THE SHIELD COLOR AND RELATIONSHIPS OF CERTAIN ANDEAN COOTS

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The American Coot (*Fulica americana*) is a wide-spread New World species with populations ranging from central Canada to northern Chile and from the Atlantic and Caribbean coasts to the Hawaiian Islands. The morphological characteristics exhibited by some of its populations, however, are such that there has been considerable uncertainty as to their specific statuses. This has been particularly true of the coots of the Ecuadorian and Peruvian Andes where "American Coots" are of two types: one with a reddish-brown frontal shield, the other with a whitish frontal shield. The white-shielded form was described as *Fulica ardesiaca* (see Hellmayr and Conover, 1942: 413). Red-shielded coots were also included under this designation until they were separated as *Fulica americana peruviana* (Morrison, 1939). This distinction was accepted by Hellmayr and Conover (*op. cit.*) on the basis of their sympatry on certain Andean lakes and on the absence of intermediates.

It is the purpose of this paper to review the available evidence concerning the relationships of these two coots in the light of observations made by Robert W. Storer and me at Lake Junín, Perú, in November, 1961. In addition, a total of 31 coots of each shield type was examined from the collections of the following museums: The American Museum of Natural History, Chicago Natural History Museum, The University of Michigan Museum of Zoology, Museum of Vertebrate Zoology, United States National Museum, and Peabody Museum of Natural History. I am grateful to the respective curators of birds of these institutions for making this study possible and to Robert W. Storer and Larry L. Wolf who aided in the examinations. Our stay at Lake Junín was supported by a National Science Foundation grant (G4846) and was facilitated by the generosity of the Cerro de Pasco Corporation. Finally, I am indebted to Robert W. Storer for his many helpful suggestions made throughout the course of this study.

The primary morphological difference between the two coots is the color of the frontal shield, that is, chestnut or mahogany red as opposed to pure white, occasionally with a light yellow or pinkish hue. The shields also appear to differ structurally, the red shield being more solid and of a more waxy texture when examined superficially. Correlated with shield color are differences in color of bill and legs. White-shielded coots tend to have bluish-white bills and slate-gray or gray-green legs whereas red-shielded coots usually have yellowish bills with green tips and yellow-green legs, often with reddish orange on the back just above the ankle. This correlation has been noted by earlier workers and was evident from our observations of large numbers of these coots on Lake Junín. However, several specimens of white-shielded coots examined had, according to the labels, yellow-green legs and/or yellowish bills with green tips. One of the red-shielded coots we shot at Lake Junín had gray legs. A comparison of the postcranial proportions of New World coots (Gill, MS) has indicated that there may be a slight difference between the two shield types in the relative lengths of some of their pelvic elements, but additional material is needed to confirm this. There does not appear to be any difference in the relative lengths of the skeletal elements of the leg or wing. With respect to plumage characteristics the two shield types do not differ in the amount of white either on the outer edge of the outermost primary or at the tips of the secondaries. Both of these characters are extremely variable. Specimens of the two shield types from the same areas do not differ in the length of the wing, tail, or culmen. Finally, there is no correlation of shield color with sex.

Red-shielded and white-shielded coots both occur on Andean lakes from southern Colombia, the northern limit of their ranges, south through Ecuador and most of Perú.

Although the two coots are sympatric on some Andean lakes, there are apparently other lakes within this range on which only one shield type is present. For example on Laguna Alcococha, a small lagoon located approximately 45 kilometers northeast of Lake Junín, we could find only white-shielded coots. White-shielded coots are not found south of southern Perú, whereas red-shielded coots range into northern Chile and extreme northwestern Argentina (Hellmayr and Conover, *op. cit.*; Goodall, Johnson, and Phillippi, 1951). A specimen of a white-shielded coot from Laguna de Tampo, Arequipa, Perú (see Hellmayr and Conover, *op. cit.*) represents its southernmost occurrence to my knowledge. Only red-shielded coots are found on Lake Titicaca between Perú and Bolivia. This difference in the distributions of the two shield types suggests that there may also be a difference in the physiological or ecological requirements.

