HISTORY AND ECOLOGY OF A COLONY OF BARN OWLS IN UTAH

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Barn Owls (*Tyto alba*) are usually solitary nesters but may also gather in loose associations under favorable conditions. The consequential high densities and extensive overlapping home ranges of the associated pairs suggest a colonial relationship. Although Evermann (1882), Reed (1897), and Dixon and Bond (1937) have all recorded colonies of Barn Owls, there have been no detailed investigations of the colonial ecology of this species. Barn Owls have, however, been the subject of numerous studies, including a recent study of a Chesapeake Bay population by Reese (1972).

In September 1968, we discovered a small colony of Barn Owls utilizing an abandoned steel mill (Ironton) in central Utah. We observed the seasonal activities of the colony until its dispersal after Ironton was dismantled for scrap by October 1971.

Ironton had been abandoned in 1962. It consisted of 60 major structures, including several multi-storied power and storage buildings, two blast furnaces, and a coke tower. It was bordered on the north and west by marshes composed chiefly of cattails (*Typha* sp.) and on the east by the western foothills of the Wasatch Mountains, which rose approximately 1500 ft above the valley floor. A large slag pile lay to the southwest, while the southeastern border included dry, grassy fields, a canal, and a small pond. A small stand of mature willows (*Salix* sp.) was beyond the pond.

The abandoned steel mill provided a unique and apparently highly suitable habitat for several vertebrate species. Approximately 2100 Rock Doves (*Columba livia*), 160 Starlings (*Sturnus vulgaris*), and an equal number of House Sparrows (*Passer domesticus*) utilized Ironton for nesting and roosting as did lesser numbers of Common Flickers (*Colaptes auratus*) and American Kestrels (*Falco sparverius*) (see Smith et al. 1972a, for a discussion of American Kestrel breeding habits in this area). House Mice (*Mus musculus*) were the most common mammals within the interior of the mill, but Meadow Voles (*Microtus pennsylvanicus*) and Deer Mice (*Peromyscus maniculatus*) were most common in adjacent natural habitats. Several feral House Cats (*Felis domesticus*) which fed primarily on adult and nestling Rock Doves were also resident in the mill area.

RESULTS

HISTORY OF THE COLONY

At least one individual and possibly a pair of Barn Owls roosted in the coke tower while Ironton was in operation. The first Barn Owl nest was found in April 1964, and the same site was active in June 1965 (R. Higley, pers. comm.). In December 1968, the colony numbered 28 individuals, including two young fledged that fall (Smith et al. 1970). In January 1968, sportsmen shooting Rock Doves killed one adult and one of the newly fledged young. The spring breeding colony had produced 12 fledged young by late June 1969, bringing the total Barn Owl population to 38 individuals. In August 1969, the work of dismantling Ironton for scrap began. This, coupled with the dispersal of young, resulted in the rapid decline of the colony, with resident pairs and individuals usually leaving the area only after the last suitable roosting structure within their territory had been destroyed. By June 1971, the last pair was gone.

REPRODUCTIVE ACTIVITIES

Nesting chronology. We observed the courtship and copulation of pairs from mid-January through March 1968. Copulation but not courtship of fall nesting pairs was observed from early August through mid-September. The first nesting pairs were incubating eggs in early February, but a few later nesting pairs incubated eggs through April. The first hatchlings were found during the first week in March and the first young fledged in mid-May. Fall nesting Barn Owls began incubation in early September and the first young fledged in early December. Thus, the nesting cycle from the deposition of the first egg through the fledging of the last young of a nest required slightly over 3 months.

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TABLE 1. Summary of reproductive activities of Barn Owls at Ironton.

