The Leon Springs Pupfish . . . a Resurrection Story

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The pupfishes of the genus *Cyprinodon* are a stubborn group which has in a number of instances adapted to conditions and circumstances which other, less tenacious fishes would have found intolerable. They have evolved a toleration, where need be, for seemingly impossible temperatures and salinities, as well as other ecological conditions which tested their durability and adaptability beyond the endurance of their peers, in some cases even leaving them as the sole piscine inhabitants of a particular spring or creek.

One of the better examples of this penchant for survival is a handsome little fish from west Texas named *Cyprinodon bovinus* Baird and Girard, 1853 (*Cyprinodon*—tooth-carp; *bovinus*—like a bull). The Leon Springs pupfish, as it is commonly known, had occupied Leon Springs for 25,000 years since the end of the last great Ice Age. Its habitat was one of rather shallow water which flowed from the spring and it had relatively few enemies. Because of its ecological environment it had become, over these thousands of years, a very specialized creature, dependent on the continuing integrity of its realm.

What time could not do, Man, in his bumbling fashion could, and when the area was occupied by white settlers it was not long before Leon Springs had been dammed to form a lake and was stocked with predatory sports fish. Not only was the whole ecology of the spring area changed, the lake was later poisoned with Rotenone and even the spring failed. No pupfish had been collected since the dam was built, and *Cyprinodon bovinus*, survivor of cataclism, time and drastic but extensive ecological change, joined the list of natural history has-beens along with the great auk and passenger pigeon, which could not survive Man.

Unaware that it was officially dead, the Leon Springs pupfish didn't have enough sense to lie down, and in 1965, after having been considered extinct for more than fifty years, it was rediscovered at a different location, ten km north of Fort Stockton in Diamond-Y Spring. Fortunately, the spring and its drainage had not been subjected to the ecological insults which so often occur when a ready source of "good" water is available, since the water is quite salty, hard and alkaline, making it unsuitable for drinking, irrigation or even consumption by cattle, which travel a good distance to avoid drinking the water even when they have been grazing nearby.

The present population of *C. bovinus* occupies less than three miles of stream and is located entirely within the Gomez oil and gas field, which is in active production. It is conceivable that a major oil spill could put the final nail in the coffin of one of the most courageous

examples of obstinate survival to be found on our contemporary earth.

From this potentially disastrous situation developed one of the most heartening cooperative efforts to take place in behalf of what some might consider an insignificant creature, since it has no economic value. With the joint efforts of Exxon, Northern Natural Gas Co., scientists, the Soil Conservation Service and land owner M. R. Gonzalez, Jr. an earthen diversionary dam was constructed around the head spring to protect the pupfish at least in this area from being decimated by a major oil spill if it should occur. The threat was a real one, since in the last few years several spills have occurred, at least one of which severely affected a portion of the habitat and killed many of the fish in the stream. Hopefully, with greater awareness of the ecological impact of certain industries and a willingness to cooperate with conservationists such as shown by this effort at Diamond-Y Spring, at least creatures which live in the shadow of the ax will have a better chance of survival.

As if its troubles weren't enough, it was discovered in 1975 by Dr. A. A. Echelle of Baylor U. that the common sheepshead minnow, *Cyprinodon variegatus*, was rapidly hybridizing with the Leon Springs pupfish, threatening it as surely as a more conventional extinction. Apparently the sheepshead minnow was introduced through the carelessness of some passing bait salesman or fisherman, since the nearest natural population is in the Rio Grande at Laredo, Texas.

Fortunately, the two mile section of habitat in which the hybridization was occuring was located downstream from another 1.5 miles of stream inhabited by *C. bovinus*, and the upper and lower sections were isolated by a mile of dry creek bed. The upper population had retained its purity.

It was decided by a team of fisheries experts that the best approach would be to collect a representative sample of fauna from the stream, with the exception of pupfish, to be held alive and reintroduced after poisoning this section to kill any fish and eggs present. Before poisoning the stream however, a special application had to be made by the Texas Parks and Wildlife Service, since *Gambusia nobilis*, the Pecos Gambusia, is also an inhabitant of the stream and is classified as an endangered species. Strangely enough, *Cyprinodon bovinus*, which is much more rare and endangered than the Pecos Gambusia, did not come under federal scrutiny and control, since at the time it was still listed as extinct. The Pecos Gambusia is still found in a few other southwestern streams.

Permission was granted, and on February 13, 1976, biologists from Texas Parks and Wildlife, Univeristy of Texas, Baylor University, Tulane University and the Texas General Land Office removed the fish and aquatic life to be held for restocking and sprayed the two-mile stretch with toxicants to eliminate all fish and eggs. After the toxicants dissipated, the fish and invertebrates which had been reserved were restocked, and a group of 150 uncontaminated Leon Springs pupfish which had been taken from the upper section of the stream were introduced with the hope of reestablishment of the species.

