MYSTERIOUS FISHES FOUND IN CAVE STREAMS

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(Continued from last month's Bulletin)

The cave environment offers one of the most secure ways of life there is, provided animals can adjust to the absence of light. Dangers from predators are probably at a minimum. **Sculpins** are found in caves more frequently than are cave fishes, possibly because they are more easily seen since they are larger, darker, and not so shy as cave fishes. **Sculpins** are carnivorous and often two or three times the size of cave fishes. Although several stomachs of **sculpins** from caves have been examined and only invertebrate remains found, the **sculpin** is a possible predator.

In most caves we find raccoon tracks in the muddy banks along the stream. The raccoons enter the caves to catch crayfish and they may take an occasional fish, but again we know of no evidence that they ever do. Another possible mammal predator is the mink. Its appetite for fish is proverbial and there is certainly no reason that a mink could not enter caves and capture fish, but here also the evidence is lacking.

We frequently hear reports in cave regions that cave fishes are washed out of caves in time of flood, a phenomenon that we have never observed. If the reports are true, then cave fishes feeling their way along a stream to re-enter a spring or cave are exposed to the same dangers from birds and other fishes as small surface-stream fishes. However, under such circumstances they are very likely somewhat protected by the turbid condition of the floodwaters.

Photo by George F. Jackson, Evansville, Indiana

MUSEUM COLLECTOR FISHING UNDERGROUND

Loren P. Woods, ready with dipnet, seeks specimens in large pool inhabited by cavefish in subterranean recesses of Wildcat Cave, Indiana.

SUBTERRANEAN TEMPERATURE CONSTANT

In addition to constant darkness, the underground habitat usually has a nearly constant temperature. This temperature in our midwestern subterranean waters is from around 52 to 58 degrees F. depending on the latitude, since this temperature generally reflects the mean annual temperature of the locality. The air temperature in Mammoth Cave, for example, varies from 52 to 56 degrees F. but the water temperature varies scarcely one degree in the course of a year or from year to year.

Other conditions of the cave waters vary considerably. A short time after heavy surface rains the underground streams begin to rise, and quiet confined brooks become raging torrents. Some cave streams may rise only slightly with but a small increase in current, and some may exhibit little or no change. Heavy rains, washing life-sustaining silt and nutriment into the caves, usually cause the underground streams to become turbid, and they may remain so for many days after a rain.

Subterranean streams vary in their conditions as much as surface streams in size, current, bottom, and bank. They may cut through solid rock or be broken into many rivulets among large boulders; they may form waterfalls or rapids or in their sluggish meanders form broad sandbars or mudflats; they may be dammed and form a broad deep lake. In some places floods leave isolated backwater pools, or the stream that is a rushing torrent in time of high water may at low water be fragmented by mudbanks and boulders into a disconnected series of ponds. The streams may wander in broad meanders in rooms of great width entering and leaving a particular cave. Springs appear to be numerous in groundwater streams but tributaries few.

Throughout the range of the Mississippi Valley blindfishes there are vast untilted limestone formations lying beneath the surface. Frequently an outcrop occurs at the surface, usually along valleys of large rivers. These formations, which are very thick, were deposited on the beds of ancient continental seas. During the long period of time that they have been under dry land they have become honeycombed with anastomosing tubes of varying size by the dissolving action of ground-water. Some of the tubes are now filled completely or partly with clay, some with water, and some are dry with only occasional springs or clay banks. The drainage of regions underlaid with a network of solution channels is often largely underground, with only a few large surface streams and some of these may originate as a large spring or disappear underground as a "lost river."

During the 19th century and the early part of the 20th only a few widely separated caves were known to contain fishes. The underlying rock strata of the intervening areas were not well known and it was assumed that each cave system contained an isolated population of animals. It was believed that cave fishes only rarely made their way from cave to cave through surface streams or that they were accidentally dispersed in times of flood by being washed from their caves and carried downstream, subsequently entering and establishing themselves in new caves.

APPARENTLY NOT ISOLATED

Underground dispersal does not appear to be more difficult for subterranean fishes than surface dispersal is for surface fishes. The difficulty in demonstrating this belief lies in the lack of ability of collectors to penetrate into underground waters in enough localities to prove that the populations seen are not geographically isolated. It is known that the solution channel networks cross *under* large river beds and also *under* the ridges forming divides between surface drainage systems. The dispersal of aquatic cave animals would seem to be limited by the extent of particular limestone formations carrying suitable streams and the degree of dissection of these formations

by surface erosion. Another factor that would bring about isolation or prevent occupation would be for the cave-bearing strata to be buried deeply under rocks of later periods or under glacial drift.

