

NATURE GAVE THIS STRANGE FISH BUILT-IN BIFOCALS

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CURATOR OF FISHES

LATE one hot, humid afternoon in September the U. S. Fish and Wildlife Service M.V. *Oregon* found a berth at the end of a long pier that crossed a mud bank along the shore of the Surinam River at Paramaribo, Dutch Guiana. I was gathering cameras and film to go ashore when an engineer came running back with the news that there were fish crawling all over the mud flats. So postponing the shore trip until a cooler hour, I spent the rest of the afternoon watching numbers of the four-eyed fish, *Anableps*, swim up out of the water to wiggle across the mud or lie at the water's edge with their tails remaining in the lapping billows.

Almost every general popular book on the natural history of fishes at least mentions the four-eyed fish and its peculiar eyes. Actually there are only two eyes, as in other fishes, but in *Anableps* the eyes are in humps, raised well above the rest of the head, and are divided horizontally by a pigmented line, so the eye appears to have two pupils. *Anableps* habitually swims at the surface with the upper part of the eye in the air and the



Figure 2. Habitat of *Anableps*—the Surinam River at Paramaribo, Dutch Guiana. The mud flats are seen at left.

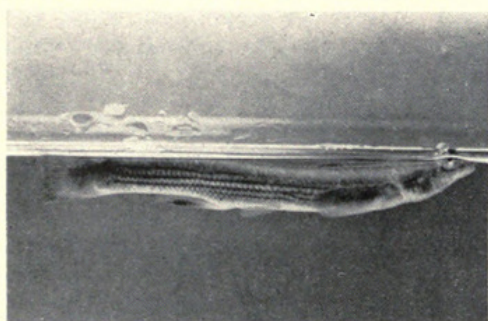


Figure 1. *Anableps*, the four-eyed fish, shown resting at the surface. Its eyes, on humps, project partly above water. (Photo made at Shedd Aquarium)

lower part in water (Fig. 1). The lens is pear-shaped with different focal lengths in each half; the retina receiving light from the air is of different structure from the retina that receives light from the water below. Their built-in bifocals enable them to see in both air and water.

There are three species of *Anableps*, all with similar eyes and, in many respects, similar habits. All reach a length of 8 to 12 inches. One species lives in the Tehuantepec River of southern Mexico, a broad, shallow, clear stream where I collected them several years ago. The range of this species extends down the Pacific coast to Panama. There are two additional species in South America ranging from Venezuela to the Amazon. One of these is chiefly marine, entering brackish estuaries; the other lives in rivers, bayous and lakes.

Although these fish and their peculiar eyes have been described again and again in

scientific and travel literature since the mid-18th century, very little is actually known of their habits. Most accounts describe them swimming and feeding in schools at the surface. When alarmed they do not submerge, but the school scatters, individual fish rapidly skipping over the water, sculling with their tails. It has been reported that they cannot submerge for more than 30 or 40 seconds, but this is not true. The Shedd Aquarium formerly had six or eight individuals acclimated in a large tank 6 by 7 by 4 feet, containing approximately 1,200 gallons of water. Surface schooling and scattering was the usual pattern of their behavior in this tank, but when fed they frequently went to the bottom to pick up food, remaining well below the surface for considerable periods.

In Surinam none was seen swimming in open water during low tides of the late afternoon and early morning. When they went into the turbid water they disappeared. At the river edge of the mud flat, one would occasionally jump out of the water, immediately curving back without much splash. When heading toward the exposed mud, the upper part of the eyes would be above water,

the fish frequently bobbing down to keep their eyes moist. They are wary and very active, swimming so rapidly they can rarely be caught with a net. The usual method of collecting adults is with a rifle loaded with dust shot.

