SHORT COMMUNICATIONS

The Bill-Brace Feeding Behavior of the Galápagos finch *Geospiza conirostris*.—Two species of *Geospiza, G. conirostris* and *G. fuliginosa*, inhabit Hood Island, the southeasternmost member of the Galápagos archipelago. Hood is a low island, with only arid zone vegetation (Bowman, Univ. Calif. Publ. Zoöl. 58, 1961) growing on an extremely rocky soil. Although brush and low trees form a dense scrub over much of the island, herbaceous vegetation is scarce, and it had been badly damaged by goats and by a prolonged drought at the time of my stay in February 1964. Both species of *Geospiza* were observed feeding in the vegetation, but *conirostris* foraged primarily on the ground, and commonly in the open spaces between clumps of brush. Here a surface layer of coarse gravel acts as a sieve for chaff, plant seeds and other food items that fall through it to a substratum of finer soil. These food items are revealed in quantity when the gravel is scraped aside. To gain access to this food source the finch must penetrate the gravel layer. Since the layer is about four to seven cm deep and is composed mainly of stones weighing 30 to 75 g, and since the finches weigh only 24 to 26 g (fat free), it is obvious the birds must expend considerable effort in reaching their food. However, *conirostris* does this efficiently and in a unique manner, which I term the bill-brace technique.

Although *G. conirostris* hops along the surface and pecks for food items as do the other members of the genus, not uncommonly it is seen to stop, place the base of the upper mandible against a large rock, and kick gravel from beneath itself with its feet, moving the legs in rapid succession as if it were running, the bill being used as a brace (fig. 1). Gravel literally flies from under the bird. Small pieces of gravel, weighing less than about 40 g, are often kicked the length of the bird (about 15 cm) to the rear and about 3 cm off the ground. The finch continues until a pit about 5 cm in diameter has been dug to the soil layer, whereupon it stops and searches for exposed food. Usually the pit is then further enlarged by a continuation of the same technique, the bird working for one to three minutes at one spot and then moving to another spot to begin anew. Birds become preoccupied in this effort and may easily be approached to within less than one meter; when not engaged in digging they typically begin to move away after being approached to a distance of from two to three meters.

These finches are capable of moving larger stones by the bill-brace technique, but the force of one leg alone is insufficient to do the job. As with smaller stones, the bird braces itself with its bill. First one foot and then the other makes contact with the rock to be moved, and the finch pushes with both legs until the rock moves or the bird quits. Occasionally in moving larger stones

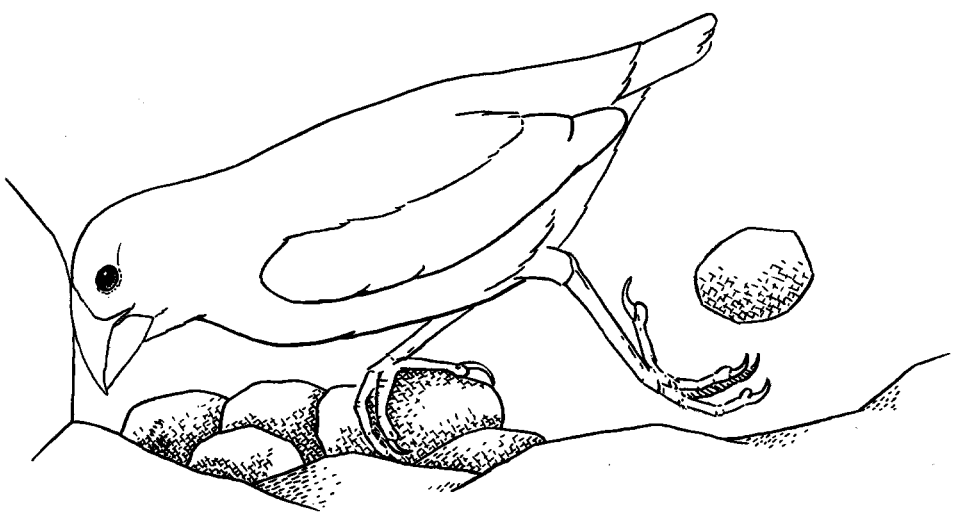

Figure 1. *Geospiza conirostris* employing bill-brace technique in moving gravel.

the bird opens its wings for balance, and rarely the carpal joint is briefly placed to the ground. Large rocks are usually only flipped over. One bird was seen to kick a 61-g rock out of a pit it had excavated, and then, in about three seconds, successively displace rocks weighing 63 and 39 g from the edge of the pit. Really startling feats of strength were seen on occasion. A half of a cobblestone weighing 111 g was rolled over with little apparent effort by one bird; a flattened stone about 14 × 9 × 6 cm in size and weighing 358 g was flipped over by a male finch weighing only 26.7 g, or about one-thirteenth the weight of the rock.

