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PROLONGED PARENTAL CARE IN THE SOOTY TERN AND BROWN NODDY

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Ashmole and Tovar (1968) reviewed and discussed prolonged parental care of young in birds, with special attention to the Laridae. They suggested that "those birds whose methods of obtaining food require great skill should have a considerable period of post-fledging parental feeding of the young." Dunn (1972) and Orians (1969) found that adult Sandwich Terns (*Thalasseus sandvicensis*) and Brown Pelicans (*Pelecanus occidentalis*), respectively, capture prey on more dives than immature birds.

Sooty Terns (*Sterna fuscata*) and Brown Noddies (*Anous stolidus*) capture fish and squid at the ocean's surface (Watson 1908, Ashmole and Ashmole 1967), and this presumably requires "great skill" in the sense of Ashmole and Tovar. Indeed, Ashmole (1963) suggested that juvenile Sooty Terns on Ascension Island first leave the island with their parents, although his only evidence was that adults and juveniles often flew together over the island during the breeding season. A similar contention regarding Royal Terns (*Thalasseus maximus*) is much better documented (Ashmole and Tovar 1968). Ashmole (1963) also reported that young Sooty Terns on Ascension Island "remain on or near the breeding ground for a week or so after they can first fly."

I present here information indicating some degree of parental care of fledged Sooty Tern and Brown Noddy young on Manana or Rabbit Island, Hawaii.

In 1971, I observed, over a 24-hr period, a quadrat containing the nest sites of nine marked Sooty Tern young that had been fledged for about a week. I began the watch at 14:45; none of the juveniles was within the quadrat or visible anywhere from my blind. At 16:15, one of the marked young flew into the quadrat, and by 19:00 all of the nine marked young were within the quadrat. All remained until 06:00, and each was fed by at least one parent during the night. The first juvenile flew away from the quadrat between 06:00 and 07:00 the next morning, and all were out of my sight when I ended the watch at 14:45 that afternoon. Sooty Tern young do not gather in large groups away from the nest sites on Manana, and many juveniles can be seen flying offshore the island shortly after the chicks begin to fledge. The fledged Sooty Tern young in my quadrat apparently were spending the day at sea, but returning to the nest sites at night to be fed by their parents.

In addition, I observed three Sooty Tern young on Manana 15 days after they could fly, and one young 21 days after it could fly. All four of the juveniles appeared in good shape and eventually left the island.

In 1971, all the Brown Noddy young that survived predation by herons during the first two weeks after hatching were fledged by the end of August. I counted 1,335 juveniles on Manana in the daytime on 23 October, and 20 in the daytime on 27 November. Many more than 20 juveniles (at least hundreds) were on Manana the night of 27 November, and many were emitting a high, whispering call associated with the soliciting of food from parents. I observed one juvenile being fed. I heard the same call on the night of 11 December, although no Brown Noddies were on Manana during the daytime. I did not hear the call on the night of 28 December.

These data indicate postfledging parental feeding of young for at least 21 days in the Sooty Tern and 100 days in the Brown Noddy on Manana Island. Juveniles of both species spend some time at sea during these periods, and may be gaining experience necessary for the efficient capture of prey. These conclusions are consistent with the hypothesis of Ashmole and Tovar (1968) that prolonged parental care of young will occur in those species of birds whose feeding behavior requires a high degree of "skill." However, only the information on the Brown Noddy strongly corroborates the hypothesis.

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SUCCESSIVE POLYGYNY IN UPLAND NESTING REDWINGED BLACKBIRDS

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Recent studies (Holm 1973, Zimmerman 1966, Verner 1964) and theoretical considerations (Orians 1969) of the polygynous mating system in birds have stressed its adaptive value in environments where the quality of males' territories differs sufficiently to affect the reproductive success of females. Particularly of interest in understanding the evolution and maintenance of polygyny are the behavioral aspects of nest site selection and the significance of such factors as the temporal pattern of nesting and the social conventions within the mating system. The importance of such behavioral and social considerations has been demonstrated, for example, in the polygynous mating system in the yellow-bellied marmot (*Marmota flaviventris*; Downhower and Armitage 1971).

Polygyny is common among Redwinged Blackbirds (*Agelaius phoeniceus*) nesting in marshes. No published information is available on the extent to which it occurs in other habitats, although many birds nest in cultivated fields, early successional areas and fields of forage crops (Bent 1958, Case and Hewitt 1963, Stowers et al. 1963, Robertson 1972). Surveys in 1957–1958 in Illinois, for example, indicated that although summer population densities were higher in marshes, most nesting occurred in hayfields (Graber and Graber 1963). The ability to utilize a variety of habitats for breeding suggests that nesting behavior of Redwinged Blackbirds is readily adaptable to different environments; studies of its breeding biology should therefore include such upland habitats and not be confined to marsh populations.

I recorded the nesting phenology of a group of Redwinged Blackbirds in an upland habitat and studied their behavior in an attempt to determine the social basis for polygynous matings. In this paper I will report instances of successive polygyny and propose a possible adaptive basis for this pattern of nesting. Information on nesting success and male territory size of these blackbirds will also be presented.

STUDY AREA

The study was made on an area of 3.2 ha. of early successional vegetation within the city limits of Iowa City, Iowa. The study area is bounded on the west by the Iowa River and on other sides by a wooded area, a housing development and the city park, an area of mown grass. Territories furthest from the river were located on undeveloped housing lots. Vegetation on the area was varied, depending on the recent history of each site. The density and phenology of vegetation ranged from grasses (Kentucky bluegrass, *Poa pratensis*, and reed canary grass, *Phalaris arundinacea*) to thick stands of goldenrod (*Solidago* spp.) and mixed clumps of forbs (daisy fleabane, *Erigeron annuus*; white sweet clover, *Melilotus alba*; dock, *Rumex crispus*; and coneflower, *Rudbeckia laciniata*). In some areas there were scattered clumps of saplings (cottonwood, *Populus deltoides*, and honey locust, *Gleditsia triacanthos*). Oak (*Quercus* spp.) and mulberry trees (*Morus alba*) occurred in the portion of the study area that paralleled the river.

The river bank dropped sharply so that a shallow area for foraging was not available. However, a storm water channel that ran through part of the study area to the river was frequently used by feeding birds. A pond outside the study area, in the park, was also used at times.

METHODS

Systematic observations were begun on June 1, 1973, by which time all but two territories had been set up, so that no observations were made on their initial establishment. I visited each nest daily from the date of its discovery. These observations did not appear to affect nesting success but may have caused a few