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Cover: Elk are native to Arizona but the species originally found here became extinct at the turn of the century. Rocky Mountain elk were brought from Wyoming in 1913 by the Winslow Elks Lodge #536. They formed the start of today's population. Photo by Leonard Lee Rue III.

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DIAMONDS ARE a girl's best friend, dog is man's best friend and the hunter is the deer's best friend.

By catching the fancy of the American sportsman, the deer has provided its future populations with insurance not available to non-hunted animals. The deer and other hunted varieties are treated to planned habitat development and careful scientific attention not devoted to the non-hunted species.

Many people cannot understand why the hunter would devote his hours and dollars to wildlife management just to turn around and hunt the animals he protects. The situation is really not that bewildering. The hunting is a very necessary part of proper wildlife management. If the hunter did not harvest large numbers of deer annually, the deer would soon become its own worst enemy.

An overpopulated deer range is not a pretty sight. Too many deer means impaired reproduction, also smaller and weaker deer that have little resistance to disease and parasites. Starvation is the main cause of death. Damage to an overpopulated range may take over 15 years to remedy once the deer are again brought into balance with the habitat. The only practical way to keep the deer in balance with their habitat is through properly controlled public hunting designed to remove only the surplus animals from the range.

NATIVE ARIZONA FISHES

Part II - Spiny-rayed Minnows

DR. W. L. MINCKLEY

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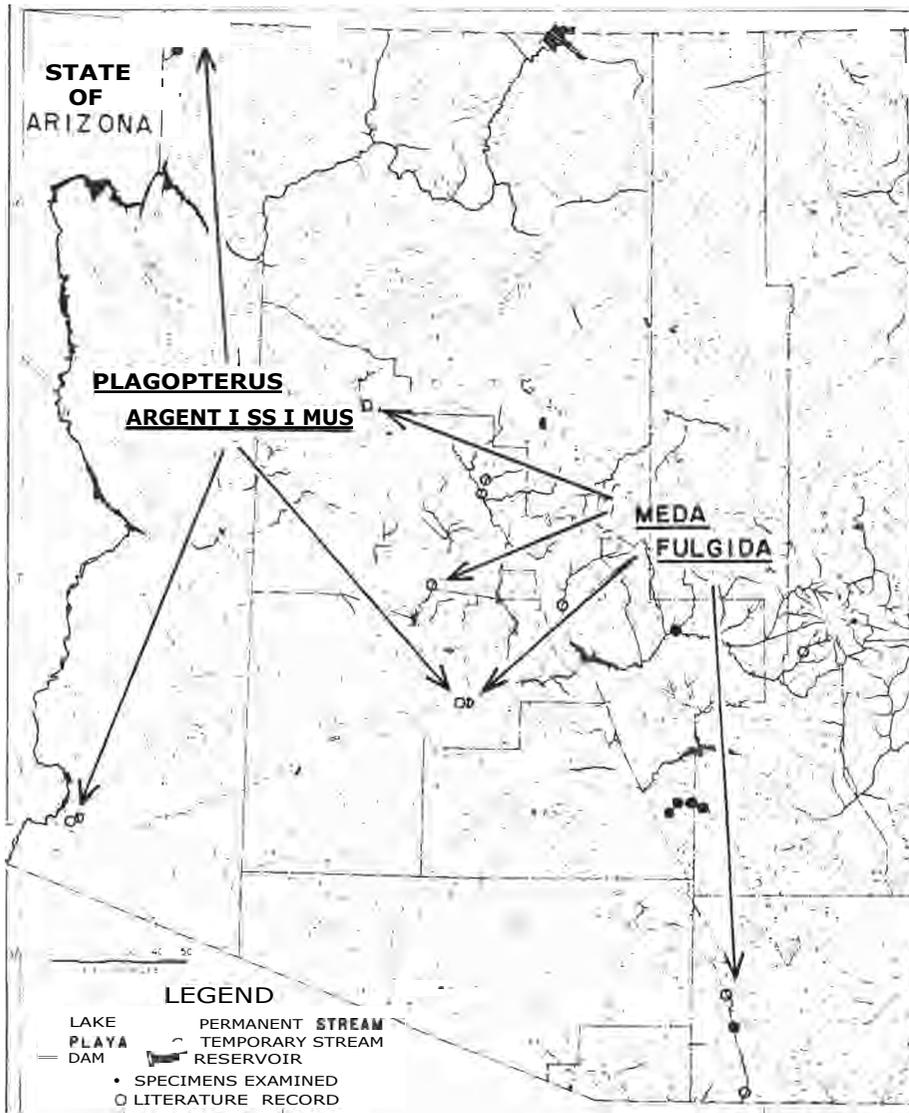
MINNOWS (family Cyprinidae) are the most diverse group of native Arizona fishes, and four of them in the state belong to the distinctive tribe, Plagopterini, or spiny-rayed minnows.¹ This unique group is found only in the middle and lower Colorado River drainage. Seven different kinds are known (six species, one with two subspecies), two of which (in Nevada) have become extinct in the past few years.² The Arizona forms are locally common, but, as with many of our native fishes, have suffered substantial reductions in their original ranges (see maps).

