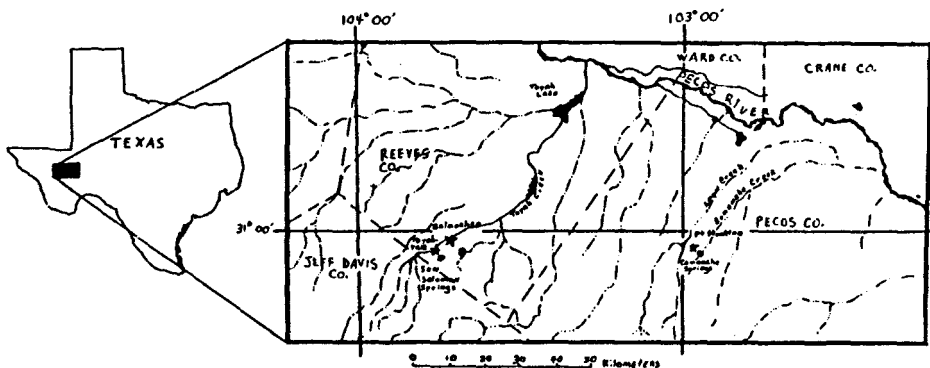


# *Cyprinodon elegans* (Cyprinodontidae)

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Faunal depletion in aquatic habitats of arid regions of the American Southwest is becoming a highly publicized and emotional issue. Saving wildlife from extinction is often difficult. Financial interest of large corporations, delicate ecosystems and general lack of knowledge of endemic organisms often preclude sound management programs. Only through public awareness can any degree of success in positive conservation measures be attained.

The principal spring which it inhabits has gone dry, eliminating the population (Hubbs and Echelle, 1972; personal observation, 1975). However, as first reported by Miller (1951), this species remains extant occurring approximately 190 km. to the west, in the vicinity of Toyahvale, Reeves County, Texas (see figure 1). Specimens from near Toyahvale are notably different from topotypical specimens, Univ. Mich. Mus. Zool. 120355, collected by Carl L. Hubbs and family in 1938 (Stevenson and Buchanan, 1973; Echelle, 1975).



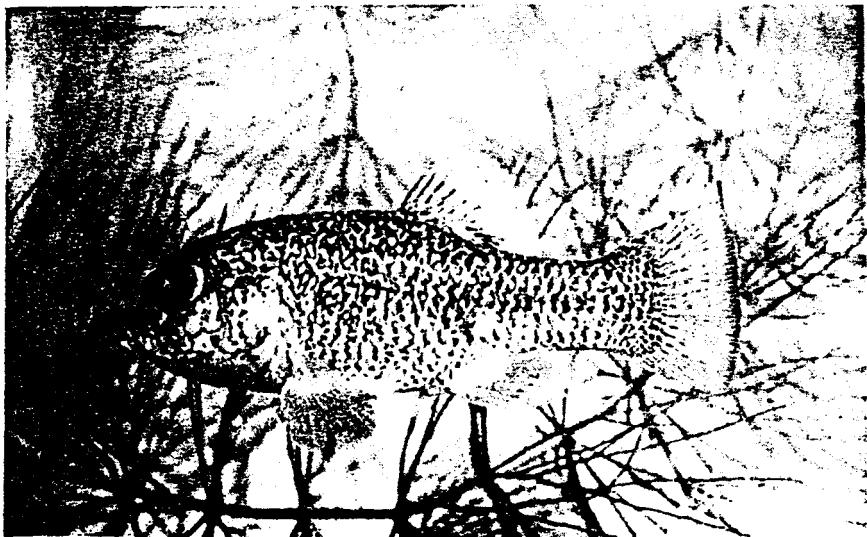
Map of Pecos River Basin, showing creeks and localities mentioned in text.

*Cyprinodon elegans* is unique in several features, which serve to separate it from closely associated forms. Body comparatively slender, depth less than half the length of body. Back not greatly arched. No crossbars. Dorsal speckled or clouded at base. Dark terminal caudal bar of adult males about 1/8 of caudal length. There exist three morphological distinct populations: Comanche Springs, Phantom Cave Spring, and Toyah Creek. For identifying characteristics see Echelle (1975).



