

## NOTES

### On the Herding of Prey and the Schooling of the Black Skipjack, *Euthynnus yaito* Kishinouye

WHILE PARTICIPATING IN the Bikini Scientific Resurvey in the northern Marshall Islands in the summer of 1947, the authors observed three medium-sized black skipjack (*Euthynnus yaito* Kishinouye) herding a closely packed school of several hundred scads (*Decapterus sanctaehelenae* (Cuvier)) over a large coral head in Rongerik lagoon. For fully a 3-hour period the aquatic life on and about this coral head was studied by use of the skin-diving technique, and during this time this unusual group passed back and forth frequently, apparently unconcerned about our presence. Since Kishinouye's reference to such herding activity by tuna (*Tokyo Imp. Univ., Col. Agr. Jour.* 8(3): 382, 459, 1923) is couched in generalities, and since our observations on the black skipjack are contrary to statements made by this author, we place these underwater observations on record to clarify several moot points in the feeding and schooling habits of this species.

The predilection of these pelagic fish for this coral head is understandable on the basis of the part such coral heads play in the general ecological features of a lagoon in the Marshalls. The coral head, typical of many, rose about 75 feet from the lagoon floor to approximately 25 feet below the surface of the water. It was roughly circular, about 75 yards across, with a rather steep talus slope forming its sides. The surface of the mound was covered with sand and larger coral fragments, interspersed with groups of living corals of numerous species and sparse patches of algae. Ecologically such coral heads seem to occupy a physical niche comparable to an oasis on land, as each supports a more luxuriant growth of organisms than does the surrounding terrain. Numerous species of common coral fish, several medium-sized carnivorous fish, and many plankton-feeding fish habitually remain on and about these mounds. Thus the elements essential to food chains are more or less isolated in the vicinity of these coral heads, and there both scads and some species of tuna

habitually forage. The fact that these conditions prevail afforded us an opportunity for repeated observations upon these pelagic species from a unique vantage point.

The three tuna usually followed the school of scads rather closely, with one tuna at each rear flank of the school and the third lagging behind them. Now and then the scads would turn off to one side, at which time the tuna on that side would move forward swiftly and herd them back into line. It became obvious that the school of scads was prevented from leaving the area over the top of the coral head, being herded back whenever it moved over deep water. On one occasion a laggard scad was swiftly picked off by the rearmost black skipjack; however, except for this incident the tuna made no attempt to prey upon the scads during our period of observation. Scads are uncommon in the lagoons in the northern Marshalls and probably do not constitute a large proportion of the diet of this species of tuna. Studies made by Jack Marr and Osgood Smith of the U. S. Fish and Wildlife Service (unpublished data) on the food habits of 33 black skipjack caught outside of the lagoons failed to show any scads in the diet of this species. Scads were most frequently encountered in the stomachs of the dog-tooth tuna (*Gymnosarda nuda* Kishinouye) which ranges in the same area.

In his report on tuna herding prey, Kishinouye (*op. cit.*: 382) states: "Bonitos, except *Euthynnus yaito*, are said to be very clever in making a school of small fish very dense, by swimming around the school of the victims, and devouring stray or forlorn individuals gradually. On the contrary, tunnies and seerfishes swim into a school of victims, and disperse them. The feeding of fish seems not always the same throughout the year. The striped bonito is said to decline to take bait in certain seasons, generally in midsummer." In his discussion of the food and feeding habits of the black skipjack, Kishinouye (*op. cit.*: 459) says that the species

is voracious and that it feeds primarily on small fish and medium-sized plankton. He also describes their feeding method, whereby they dart swiftly into a school of small fish and scatter them in the same manner as do the pelamids and tunas. Our observations on the feeding methods of the black skipjack certainly do not coincide with those set forth by Kishinouye. However, it is entirely possible, as he states, that the feeding habits of the black skipjack may vary throughout the year. Undoubtedly their habits vary depending upon the type of food available at any particular time of the year.

Kishinouye also implies that *Euthynnus yaito* is usually a solitary fish and is not found in schools. Schools of this species, ranging from a few fish to many hundreds or even thousands of individuals, are often seen around the Hawaiian Islands throughout the year; and, during the summers of 1946 and 1947, very large schools of this species were common in the northern Marshalls. It is quite likely that such schools exist in the Marshalls throughout the year; except for the summer months, however, no observations have been made. Chapman (*Calif. Fish and Game*, 32 (4): 165-170, 1946) states that black skipjack were present in large schools at Midway Island, Johnston Island, and Palmyra Island in the fall of 1943. Most of the observations reported by Kishinouye were made

at the periphery of the range of *Euthynnus yaito*; in this region smaller schools and perhaps even solitary individuals would more or less be expected.

The only observations on the herding of prey by fish other than the tuna or tuna-like fish were reported by Gudger (*Carnegie Inst. Wash., Pub.* 252: 75-76, 1918), who cites three instances involving the great barracuda, *Sphyræna barracuda*. (Walbaum). In each case only a single barracuda was concerned; but since this species is rather solitary, it would have been rare indeed to see it engaged in a co-operative effort. In two cases the prey was herded into very shallow water; in the other instance the small fish remained around piles and swam among the rocks, not attempting to escape. In none of these observations on barracuda did the process of herding seem to be so well defined or so efficiently accomplished as it was in the relationship of the black skipjack to the scads. Of great significance was the fact that these skipjack were engaged in a co-operative effort.—Robert W. Hiatt, Department of Zoology and Entomology, University of Hawaii, and Vernon E. Brock, Division of Fish and Game, Territorial Board of Agriculture and Forestry, Honolulu, Hawaii. Published by permission of Chief of Staff, Armed Forces Special Weapons Project, National Military Establishment.

## An Addition to the Fish Fauna of the Hawaiian Islands

SPENCER TINKER, Director of the Waikiki Aquarium, called the writer's attention to a large and showy chaetodontid which he had added to the aquarium collection as a species unknown to him and to local fishermen. This species was readily identified as *Pomacanthodes imperator* (Bloch), heretofore not reported from Hawaiian waters. *P. imperator* is a reef dweller characteristic of the Indo-Australian faunal region of which Hawaii stands as the northeastern frontier; hence, upon faunal grounds, the occurrence of the species in Hawaii is not inexplicable. However, in view of the intensive shoal water fisheries in the Hawaiian area together

with the volume of ichthyological collecting and observing that have occurred here in the past, it would appear that the species is very rare in local waters.

This specimen, 198 mm. in total length, was taken on January 10, 1948, in 15 fathoms of water by a trap fisherman off Ewa, Oahu. The fish, which was injured in the trap, died on January 13, 1948, and is presently preserved in the fish collection at the University of Hawaii Marine Laboratory at Waikiki. — Vernon E. Brock, Director, Division of Fish and Game, Territorial Board of Agriculture and Forestry, Honolulu, Hawaii.