- Hendrickson et al. fieldwork in 1993, 1994, 1996-7 – Captive stock in Hendrickson lab
- Hendrickson, Krejca, Rodríguez Martínez, 2001.



Mexican blindcats genus *Prietella* (Siluriformes: Ictaluridae): an overview of recent explorations

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Synopsis

The ictalurid genus *Prietella* was described from a single locality in northern México (Coahuila) in 1954, and until very recently went largely unstudied. Cave explorers have recently uncovered new localities and a second species much farther to the south (México: Tamaulipas). Our team visited over 50 sites, including all of the previously known sites possible, and explored many new sites, expanding the known range of *Prietella* and describing their habitat. We identified geological units and mapped caves, identified associated troglobitic invertebrates, estimated population sizes and measured water chemistry parameters. We also comment on laboratory diet, parasites, sensory biology, behavior (such as jaw locking and periods of inactivity), reproduction and systematics based on preliminary genetic data. *Prietella phreatophila* is listed as endangered, and due to the recent discovery of many more sites (formerly documented from three localities, now known from twelve sites, though some are hydrologically connected) we recommend threatened status, with careful attention to growing threats such as over pumping and contamination of the aquifer it lives in. Should these patterns continue unchecked, re-listing this species as endangered may be called for. *Prietella lundbergi* was also described from one site but is now known from two, though it is quite rare at both (only five specimens have ever been seen). *P. lundbergi* was described after the most recent revision of the Mexican endangered species list and should probably be considered as endangered.

- Hendrickson, et al. visited over 50 sites, including most previously known sites.
- They provided information on range, habitat, geology, water chemistry, and associated species.
- Population estimates at a single site were based on M-RC.
- Laboratory studies included diet, parasitology, sensory biology, behavior, reproduction, and systematics.

1. Dandridge Spring and Richter Cave 40 km SW Sonora, Sutton Co., Tx.
2. Devil's Sinkhole 10 km NE Rocksprings, Edwards Co., Tx.
3. Big Tree Cave and Emerald Sink 5 km NNE Langtry, Val Verde Co., Tx.
4. Emilio's Cavern Comstock, Val Verde Co., Tx.
5. Goodenough Springs 38 km NW of Del Rio, Val Verde Co., Tx.
6. ...

P. phreatophila

- Texas – 6 (not found)

7. *Sótano de Amezcuca* and La Rajada 40 km W of Ciudad Acuña, Coah., Mex.
8. *Noria de San Pedro** 32 km WSW of Santa Eulalia, Coah., Mex.
9. La Vinata Well 18 km SW of Santa Eulalia, Coah., Mex.
10. Cueva de Rancho Las Pilas 90 km SW of Ciudad Acuña, Coah., Mex.
11. El Abra and Tinaja Azul 75 km W of Piedras Negras, Coah., Mex.
12. *Ojo del Yermo* 60 km N of Melchor Múzquiz, Coah., Mex.
13. Poza San Miguel 35 km NW of Allende, Coah., Mex.
14. *El Consuelo** 16 km NW of Allende, Coah., Mex.
15. *La Tembladora** 5 km SW of Allende, Coah., Mex.
16. Nacimiento Kikapoo and Falcón well 33 km NW of Melchor Múzquiz, Coah., Mex.
17. *Cueva de Juana* 22 km W of Melchor Múzquiz, Coah., Mex.
18. *El Socavón area: El Socavón, above El Socavón 1 and 2, El Cedral* 5 km SW of Melchor Múzquiz, Coah., Mex.
19. *El Potrero area: 1 and 2, Tiro Palmito, and vertical mine shaft near El Potrero* 8 km SE of Melchor Múzquiz, Coah., Mex.
20. Cueva Cabrito 9 km WSW of Estación Obayos, Coah., Mex.
21. Cueva La Zumbadora 4 km NW of La Madrid, Coah., Mex.
22. Cueva El Venado El Venado, 22 km SE of Cuatro Ciénegas, Coah., Mex.
23. Mojarral East and West, La Campana 15 km SSE of Cuatro Ciénegas, Coah., Mex.
24. ...