	Fall 1968		Spring 1969		Spring 1970	
	No.	%	No.	%	No.	%
No. of nesting efforts	2		11		2	
No. of nests with eggs	2	100.0	11	100.0	1	50.0
Total eggs produced	7		47		9	
Av. no. eggs per nest	3.5		4.3		4.5	
No. nests hatching eggs	2	100.0	9	81.8	1	50.0
Total eggs hatched	4	57.1	19	40.4	4	44.4
Av. no. eggs hatched per nest	2.0		1.7		2.0	
No. nests fledging young	2	100.0	7	63.6	1	50.0
Total young fledged	4	100.0	12	63.2	4	100.0
Av. no. young fledged per nest	2.0		1.1		2.0	

Courtship and nest site selection. We observed the courtship activities of two pairs of Barn Owls on 10, 11, 18, and 24 January 1970. These nights were uniformly dark and cold, with partially overcast skies. During courtship the female, followed closely by the male, flew in wide circles around the pair's territory at heights of 75–125 ft. The male frequently emitted a series of rapid, high-pitched calls resembling chirps. The pair visited the nest site structure at intervals but also rested on other tall structures within their territory. The total length of time involved in this form of courtship varied from less than 0.5 hr to slightly over 1.7 hr. On 24 January, a pair engaged in three apparently separate courtship flights which lasted a total of 2.2 hr. We twice observed pairs copulating at the culmination of the courtship flight. Occasionally, copulation of pairs was also observed later during and after egg deposition and incubation, but ceased prior to the hatching of the young. Copulation took place on a high, open platform within the nesting territory and most pairs used the same site repeatedly. However, one pair which we observed in copulatory activity eight times used one site five times and three other sites each once.

Nesting pairs displayed considerable adaptability in their utilization of the steel mill structures for nest sites. Examples include three nests located within the supporting framework of the blast furnaces, three within the hollows of a 75-ton overhead crane, two located within 2.5 ft diameter pipes, and one in a blast furnace skipcar. Heights of the nests averaged 70 ± 9.0 ft (N = 15, range, 33–145 ft) and the majority were situated in relatively inaccessible sites. All nests except one during the fall of 1968 were hidden in recesses or protected by some form of overhead cover. Nests within buildings were always situated near broken windows, ventilator openings, or other suitable exits. Distances between the nearest neighboring active nests were highly variable ($\bar{x}$ = 162.9 ± 90.4 ft, N = 9, range 15–341 ft). The shortest distances were between two nests located on opposite sides of a blast furnace whereas the longest distances were between nests separated by relatively open areas.

The nesting records of Bent (1938), Wallace (1948), Keith (1964), and others indicate similar adaptability of Barn Owl nesting site selection in other parts of their range. Behle (1941) found Barn Owls occupying crevices in river banks in southwestern Utah and presumed them to be nesting in these sites.

Ironton Barn Owl nests consisted of a varying mixture of pellet fragments, prey remains, and Rock Dove fecal material. The rapid accumulation of the former during growth and development of the young, coupled with the poor ventilation characteristic of the majority of nest sites, resulted in highly odious nests. Entrances to several of the sites were small, one being a circle only 6.5 inches in diameter, and the adults occasionally appeared to experience difficulty during entry and exit.

Clutch size and incubation. Egg deposition dates which we were able to measure occurred at intervals of 2.3 ± 0.21 days (N = 18, range 1–7 days). Thirteen eggs were laid at 2-day intervals, but 1- and 4-day intervals were each observed once and 3-day intervals, twice. The last egg of a clutch of nine was laid 7 days after the deposition of the eighth egg but did not hatch. Wallace (1948) suggests that eggs are laid at 2-day intervals.

A summary of the productivity of the Barn Owl colony is presented in table 1. Barn Owl clutches at Ironton averaged 4.2 eggs: initial spring clutches averaged 4.9 ± 0.7 eggs (N = 9, range 2–9 eggs); three renesting pairs produced second clutches of 4.0 ± 0.46 eggs (range 3–5 eggs); two fall clutches averaged 3.5 ± 0.35 eggs (range 3–4 eggs). Although no statistically significant differences are evident between seasonal and renesting clutch

sizes, the small samples prevent definitive conclusions. Most studies have reported larger average clutch sizes. Thus, Bent (1938) noted that Barn Owl clutches usually varied from 4–11 eggs, with 6–7 being most common; Schifferli (1957) found a mean clutch size of 5.3 eggs (38 clutches) in Switzerland; and Reese (1972) reported an average clutch size of 5.5 eggs (74 clutches) in a Chesapeake Bay population.

