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DIFFERENTIAL MORTALITY OF BARN OWLS DURING FLEDGING FROM MARSH AND OFF-SHORE NEST SITES

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Abstract.—Mortality associated with the initial flights of 34 radio-tagged Barn Owls (*Tyto alba*) from off-shore and marsh locations was studied. All owls from marsh locations survived their first flights, whereas only 16.7% from off-shore nest boxes and 35.7% from duck blinds survived fledging ($P < 0.001$). Increased mortality associated with off-shore nest sites may reduce Barn Owl recruitment to the population.

DIFERENCIAS EN LA MORTALIDAD DE INDIVIDUOS DE *TYTO ALBA* DURANTE EL PERÍODO DE VOLANTONES EN LUGARES ANEGADOS Y FUERA DEL LITORAL

Sinopsis.—Se determinó la mortalidad, asociada al primer vuelo, de 34 individuos de *Tyto alba* monitoreados con radiotransmisores, estudiados en localidades fuera del litoral y en un anegado. Todos los individuos estudiados en el anegado sobrevivieron su primer vuelo, mientras que tan sólo el 16.7% en cajas de anidamiento y 35.7% en escondijos para cazar patos (ambos fuera del litoral) sobrevivieron ($P < 0.001$). El incremento en la mortalidad asociado con el anidamiento en lugares fuera del litoral puede reducir el reclutamiento poblacional de estos buhos.

For decades Barn Owls (*Tyto alba*) have nested in off-shore duck blinds in Maryland. During the 1960s and early 1970s, reported fledging success from these blinds ranged from 84 to 97% (Klaas et al. 1978, Reese 1972). Recent inspections of off-shore duck blinds in these same waters revealed fewer blinds available and less use by Barn Owls (J. L. McConnaughey and D. F. Brinker, unpubl. data; S. A. Smith et al., unpubl. data).

Along the Atlantic coast Barn Owls are associated with extensive salt marsh ecosystems. Blodget (1989) suggested that coastal salt marshes have always supported core populations of Barn Owls. Barn Owls feed on the abundant small mammals in these habitats and nest in surrounding areas (Colvin 1984). In an effort to enhance nesting opportunities near salt marsh foraging habitat, we erected nest boxes in several off-shore locations as substitutes for duck blinds. These boxes were effective in attracting nesting Barn Owls.

Concurrent with this effort, a study was initiated to examine mortality of young Barn Owls attempting to fledge from off-shore structures, particularly duck blinds and nest boxes, compared to marsh nest sites.

STUDY AREA AND METHODS

The study was conducted on the lower Eastern Shore of Maryland's Chesapeake Bay and the coastal bays of Worcester County, Maryland and Accomack County, Virginia. These tidal bays were primarily shallow

with depths ranging from 0.5 to 2.0 m. Daily tides fluctuated between 0.5 and 1.0 m. The surrounding marsh habitat was dominated by saltmarsh cordgrass (*Spartina alterniflora*), saltmeadow cordgrass (*S. patens*), big cordgrass (*S. cynosuroides*), spikegrass (*Distichlis spicata*), needlerush (*Juncus romerianus*), Olney three-square (*Scirpus olneyi*) and saltmarsh bulrush (*S. robustus*). Scattered ponds, tidal creeks and rivers were distributed throughout. Nearby uplands were predominated by row-crop agriculture and woodlands.

As part of another study on nest box preference, paired boxes (91.44 × 40.64 × 50.8 cm) were placed at 20 off-shore locations and 20 locations on the marshes. Off-shore boxes were placed within 100 m of the shoreline to mimic the location of off-shore duck blinds. Generally, duck blinds in the Chesapeake Bay area have not been far from shore. Reese (1972) found most blinds less than 65 m off-shore. Marsh boxes were placed on the salt marsh within 30 m of a tidal creek or canal. Boxes at each location were spaced 0.5–1.0 m apart. Only one pair of nesting owls was expected to use a particular pair of nest boxes, because Barn Owls generally defend an area 5–9 m around their nest site from conspecifics (Smith et al. 1974). In this way both roosting and nesting sites were available at each location.

All duck blinds and nest boxes in the study area were monitored for Barn Owl use every 2 wk from March through October, 1989 and 1990. All nestlings were banded. Five- to six-week-old owls from each active nest site were randomly selected and equipped with radio transmitters (Custom Telemetry and Consulting, Inc., Watkinsville, Georgia). Owls younger then 5 wk old were too small for the radio transmitter, whereas older individuals were likely to fledge prematurely. Transmitters were secured to the birds with a back-pack harness design similar to that described by Dwyer (1972). This assemblage weighed about 10 g (<2% of fledgling weight) and had a life expectancy of at least 75 d. Attempts were made to radio tag two young per nest; however, the actual number depended upon transmitter availability and brood size.

