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Neophobia by the Lesser-Antillean Bullfinch, a Foraging Generalist, and the Bananaquit, a Nectar Specialist

Sandra J. Webster[1] and Louis Lefebvre[1,2]

ABSTRACT.—Generalist birds are thought to be less neophobic than specialists, but the dietary difference is often confounded by differences in experience and food availability. We conducted field tests with an artificial nectar source on a foraging generalist [Lesser-Antillean Bullfinch (*Loxigilla noctis*)] and a nectarivorous specialist [Bananaquit (*Coereba flaveola*)] in Barbados. Both species are equally opportunistic and tame on this island. Bullfinches arrived first at the feeding stations and showed a shorter latency to feed in the tests than did Bananaquits, suggesting that differences in specialization lead to the differences in neophobia predicted by ecological plasticity. *Received 1 Nov. 1999, accepted 5 March 2000.*

Dietary generalists exploit a large variety of

[1] Dept. of Biology, McGill Univ., 1205, avenue Docteur Penfield, Montréal, Québec, H3A 1B1 Canada.

[2] Corresponding author;
E-mail: louis_lefebvre@maclan.mcgill.ca

food types and are consequently more likely than specialists to encounter novel stimuli associated with food. Greenberg (1984, 1990, 1992) has shown that generalist warblers (Bay-breasted Warbler, *Dendroica castanea*) and sparrows (Song Sparrow, *Melospiza melodia*) feed more rapidly in the presence of novel objects than do more specialized species of their genus (Chestnut-sided Warbler, *D. pensylvanica*; Swamp Sparrow, *M. georgiana*). In many cases, the generalist/specialist continuum is confounded by opportunism/conservatism. In warblers, for instance, the neophilic Bay-breasted Warbler is the *Dendroica* species that displays the largest number of opportunistic foraging behaviors when it migrates to its wintering areas in Central America (Greenberg 1979). Separating generalism from opportunism would be useful in teasing out the respective contributions of

these variables to ecological plasticity. Two tame, opportunistic species of the West Indies Passeriformes offer this possibility. In Barbados (Bond 1985, Lefebvre 1996) and several other West Indian islands (Pinchon 1964, Devas 1970, Voous 1983), the Bananaquit (*Coereba flaveola*) and the Lesser-Antillean Bullfinch (*Loxigilla noctis*) routinely feed at provisioned sources of artificial nectar. The birds often perch on the sides of glasses, cups, and sugar bowls and are deliberately attracted to hotels and restaurants by dishes of dissolved sugar (Lefebvre 1996). Although matched for size, abundance, tameness, and opportunistic response to sugar provisioning, as well as being closely-related according to Sibley and Ahlquist's (1990) molecular classification, the species show a striking difference in feeding morphology and diet breadth. The Bananaquit has a long, brush-like tongue and a curved bill that are morphologically specialized for feeding from flowers (Raffaele 1983), while the Lesser-Antillean Bullfinch has a short, thick bill that allows it to crack open seeds (Pinchon 1964). In Barbados, the bullfinch, but not the Bananaquit, routinely forages with other granivorous and omnivorous birds that exploit food left by humans (Dolman et al. 1996). If generalism has effects on neophobia that are independent of both tameness and opportunism, bullfinches should respond more rapidly than Bananaquits to a standard feeding test (Greenberg 1984) presented in the field.

The experiment was conducted during July and August 1999 at five sites (separated by at least 20 m) on the grounds of the Bellairs Research Institute of McGill University, St-James, Barbados. We used the procedure developed by Greenberg (1984) to compare the latency to feed in trials that randomly feature either a novel object or no novel object close to a patch of accessible food. The procedure also incorporated a measure of tameness, because latency is calculated as return time after interruption by the experimenter of a bird's initial feeding bout. Before each set of trials, a dish containing 50 ml of a 30% sucrose solution (typical for flowers) was placed on an elevated surface (wall, table, etc.) at each site, approximately 1 m off the ground, until both species fed within 5 min after the food was presented. This familiarization phase took an average of 2 days. On each of three matched