Certainly in the Guianas, *Anableps* swims and schools at the surface; but in the section of the sluggish, silty, brackish portion of the Surinam where the tides change the river level and salinity, large numbers were out of the water, small sections of the mud flats being occupied by as many as 50 fish at a time. Most of the fish,

3 to 12 inches long, rested out of water on the mud just where the ripples washed over them and kept them moist (Figs. 2 and 3). Some fish would travel with eel-like motions across the flats as far as 30 feet from the open water, but these would move into pools or channels at intervals of five or ten minutes and then back up on the mud again. The passage of the fish across the mud would be

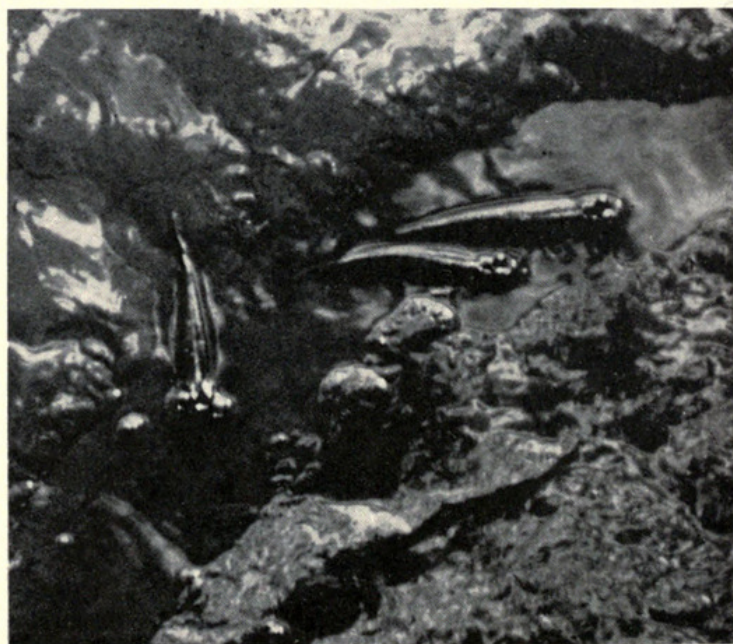


Figure 3. A group of *Anableps* lying in a rivulet on mud flats.

marked by a smooth track about half an inch wide. When established on the mud and no longer awash, they used their pectoral fins to brace their heads higher than the body. They could see and hear quite well

in the air, for although we were 20–25 feet away from them, sudden motion or scuffling on the wooden dock would frighten them back into the water.

The fish lying out on the mud formed loose aggregations of all sizes with no evident attempt to avoid contact with others or to be near others. Neither was there any orientation in relation to the position of the sun, shore, water or pools; but they lay like so much loose-strewn kindling, facing all directions. There were channels through the mud — little drainage rivulets — and many fish rested in or along the edges of these or with the mouth over a little water-filled depression. At intervals the mouth would be dipped



Figure 4. A small pool where young *Anableps* live, with holes for protective retreat when danger threatens. The radiating lines mark areas in which the young fish have been eating mud.

into the water and rapid movements of both mouth and gill covers could be seen. I think this action took in water to moisten the gills. As the tide raised the river level, the fish moved higher onto the mud flat maintaining their relative distance from the edge of the water ripples. By dark (6 P.M.) the advancing tide had completely covered the mud flat and no fish could be seen anywhere.

As with many of their top minnow relatives such as the guppy, swordtail and black mollie, *Anableps* produces living young instead of eggs. Fully grown fish are very good to eat, and in the Guianas there is a great demand for fish; but *Anableps* is avoided by the majority of people because the young found inside the fish has caused the belief that *Anableps* is cannibalistic.

In Mexico a female *Anableps* 7 inches in length was reported to contain nine young, 1.5 inches long. The young I observed in the early morning in pools on the mud flats were 1 to 2 inches in length. Possibly the smallest were only a few hours or few days old. They were exceedingly abundant, as every possible puddle on the uneven surface of the mud flat contained a large number. By the time they are 3 or 4 inches long they swim and behave as the adults described above. None of the 1 to 2-inch young was seen to swim, but only to crawl over the bottom.

The young under 2 inches in length lived high on the mud flat in shallow pools three to six inches across and one-half to one inch deep (Fig. 4). These tiny fish could be de-

tected when they stirred up the loose silt and, as the cloud settled, only the elevated eyes could be seen. If I remained perfectly still they would emerge not only from the silt but from caves in the sides or holes in the bottoms of their puddles, crawl to the edge close against the water surface, and begin eating the silt and straining it through their gills for whatever organic material could be extracted. This eating process was followed by a fine cloud of silt ejected from the gill opening and resulted in a pretty pattern of lines radiating from feeding spots where each fish had nibbled away the darker surface silt, exposing lighter mud beneath (Fig. 4).