- Coahuila – 18 (present at 9)

25. Cueva de El Tule and Cueva de la Espantosa Lampazos, Nuevo Leon, Mex.
26. El Ebanito 15 km SW of Linares, Nuevo León, Mex.
27. Purificacion area Caves 30 km NW of Cd. Victoria, Nuevo León and Tamps., Mex.
28. El Sótano 3 km ENE of El Carrizo, Tamps., Mex.
29. ...

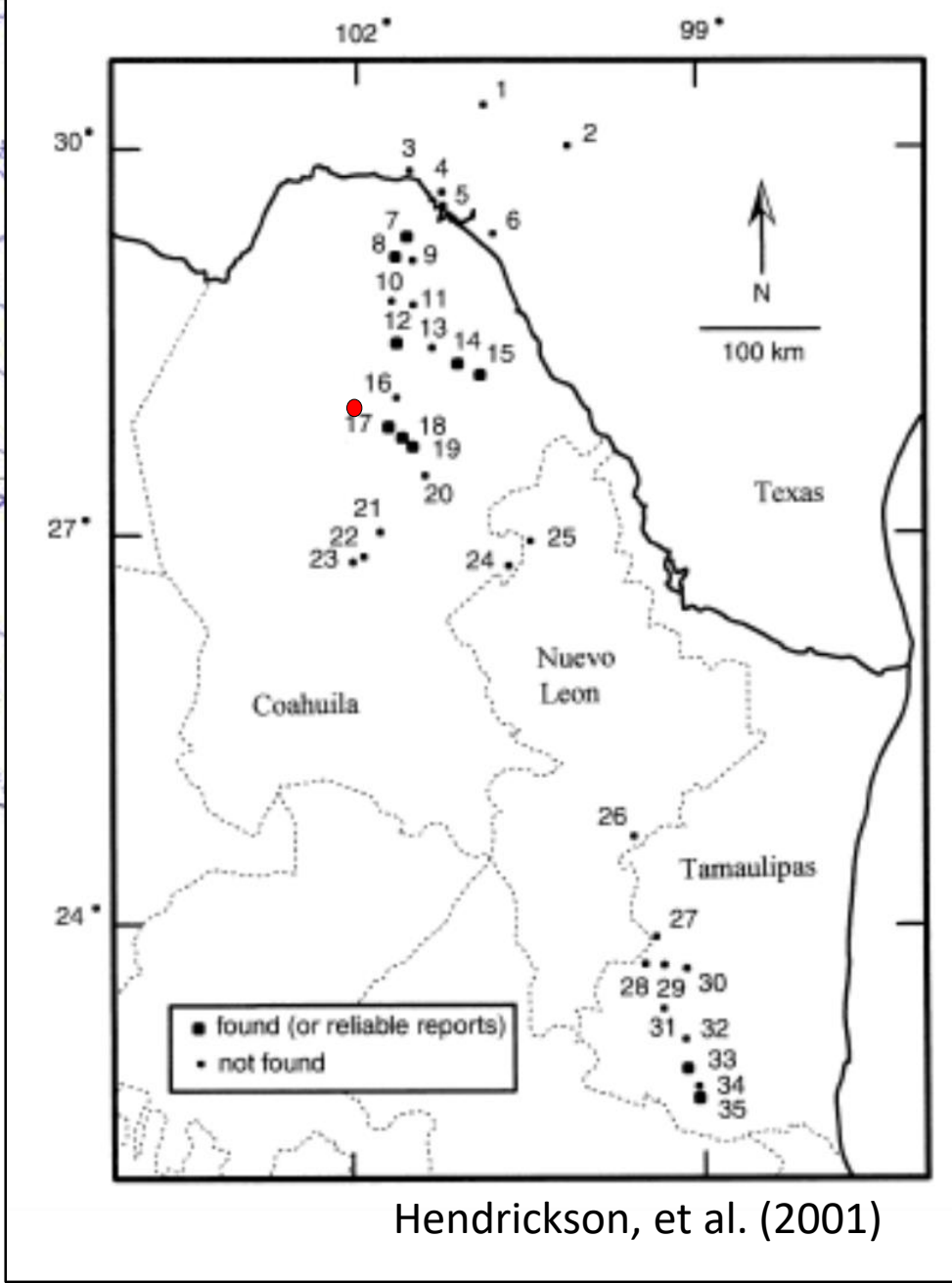
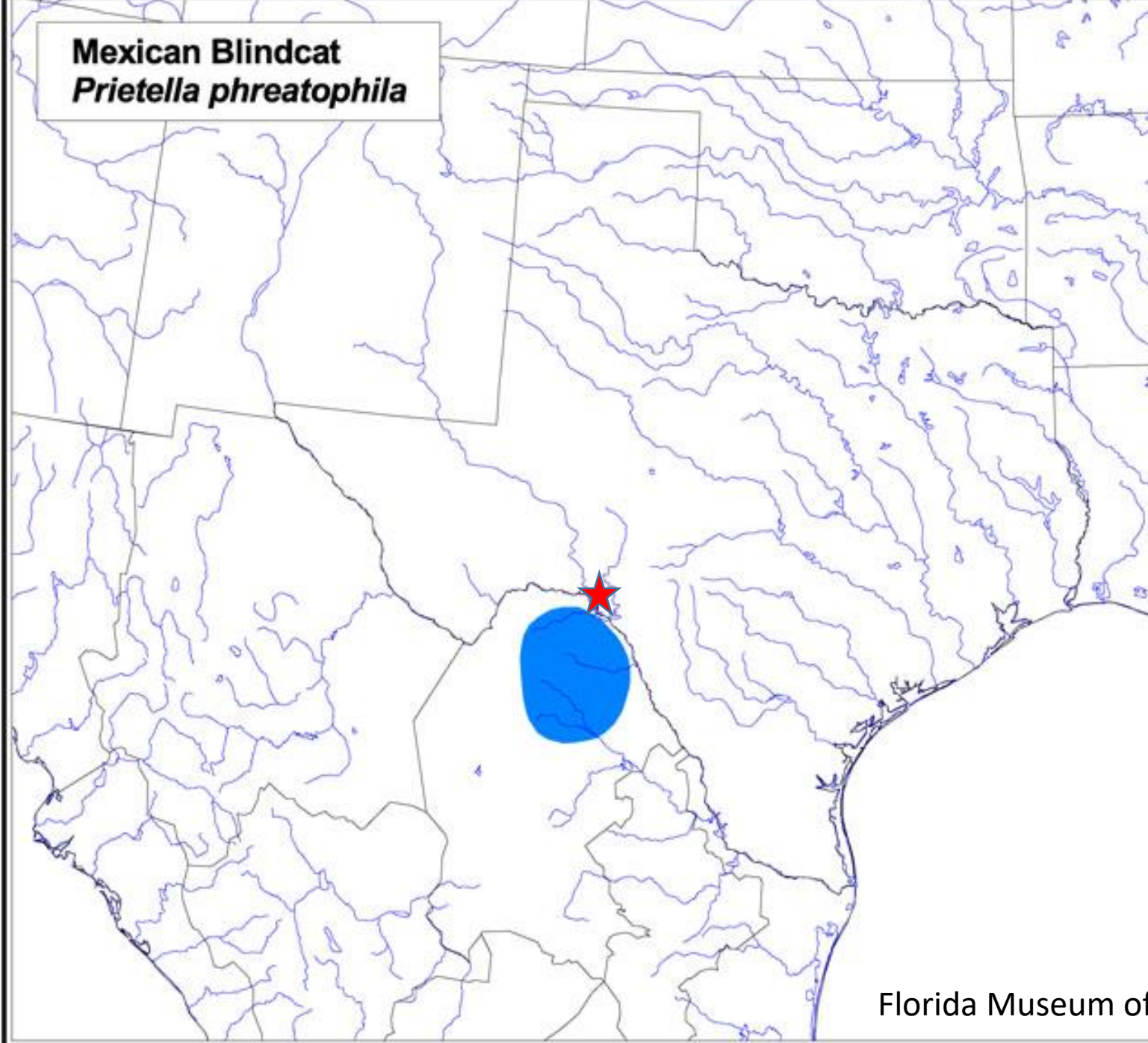
- Nuevo León – 3 (not found)

