

ERADICATION OF SPOTTED JEWELFISH, *HEMICHROMIS GUTTATUS*, FROM  
POZA SAN JOSÉ DEL ANTEOJO, CUATRO CIÉNEGAS BOLSÓN,  
COAHUILA, MEXICO

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**ABSTRACT**—We report an apparently successful effort to restore native fishes to a pool in the Cuatro Ciénegas Bolsón, Coahuila, Mexico. The results demonstrate the feasibility, in small, confined systems, of eliminating a recently introduced nonnative fish, the spotted jewelfish (*Hemichromis guttatus*), and transplanting a native fish assemblage from nearby areas. We recommend that similar removal and restoration activities be conducted to protect the unique, highly endemic Cuatro Ciénegas fish fauna.

**RESUMEN**—Se reporta un esfuerzo aparentemente exitoso por restaurar los peces nativos de una poza en el Bolsón de Cuatro Ciénegas, Coahuila, México. El resultado demuestra la factibilidad, en pequeños sistemas confinados, de eliminar la especie recientemente introducida y no nativa del pez joya manchado (*Hemichromis guttatus*), y trasplantar el grupo de peces originales, transportándolos de áreas cercanas. Recomendamos realizar esfuerzos similares en otras áreas, que conduzcan a la protección de esta única fauna de peces altamente endémicos de Cuatro Ciénegas.

In this paper, we report an apparently successful restoration of the native fish fauna to a pool, Poza San José del Anteojo, in Cuatro Ciénegas Bolsón, a closed, intermontane valley in central Coahuila, northern Mexico. At least half of the 16 native fish species are endemic to this area

(Minckley, 1984; Norris and Minckley, 1997). The renovation involved reintroduction of native fishes after eradication of spotted jewelfish (*Hemichromis guttatus*), an exotic African cichlid. This fish was discovered in Cuatro Ciénegas Bolsón in 1996 and has spread to a variety of

TABLE 1—Numbers of spotted jewelfish, *Hemichromis guttatus*, collected and removed from Poza San José del Anteojo, Cuatro Ciénegas Bolsón, Coahuila, Mexico.

Date	Number of fish
May 2000	3,041
August 2000	1,087
September 2000	1,479
November 2000	511
December 2000	133
February 2001	674
March 2001	323
April 2001	2,144
May 2001	1,929
September 2001	1,932
October 2001	395
November 2001	687
December 2001	579
January 2002	789
February 2002	1,846
March 2002	444
April 2002	4
May 2002	0
June 2002	0
July 2004	0
Subtotal	17,997
Landowner	1,074
Total	19,071

locations in the basin (Contreras and Ludlow, 2003). The effects of this exotic on the native fishes of the basin have not been documented, but the landowner of Poza San José del Anteojo, Waldo Almaguer (pers. comm.), was convinced that native fishes declined drastically following invasion by the cichlid.

On our first visit to this pool (26 May 2000), we found only spotted jewelfish and a few individuals of the native Mexican tetra (*Astyanax mexicanus*). Based on anecdotal information from the landowners (Almaguer family), other native fishes, including a catfish (*Ictalurus*), the robust gambusia (*Gambusia marshi*), and the Cuatro Ciénegas cichlid (*Cichlasoma minckleyi*), all disappeared following invasion by spotted jewelfish.

The Poza San José del Anteojo is in the Cuatro Ciénegas Bolsón, 6 km W of the town of Cuatro Ciénegas (26°58'10"N, 102°07'14"W). The aquatic vegetation is dominated by *Chara*, and grasses surround the pool. The pool is fed by ground-water, usually with no surface inflow or outflow, and the water is clear and shallow, with a maximum width of 28 m and a maximum depth of

0.8 m. We visited the area 20 times from May 2000 to July 2004: 10 times at 1-month to 4-month intervals from May 2000 to September 2001 and once per month from October 2001 to June 2002. During each visit, the area was fished with 25 standard minnow traps set for 5 to 10 h, and all spotted jewelfish captured were removed from the pool.

In the first survey (May 2000), 3,041 spotted jewelfish were collected, 81 in a single trap. Numbers captured per visit fluctuated with little discernable pattern except for seasonal variation and an obviously reduced abundance in the last 4 visits, with no fish captured in May and June 2002 and July 2004 (Table 1). Overall, 19,071 spotted jewelfish were collected, 17,997 by us, and 1,074 by the landowner, who assisted by removing spotted jewelfish when we were not present.

In May 2000, we collected 5 species of native fishes from Poza el Anteojo, 1 km W of Poza San José del Anteojo, and transplanted them into Poza San José del Anteojo. These pozas probably were connected prior to relatively recent human modifications of the area, and they are likely to have had similar fish faunas. Species and numbers transplanted were as follows: Mexican tetra (40), catfish (15), robust gambusia (80), and Cuatro Ciénegas cichlid (25). However, we failed to collect any of the transplanted fishes during subsequent sampling of Poza San José del Anteojo. In April 2002, we again transplanted Mexican tetra (20), catfish (8), robust gambusia (25 males, 25 females), and Cuatro Ciénegas cichlid (14 unsexed) from Poza el Anteojo into Poza San José del Anteojo. By August 2002, Mexican tetra and robust gambusia had increased substantially, and they were abundant in subsequent collections. We saw juvenile catfish and 5 individuals of Cuatro Ciénegas cichlid in nuptial coloration, but did not observe breeding. We released 20 additional Cuatro Ciénegas cichlids into the poza in August 2002, but found only 2 specimens on 5 July 2004, possibly because of illegal fishing for the species. Any transplantation of fishes associated with restoration should be done with careful attention to preserving as much of the natural pattern of variation as possible.

The spotted jewelfish was not found in any of our last 3 sampling efforts (Table 1), suggesting that the population has been eradicated. Efforts

to eradicate established exotics can be expensive and time consuming, even in small systems (Echelle et al., 2004), but the work reported here suggests the feasibility of eliminating the spotted jewelfish from small, confined habitats in the Cuatro Ciénegas Bolsón. It is important to continue surveying Cuatro Ciénegas Bolsón to determine where the spotted jewelfish occurs and, whenever possible, to eradicate any newly discovered populations.

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