

## BAIT-FISHING BY BIRDS: A FASCINATING EXAMPLE OF TOOL USE

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Bait-fishing, or baiting (Kushlan 1978), where a bird places natural or artificial lures on the water to attract fish, is a rare and fascinating example of tool use by birds (Beck 1980; for a review of tool-use in birds see Boswall 1977, 1978, 1983). Using bait has been reported in the Great Egret (*Casmerodius albus*) Squacco Heron (*Ardeola ralloides*), Green Heron (*Butorides virescens*), Striated Heron (*B. striatus*), Black-crowned Night-Heron (*Nycticorax nycticorax*), Great Blue Heron (*Ardea herodias*), Black Kite (*Milvus migrans*), Sun Bittern (*Eurypyga helias*), and Pied Kingfisher (*Ceryle rudis*).

Bait-fishing has most commonly been observed in the Green Heron and its sibling species the Striated Heron. Lovell (1958) described a Green Heron in Florida that placed bread fragments thrown to it in the water and then captured fish which came to the bread. It also drove away American Coots that swam to the bread.

In the same paper Lovell describes an American Egret that walked over to a piece of bread thrown to it and, although not touching it, waited beside the bread and captured a fish attracted to the bread. Lovell suggested that this passive use of bait represented a stage in the development of the more manipulative bait-fishing evident in the Green Heron and other species.

This incipient bait-fishing behavior, in which the egret did not place the bait in the water but passively utilized the bread as bait, is similar to the use of bait recently reported for a Great Blue Heron (Zickefoose and Davis in press). In this case, a Great Blue Heron, in Richmond, Virginia, walked into a pond and over to pieces of bread tossed to it and drove away Mallards and Canada Geese that approached the bread. In the succeeding twenty minutes the heron captured three fish that were attracted to the bread. The Great Blue Heron's protectiveness of its bait suggests recognition of the bread as a fish attractant.

Sisson (1974) reported that a Green Heron at the Miami Seaquarium bait-fished using pellets of fish food, and included a convincing series of photographs. The article includes a suggestion that bait-fishing is learned behavior. In contrast, Norris (1975a, 1975b) reported on an immature Green Heron placing a feather on the water surface of a Florida ditch as bait, and since the bird was immature, suggested that the behavior must be deeply ingrained in the species. Two reports of Green Herons bait-fishing with bread at other locations in Florida were given by G. Cashin and V. Newell, and J. Hancock reported a wild Green Heron bait-fishing with a food item at the Havana Zoo in Cuba, all cited by Boswall (1983, pp. 96-97). Higuchi (1988b) reported a Green Heron bait-fishing with bread and popcorn at a Florida location. Keenan (1981)

reported on a South Carolina Green Heron repeatedly using mayflies it had captured as bait. Preston et al. (1986) reported at least one Green Heron catching and using live mayflies for bait in Arkansas.

H. Shrivies in a 1976 letter (in Boswall 1983, p. 94) reported a Striated Heron in Kenya bait-fishing with boiled maize. The following year at the same location, W. J. Eggeling (in Boswall 1983, pp. 94-95) reported a Striated Heron bait-fishing with a short piece of white synthetic straw, and several days later one bait-fishing with pieces of bread. At the same location A. Root reported (in Boswall 1983, p. 97) a Pied Kingfisher using pieces of dried bread to bait fish, dropping them from a perch and diving on fish attracted to the bait. Striated Herons have been reported using small insects or spiders for bait-fishing in Botswana (Crous 1990, Jones 1991, Oake 1992). Additional reports of Striated Herons bait-fishing come from west Africa (Walsh et al. 1985) and southern Africa (Wood 1986). Robinson (1994) reported at least three individual Striated Herons bait-fishing in Manu National Park, Peru, using seeds, flowers, and a twig as bait. The heron that used a twig broke it off from a hanging branch.