The arrival of a glacier tying up the ground-water under it and shutting off all food, finally burying the habitat under a thick layer of drift, would exterminate any subterranean vertebrates. No cave fishes are known to live in the glaciated part of the Mississippi Valley. If they were once living farther north than now, they have for some reason not returned since the retreat of the glacier. There are two or three vague reports of amblyopsids in northern Ohio, northern Indiana, and southern Michigan, and it is not impossible that some may eventually be found in these areas.

EXPLORATION IS RIGOROUS

Cave exploration is strenuous work and usually not very rewarding. During the past three years Dr. Robert F. Inger, Curator of Amphibians and Reptiles, and the writer have searched the waters of more than fifty caves and springs finding cave fishes in only twelve or fifteen of them. The great majority of caves investigated contained fair-sized streams but not enough headroom, so that we covered as much distance in the caves by crawling or wading as we did by walking. The water ranged from knee-deep to as deep as it was possible to wade, and sometimes the ceiling would be so close to the water that it would be difficult to keep the light from being extinguished. It was necessary to maintain a grip on the lamp and dipnet while climbing, wriggling, or wading along, alternately watching the water for fishes and the ceiling for projecting rocks.

Because of conditions in these low wet caves, equipment was kept to a minimum. For light we used miners' acetylene lamps with 8-inch reflectors. These lamps, which were much more satisfactory than flashlights or gasoline lanterns, could be dropped, submerged, or pushed ahead as we crawled, and they would still function, giving a strong, diffuse light. Fish were collected in large wire strainers lashed to a 3- to 4-foot handle. Cloth dipnets could not stand cave conditions and moved too slowly through the water, warning the fish of their approach. Eight-ounce jars with formalin were used to preserve the fish and a two-quart tin pail was satisfactory as a temporary container for living fishes. Even this small amount of impedimenta on occasion seemed almost too much to be dragging along.

Cave fishes may be reduced in numbers in some readily accessible caves, but they will never be exterminated by collectors. However, they are in grave danger of extermination in many areas of their range because of various engineering activities of man. The impoundment of large streams for purposes of hydroelectric power, navigation, or recreation raises the ground-water level, flooding the caves completely, ponding the streams that feed them, and no doubt rendering many of the cave-fish habitats sterile and unfit places to live because the food is washed into higher caves or deposited on the bottom of the newly formed lakes.

This may cause temporary dislocation, but it is not nearly so serious a threat as the development of many oil fields, particularly through the Ohio River Valley. The salt water and oil from numerous wells go down into the underground water and pollute widespread areas. Another important source of pollution in some regions lies in extensive mining and quarrying operations. Silt from stamping and washing operations and sludge from the mines render the nearby waters uninhabitable. A few caves have been utilized as natural sewers by industries or population centers.

Fortunately the best areas for caves and cave animals are not yet polluted because they lie in wild or sparsely populated regions. But certainly large sections of their former range are no longer available to these inhabitants of the underworld.

"Highlights Tours" Offered Daily

Free guide-lecture tours are offered daily except Sundays under the title "Highlights of the Exhibits." These tours are designed to give a general idea of the entire Museum and its scope of activities. They begin at 2 P.M. on Monday through Friday and at 2:30 P.M. on Saturday.

Special tours on subjects within the range of the Museum exhibits are available Mondays through Fridays by advance request.

Although there are no tours on Sundays, the Museum is open from 9 A.M. to 4 P.M.

Expedition to Collect Fishes in Mexican Waters

Loren P. Woods, Curator of Fishes, left November 26 for Mexico on an expedition to collect marine fishes. He plans to collect along the Pacific coast in the vicinity of Salina Cruz and Acapulco and on the Gulf of Mexico coast in the Bay of Campeche. He expects to work largely from vessels of the local fisheries.

Technical Publications

The following technical publications were issued recently by Chicago Natural History Museum:

Fieldiana: Zoology, Vol. 33, No. 4. *Philippine Zoological Expedition, 1946–1947, Systematics and Zoogeography of Philippine Amphibia.* By Robert F. Inger. July 23, 1954. 351 pages. $6.

Fieldiana: Zoology, Vol. 34, No. 26. *Notes on Frogs of the Genus Telmatobius, with Descriptions of Two New Peruvian Species.* By Karl P. Schmidt. July 23, 1954. 11 pages. 20c.

Fieldiana: Geology, Vol. 10, No. 17. *Fauna of the Vale and Choza, 7; Pelycosauria: Family Caseidae.* By Everett Claire Olson. July 29, 1954. 12 pages. 25c.

Fieldiana: Geology, Vol. 10, No. 18. *Fauna of the Vale and Choza, 8; Pelycosauria: Dimetrodon.* By Everett Claire Olson. July 29, 1954. 6 pages. 10c.

Fieldiana: Zoology, Vol. 34, No. 27. *Bats from Chimantá-Tepuí, Venezuela, with Remarks on Choeroniscus.* By Colin Campbell Sanborn. July 23, 1954. 5 pages. 10c.