The spiny-rayed minnows are named for peculiar adaptations of the supporting structures of their fins. The most unique of these are the double, spine-like rays at the leading edge of the dorsal fin. One of these "spines" fits into a groove in the other (see drawing). In other native minnow species the first rays of the dorsal fin may be stiffened or covered with thick skin, but they are not rigid and sharp pointed, nor do they fit together in any special manner. The plagopterine fishes also have spine-like rays in the pelvic fins, a feature not found in any other minnow. All four of the spiny-rayed minnows are silvery, active and are found in streams of the State rather

than in lakes.

The woundfin, *Plagopterus argentissimus*, is the most distinctive of the Arizona species (Fig. 1). It's smooth, scaleless body, flat belly, and strong, expanded fins are remarkably suited for life in the swift, sandy-bottomed channel of the lower Virgin River, the last stream in Arizona (or in the world, for that matter) which supports woundfins. This same fish once lived in the Gila River as far upstream as Tempe, but became extinct very soon after Caucasian man began to develop the area. Only three historic records are known and the last woundfin collected from the Gila River system was in 1894.²

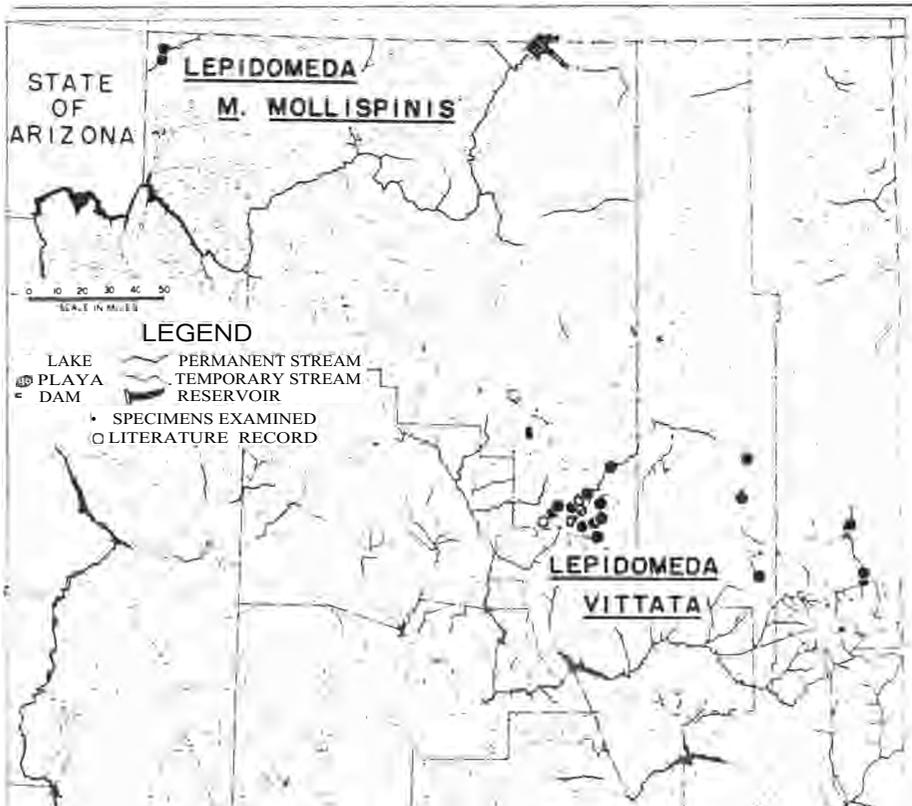
This species has a very strong, elongate spinous portion in its dorsal fin, which can easily penetrate one's finger if the fish is handled roughly. This presumably caused Edward Drinker Cope in 1874 to give it the generic name *Plagopterus*, which literally means "wound" (*plagos*) and "fin" (*pterus*). The second name, *argentissimus*, is translated as "most silver." This is in reference to the over-all body color. Almost nothing is known of the biology of this fish, and modifications of the Virgin River by highway construction and possible future damming make its future parti-



