

## Return to the Cumaca cave, Trinidad, W.I.

by ALDEMARO ROMERO<sup>1</sup>, ANURADHA SINGH<sup>2</sup>, ANNABELLE MCKIE<sup>3</sup>, MICHAEL MANNA<sup>3</sup>, RUTH BAKER<sup>1</sup> AND KELLY M. PAULSON<sup>1</sup>

In the October 2000 issue of the *NSS News*, the senior author and Joel Creswell reported the intriguing finding of an eyed, pigmented cave fish population that everyone thought to be blind and depigmented (the "eyeless" cave fish from Trinidad, W.I., *Rhamdia quelen*). Our visit to that cave in January of 2000 revealed not only that the alleged blind cave fish was not blind but also extremely photophobic (and difficult to catch when using flashlights). If those preliminary observations were to be confirmed, then we had witnessed a phenomenon never before reported: an eyed, pigmented fish population replacing its blind, cave derivative. The question was, was it true?

### THE 2001 EXPEDITION

On March of this year we headed back to the Cumaca cave. Also known as the Oropouche or Urumaca cave, this is a relatively short (about 180 meters) horizontal cave. Beyond helmets and flashlights, no special speleological gear was needed. However, for observing the fish, we did need special equipment. Given that our preliminary observations had indicated the fish to be extremely photophobic, this time we went there outfitted with night-vision goggles and video cameras with infrared capabilities. In case the fish were sensible to even infrared illumination, we also brought a fish echosounder. That device would allow us to register any fish movement even without the use of any illumination.

After obtaining the appropriate collecting permits with the Trinidad and Tobago Wildlife Section of the Forestry Division and from the cave's owner, we headed back for a couple of visits to the cave, this second time accompanied by professional fish collectors. The fish were not only photophobic but also extremely sensitive to any vibration in the water. For example, we could stand still for several minutes with our feet in the water, using our night vision goggles, and yet the fish would never come closer than one meter from us.

What we wanted were two things: a) to videotape as many fish as possible in their natural conditions (the waters are shallow and very clear) and, b) take a few individuals out of the cave to photograph, measure, and

study them under experimental conditions. We wanted to see whether or not the fish population in the cave was similar to the surface one, if it was composed of troglomorphic (blind, depigmented) individuals, or if it was a mixture of both.

The latter possibility had to be taken into consideration. The senior author of this article reported in 1983 that the La Cueva Chica population of the Mexican blind cave tetra, *Astyanax fasciatus*, was no longer totally blind and depigmented, but actually the result of a hybridization that took place some time in the early 1940s. As a consequence of that, by the early 1980s the entire population was composed of individuals with intermediate eyes and pigmentation between the typical blind and eyed populations.

We chose to visit the cave in March because that is the height of the dry season; the fish would be easier to locate, observe, and capture using dip and seine nets.

### LAB STUDIES

After spending several hours in the cave observing and videotaping the fish, as well as the noisy oilbirds (*Steatornis caripensis*), we were able to capture a total of 11 *Rhamdia*. We had to rush them to the laboratory that the Department of Biology of the University of the West Indies, at St. Augustine, had made available to us. The idea was to keep the fish alive for experimental studies regarding responses to light. We also wanted to photograph each one of them and take all the appropriate body ("meristic," to biologists) measurements. Even if the fish were eyed and pigmented in appearance, chances were that they may not be identical to the surface population. Also, some minute details may have been overlooked on direct observation in the cave as, for example, the exact diameter of the eye orbit or the number and/or kind of melanophores (pigment cells) in

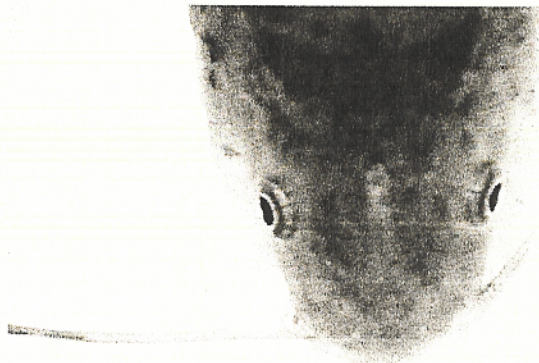
their skin.

After carrying out all of our observations, including some photographs taken with a powerful dissecting microscope at our lab in Macalester College in St. Paul, MN, we were surprised to see that the current cave population is essentially identical to the surface one: no discernable eye or pigment reduction. Not only that, but the average size of the individuals of the current population was much greater than that of the one reported for individuals previously collected there since the 1920s when the "eyeless" cave fish of Trinidad was first reported by the British ichthyologist John Norman.

What happened? In a paper (to be published in a scientific journal) we speculate on several possibilities. First of all, we have been able to examine the original blind specimens collected in the 1920s and could confirm that they were blind and depigmented. We also examined other specimens collected between the 1950s and the 1980s. Among them we found numerous specimens that seem to represent variations in their level of troglomorphy: some had no externally visible eyes; others had sunken eyes, and others had well-developed (externally visible) eyes. The same degree of variation could be observed regarding pigmentation. However, as we progressed in time, the cave fish look more and more similar to the surface ones.

Unlike the Mexican blind cave tetra of La Cueva Chica, the current cave population of *Rhamdia* does not appear intermediate, but rather identical to the surface one. It seems that even if at some point there was some hybridization going on (particularly between the 1950's and 1980's) the surface fish have continued to invade the cave and out-compete the blind forms. After all, the eyed ones are much larger and appear to be much more aggressive than the blind ones.