30. Manantial La Penita and Cueva del Manantial La Penita 5 km W of Cd. Victoria, Tamps., Mex.
31. Guayalejo Spring Juamave, Tamps., Mex.
32. *Cueva del Nacimiento del Río Frío and Nacimiento del Río Frío* 32 km NW of Cd. Mante, Tamps, Mex.
33. Springs near San Rafael de los Castro San Rafael de los Castro, Tamps., Mex.
34. *Manantial de San Rafael de los Castro and Cueva del Manantial de San Rafael de los Castro* 11.5 km W of Cd. Mante, Tamps., Mex.

P. lundbergi

- Tamaulipas – 7 (present at 1)

Mexican Blindcat
Prietella phreatophila



Hendrickson, et al. (2001)

Convergence among cave catfishes: long-branch attraction and a Bayesian relative rates test

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Abstract

Convergence has long been of interest to evolutionary biologists. Cave organisms appear to be ideal candidates for studying convergence in morphological, physiological, and developmental traits. Here we report apparent convergence in two cave-catfishes that were described on morphological grounds as congeners: *Prietella phreatophila* and *Prietella lundbergi*. We collected mitochondrial DNA sequence data from 10 species of catfishes, representing five of the seven genera in Ictaluridae, as well as seven species from a broad range of siluriform outgroups. Analysis of the sequence data under parsimony supports a monophyletic *Prietella*. However, both maximum-likelihood and Bayesian analyses support polyphyly of the genus, with *P. lundbergi* sister to *Ictalurus* and *P. phreatophila* sister to *Ameiurus*. The topological difference between parsimony and the other methods appears to result from long-branch attraction between the *Prietella* species. Similarly, the sequence data do not support several other rela-

- ***Prietella phreatophila* (Coahuila) & *P. lundbergi* (Tamaulipas) are distant relatives and *Prietella* is not monophyletic.**
- ***P. phreatophila* derived from an *Ameiurus* and *P. lundbergi* from *Ictalurus*.**
- **Formerly, morphology placed *Prietella* sister to *Noturus*.**
- **All Coahuila specimens represent a single species.**
- **Arce-H., et al (2016) placed all four troglobitic ictalurid species as sister taxa. But, morphology can lie in the dark...**

Northeast Coahuila aquifer system

- Extensive confined aquifer zone is primary regional water supply.
- Significant recharge occurs in upland areas.
- Balance between upland and drainage channel recharge is undetermined.
- Flow paths and sources of springs are still unknown, yet exploitation of the aquifer is increasing rapidly.

Threats

- Edwards-Trinity aquifer is the primary water source for the City of Del Rio and is threatened by water speculation.
- Socavón (Múzquiz water supply) has stopped flowing in recent years. Most historic sites impacted or dry.
- Cd. Acuña – Piedras Negras – Monclova areas are growing rapidly and adding industry.
- Coal mining and fracking are expanding in both Texas and Mexico.
- Agriculture
- Increased risk of contamination from extensive new oil and gas development and pipelines.

12/2016



410

San Antonio

90

57

83

59

Nuevo Laredo

69E

Coahuila

Sierra Madre Oriental Mountains

85D

77

The image shows two blindcat fish (Amia nelsoni) swimming in dark water. One fish is light brown and the other is light pink. They are both facing right. The word "Protection" is written in white text at the top center of the image.