Bill-brace foraging was observed daily and readily at Punta Suarez at the west end of Hood Island between 12 and 19 February 1964, as well as at Punta Cevallos at the east end of Hood Island on 15 February, and in the higher, more densely vegetated central part of the island on 17 February. This technique was seen less frequently in the latter area, probably because the more conspicuous soil and leaf litter provided a more abundant supply of food on the surface than at the other localities, and thus the finches had less reason to dig. Gardner Island, at the northeast end of Hood, was visited briefly on the midafternoon of 15 February, but birds were quite inactive and I could not ascertain whether *conirostris* used this habit there as well. However, with the exception noted below, no other geospizines were observed using the bill-brace technique during my six-week residence in the Galápagos archipelago, although it was not specifically looked for except in the four-day observation available after my visit to Hood Island.

Geospiza fuliginosa seemed to be less common on Hood Island than *G. conirostris*, although it was seen daily in small numbers. It was shyer and appeared to spend more time in the vegetation than *conirostris*. On the ground it foraged primarily by the "hop-about-and-peck" technique; on several occasions birds feeding near *conirostris* were seen feeding in pits dug by the latter. However, the *fuliginosa* did not give the impression of following the *conirostris*, but rather of chancing upon these relatively more favorable spots to feed. On three occasions individual *fuliginosa* were seen to employ the bill-brace technique in the manner of *conirostris*, although they used it much less efficiently. Two of the birds did this only occasionally and briefly; the third was much more persistent. Most of the stones that it moved weighed less than about 10 g. The largest stone, weighing 21.5 g, was kicked from the edge of the pit that the finch had excavated; the pit itself finally measured 5 cm in diameter and 2.5 cm in depth. Although *fuliginosa* weighs only about 13 to 15 g, even this effort seems hardly comparable to the feats of *conirostris*, which commonly moves rocks of two to three times its own weight.

Geospiza conirostris has no obvious morphological attributes that would facilitate the use of the bill-brace technique as compared with similarly sized species of *Geospiza*, as, for example, *G. fortis*, although it does seem to be better adapted to this than *G. fuliginosa*. The bill of *conirostris* is more laterally compressed than that of most other species of *Geospiza*. This compression doubtlessly strengthens the bill against the forces applied to it. The deep bill, which gives a broader contact with the body of the cranium, would seem to direct more of the stress on it to the frontal and interorbital regions of the skull than does the shallower, more elongate bill of *fuliginosa* (see Bowman, *idem*, plates 9, 10, 13, and 14), although this comment would apply even better to *G. magnirostris*. Finally, the greater size of *conirostris* and, hence, its heavier bone structure is in obvious contrast to the more delicate skull of *fuliginosa*. One might also expect its neck musculature to be more strongly developed than comparably sized geospizines, but an examination of the skull reveals no clear evidence of this. Although the advantages possessed by *conirostris* as compared with *fuliginosa* seem to be primarily expressions of the size difference between the two species, one wonders to what extent, if any, this foraging technique may have influenced the development of the above-mentioned characters in the evolution of *Geospiza conirostris*.

Geospiza conirostris also employs the bill in moving gravel in two other ways, especially when the bird is searching for food. The less frequent method is to use the bill as a "hoe." The bird normally does this to remove fine gravel from fissures in very large lava blocks. The closed bill is placed crosswise into a fissure, the culmen against the larger rock, and gravel is scraped out with a motion of the head back toward the body and to one side. More often a finch simply grasps small rocks, twigs, or grass stems with the bill, lifts up the object and tosses it aside. Often the bird will pause with the object in its bill before throwing it away. Rocks weighing as much as 23 g are handled in this manner; a 16-g rock was tossed 5 cm to one side. Occasionally the

smaller gravel is dropped in a pit that the bird is excavating and then kicked out by the bill-brace technique; one bird was seen to pull at a 61-g rock wedged in the gravel at the edge of its pit until the stone fell in, to be kicked out by the bill-brace technique. The readiness and facility with which *conirostris* uses its bill in this way seems especially interesting in view of the similar ability shown by several other geospizines in manipulating objects with their bills, particularly the famous "tool-using" habit.