Something similar has been observed by our Mexican colleague Luis Espinasa in a



Frontal view of one of the cave specimens of *Rhamdia quelen* collected in the 1970s. It shows a high degree of eyelessness and pigmentation.

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**Frontal view of one of the cave specimens of *Rhamdia quelen* captured in 2001. It has eyes and pigmentation, just like any other individual of the river populations.**

cave in Mexico where light penetrates: the lighted area is occupied by eyed Mexican tetra which are very aggressive toward its blind congener when the latter tries to go into the illuminated portion of the cave. Since the

epigeal *Rhamdia* is of nocturnal habits, with rather large, sensitive eyes, is very aggressive and of larger size, it is not difficult to see how it out-competed the blind form.

#### **SOME ANSWERS BUT MORE QUESTIONS**

In principle, our observations are exciting. We may have documented the first case of a blind cave fish population being replaced by its epigeal ancestor. Now the questions are: how did the surface fish penetrate the cave, and why? Will this new population ever evolve into a troglomorphic one?

Obviously the answers to these questions can only be obtained after long-term studies. Together with our Trinidadian colleagues at the University of the West Indies, William Poly and some of us are using mark-recapture techniques to understand the movements of the fish in and out the cave. We are also investigating climatological and geological data to see what may have caused the invasion of the Cumaca cave by the surface fish. We will also continue to observe the surviving fish to better understand their behavior.

At the end, these changes are intriguing and extremely interesting. We biologists love to see evolution in action and it seems that the cave population of the "eyeless" (?) cave fish of Trinidad keeps changing before our own eyes.

#### **ACKNOWLEDGMENTS**

Field work for this research was supported by a Wallace Research Grant to A. Romero and by NSS grants to A. McKie and William Polly and another one to M. Manna. Mr. Gary Aboud gave us permission to visit the Cumaca cave. We thank the personnel at the Biology Department of the University of the West Indies (St. Augustine) for logistical support. The following people provided with field assistance in Trinidad: Simeon Allick, Pooran Badal, Eunice Ifill Floyd Lucas, David Persaud and Carol Ramjohn.

#### **SOME REFERENCES**

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# NEWS AND NOTES

if I knew some of the UT cavers such as Bill Russell, James Reddell, and Dick Smith. I replied that while I knew most of the active cavers I had not yet come face-to-face with Dick. Fred looked thoughtful for a moment, smiled and said, "That guy's got a mind like a steel trap! He is the brains behind that UT group. You have a real treat in store for you!" Fred was right all three times."

We cannot overstate the loss of a gentleman, a brilliant intellectual mind, a sharp wit, a great caver and, above all, an exceptional friend in the fullest sense of that term.

We are diminished.

**Carl Kunath (former NSS 6230F)**

**Gerald Atkinson (NSS 22368)**

**James Reddell (NSS 4897F)**

## DID YOU KNOW....?

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## CORRECTION

In Aldemaro Romero's article on the fish of Cumaca Cave, Trinidad (August NSS News, pages 220-221), please note that the captions on the two fish images were mistakenly switched.

## XEROX NEVER-TEAR PAPER

There's a new water-resistant paper product that should be of interest to cavers. It's very hard to tear and feels plastic to the touch, like the tyvek paper they wrap houses with during construction. We use a local copy store to make copies onto the paper, and the laser printer's ink doesn't run or smear when it gets wet. It is a special plastic that doesn't melt with the heat of a laser copier. This product is great for rescues, cave registers, maps, and even outdoor signs.

If you have any questions contact either Peter Grant at (802)453-2278 or [pgrant@together.net](mailto:pgrant@together.net) or John Keough, [jkeou@sover.net](mailto:jkeou@sover.net) or (802)672-2003. Peter discovered and purchased this paper for the Vermont Cave Association (Xerox Never-Tear Paper, Re-order No. 3R3118).

Just recently Peter purchased Latitude 26 Inc. Waterproof Inkjet Paper that allows you to use your inkjet to print on the paper and it instantly becomes waterproof. It will melt in a laser printer or copier, so don't ruin someone's machine that way. We have yet to use this paper and see how it holds up over time in cave. It's available at Eastern Mountain Sports for \$133.00 per 100 sheets or \$20.00 for 15 sheets.

**John Keough & Peter Grant**

## FRANK HOWARTH HONORED

Internationally renowned entomologist Frank Howarth (NSS #6344) was recently appointed the L.A. Bishop Distinguished Chair of Zoology at the Bishop Museum in Honolulu. The appointment is the highest honor given to a Bishop museum zoologist.

Frank is one of the world's leading experts on cave and especially, lava tube inhabiting organisms and the premier authority on Hawaiian natural history. He has published over 100 scientific papers and books including the popular *Hawaiian Insects and their Kin*, co-authored by nature photographer William P. Mull. The book includes photos and descriptions of cave-dwelling insects studied by Frank.

Nicholas Sullivan, who submitted the information about Frank, notes that Frank and fellow Hawaiian caver Fred Stone have assisted him for 25 years in studies of the caves of Chillagoe, Australia. They've mapped over 500 caves, described over 20 species of troglobites (including two new genera) and 50+ other species of cave-inhabiting organisms. Over 30 scientific papers have resulted.

Brother Nicholas describes Frank as an "indefatigable worker" after working with him on some 20 expeditions.

Congratulations, Frank!

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