Map 1. Past (open circles) and present (dots) distribution of two native Arizona spiny-rayed Minnows.

cularly bleak. Attempts are presently underway, by the Game and Fish Department and personnel from Arizona State University, to maintain a stock of this species in hatchery race-ways, and perhaps to introduce woundfin into other natural waters of the state. Introductions would be primarily to preserve the species and to produce additional forage for game fishes.

The second spiny-rayed minnow native to Arizona is found only in the Gila River basin. *Meda fulgida*, the spikedace, formerly lived throughout much of the drainage system upstream from the junction of the Salt and Gila, but now has been replaced in the Verde River basin by the introduced red shiner (*Notropis lutrensis*). It is now rarer elsewhere than it was in



Map 2. Past (open circles) and present (dots) distribution of two native Arizona spinedaces.

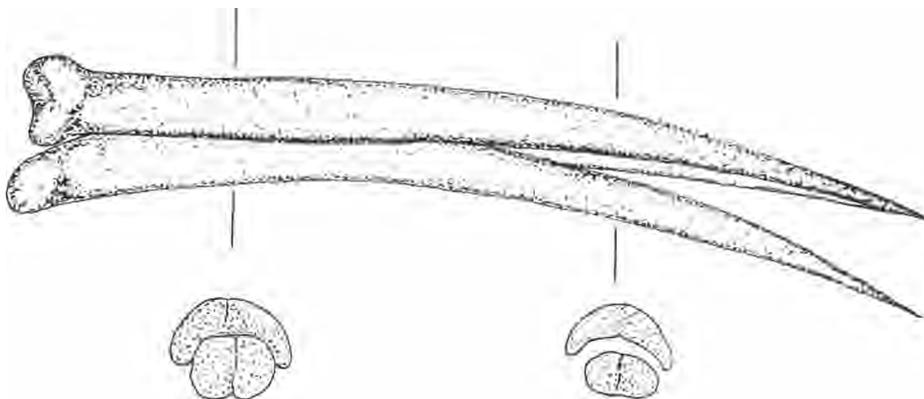


Illustration of pair of modified fin-rays forming "spine" in plagopterine fishes, with cross sections at two locations.