It might be noted parenthetically that a more widespread technique of turning over objects, flipping them over with a sideways sweep of the bill, is also to be seen on Hood Island, but not from a geospizine. Rather it is the mockingbird, *Nesomimus macdonaldi*, so similar in build and disposition to the related curved-billed *Toxostoma* thrashers, that does this and does it well.

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***Falco rufigularis*—the Correct Name of the Bat Falcon.**—In current literature *Falco albigularis* and *Falco rufigularis* are competing names for a common and widespread neotropical species. Peters (Check-list of Birds of the World, 1, p. 291, 1931) and Friedmann (Birds of North and Middle America, pt. 11, p. 674, 1950) adopted *F. albigularis*; Hellmayr and Conover (Catalogue of Birds of the Americas, pt. 1, no. 4, p. 306, 1949) adopted *F. rufigularis*. Subsequent authors disagree, depending on which of these authorities is followed.

Both names have the same authorship and date; both appear on the same page of Daudin's Traité Elémentaire Comparative d'Ornithologie, 2, p. 131, 1800. *Albigularis* has line priority; *rufigularis* has undisputed applicability (which has been questioned as to *albigularis*) and is supported by the first reviser principle enunciated in the new International Code of Zoological Nomenclature, Art. 24 (1961). Daudin supplied no description, but named as separate species two specimens briefly characterized as "Orange-breasted Hobby" by Latham (Gen. Syn. Bds. Suppl., pp. 28–29, 1787)—a designation that Latham (Gen. Syn. Bds. 1, p. 105, 1783) seems to have used originally for the species currently called *Falco deiroleucus* Temminck. In the extensive literature prior to 1874 whenever a Daudin name was applied to the Bat Falcon it was called *rufigularis*; (*e.g.*, Gray, Genera of Birds, 1, p. 20, 1844; List of Spec. Brit. Mus., pt. 1, Accip., p. 54, ed. 2, 1848; Strickland, Orn. Syn., 1, p. 88, 1855; Sclater, Proc. Zool. Soc., Lond., p. 134, 1855; Cassin, Proc. Acad. Nat. Sci. Phila., 7, p. 278 footnote, 1855; Pelzeln, Orn. Bras., 1, p. 5, 1867). Strickland (1855) unequivocally made a choice between competing names regarded as applicable to the same species, for in selecting *rufigularis* of Daudin, he listed *albigularis* of the same author in the synonymy, thus complying in the strictest sense with the first reviser rule.

Nomenclatural principles were far from settled in 1874, when Sharpe in the Catalogue of Birds in the British Museum, 1, p. 401, adopted *Falco albigularis*, relegating *rufigularis* to synonymy. No reason was given, but presumably Sharpe acted on the basis of line priority, which many zoologists have favored. Gurney, a birds of prey specialist, strongly criticized Sharpe for replacing the better known name (Ibis, pp. 158–159, 1882); in his own subsequent List of the Diurnal Birds of Prey (p. 103, 1884) he not only maintained *rufigularis*, but pointed out that Latham's description of the specimen named *albigularis* by Daudin was ambiguous. Berlepsch (Nov. Zool., 15, p. 294, 1908) expressed a similar opinion in adopting *rufigularis*. As a result, despite the tendency of many authors to follow the nomenclature of the British Museum Catalogue, during the end of the 19th century and the early 20th century *rufigularis* continued to have about equal currency (see synonymies in Hellmayr and Conover, *op. cit.*, pp. 303–309). Under the Règles Internationales de la Nomenclature Zoologique (1901) the first reviser principle was given effect where competing names were of the same date. But many ornithologists, especially in the United States, preferred to follow the line priority rule. Peters, who in general complied with the International Rules in

