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CHANGE OF FUNCTION IN FISHES' FINS.

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In the OTTAWA NATURALIST, of October last year, a book notice appeared of the nature of a brief review of that highly interesting subject the life-histories of fishes. It included amongst other new and important statements the affirmation that in young fishes "the breast fins, and in some species the hind pair of fins, become enormously developed, and project like wide-spread fans from the sides of the body. These, no doubt, are effective for protection rather than locomotion." Having watched young fishes half an inch to one or two inches in length, when schooling at the surface of the sea in calm summer weather, I have repeatedly noticed that the enormous paired fins, often deeply coloured, black and white in the Rockling (*Motella*), orange red in the Gurnard (*Trigla*), ochre yellow in the Ling (*Molva*), or gleaming white in the American Hake (*Phycis*), are of little or no use in outward locomotion : but hang helplessly by the side of the body. Projecting like richly tinted fans when expanded, or like stout spines and rods when closed, they must effectively deter many enemies eager to make a mouthful of the tender young fish ; and thus serve a purpose similar to the points and projections of caterpillars or the spines of the porcupine, and the like. As I ventured to point out many years ago, the theory put forward by Dr. Albert Gunther, of the British Museum, that they were simply instrumental in balancing the fish is wholly inadequate, and certainly a large number of minute larval fishes (*e.g.*, the cod and mackerel), which would appear to need them most, do not possess these large (supposed) balancing organs.

Upon a recent visit to Cape Breton, I observed vast numbers of American Hake (*Phycis chuss*, Walbaum) 3 in. to 4 in. in length, hovering around the wharves at the various harbours which were included in my tour. Like most species of the genus *Phycis* the American Hake retains when adult extremely elongated ventral fins, which, as already stated, are characteristic of the young or the advanced larval condition of many of the family *Gadidæ*. These long fins of the hake are of an opaque white colour and they are used in a most unexpected and interesting way. The little fish were observed by me foraging about the weed-covered piles, moving over sunken logs, and all the time nibbling zoophytes and other food upon the stones at the bottom. Thousands of them could be observed, each stretching forward a large pair of white hands, so to speak, with long fingers probing amongst moss and weeds. These, which I have described as white hands, with slender fingers, were nothing more nor less than the huge hind pair of fins $\frac{3}{4}$ of an inch in length (in fishes about 3 inches long), and instead of being allowed to hang downward or backward as is usual in fishes, these ventral fins were turned so far forward as to extend along each side of the head. They exactly resembled a pair of chalk-white hands. It was an odd sight to see schools of these dark coloured infant fishes feeling about amongst the weeds, and actually creeping up stumps and piles under water, by means of these actively moving limbs. M. H. Perley in his account of the fishes of New Brunswick says of the hake : " It has one barbule under the chin ; the ventral fins are simple rays, divided or forked, one of the divisions longer than the other." The rays or rods, forming each fin, are three in number, and united by a fin-membrane for a short distance, beyond which the rays are separate and free, like attenuated fingers, capable of considerable varied movements. These fins appear indeed to have wholly changed their original purpose and in the young stages of the hake are no doubt sensory organs, and used like fingers in feeling for food. A minute histological study of these fins would no doubt show that the sensory nerve supply is unusually largely

developed. If the plevic fins in fishes really represent the legs and feet of higher animals, while the pectoral fins are homologous with the arms and hands, the change of function described is of great interest, for the hind limbs in this case have not only lost their principal locomotor purpose, but have assumed the complicated functions of the fore-limbs. Mr. H. Charles Williamson, an able expert officer of the Scottish Fishery Board, published in 1893 a thorough research upon the free fin rays of the gurnard's pectoral fin, and described in detail the bones, myology, and nerve supply in the finger-like rods of the breast fins in that fish,* illustrated with nearly a hundred figures, and his conclusion is that, in view of their abundant sensory nerve supply, and the remarkable structure of their tips, and apart from any mechanical uses they may have, the free rays of the gurnard's fins are primarily extremely sensitive organs of touch. Mr. Williamson points out that it is generally agreed that the fin-rays in these cases are sensitive, "but one zoologist, Deslongchamps, has maintained that they also have a mechanical action. He had the opportunity of watching some gurnards, which were confined by means of a net in shallow water. He states that he observed the gurnards marching about on the fin rays, and also stirring up sand by means of these structures. Bloch, according to Tiedmann, suggested that the free rays may be lures to attract prey." The use of such rays as lures, or for digging or other mechanical purposes is questionable, when we find it proved that they are extremely sensitive. In the case of the Goose-fish (*Lophius*), which uses its breast fins as legs, or the still more remarkable Jumping Goby of Ceylon and Fiji we have a change of function scarcely inferior in interest. Moseley describes the latter extraordinary fish as follows:—"Hopping about on the mud, beneath the mangroves on the (Fiji) shore was the *Periophthalmus*, at which I had often been astonished in Ceylon. This little fish skips along the surface of the water, by a series of jumps, of the distance of as much

*11th Ann. Rep. Scottish Fishery Board, pp. 322-332.

as a foot, with great rapidity, and prefers escaping in this way to swimming beneath the surface. The fish are very nimble on land and difficult to catch. They use their muscular pectoral fins to spring with, and when resting on shore the fore part of their body is raised and supported on these." Other fishes instead of using the paired fins for movement may use them as anchors like some of the shore gobies, the lump-fish, and the suckers (*Liparididæ*) whose ventral fins unite to form a broad sucking disk under the body, enabling them to adhere to rocks and stones with the firmest tenacity.

A study of the nerve-supply and myology of the American hake's hind pair of fins has not yet been made, but it would yield some valuable results. Williamson's research on the gurnard and Harrison Allen's account of the microscopic study of the free rays in the Atlantic sea-robin (*Prinotus*) have shown that these separated rays in the breast fins function as tactile organs, and are really fingers. As I watched, some months ago, the young hake pushing forward their ventral fins like long fingers, poking into crevices with them, and touching particles of food, or climbing over stones, and resting quietly upon these fins just as a dog rests his head upon his paws, the conclusion was irresistible that total change of function had taken place with the change of form in these fins. It is necessary to add that the eyes of these small hake are unusually large and prominent, and the remark of Williamson does not apply in this case that "in many fishes which have comparatively broad heads, and in which the eyes are situated high up on the head, some of the fin-rays of either the pectoral or pelvic fin are filamentous. From the position of its eyes, the fish is unable to see objects of prey close to itself. It therefore depends on organs of touch for aid in the capture of its food."

These fishes illustrate, indeed, a change precisely the reverse of that seen in the bat, for their wing-like fins have been converted into a kind of hand with separated fingers, extremely sensitive as organs of touch, whereas the fingers of the bat have been elongated and united by membrane to form a fin-like wing.



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