Protection

- Listed as endangered in both México and U.S.
- Some shared aquifers are now acknowledged and are jointly managed by both countries.
- Texas blindcat population in NPS Recreation Area and much of the southern range is now within a federal reserve (Área de Protección de Recursos Naturales Sabinas).
- Efforts are underway to establish captive breeding population.

“Blind Catfish Discovery in Texas Suggests Underground Link With Mexico” –Time.com

“The geology told us they should be there,” Hendrickson said. “We figured one day we would find them, and sure enough, we did. It just took a long time.” –*National Parks Magazine*



© Jean Krejca





Prietella in Texas

- *Prietella phreatophila* were observed in a cave in the Amistad National Recreation Area, Val Verde Co., Texas in 2015.
- Three individuals were collected in 2016.
- A single individual remains in captivity at the San Antonio Zoo, along with two individuals collected in Mexico 20 years ago.
- This discovery led to the formation of a collaborative effort by NPS, TPWD, SAZ, and Zara Environmental.
- Morphology and Cyt b sequence validated conspecificity with Coahuila specimens (1% divergent).

Amistad National Recreation Area Project

OBJECTIVES

- Inventory biological communities in caves that represent potential habitat for the Mexican blindcat and other rare species
- Collect cave fauna specimens, as necessary, and accession the specimens according to NPS museum standards
- Produce final report of location of species of conservation concern, species lists, and biological community characterizations of each cave surveyed
- Collect specimens from Mexican populations of Mexican blindcat and establish a captive population at the San Antonio Zoo
- Begin a status update of the Mexican blindcat population in its core range in Coahuila, Mexico

Prietella Husbandry at SAZ

- Facility: Fish are housed in a climate-controlled 45-foot shipping container maintained at a constant 78°F (26°C).
- Food-grade metal racks hold food-grade covered boxes. Each box is filled 2/3 with Edwards Aquifer water and has a dedicated sponge filter and rinsed limestone rocks.
- 100-gallon cattle troughs are used to house larger specimens.
- Water is conditioned with carbon filters for a minimum of one week prior to use with aquatic animals.
- Standard water testing (Ammonia, Nitrite, Nitrate, pH, hardness) is performed bi-weekly and ~10% water changes are conducted on a weekly basis.
- Food is offered once per week from the following list of items: frozen brine shrimp, frozen bloodworms, frozen *Mysis* shrimp, frozen glassworms, frozen *Gammarus*, frozen *Cyclops*, frozen tubifex worms, and Hikari Microwafers[®].