Higuchi (1986, 1987) reported the use of bait-fishing by numerous individual Striated Herons at a single location in Japan. They used bait that included flies, other adult insects, insect larvae, earthworms, twigs, leaves, berries, feathers, plastic foam, and crackers. The herons dug up earthworms from muddy ground and used them for bait. On two occasions, an adult heron broke a 6-7 cm twig into two pieces, and used one fragment for bait. This behavior characterizes the Striated Heron as one of the very few tool-making birds. Adult herons were significantly more successful at bait-fishing than immature birds. Higuchi (1988a) reported observations of three different individual Striated Herons bait-fishing. One individual spent 83.5 percent of its foraging time bait-fishing, and was significantly more successful when bait-fishing than when using other foraging tactics. Higuchi concluded that differences in the percentage of time spent bait-fishing were related to foraging habitat quality.

R. J. Prytherch reported (in Boswall 1977, p. 95) watching a vagrant Squacco Heron in England place sixteen insects on calm water in twenty minutes, and capture one fish. L. P. Alder reported (in Boswall 1977, p. 95) a captive Sun Bittern in England bait-fishing with maggots put out as food for passerine birds.

Roberts (1982) reported a Black Kite that picked up scraps of bread from the ground, carried them to a perch over water, dropped them, and dove on fish and crayfish attracted to the bread. In an ironic reversal, one of us (WED) in 1995 watched a crocodile at Kakadu National Park, Northern Territory, Australia, apparently bait-fish (bait-bird?) for Black Kites with fish! The crocodile dismembered a large catfish by slapping it against the water surface, and then ate the large fragments, leaving several smaller fragments floating. The

crocodile then submerged among the floating fragments until only its eyes remained above the surface, and it appeared to watch intently as several Black Kites circled above it and approached the floating pieces of catfish. The kites had been circling for some time, and although they made close approaches they did not attempt to snatch fish fragments from the surface, and did not become a feathered dessert for the crocodile. Baiting for birds with fish by crocodiles has been previously observed (Nick Mooney, unpubl. data.).



*Figure 1. Previously unpublished photograph by Ronald K. Beasley showing a Black-crowned Night-Heron using bread as a lure while bait-fishing. In published photographs (McCullough and Beasley 1996) the heron is shown breaking up the bread into smaller pieces and catching a fish attracted to the bait.*

Beasley reported bait-fishing by a Black-crowned Night-Heron at Heritage Park, Irvine, California (McCullough and Beasley 1996). The latter is the first published report of bait-fishing by a Black-crowned Night-Heron, although Drinkwater (1958) described them luring fish by bill vibrating (bill opened and closed rapidly in water). Beasley included four photographs of the heron performing bait-fishing. Figure 1 consists of a previously unpublished photograph by Beasley. The Black-crowned Night-Heron flew over to where Beasley was feeding bread to ducks and began bait-fishing with fragments of

bread that landed near it. The heron would move the bread fragment to within its range, break it into smaller fragments with its bill and then attack fish attracted to the bait. The heron caught more than two dozen small fish. From the success of this procedure and the fact that ducks gave the heron a wide berth, Beasley surmised that the heron had practiced bait-fishing previously. The fact that the heron moved and manipulated the bread bait suggests an innate component in its bait-fishing, analogous to that of *Butorides*. Since much of the Black-crowned Night-Heron's foraging takes place at night, and is rarely observed, bait-fishing could be more common in this species than indicated by this single example.

Are these bait-fishing behaviors instinctive or examples of learned behavior? The preponderance of examples of bait-fishing are from members of the Green-Striated Heron superspecies, and this suggests that these closely related birds may be genetically predisposed to acquire bait-fishing behavior. The manipulation and repositioning of bait may indicate an innate perception of bait items that is lacking in the opportunistic bait fishers (Great Egret and Great Blue Heron) which merely wait near bait provided. However, several factors suggest a strong learned component to bait-fishing behavior: (1) the behavior is rare, even when taking into consideration the cryptic behavior of Green, Striated, and Black-crowned Night-Herons, and its distribution is restricted to a few areas in a vast distribution (Higuchi 1986); (2) many of the observations involve bait-fishing with human-provided bait (e.g., bread) which suggests the possibility that since fish are often attracted to bread, humans may be providing a model for bait-fishing to observant herons, thus facilitating learning; (3) where bait-fishing occurs, several individuals often are involved (e.g. Higuchi 1986, 1988), suggesting that herons may be learning the behavior through imitation. We conclude that there is a strong learned, opportunistic component to the origin for bait-fishing behavior.

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