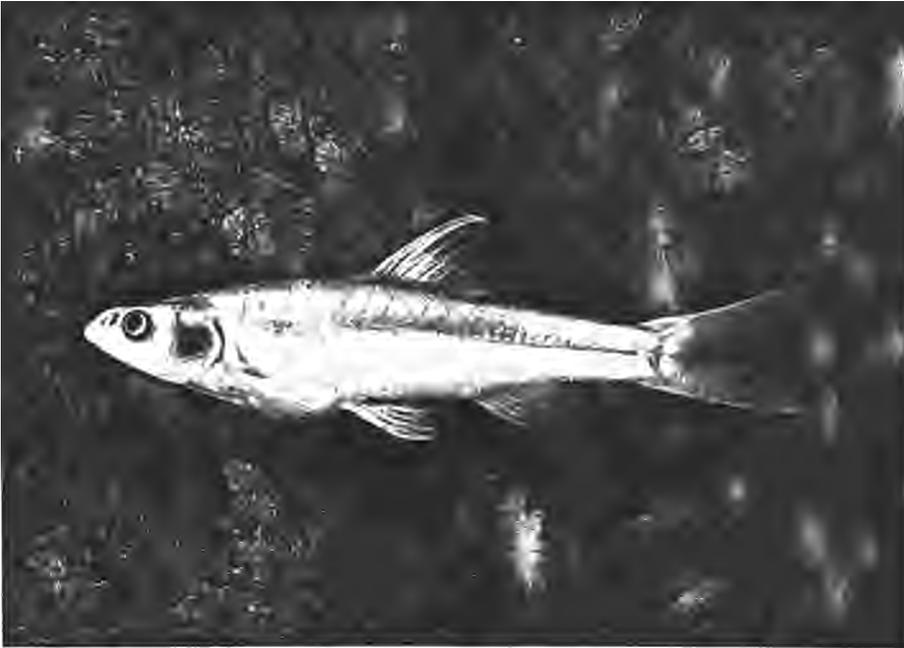


Fig. 1. *Plagopterus argentissimus* from Virgin River, Arizona.
About 3.5 inches total length.

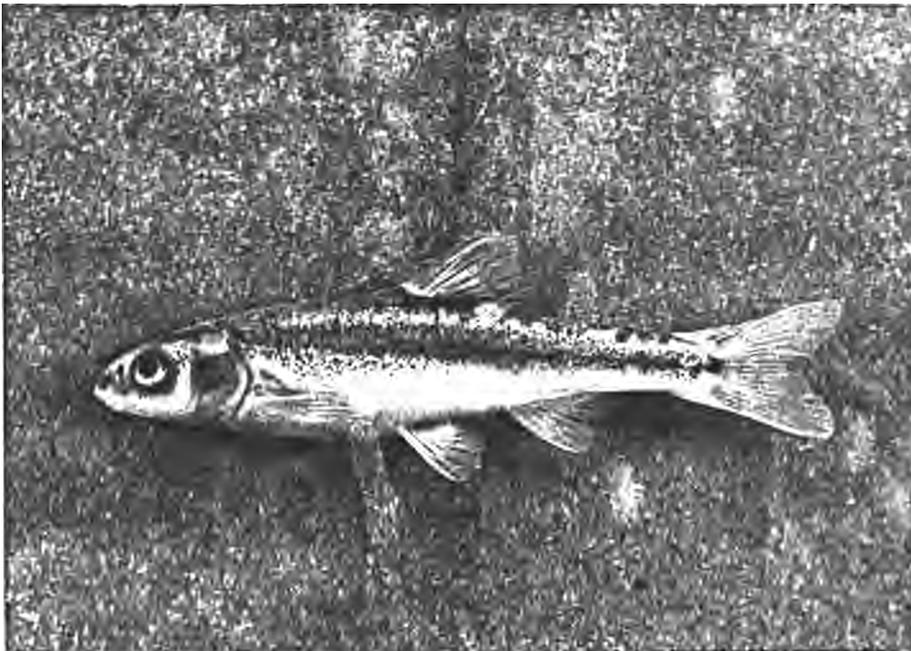


Fig. 2 *Meda fulgida* from Aravaipa Creek. About 2.5 inches
total length.



Fig. 3. *Lepidomeda vittata* from East Clear Creek. About 4 inches total length.