his Check-list, expressly stated (*op. cit.*, p. vii, 1931) that he followed the line priority doctrine and rejected the first reviser principle; presumably on that basis he adopted *F. albigularis*. Hellmayr and Conover (*op. cit.*, p. 306 footnote, 1949), without mention of the first reviser principle, adopted *rufigularis* on the ground that *albigularis* was of uncertain applicability. The new (1961) International Code of Zoological Nomenclature, Art. 24, makes the first reviser principle unequivocally applicable to the situation here involved. This principle tends to maintain stability. Universality of usage makes it desirable that the Code be accepted, even though there are bound to be cases when a zoologist may question the wisdom of a particular rule; invariably there are competing arguments on each side. Here the application of the first reviser principle proves especially helpful, for it solves a conflict of usage without requiring a decision of the more controversial question as to the applicability of *albigularis*. Under the first reviser rule *Falco refigularis* is indubitably the correct name.—EUGENE EISENMANN, *American Museum of Natural History, New York, New York 10024, 19 July 1965.*

Absence of Brood Patch in Cassin Auklets.—Incubation patches of varying number and location have been described from several alcids, including the Great Auk, *Pinguinus*, the Razorbill, *Alca*, the murres, *Uria*, the guillemots, *Cepphus*, the Puffin, *Fratercula*, and the Dovekie, *Plautus*, by Storer (Univ. Calif. Publ. Zool., 52:121, 1952), Kozlova (Zool. Inst. Acad. Sci. USSR, no. 65, 1957), Belopol'skii (Ecology of Sea Colony Birds of the Barents Sea, 1957), and Lockley (Puffins, 1962). Baillie (Condor, 54:121, 1952) and Kozlova have further stated that brood patches are present in all species of the family Alcidae. In the murres these structures have been described as areas of loose, bare skin by Tuck (Canadian Wildl. Ser., Bull. no. 1, 1960).

Cassin Auklets (*Ptychoramphus aleutica*) were examined for brood patches on the breeding ground on South Farallon Island, California, on 8–15 July 1964. Of 53 adults with no eggs or young, 21 adults on eggs, and 26 adults with young, no auklets had a trace of a bare spot on the neck, breast, belly, flanks, or under the wings. On another visit to the island on 2 June 1965, George E. Chaniot, Larry L. Wolf, and I found nine incubating adults of both sexes. No brood patch was found on any of these birds. Eight of the birds were anesthetized or skinned and were examined for concealed bare areas. No bare spots were found, and no areas of the skin appeared unusually thickened or vascularized. Thoresen (Condor, 66:456, 1964) noted incubating Cassin Auklets holding the egg in various positions under the body. We photographed one auklet holding the egg against the side of the body under one wing. The egg appeared to be held on the top of the webbed foot off the bare ground of the burrow. The skin against which the egg was held on the flanks of the incubating birds between the abdominal, femoral, and axillar feather tracts was covered with fine contour feathers about 5 mm long, although the longer feathers of the dense tracts were absent in this region. This skin also differed from the skin of the abdominal region in lacking a layer of thick down. The absence of down probably permits more heat to pass from the incubating bird to the egg. The body temperature of six birds, measured with a thermometer inserted 10 mm into the cloaca and up the rectum, averaged 41.5°C, and the temperature of the skin beneath the wings and on the flanks averaged 39.7°C.

The absence of a brood patch in Cassin Auklets may be related to the small size of these sea birds. The body surface-volume ratio is larger in small birds, and the presence of a relatively large unfeathered area on the small body might bring on excess loss of heat to the cold ocean. The bare feet of sea birds, on the other hand, are known to have vascular adaptations which conserve body heat, according to Irving (Handbook of Physiology, Adaptation to the Environment, Sect. 4:361, 1964). It is of interest to note that the species of alcids in which a brood patch has been described, except for the Dovekie, are larger than Cassin Auklets.

The nine incubating Cassin Auklets examined on 2 June 1965 were all in body molt, and seven of the birds had also begun the molt of the 11 primaries. A male with the inner three primaries on each wing in molt had testes 7.9 mm in length, two males with the inner two primaries in molt had testes 9.2 and 14.2 mm, two males with the inner pair of primaries in molt had testes 12.3 and 12.8 mm, and a male with no growing primaries had testes 12.6 mm in length. The males with the five largest testes had sperm and also many sloughed necrotic, immature germ cells in the lumena of the seminiferous tubules and in the epididymis, and these testes were evidently in