The Physiological Implications of Ingesting Fresh-water Mussel Shells to Great Crested Flycatchers

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Introduction

The Great Crested Flycatcher (*Myiarchus crinitus*) is a migratory songbird that breeds in the eastern half of North America and winters in Central America (Lanyon 1997). Like other tyrannids, the Great Crested Flycatcher feeds primarily on flying insects that are captured during characteristic sorties from upper canopy perches. Here we report on unusual foraging and diet by female Great Crested Flycatchers during the breeding season.

We conducted field work along the Neshaminy Creek near Newtown (40°13′45′′N, 74°56′14′′W) in eastern Bucks County, Pennsylvania, from 11-17 May 2000. The field site is primarily agricultural (corn) with old second growth hardwood forests (*Quercus*, *Acer*, and *Carya*) intermingled with the agricultural fields. Forests along this portion of Neshaminy Creek are tall (ca. 30 meters) with a complete canopy, although generally not more than 100 meters wide on either side of the creek.

While conducting migratory and breeding songbird surveys and general collecting for the Academy's collection, we observed some unusual Great Crested Flycatcher behavior. On the morning of 13 May 2000, we saw two Great Crested Flycatchers, in different areas, foraging on the ground and within one meter of the ground, but were unable to identify their prey. The following day we witnessed the same behavior and collected one of the individuals near ground level.

This individual was prepared as a museum study skin and cataloged in the Academy of Natural Sciences Ornithology collection (ANSP# 189552). Examination of the gonads and a search for a bursa of Fabricius revealed that this individual was an adult female (ovary 8 x 6 mm, no bursa present). Examination of stomach contents revealed that this individual had been foraging on fresh-water mollusc shells (not live clams, just the shells). The stomach contained two Asian clam (*Corbicula fluminea*) shells (*ca*. 8 x 8 mm) that were common along the stream in this area.

Discussion

Beal (1912) reported on the stomach contents of 265 Great Crested Flycatchers and found that 93.7% of them contained animal matter (primarily insects). Interestingly, three individuals were found to have lizard bones in their stomachs. During times of drought and decreased insect numbers, Brown-crested Flycatchers (*M. tyrannulus*) have been observed catching and eating lizards and hummingbirds (Cardiff and Dittman 2000, Gamboa 1977, Snider 1971a, 1971b). Thus, it appears that during times of physical stress (migration, drought, etc.), *Myiarchus* flycatchers may shift their diets from primarily insectivorous to include opportunistically small vertebrate prey items.

One likely explanation for the ingestion of lizard bones and mollusc shells is the need for additional calcium by females during the physiological stress of laying eggs. The final stage of egg production in the oviduct of birds is the addition of calcium carbonate to the eggshell by the uterus or shell gland (Carey 1983, Gill 1995). Simons (1971) reported that 98% of the eggshell is made of crystalline calcite, a form of calcium carbonate. According to Simkiss (1975), a bird's appetite for calcium and the transport of calcium through the small intestine increases before and during the egg laying period. However, dietary intake must be supplemented by the mobilization of calcium from the skeleton. As much as 12% of skeletal calcium may be transferred to egg production by laying females. Female birds have the ability to store calcium prior to the breeding season in a special tissue in the marrow cavities of bones, called medullary bone, that acts as a substrate for calcium carbonate deposition.

As mollusc shells are almost exclusively calcium carbonate, ingestion of such objects would be

advantageous to females during the breeding season. By ingesting more calcium (e.g., mollusc shells) prior to egg laying, less calcium carbonate would need to be removed from the medullary bone to produce eggs. Birds selectively foraging on mollusc shells prior to egg laying may then have less of a calcium debt to replace following laying which could lead to an adaptive advantage over individuals not seeking calcium from the environment.

The Asian clams found in the stomach of the bird we collected were introduced to the United States in the 1920's although they may have been established as early as the mid 1800's (Fox 1969). Chinese immigrants working in the Pacific Northwest likely released this species as a food source (Sinclair 1971). The clams very quickly spread across North America and had become established on the East Coast by the 1970's (Lachner *et al*. 1970). Throughout its new range in North America, the Asian clam has become a pest species in irrigation canals and may be causing problems for native freshwater clams (e.g., *Sphaerium*, *Pisidium*, and *Musculium*, Miller and Payne 1994). It is likely that Great Crested Flycatchers always have been obtaining environmental sources of calcium as a supplement during the egg-laying season. Prior to the 1970's (and the invasion of the Asian clam on the east coast), Great Crested Flycatchers likely fed on native fresh-water mussel shells and seem to have adapted their diets to the Asian clam invasion.

The Great Crested Flycatcher is a common and obvious (based on size and voice) migrant to the region, yet we know very little about its dietary intake. In the last century, only a single scientific paper has reported on Great Crested Flycatcher diets (Beal 1912), and points to how little we really know about even the most common bird taxa. Keen field observation, combined with continued voucher specimen collecting, can help to put a dent in this vacuous knowledge gap.

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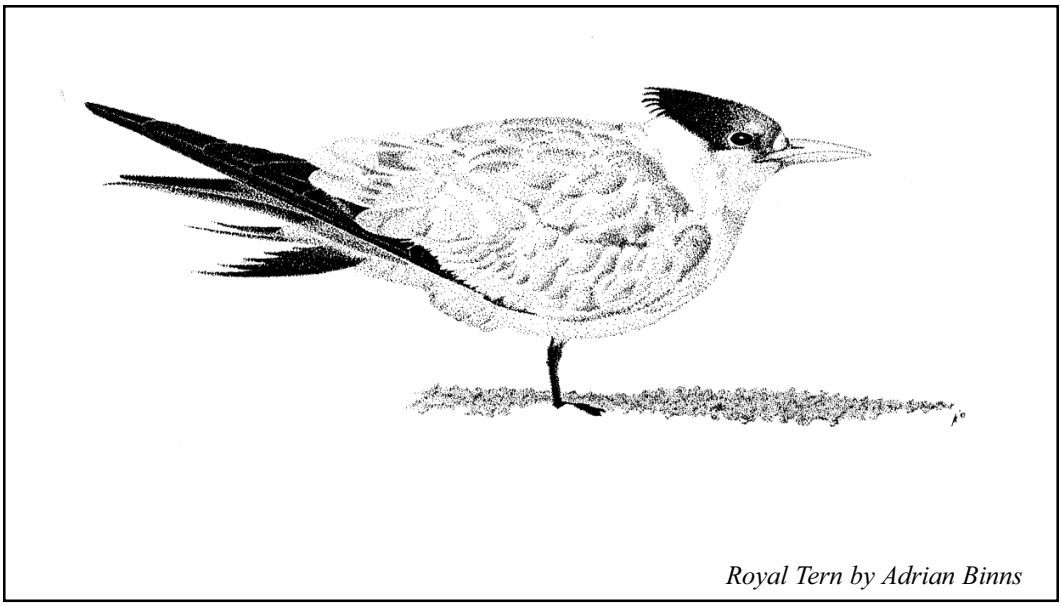

Royal Tern by Adrian Binns