Incubation began with the deposition of the first egg. Females incubated the eggs throughout most of the day but exchanged with males during the late evening hours. We frequently found both adults sitting side by side on a clutch. Forbush (1927) also noted females exchanging with males and pairs sitting together on eggs; however, Niethammer (1938), Reese (1972), and Maestrelli (1973) have suggested that incubation duties are performed only by the female.

The incubation periods of 11 marked eggs averaged 30.8 ± 0.94 days (range 27–34 days). The total period of incubation of a clutch of seven eggs, measured from the time of the deposition of the first egg to the hatching of the fourth (and last egg of the clutch which hatched), was 40 days. The similarly determined incubation period of a clutch of five eggs (four of which hatched) was 43 days. Bent (1938) suggests an incubation period of 21–24 days per egg, a figure inconsistent with our data, but Wallace (1948) and Horner (1963) determined incubation periods of approximately 30 days. Recently, Reese (1972) has reported a probable 24–30-day range and Maestrelli (1973) a 29⁺-day period.

Hatching and fledging success. Seven of 15 nesting attempts successfully fledged any young; six of the nests failed with no eggs hatching and two failed with young in the nest. The combined data of successful and unsuccessful nests reveals only 1.7 young hatched and 1.3 young fledged per nest. Reasons for the high degree of nesting failures are unknown. Human interference may have been at least partly to blame, but care was taken to avoid unnecessary disturbance of nesting owls. No indication of predation on nestlings or eggs was found.

Two pairs with clutches and one pair with five young abandoned their nests. Within 13 days all three pairs had renested, one retaining the same nesting site and the others selecting new nesting sites within their territories. Although all three pairs produced new clutches, only one succeeded in hatching and fledging young. We found the oldest young of the abandoned nest alive but weak and fed it in the laboratory for 8 days. We then placed it in another Barn Owl nest in the colony which contained two slightly older young. The adults accepted the added young and successfully fledged all three.

The productivity of the Ironton Barn Owl colony was comparatively low. Schifferli (1957), Keith (1964), and Reese (1972) recorded brood sizes of 4.0⁺ young per nest from their studies. Reese (1972) found a 6-year average of 2.1 fledged young per nest from all known nesting efforts, and Maestrelli (1973) reported an average of 3.7 fledged young per clutch from six clutches produced by a captive Barn Owl pair. Henny (1969) computed necessary replacement productivity requirements of Barn Owl populations to be 1.9–2.2 young per breeding age female, a much higher figure than that achieved by the Ironton population during our study. We cannot explain the low reproductive rate of the Ironton Barn Owls. It may have been a density-dependent, natality-reducing mechanism triggered by the high population density of the Barn Owl colony within the mill, but the possibility is speculative.

CARE AND DEVELOPMENTAL BEHAVIOR OF YOUNG

Observations of 11 young owls indicated an average time of 64.3 ± 0.45 days (range 62–67 days) from hatching to fledging. Pickwell (1948) and Reese (1972) also reported similar times for Barn Owls.

Food brought to the nest. Food stockpiles were found at every nest during the incubation period. Stockpiling began slightly before the deposition of the first egg of a clutch and continued throughout the incubation and hatching period. Initial food stockpiles were small, usually numbering 2–5 vertebrates, rarely to 11, and were occasionally consumed by the adults, possibly the female as suggested by Wallace (1948). Stockpile size increased during the first 3 weeks after the young hatched, with the largest found numbering 32 rodents and birds. Wallace (1948) reported a stockpile of 190 mammals, primarily rodents.