A directional H-type antenna and receiver (Telonics, Inc., Mesa, Arizona) were used to locate radio-equipped birds. The maximum receiving range on the ground was 1.6 km. Locations were checked daily, during daylight hours, from the time of transmitter attachment until after fledging. Birds were considered to have survived fledging if they were found alive away from the nest site. To maximize sample size, some fledged birds were recaptured and transmitter packages were removed for use on other individuals. Transmitters were left on other fledglings and these birds were located twice a week for 2–4 wk after fledging. Three intensive searches within a 6.5 km radius of each nest were performed for missing radio-tagged birds within the first 2 wk after they left the nest. Searches were conducted by boat and/or car along all coastlines, rivers, creeks and roads.

Initial flight mortality was evaluated among the different nest locations using Fisher's exact test. Statistical analyses were performed using SAS (SAS Institute, Inc. 1988).

TABLE 1. Outcomes of first flights by radio-tagged Barn Owls by nest site location during the March 1–October 31 field seasons of 1989 and 1990.

Nest site	# radio-tagged	# nests	# surviving first flight	# found dead	# missing
Off-shore duck blind	14	9	5	2[a]	7
Off-shore nest box	12	9	2	8[a]	2
Marsh nest box	8	5	8	0[a]	0

[a] Mortality was significantly different among individual nest site types (Fisher's exact $P < 0.001$).

RESULTS

Thirty-four young Barn Owls were radio-equipped prior to fledging. All radio-tagged young from marsh nest boxes survived initial flights, whereas only 16.7% of the young from off-shore boxes and 35.7% from off-shore duck blinds survived fledging (Table 1). Nine young from off-shore sites were never located after they left their nests. There was a significant difference (Fisher's exact $P = 0.007$) in mortality when comparing marsh locations to off-shore nest sites combined. Three additional banded young (not radio-equipped) from off-shore duck blinds were found dead, washed ashore, whereas three other banded fledglings (not radio-equipped) from a marsh box were recaptured alive. These findings are consistent with our telemetry results and suggest that the telemetry equipment was not a contributing mortality factor. Additionally, a radio-equipped owl was recaptured the following year with the transmitter and harness still attached. The radio equipment apparently did not affect survivability.

Transmitters were left on nine successfully fledged birds, of which seven were always found roosting within 1.5 km of their nest sites for a minimum of 2 wk after fledging. The remaining two birds were victims of predation within 400 m of their respective nests 1 wk after fledging.

DISCUSSION

The use of radio-telemetry to study mortality associated with first flights of Barn Owls from off-shore nest sites has altered views about these structures. Klaas et al. (1978) and Reese (1972) reported high fledging success of Barn Owls from off-shore duck blinds. Knowledge of their fate after leaving the nest was unknown, however. Our findings indicate that mortality of young Barn Owls attempting to fledge from these structures is greatly increased compared to marsh nest sites. Unsuccessful fledglings apparently drowned, because all known dead were found washed ashore or floating in the water. In Utah, Smith et al. (1974) noticed that first flights were generally 23–55 m from the nest. Duck blinds used for nesting in this study ranged from 46 to 1830 m from shore. All fledging survivors

came from either marsh sites or off-shore sites less than 400 m from shore.

The apparent inability of some fledglings to reach land may be influenced by wind direction. For example, on seven occasions while approaching duck blinds to radio-tag nestlings, 7–8-wk-old owls prematurely flew. All flew with the wind and landed in the water within 200 m of the blind. In most instances wind direction was towards open water. Within 5 min, these birds were submerged and probably would not have survived if not rescued.

The only missing owls were from off-shore locations and were presumed to have died. It is unlikely that these individuals escaped detection by roosting far from their nest sites since similar habitat was available near both off-shore and marsh nest sites. All fledglings from marsh boxes, as well as known survivors from off-shore locations, were found roosting within 0.5 km of their nest sites during the days immediately following fledging. Fledglings were often found roosting in the marshes near their nests. This behavior appears typical in marsh habitats. Jemison and Chabreck (1962) frequently flushed adult Barn Owls on the ground in Louisiana marshes. If missing fledglings did not drown and exhibited aberrant behavior by leaving the area, they probably perished because of the lack of parental care. Adult Barn Owls continue to feed young in the vicinity of the nest site for weeks after fledging and dispersal occurs after this period of dependency (Smith et al. 1974).

Henny (1969) estimated that 1.04–2.52 young per breeding aged female are needed to maintain a stable Barn Owl population. This estimate assumes negligible loss in the nest after banding, and assumes that after young leave the nest mortality would be represented by band recoveries. Colvin (1984) found 12–61% mortality of young between the time of banding and fledging in New Jersey and questioned the accuracy of population models based on data for young at banding age only. Without our telemetry data, we would have estimated 75.7% of our young survived their initial flights from off-shore structures, when in fact the percentage of young known to survive was only 26.9%. This is well below first year survival rates reported by Henny (1969) and Stewart (1952) in North America.

Off-shore structures provide nest sites for Barn Owls in areas where cavities are limited. They are generally free of mammalian predators and are close to foraging habitats. Recruitment of young Barn Owls into the population may be reduced, however, by additional mortality to young attempting to fledge.

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