When I focused the camera close to them, this movement caused all to disappear either into the mud or into holes. Some of the holes had two or more entrances and a fish would seldom move far from its home, always returning to the same hole. Some could feed with their tails still part way down in the hole. I never saw two fish using the same retreat, though the entrances were sometimes only an eighth to a quarter-inch apart. As the tide rose covering these miniature pools the tiny fish disappeared completely into the mud and into their holes. The bottom could be seen as clearly as when the pools were isolated but the fish were no longer visible. This high tide retreat may be to escape the larger fishes, drums, cichlids and characins that come onto the flats to feed when these flats are covered with water. There are tracks of shore birds all around the puddles, so shyness on the part of the young, the ability to bury themselves where they are, the alertness to withdraw quickly into a hole are all necessary to their survival.

RARE FISHES OBTAINED IN WEST INDIES

During the latter part of 1959, Loren P. Woods, Curator of Fishes, participated in a 31-day exploratory fishing cruise of the U. S. Fish and Wildlife Service Motor Vessel *Oregon* to the West Indies. Very poor trawling grounds were found at depths of 17 to 380 fathoms in the waters of the Virgin Islands, Saba Banks and Puerto Rico. Everywhere the bottom was very rough, rocky or covered with growths of coral or sponges, resulting in torn nets and relatively few fishes. However, those few were of unusual interest because so little collecting has been done in such difficult areas. Many undescribed species and many kinds previously very rare in collections were secured along with a variety of better known, widely distributed species. These latest collections are especially useful for comparison in the study of specimens from the Western Caribbean and Brazil-Guiana offshore waters gathered on *Oregon* cruises during the past three years.

Activities were hampered by frequent storms and high seas but these were not of sufficient intensity or duration to prevent covering of each island and bank area.

LAST CALL FOR ENTRIES OF NATURE PHOTOS

Photographers, both amateur and professional, desiring to submit entries for the 15th Chicago International Exhibition of Nature Photography, are urged to send their prints and color slides promptly. The deadline is January 18. From the thousands of entries the judges will select several hundred to be exhibited in Stanley Field Hall of the Museum during the period from February 6 to 26. Medals and honorable mentions will be awarded to those considered the best. The exhibition is held under the joint auspices of the Chicago Nature Camera Club and the Museum.

While the facilities in Stanley Field Hall are suitable only for the exhibition of prints, either black-and-white or in color, the slides will be exhibited by projection on the screen of the James Simpson Theatre on two Sunday afternoons, February 7 and 14 at 2:30 P.M. Admission to the theatre showings is free.

The print division and the color slide division each have three subject classifications: (1) Animal Life; (2) Plant Life, and (3) General which comprises landscapes and seascapes, clouds, and other inanimate natural phenomena. Contestants are permitted to submit up to four entries of prints plus four of slides. Entry forms will be supplied by the Museum on request. Photographs should be mailed directly to the Museum.

The panel of judges is composed of Mrs. George W. Blaha, APSA, photographer and naturalist; Arthur Hunter, teacher and naturalist; Ray Souers, photographer, and two members of the Museum staff—Dr. Alan Solem, Curator of Lower Invertebrates, and Dr. John W. Thieret, Curator of Economic Botany.

The Nature Division of the Photographic Society of America will award special medals for slides adjudged the best examples of color harmony in nature. The other awards will be made by the Nature Camera Club.

In volume of entries submitted by photographers all over the world, in number of pictures exhibited, and in number of awards, this contest has always been the world's largest devoted especially to nature photography, and in fact is one of the world's largest photo contests of any type.

Mammalogist Completes Study Trip

Philip Hershkovitz, Curator of Mammals, recently returned from a three-week trip to study African and South American mammals in the collections of the museums in Cambridge of Harvard University, the American Museum of Natural History, New York, and the U.S. National Museum in Washington, D.C.

The giant clam of the Pacific and Indian oceans, largest known bivalve, is exhibited in Hall M.



Woods, Loren P. 1960. "Nature Gave This Strange Fish Built-in Bifocals."
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