Food brought to the nest differed little from the adult diet (see Smith et al. 1972b). A total of eight prey species were recorded, of which 68.9% were Meadow Voles, 5.1% Starlings, and 11.7% Deer Mice. Other less common prey included House Mice (6.6%), Vagrant Shrews (*Sorex vagrans*) (4.0%), House Sparrows (3.2%), and icterids (1.2%).

Both adults participated in the feeding of

the young. The first food was usually brought to the nest approximately 45 min after sunset, or about 30 min after the adults began hunting. Food was brought to a nest containing two young aged 10.5 and 10.8 weeks nine times from 20:45 to 01:45 (from 0:45 to 5:45 after sunset) for an average rate of 1.8 times per hr. After 01:45, nest visits with food were highly sporadic. We did not observe feeding of the young after 04:50, although the adults continued to hunt as late as 05:45 (0:15 before sunrise). By attaching a terragraph to a nest containing four young, Bussmann (1937) found an average of 11.3 feedings per night over a hunting period of 5 hr 33 min.

Although the young were able to hiss within 3 weeks, they did not begin uttering the hoarse food cry until 6–8 weeks old. At this time the young usually called persistently from shortly after sunset until about 2–3 hr before dawn, pausing only for 15–25 min during and immediately after being fed.

Postfledging behavior. After fledging, young Barn Owls typically remained in company of the adults for 7–8.5 weeks, although the transplanted owl discussed previously remained 13 weeks. The young roosted in the vicinity of the nest site during the day and began calling to the adults for food almost immediately after sunset. Adults returning to the nest site building were approached by the young begging for food. If the adults did not offer food or had returned without food, the insistent young pursued them from perch to perch until they resumed hunting. We did not observe the young hunting during this postfledging dependency period.

The fledged young rapidly became adept flyers but showed inexperience in landing. We twice observed young owls misjudge landings on a 35-ft high, narrow pole and fall to the ground; neither owl was injured by the mishap. Nightly observations of two broods revealed that early postfledging flights were short circles of about 75–180 ft and centered around the nest site structure. Longer flights were attempted within 2 weeks although the young always confined their nocturnal movements to within the territory of the adults.

The adults apparently terminated the postfledging dependency period of the young by a rapid reduction of the amount of food supplied to them. This occurred during August and early September, after which the young began to leave the colony and disappear. By October, all but one young of the year had left the colony.

TERRITORIALITY

We were able to capture and color band six of the adults early in the study and consequently based much of our information regarding territorial habits on these owls.

At least five of the Barn Owl pairs at Ironton remained paired and retained essentially the same home ranges throughout the year. Both members of a pair roosted together at two or three alternate sites. Choice of roosting sites was influenced by climatic conditions and pairs moved into the most protected structures during the coldest months. From 8–15 weeks prior to the initiation of the nesting cycle, pairs began roosting in the building in which the nest would be located.

Overlap of home ranges of adjacent pairs varied from very little to virtually 100%. Two pairs occupied essentially the same home range throughout our study and home ranges of three additional pairs showed approximately 55–70% overlap. Home ranges of unpaired owls overlapped with those of paired owls but never with other unpaired owls. All paired and unpaired owls, however, maintained different centers of activity (defined here as the diurnal roosting buildings or structures or combination).

Territoriality was observed only during the nesting cycle, with pairs showing much variation. Pairs with greatly overlapping home ranges were weakly territorial and commonly defended only 15–30 ft around the nesting vicinity. Territorial defense by these pairs took the form of threat postures and occasional initiation of short, intercepting flights toward intruding Barn Owls, although no contact was observed. In contrast, the most aggressive territorial display involved a female over 150 ft from her nest. The female attacked the male of an adjacent territory roosting but 35 ft from the entrance to his own nest and drove him into the nest building. Interestingly, the two pairs had maintained essentially nonoverlapping home ranges. Possibly the late evening sighting of the male stimulated the aggression. Territoriality during the remainder of the year was either passively maintained or ignored, judging by our ability to drive Barn Owls into previously defended territories of adjacent pairs.