pairs of trials conducted on different days, the experimenter then presented a dish filled with 50 ml of 30% sucrose at one of the five sites. The latency of the birds to approach the dish was recorded. If the birds did not feed within 20 min, the trial was terminated and repeated the following day. Once a bird started to feed, the experimenter approached the feeding station at a constant, slow pace, and randomly (determined by coin flipping) initiated either a control trial (rotating the food dish) or a novel object trial (rotating the dish and placing one of three objects 2 cm from the dish). A marker was dropped at the experimenter's location when the bird interrupted its initial feeding in the approach phase; distance between the marker and the dish was measured at the end of each trial. On novel object trials, the coin was tossed again to determine which of the three novel objects would be used. The novel objects were three straws of different colors sticking vertically from a ball of paper, three springs approximately 2.5 cm in diameter and 10 cm long, and a handful of curly, frayed paper. Each object was mounted on a piece of 8×8 cm cardboard. Latency to feed from the dish was recorded for all trials. Birds were given a maximum of 20 min to return to the dish in both types of trials; a failure to return was scored as a latency of 1201 sec. One trial was conducted per day at each of the five sites, with a total of six testing days per site (three controls, three novel objects). During the trials, the experimenter was initially located 15 m away from the feeding station to allow the birds to feed undisturbed.

Bullfinches and Bananaquits visited the food patch together on 26 of the 30 trials. On these trials, a single bird from each species would normally feed without interference from opposite sides of the dish. On two trials, the dish was visited only by a bullfinch, while on two trials, only a Bananaquit fed. Bullfinches arrived at the food first on 20 of the 30 trials, while Bananaquits arrived first on 8 trials (Fig. 1A; difference between species: $\chi^2 = 5.14$, 1 df, $P < 0.05$); the two species arrived together on the remaining two trials. After experimenter interruption, bullfinches returned faster than Bananaquits (Fig. 1C; ANOVA, Systat 8.0: $F_{1,8} = 12.217$, $P = 0.008$; latencies log transformed for normalization), and both species were somewhat slower to re-
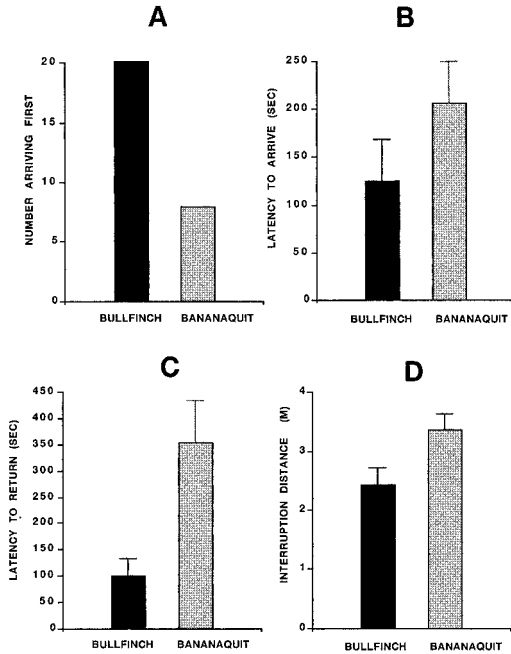
A

B

C

D

FIG. 1.   Response to the different phases of the test in Lesser-Antillean Bullfinches and Bananaquits. A. number of trials in which each species arrived first; B. latency (sec) to initial feeding before interruption; C. latency (sec) to return after interruption; D. distance (m) of experimenter when initial feeding was interrupted. Means for B, C, and D are averaged over replicates.

turn in the presence of novel objects (ANOVA: $F_{1,8} = 4.973$, $P = 0.056$). Neither the replicate effect nor any of the interaction effects were significant. The two species did not differ significantly in their latency to arrive when the food was put out (Fig. 1B; $F_{1,8} = 1.361$, $P > 0.05$), nor in how close they allowed the experimenter to approach (Fig. 1D; $F_{1,8} = 2.885$, $P > 0.05$).

