

## A CONCEPT OF SPECIES AMONG FISHES

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### AN ABSTRACT OF ORIGINAL OBSERVATIONS

Counts of the numbers of spines and rays in the fins of darters show that the degree of difference between the mean spine or ray counts of two populations increases as the water distance between these populations increases. It has not been possible to relate these differences in mean spine or ray numbers to differences in the environment.

During the past two years counts have been made of the spines and rays in the fins of many other kinds of Illinois fishes. By using the mean number of spines or rays in each of the seven fins of each of the spiny-rayed fishes of the state (a group comprising 47 species), we have been able to calculate coefficients of difference (the average of seven percentage differences) between any two species. These coefficients of difference for all combinations have been summarized in a table. From this table it is possible to construct a family tree showing the degrees of relationship of these 47 species, as well as their relative rates of evolution. This biometrical family tree of spiny-rayed fishes corresponds very closely to those family trees constructed by systematic ichthyologists from a much wider range of characteristics and is less open to criticism since it involves the experience and judgment of the investigator to a smaller degree.

Sterile hybrids are found in nature which involve six kinds of Illinois sunfishes. The occurrence of hybrids between certain described species and genera of sunfishes and not between others offers the possibility of an empirical test of the validity of coefficients of difference as indices of degree of relationship. The parents of 14 known hybrid combinations all show coefficients of difference below 4.7 per cent. Furthermore, combinations of these six species which are known to enter into sterile hybrids are the only ones which show coefficients of difference smaller than 4.7 per cent. Other nearly related species among which we are fairly certain hybrids do not occur show coefficients exceeding 5.7 per cent. For example, the two species of crappies, which from external appearances and general morphological characteristics resemble each other more closely than do many of the species which are known to hybridize, show a coefficient of difference of 5.7 per cent. Similarly, the large mouth black bass and the small mouth black bass resemble each other closely but show a coefficient of difference of 6.1 per cent.

The genetic meaning of this relation between hybridization and differences in the spine and ray counts of the fins is not clear. The most promising viewpoint seems to be that the *number* of spines or rays in a fin has little adaptive significance and that changes in the general genetic constitution produce random plus and minus variations in this number. Averaging the percentage differences of seven fins expresses the total amount of genetic difference between two species more accurately than does the difference in one fin.