Mature pair of *Cyprinodon elegans*, male on left. Note the elongate body and blotched pattern of the female, characteristic of this species. Photo by Braz Walker

Mature male *Cyprinodon elegans* hold territories, which are used as feeding and breeding sites. In flowing waters a central site, perhaps on an algae mat, identifies its 0.46 m<sup>2</sup> territory (Itzkowitz, 1969). The males lie upstream from their territories, when not feeding or breeding. If an intruder should enter the territory the males immediately attack. By waiting upstream, the flow of the water carries the fishes along, and they initiate head-on attacks. Seldom is either fish hurt. The intruder usually leaves at high speed. The males wait for mates upstream from their territory. The females enter from downstream and select a breeding site on the algae mat. The females initiate mating by biting the algae mat. Males drift downstream to lie with their snouts behind the females' operculars. Together the pairs form an "S" shaped curve with their bodies. An egg is deposited in a jerking motion. The females move away at high speed.

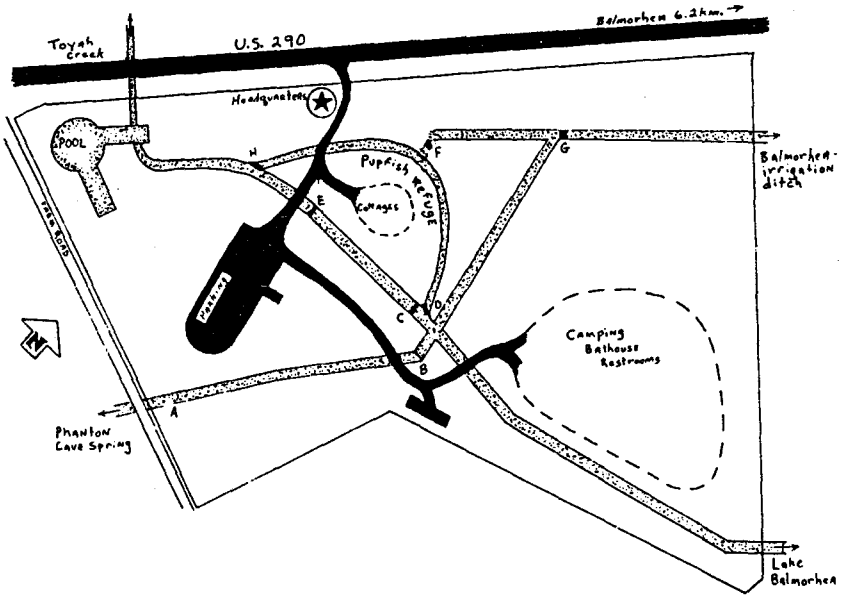


Nuptial male *Cyprinodon elegans* showing no crossbars and with dorsal speckled at the base. Photo by Braz Walker

In standing waters *Cyprinodon elegans* again select a territory which is centered around some landmark, rock, leaf, or clump of plants. The territories are not circular but are generally irregular in shape fitting the contour of the bottom. Instead of facing upstream the males constantly survey their territory. As many territories overlap, fights often occur. Spawning behavior in standing water is usual of the genus.

The females select the spawning site, the males move into position, snouts behind and slightly below the females' operculars. The typical "S" curve is formed and an egg is deposited in the bottom sediments. From aquarium studies it was determined that the average diameter of a fertile clear egg is 1.5 mm. In aquaria, a well-fed pair spawn an average of 30 eggs per day. Hatching requires 5 days at 20°C. Newly hatched fry are rather small and still retain a rather large yolk sac. Only the smallest of foods, infusoria, are taken at first. Growth is rapid with sexual maturity being reached by the fifth month. Males grow faster.

A refugium at Balmorhea State Park (Toyahvale, Texas) was established through cooperative effort of the Texas Parks and Wildlife Department and Texas Organization for Endangered Species. By constructing the canal in a manner which approximates the natural conditions of stream life, it was hoped that the San Solomon Springs endemic fauna could be maintained. Construction on the canal began on August 12, 1974, and was completed on April 28, 1975, at a total cost of \$37,700.00. The entire sum was obtained from state funds (Project No. 354-547, Fish Canal—Balmorhea State Park). The general contractor for the construction was Oasis Builders of Kermit, Texas.



