

Hubbs C L. Hybridization between fish species in nature. *Syst. Zool.* 4:1-20. 1955.
[Scripps Institution of Oceanography, University of California, La Jolla, CA]

This paper provided a review of the available data on natural hybridization in North American freshwater fishes. It also clearly demonstrated the correlation between phylogenetic relationship and the capacity to produce hybrids. [The SCI® indicates that this paper has been cited in over 175 publications since 1955.]

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When my father, Carl L. Hubbs, accepted a position at the University of Michigan in 1919, he initiated a program to survey the freshwater fishes of North America. His survey of the fishes typically involved a trip by car to selected parts of the US. Initially, the collecting was done with the assistance of a graduate student, but later the collectors were the Hubbs family. The "allowance" to the children was based on the number of species collected (five cents each) with special awards for new species (one dollar) or new genera (five dollars). Fortunately, he was a splitter; thus we obtained frequent special awards.

He soon noted that natural hybrids occurred in many collections. This observation was in conflict with the teachings of his mentor, David Starr Jordan. Although he was quite enthusiastic about the capture of hybrids, the children did not obtain any special awards for those captures. The collection of

natural hybrids was simply a result of normal collecting activities. He was able to perceive that the occurrence of natural hybrids correlated with evolutionary expectations in that they were most likely to be found in (1) disturbed environments; (2) localities where one parental species had been introduced; (3) localities where one parental species was rare and the other abundant; and (4) areas of stress where heterosis would enhance abundance. He also noted that hybridization was inversely associated with fish diversity so that few marine fish hybrids occurred and freshwater fish hybridization was most common in western states.

The studies with the Amazon molly were a natural outgrowth of his work with fish hybridization. The Amazon molly (*Poecilia formosa*) is an all-female fish of hybrid origin between *Poecilia latipinna* and *Poecilia mexicana*. This was the first demonstration of parthenogenetic reproduction in vertebrates. Together with my mother he reared 22 generations of females, each identical to all the others despite having diverse fathers.

The major theme of fish hybridization was well documented by a graphic procedure that clearly showed that interspecific hybrids (of which most are sterile) were most common among closely related species. Laboratory hybrids are heterotic and provide raw materials of substantial value to a fish culturist.

The high incidence of citations for this paper is due to inherent interest in fish hybridization, unisexual species, and use of hybrids in fish culture. The paper summarized concisely a research program that lasted 35 years. For a more recent review, see reference 1.

1. Schwartz F J. World literature to fish hybrids with an analysis by family, species, and hybrid. (Whole issue.)
Gulf Coast Res. Lab. 3. 1972. 328 p.