Fig. 4. *Lepidomeda mollispinis* from Santa Clara River, Utah, tributary of Virgin River. About 4 inches total length.

the 1950's.⁴ Spikedace are sharply marked by tiny, black spots on their silvery sides, and have brownish **mot-
tlings** over the back (Fig. 2). They live in slowly-flowing, shallow **pools**, usually concentrating near the upper ends where swifter water enters. Spawning is in spring in shallow, moving water over sand or gravel bottoms. Breeding males become brassy yellow in **color**.⁵

The two remaining species of spiny-rayed minnows belong to the genus *Lepidomeda*. The Little Colorado River spinedace, *L. vittata*, is restricted to the Little Colorado basin, where it inhabits streams along the Mogollon Rim. The Virgin River spinedace, *L. mollispinis*, inhabits springs and smaller creeks of the Virgin River system (Map 2). Both of these species tend to be grayish dorsally, and sometimes mottled on the sides, but a silvery aspect dominates their over-all coloration. Both species live in pools of creeks and frequent deeper and quieter waters than does either *Meda* or *Plagopterus*. *Lepidomeda vittata* feeds principally on aquatic insects. The reproductive season extends throughout the **summer**.⁶ Biology of the Virgin River spinedace has yet to be studied.

These two spinedaces are less highly specialized than are the spikedace and woundfin. Their dorsal spines do not extend to the tip of the fin, and terminate in a soft, relatively unmodified

condition. Also they have chubby, unspecialized body shapes, and rounded, non-distinctive heads (Figs. 3 and 4).

The Little Colorado spinedace came dangerously near extinction in the early 1960's as a result of natural and man-induced **factors**.⁷ During the mid-60's, it spread to re-inhabit much of its original range when precipitation and other habitat conditions **im-
proved**.⁶ Sampling in 1969 indicates that some populations are again at a low level, but study has not been extensive enough to define the magnitude of the decline or to define the exact causes. The Virgin River species is common in many tributary creeks in Arizona, Nevada and Utah, but the Arizona populations may be destroyed by the same modifications that are expected to influence the woundfin in the Virgin River system.

These four small fishes have little definable economic value other than providing a possible link between the invertebrates and the larger game fishes and occasionally being used for **bait**.⁸ Their major worth is in their scientific uniqueness. They form a closely-knit group of special fishes, isolated in the lower part of a major western drainage system. They evolved here, in long isolation, and their distributions reflect conditions and drainage relationships that existed in the very distant past.

¹Miller, R. R., and C. H. Lowe. 1964. Part 2. An annotated check-list of the fishes of Arizona. *In*, Lowe, C. H., *The Vertebrates of Arizona*. Univ. Arizona Press, Tucson, pp. 133-151.

²Miller, R. R., and C. L. Hubbs. 1960. The spiny-rayed cyprinid fishes (*Plagopteriini*) of the Colorado River system. *Misc. Publ. Miss. Zool. Univ. Mich.* 115: 1-39, 3 pls.

³LaRivers, I. 1962. *Fishes and Fisheries of Nevada*. Nevada State Fish and Game Comm., 782 pp., 1 map.

⁴Minckley, W. L., and J. E. Deacon. 1968. Southwestern fishes and the enigma of "endangered species." *Science*, 159: 1424-1432.

⁵Barber, W. E., D. C. Williams, and W. L. Minckley. 1969. Biology of the spikedace, *Meda fulgida*, in Arizona. *Copeia*, 1969(4): in press.

⁶Minckley, W. L., and L. H. Carufel. 1967. The Little Colorado River spinedace, *Lepidomeda vittata*, in Arizona. *Southwest. Nat.*, 12: 291-302.

⁷Miller, R. R. 1963. Distribution, variation, and ecology of *Lepidomeda vittata*, a rare cyprinid fish endemic to eastern Arizona. *Copeia*, 1963 (1): 1-5.

⁸Miller, R. R. 1952. Bait fishes of the lower Colorado River from Lake Mead, Nevada, to Yuma, Arizona, with a key for their identification. *Calif. Fish and Game*, 38: 7-42.