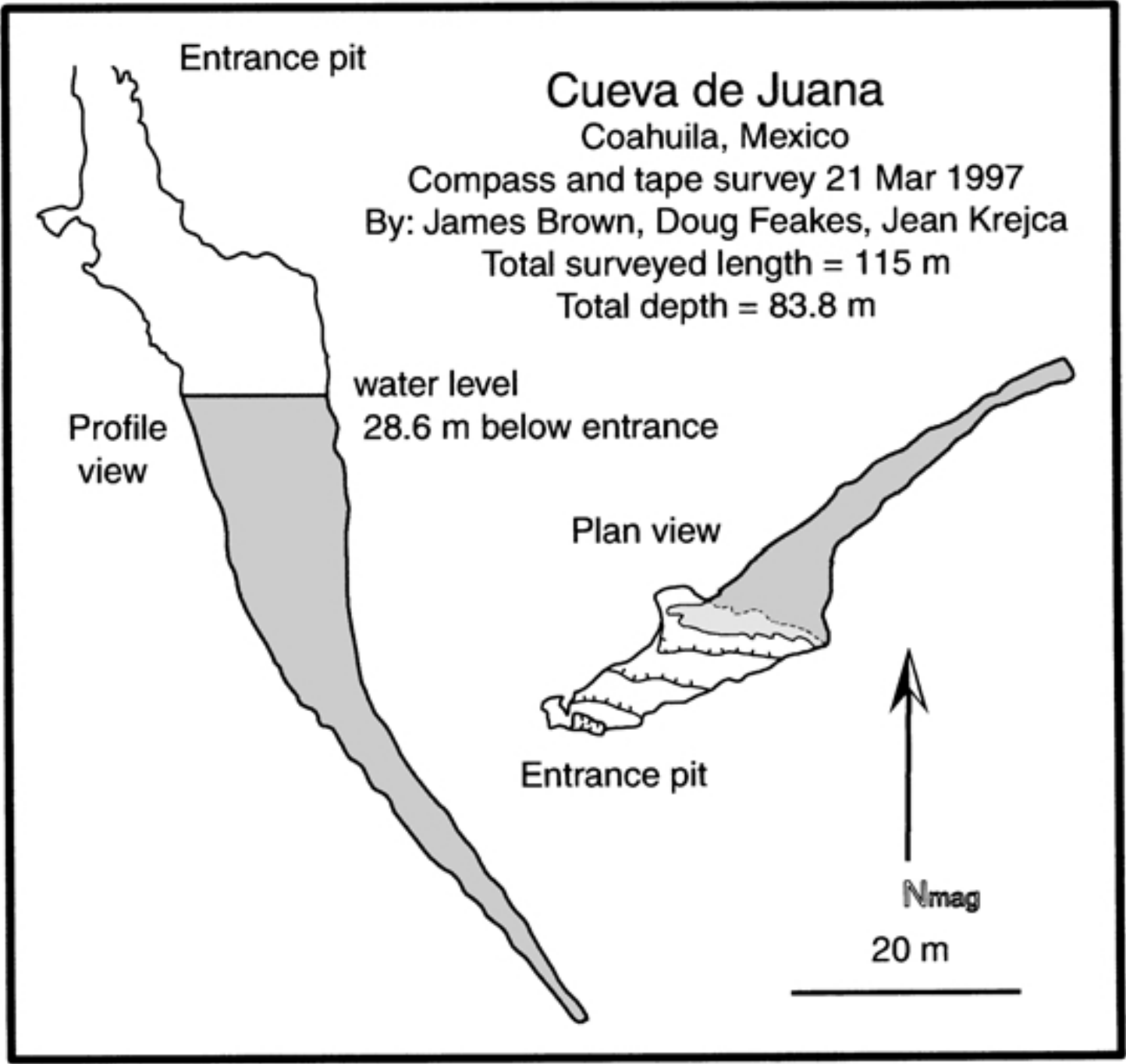
Exploring the distribution of groundwater salamanders and catfish with environmental DNA

- Goal is to gather data on salamander (*Eurycea*) and blindcat distribution through environmental DNA detection in groundwater, while fine-tuning the technique for other groundwater organisms.
- Target fish species include *Prietella phreatophila*, *Satan eurystomus*, and *Trogloglanis pattersoni*.
- A key component of this effort will be sampling water wells.

Future Directions

- Amistad Survey Project and SAZ captive husbandry effort are underway.
- Informal survey efforts in Northern Coahuila are ongoing.
- Contex proposal includes collaborators from the University of Texas at Austin, Comisión Nacional de Áreas Naturales Protegidas and the Centro de Investigaciones Biológicas del Noroeste. (*fingers crossed*)
- Goals of proposed effort are to expand fieldwork in Mexico, hydrogeologic studies, and surveys using environmental DNA.





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Texas Parks and Wildlife Department



From Caves to Springs: Morphological Variation in Texas *Eurycea*



Honey Creek Cave



Bullis Bat Cave



Camp Bullis Cave #3



Hector Hole



Camp Bullis Cave #1



Sharon Spring (cave)



Lewis Valley Cave



Cascade Caverns



Morales Spring



Cave and surface morphs from Honey Creek Cave



Fern Bank Spring



Taylor Spring



Bullis Spring 09-83



White Springs



Preserve Cave



Cascade Caverns



Cave Without A Name



Golden Fawn Cave



Hoffman Ranch Estavelle