ACTIVITY PATTERNS

Barn Owls spent most of the day at one of several alternate roosting sites within their home range. They remained alert and readily took flight if disturbed. When forced to move, they usually flew to open, exposed perches

where they could monitor our activities, and only moved into more secluded perches within buildings after we left their vicinity. On overcast days individuals occasionally moved to perches outside the roosting building during the later afternoon and early evening hours.

Barn Owls began foraging from 15–30 min after sunset but before darkness and thus could be easily observed flying to their hunting areas. Several pairs hunted over areas as far as 1.5–2.3 miles from the nest site or roosting building. Cottam and Nelson (1937) and Reese (1972) also found Barn Owls traveling comparatively long distances to nightly foraging areas. Unless young were at the nest, the adults remained on the hunting grounds throughout most of the night, alternately foraging and roosting. The majority returned to their diurnal roosting sites before first light; however, we frequently observed a few returning in first light but before sunrise.

Onset of hunting appeared to be a function of time of darkness and varied from extremes of 16:00 in winter to 20:45 in midsummer. We twice observed owls hunting during early morning hours on overcast days. Haverschmidt (1970) observed Barn Owls in Surinam hunting in bright sunlight once each in February and June.

MORTALITY

Mortality of mobile owls is difficult to discern and our information is sketchy. Ascertained causes of mortality of Ironton Barn Owls included shooting, automobiles, and accidents. Two owls were killed by sportsmen shooting Rock Doves in the mill area. Three owls, one adult male and two newly fledged juveniles, were found dead on nearby highways. The adult was found about 0.9 miles from its roosting site at Ironton. The juveniles, both of which had been banded in June 1969, were found in August and September 1969, alongside an interstate highway 3.6 miles northwest of the colony. We also found the mummified remains of one adult female and three juveniles which had apparently inadvertently entrapped themselves within some of the steel mill structures and died of starvation.

DISCUSSION

Undoubtedly, the extensive and ideal habitat of the abandoned steel mill fostered the rapid development of the Barn Owl colony. That the upper size limit of the colony had been reached is somewhat less obvious, but may have been indicated by the generally low productivity of the colony plus the late summer dispersal of all but one young of the year. The size limit may have been a function of the number of roosting and nesting structures available as both paired and unpaired owls maintained territories which encompassed one or more structures.

After the steel mill was dismantled, we checked possible roosting sites throughout the broad, north-south-lying Utah Valley in an attempt to again locate the owls. Four individuals were found: one roosting in a silo approximately 3.7 miles southwest of the original colony; two roosting in a small copse of woods 4.5 miles southwest; and one roosting in an abandoned railroad water tower 2.3 miles northwest. One year later, in April 1971, we banded four young of a pair nesting in an old cottonwood (*Populus* sp.) approximately 18 miles north of the original colony. Unfortunately, we were unable to determine if any of these owls were from the original colony.

SUMMARY

We described the history and ecology of a small colony of Barn Owls in central Utah which utilized the abandoned Ironton steel mill for roosting and nesting sites. The known size of the colony varied from a winter population of 28 owls to a peak summer population of 38 adults and fledged young. The colony was abandoned following the demolition of Ironton for scrap.

Spring and fall nesting activities were recorded. Average clutch size was 4.2 eggs; hatching success was 43%; and fledging success was 88% of eggs hatched. Following fledging, the young spent up to 13 weeks in company of the adults.

The majority of the adults remained permanently paired throughout the year. Territoriality was evident during the breeding season and centered primarily around the nest site structure. However, considerable overlap of home ranges of adjacent pairs was commonly found. Adults were almost wholly nocturnal in activity patterns and hunted over relatively large areas.

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