Schematic map of Balmorhea State Park, locality of the pupfish refugium, after map by Texas Parks and Wildlife (POI0075).

The concrete refugium, itself, is about 275 m. long and 1.5 to 2.0 m. wide at the water line. The canal is rounded at the base with the greatest depth being 0.8 m. The entrance gate, point H of figure 2, is a combination screen and canal lock. The screen is small enough to maintain a barrier against unwanted animal transfer, but, its present design is not too effective. From November to March, when water is not needed for irrigation, the gate, point D, figure 2, is closed. During this period water leaves the canal through a screen at point F and flows down a steep incline to a marshy section of a nearby irrigation canal. Although there are no screens at the end of the canal, point D, unwanted fish are excluded by a vertical drop of about 0.6 m. between the base of the refugium canal and the water line of the adjoining irrigation canal. This water line does not prevent fish from leaving the canal, only from entering. In addition to the screens and waterfalls, the cool-water predator species will hopefully be discouraged from living in the canal by higher water temperatures. As much of the canal is only 4 to 10 cm. deep, there should be enough solar energy in this latitude to warm the water. The water is constantly flowing so excessive temperatures should not be reached. Trapping and netting will also be used periodically to remove unwanted species.

As yet, no specimens have been stocked by the Texas Parks and Wildlife Department. Current plans are to stock two local endangered forms, *C. elegans* and *Gambusia nobilis*, after selected aquatic plants gain hold in the refugium.

As mentioned earlier, the screen at the entrance of the refugium has not worked as well as planned. Some time after work on the canal was completed, leaves from nearby trees blocked the screens. Pressure exerted by the flowing water ripped the screen, allowing fish to enter. The canal was partially drained for modifications during the summer of 1975, and since young fish were noted in the canal in the spring of 1976 it can be assumed the damage occurred during the fall of 1975.

Cokendolpher (1976) reported that the refugium was supporting a large population of *Cyprinodon elegans*, both breeding adults and young, in March of 1976. Other species noted in the refugium at that time were: *Astyanax fasciatus mexicanus*, *Dionda episcopa*, *Cichlasoma cyanoguttatum* and a large crayfish species, all of which inhabit the pool and surrounding canals. The introduction of *C. cyanoguttatum* is believed to have happened recently, as no mention of this species is made in Stevenson and Buchanan (1973) or Echelle (1975).

*Cyprinodon elegans* faces many problems in the Balmorhea-Toyahvale area. As in many desert areas the mining of water threatens the aquatic ecosystem. The use of water for agricultural purposes has lowered the measured flow in Phantom Lake from about 1.26 cms. in 1900 to near 0.14 cms. in 1970 (Hubbs and Echelle, 1972). An additional problem in the Balmorhea area is the introduction of exotic fishes. A local farmer dredged out a portion of the Phantom Cave Spring irrigation canal and stocked it with black bass, *Micropterus sp.*, (A.A. Echelle, personal communication). The bulk of the Phantom Cave "morph" of *C. elegans* may already be lost. The effect of the *Cichlosoma cyanoguttatum* introduced to the San Solomon spring system is undetermined at this time. Most important, since the release of *Cyprinodon variegatus* in Lake Balmorhea, it has proved its ability to effectively compete with *C. elegans* in slow-moving waters. Stevenson and Buchanan (1973) also point out the genetic contamination between these two *Cyprinodonts*. As *C. variegatus* is typically a slow-water species, a hybrid zone now exists in the irrigation canal confluence of Lake Balmorhea, figure 8, Stevenson and Buchanan (1973) (personal observation, 1975). Fortunately, the upstream stocks of *C. elegans* are separated from this congener by numerous physical barriers, rapidly flowing water, and waterfalls in the irrigation system.

At present there are no conservation plans specifically aimed at the Toyah Creek or Phantom Cave "morphs". However, the Balmorhea State Park Refugium, stocks at Dexter National Fish Hatchery, and strict State and Federal Endangered Species laws will hopefully assist this distinctive pupfish in its efforts to survive in the American Southwest.

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