Both red- and white-shielded coots occur in large numbers on Lake Junín in central Perú and in November, 1961, were abundant along the canal connecting the Upumayo dam with the northwest end of this lake. We estimated that white-shielded coots were approximately five times as common as red-shielded coots in this area. Morrison (1939) also found white-shielded coots to be the more common here. During November, 1961, coots were in all stages of the breeding cycle as was indicated by the presence of young of all ages, pairs without young, and unpaired birds in various stages of molt. Two coots were considered paired when they were observed feeding along the edge of the marsh in close proximity to each other but with no other coots in their immediate vicinity. Likewise they were considered paired if they were with young. In addition to many pairs consisting of two white-shielded coots and one pair of red-shielded coots (with young), we observed at least six mixed pairs, in which one of the coots had a white shield and the other a red shield. Two of these six pairs had downy young. One such pair with recently hatched young permitted prolonged observation as they fed along the edge of the canal. Both members of the pair attended and fed the three young. They showed no signs of hostility toward each other although they did toward three full-sized juveniles feeding nearby.

The occurrence of mixed pairs of the two types of coots indicates that they are but color forms of a single species, a conclusion which is supported by the similarity of the two forms in all characters except the color of the frontal shield. That this Andean coot population should be considered a representative of the American Coot seems evident from the morphological similarity of the red-shielded form to the American Coot of the Colombian Andes (*Fulica americana colombiana*) which served as the basis for Morrison's description of *F. americana peruviana*. It is recommended therefore that *Fulica ardesiaca* and *Fulica americana peruviana* be synonymized, and because *ardesiaca* is the oldest available name, that *Fulica americana ardesiaca* be adopted as the inclusive taxonomic designation to indicate the relationship of this population to the American Coot.

The nature of the underlying basis of the difference in shield color is still not clear. Earlier workers (see Hellmayr and Conover, *op. cit.*) have suggested that red-shielded coots are the nuptial color phase of a white-shielded species, an hypothesis which is not supported by the observations of concurrent breeding of the two forms. In fact it is not known whether the shield color of any individual ever changes color. The general absence of intermediates militates against such a possibility since it is unlikely that a shield could change from white to mahogany-red rapidly enough to escape notice. Thus, this may well be a genetically-based dimorphism.

Studies of the nature of the frontal shield of the American Coot in California (Gullion, 1951) have revealed that the frontal shield consists of two parts, one of reddish brown coloration, the other whitish. The reddish brown structure, the callus, is

horny or corneus in texture and is structurally discontinuous with the rhinotheca of the maxilla. It is therefore an accessory to the frontal shield proper, as it is not comparable to the structurally-continuous frontal shields found in other species of coots. The white portion is a continuation of the rhinotheca and therefore the true frontal shield. The relative size of the two components varies considerably from individual to individual. In some, the two may be present in equivalent proportions, whereas in others the callus may be very large and consequently the predominant feature of the shield. In still others the callus is only rudimentary, being represented by a small red spot on an otherwise white frontal shield. Although detailed structural analyses are lacking, the red shield of the red-shielded coots of the Andes seems comparable to a callus which has completely replaced the true shield. The apparent structural similarity of the two was noticed by Gullion (*op. cit.*). The Andean white-shielded coots on the other hand seem to lack the callus, their frontal shield being composed entirely of a structure comparable to the whitish component of the shield of the American Coot.

A similar situation may well exist in the West Indies where the red-shielded American Coot (*F. americana grenadensis*) has a white-shielded counterpart, the Caribbean Coot (*F. caribbea*). The two differ only with respect to the nature of the frontal shield, the Caribbean Coot completely lacking the reddish brown callus. The relationship of these two coots has never been satisfactorily worked out, and in view of the Andean situation it seems likely that intensive field work at critical locations in the West Indies will reveal interbreeding between the two.

SUMMARY

The two Andean coots *Fulica americana peruviana* and *Fulica ardesiaca* are extremely similar morphologically and are sympatric on some Andean lakes, although not on others. The primary difference between the two is the color of the frontal shield which is mahogany red in the former and white in the latter. Mixed pairs of these coots were observed on Lake Junín, Perú, in November, 1961, and on this basis it is recommended that the two be considered conspecific with the adoption of *Fulica americana ardesiaca* as the inclusive taxonomic designation. It is suggested that the nature of the difference in frontal shields is a genetically-based dimorphism with respect to the presence or absence of the reddish brown callus found in the American Coot (*Fulica americana americana*).

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