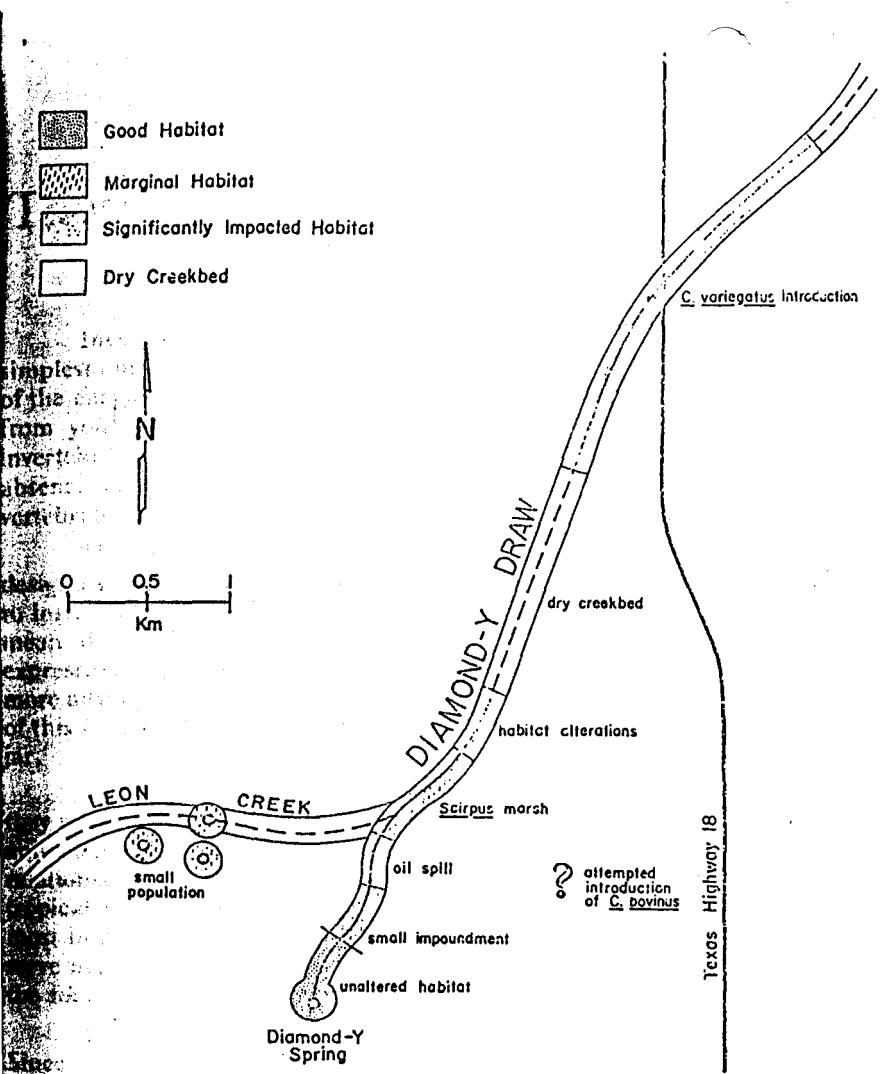
As is so often the case with cyprinodonts, the male fish is more handsome and colorful. While less striking in its breeding garb than *C. eximius* or *C. variegatus*, the Leon Springs pupfish wears a tasteful blend of more subtle hues which gives it a beauty of its own. Body coloration of the breeding male is a rather powdery blue-grey, with faint blue iridescence on the nape. Pectorals and pelvics are yellowish, and other fins as well show pale yellow areas. The caudal is edged in jet black, with a narrow black crescent at the caudal peduncle. Bases of the dorsal and anal fins are black, fading slightly toward the outer margin.

Females are rather greyish-yellow or grayish-brown on upper body; lighter below, with these areas divided by a series of dark lateral blotches forming a broken lateral band. Caudal and dorsal dusky, with a black spot ocellated by a small light area located on the posterior part of the dorsal.

C. bovinus prefers quiet, shallow stretches of flowing water. The bottom of much of its habitat is marl combined with the roots of aquatic vegetation, and in some stretches a deeper channel has formed, leaving a shallow ledge above. These ledges are favored spawning places. The entire habitat is restricted to a small, spring-fed segment of Leon Creek north of Fort Stockton. At the upper part of the area is a large marsh through which there is a watercourse containing silt-laden pools connected by small channels of shallow water flowing only slightly. Diamond-Y is the largest spring feeding the watercourse, with several others trickling in along the way. The marsh disappears downstream until there is just a small, barely flowing channel under the Highway 18 bridge. This disappears a bit downstream.

Males are rather aggressive and territorial creatures not only in their breeding behavior but during an activity called "pit-digging." Pit-digging consists mostly of swimming very rapidly in place so that the flow is directed downward, washing away debris and small portions of substrate in order to expose edible organisms. Pits are jealously defended, and while females also exhibit pit-digging, it is much more common in males. Females and juveniles are invariably ejected by a male fish which decides to take over. Not only is food uncovered, heavier particles, sometimes food items, tend to accumulate in the bottom of the pit. Food seems to consist of diatoms, algae, amphipods, ostracods and gastropods, in that order. Most pupfish are considered to be mostly vegetarian, although some will subsist as either carnivores or herbivores according to what is available. The intestine is quite long, and some consideration is given to the possibility of extracting nourishment from large quantities of detritus and mud which are ingested much in the way some suckermouth cat-fishes (*Hypostomus*) do.

Apparently the life span of *C. bovinus* in nature is about 20-23 months. Spawning occurs throughout the year, but reaches its peak in mid or late July. Spawning activity increases sharply above 24°C and begins to decrease above 29°C. James Cokendolpher, among others, has successfully spawned the Leon Springs pupfish and has reportedly repeated with the second generation stock, although these were lost due



Habitat of *C. bovinus*, compliments of Stephen E. Kennedy

to unavoidable circumstances. He reports that spawning is not difficult, although raising the young is more of a problem. Hopefully a domestic strain can be established to replace the natural population if something should happen. It must be **stressed** that this fish **may not be collected** without a permit since only a few hundred individuals remain in this one, tiny ecological niche in all the world.

Any creature capable of homesteading the same small chunk of habitat for 25,000 years has got to be respected and preserved. ‡

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