Overall, the results support the prediction that the more generalized bullfinch will more rapidly approach a novel feeding situation than the more specialized Bananaquit. Behaviors typical of neophobia (jumping, flitting) were often observed near the novel objects by Bananaquits, but not bullfinches. In addition, at four out of the five sites, Bananaquits failed to return within the 20 min time limit of the trial with at least one of the novel objects, while bullfinches always returned. This difference was not sufficient to support the strongest prediction of neophobia tests: a signifi-

cant species by patch type interaction. Only the main effects of species and patch type were significant, suggesting that bullfinches respond more quickly than Bananaquits whether or not the food has a novel object next to it. This is consistent with the fact that bullfinches arrived first at the patch more often than did Bananaquits. The interspecific difference is difficult to attribute to motivational or other contextual factors because the food we used biased the test in favor of Bananaquits.

Our tests of neophobia involved the proximity (and often, direct intervention) of a human experimenter, just as new feeding opportunities in the field are often related to anthropogenic modification of natural habitats. Tameness is likely to be confounded with opportunism as well as generalism in many situations where ecological plasticity plays a role. In cases where the generalist is also more tame and opportunistic than the specialist, we can expect interspecific differences to be stronger than the ones reported here because the confounded effects presumably are cumulative. Our study demonstrates that in the absence of such interactions, a difference in diet breadth and morphological specialization is sufficient to lead to the overall behavioral differences predicted by the ecological plasticity model (Greenberg 1990).

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Belding's Savannah Sparrows Eat Eggs From Live Fiddler Crabs

Catherine E. deRivera[1]

ABSTRACT. —On 17 occasions in Chula Vista, California, at least one Belding's Savannah Sparrow (*Passerculus sandwichensis beldingi*) was observed chasing egg-carrying female fiddler crabs (*Uca crenulata*) and pecking eggs from ones it caught. Sparrows did not eat any part of the adult crab while eating the eggs. A fledgling learned this novel hunting technique after accompanying its parent for a month. *Received 29 December 1999, accepted 1 May 2000.*

Feeding innovations have been reported for numerous species of birds (Lefebvre et al. 1997). Perhaps the best known example is the opening of milk bottles by Great Tits (*Parus major*; Fisher and Hinde 1949). Here I report a feeding innovation by Belding's Savannah Sparrows (*Passerculus sandwichensis beldingi*) in which the birds ate eggs from live California fiddler crabs (*Uca crenulata*) but did not eat the adult crabs.

Belding's Savannah Sparrow is an endemic subspecies that inhabits the remaining coastal salt marshes in southern California and Baja, Mexico, and is on California's state endangered species list (Bradley 1973). Savannah Sparrows often forage in the littoral zones where they eat a wide variety of arthropods; in winter they supplement their diet with the growing tips of marsh vegetation (Massey

1979, Wheelright and Rising 1993, Powell and Collier 1998).

I observed an adult Belding's Savannah Sparrow eating fiddler crab eggs on the D Street Fill mudflat in Chula Vista, California, where the Sweetwater River empties into San Diego Bay. This mudflat is an extension of the Sweetwater Marsh National Wildlife Refuge. The predominant vegetation is pickleweed (*Salicornia virginica*), which is typically found in habitat used by Belding's Savannah Sparrows and California fiddler crabs (Powell 1993; deRivera, unpubl. data). I observed 1600 m² of the mudflat.

Fiddler crab eggs are readily available to predators throughout the fiddler crab breeding season, from May through August. Female California fiddler crabs carry large clutches of eggs for approximately 16 days (deRivera 1999). Although female crabs spend much of their incubation time underground, some of the egg-carrying females surfaced on 85% of the breeding-season days. More than 161 females with eggs were seen on the surface over 35 observation days in 1999. Egg-carrying females were easy to spot because they held their abdomens in a characteristic lowered position and their eggs protruded beyond their undersides.

I noticed a Belding's Savannah Sparrow chasing an egg-carrying fiddler crab on 22 June 1999. I looked for sparrows on 20 nonconsecutive days during the remainder of the

[1] Dept. of Biology, Univ. of California San Diego, 9500 Gilman Dr., La Jolla, CA 92093-0116; E-mail: deRivera@biomail.ucsd.edu