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Lunar Influence on the Fall Migration of Northern Saw-whet Owls

Jackie Speicher,^{1,2} Lisa Schreffler,¹ and Darryl Speicher¹

ABSTRACT.—Seasonal migration is an important component in the life cycle of Northern Saw-whet Owls (*Aegolius acadicus*). We evaluated the influence of the four lunar events (new moon, first quarter moon, full moon, and last quarter moon) on nocturnal activity of Northern Saw-whet Owls based on captures during fall migration, 2000–2008. We found differences between the lunar events with decreased capture rates during the full moon and the new moon. These results suggest lunar phase influences migratory movements and behaviors in this species. This may be attributed to predator avoidance during periods of relative brightness or darkness at night. Received 10 July 2009. Accepted 19 October 2010.

The amount of light at night should be an important variable to nocturnal migrants. One potentially important influence on timing of flights is the lunar cycle, which is described by its four predictable conditions (first quarter moon, full moon, last quarter moon, and new moon). Pyle et al. (1993) reported that decreased lunar light was correlated with an increased number of departures during fall migration by landbirds. Moonlight affects behavior by either increasing foraging behavior or predator avoidance. Leach's Storm Petrels (*Oceanodroma leucorhoa*) decrease activity during times of increased moonlight when

gull (*Larus* spp.) predation rates are relatively high (Watanuki 1986). This behavior modification suggests that petrels assess the risk of predation. Tropical Nightjars and other caprimulgids also increase foraging activity during periods of lunar illumination (Brigham and Barclay 1992, Jetz et al. 2003). Changes in feeding behavior in association with changes in moonlight have also been noted for small mammals which are prey species (Price et al. 1984, Gannon and Willig 1997, Lang et al. 2006, Schmidt 2006). Foraging activity typically decreases with increased lunar light.

The Northern Saw-whet Owl (*Aegolius acadicus*) is a short-distance migrant that breeds in coniferous or mixed deciduous forests of North America. The adults are approximately 15–21 cm long (wingspan: 43 cm). Their weight ranges from 65 to 151 g with females averaging slightly larger than males (Cornell Laboratory of Ornithology 2009). Northern Saw-whet Owls prey primarily on small rodents, including mice (*Peromyscus* spp.) and voles (*Microtus* spp.).

The Northern Saw-whet Owl is also the potential prey of larger owls. Competing biological needs likely mean that owls react to lunar events in the context of foraging, avoiding predation, and movement. The full moon would be predicted to increase vigilance for predators leading to a decrease in foraging effort. Light conditions may also prompt a temporary pause in migratory flights or extended stopovers. We assessed the influence of the lunar condition on the capture rate of Northern

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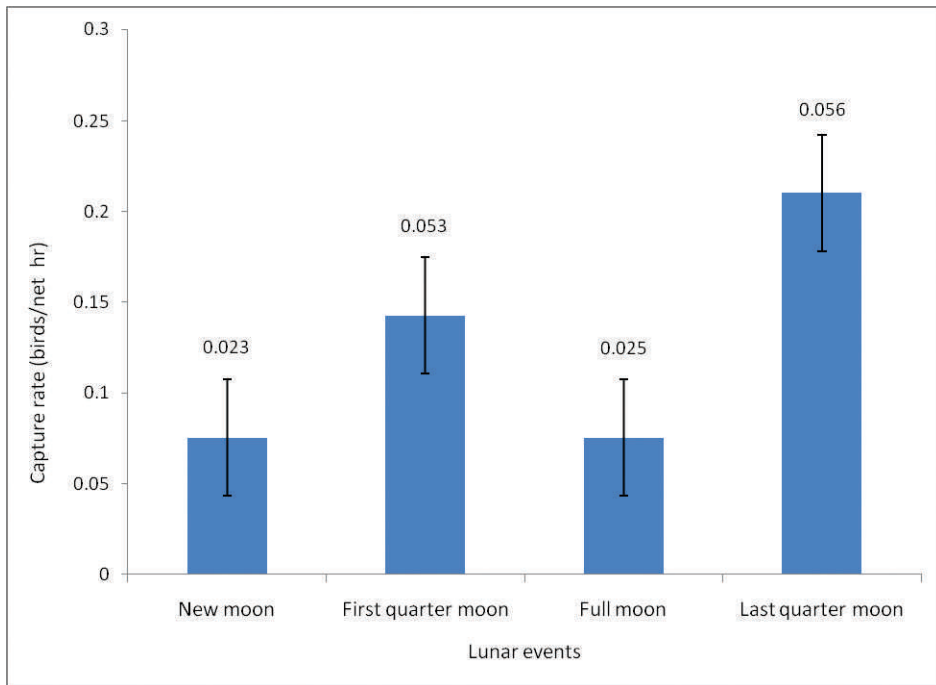


FIG. 1. Mean (\pm SE) capture rates (birds/net hr) of Northern Saw-whet Owls during the four lunar events ($n = 178$ individuals).

Saw-whet Owls to examine if illumination was a factor in timing of migration.

METHODS

The study area was in Skytop, Pennsylvania ($41^{\circ} 22' N$, $75^{\circ} 24' W$, elevation 513 m) on the south side of West Mountain. It is a semi-permanently flooded cold deciduous forest dominated by eastern hemlock (*Tsuga canadensis*), red maple (*Acer rubrum*), and rhododendron (*Rhododendron carolinensis*). Northern Saw-whet Owls were not recorded at this location before this study and their status as residents remains unknown.

The study period lasted from 1 October to 15 November, 2000–2008. Each calendar day was assigned a corresponding lunar cycle code from one to 28 (NASA 2009). Day 1 represents the new moon, day 7 represents the first quarter moon, day 14 represents the full moon, and day 21 represents the last quarter moon.

Five mist nets ($12 \times 2.5 \times 60$ mm mesh) were placed in a continuous line oriented in a north-south direction. A conspecific audio lure was positioned at the center of the net array. Nets were opened each evening from 1900 to 2300 hrs and mist nets were visited every 30 min. Individuals captured were weighed (g), measured, banded, and released using

standard Bird Banding Laboratory protocols. Data were recorded for each encountered individual.

We calculated the rate at which owls were captured each evening by dividing the total number of birds caught by each evening's net effort. Data were pooled and averaged for each lunar day. Data were analyzed using ANOVA.

RESULTS

Each field season included all four lunar events (first quarter moon, full moon, last quarter moon, and new moon). No significant difference in net hours was evident between the four individual lunar events. No significant differences in capture rate were evident between each of the four lunar events (ANOVA: $df = 3$, $P = 0.09$) (Fig. 1). Mean capture rate was lowest during the new moon and full moon. The only exception to this pattern occurred in 2004 when there was an increase in captures associated with a total lunar eclipse.

DISCUSSION

Weather variables including precipitation, high winds, and cloud cover had a negligible effect on capture data during the 9-year study. However, there was a decrease in capture rates during the full and new moon relative to the last quarter moon.

Our study design incorporated an audio lure to attract migrating owls into the nets. This increases the probability of captures (Whalen and Watts 1999, Project OwlNet 2000). Longland and Price (1991), in a study of Barred Owls (*Strix varia*) using a taped audio playback, ascertained that Barred Owl response diminished with increased light. The risk of predation during the full moon may have deterred owls from investigating the audio lure. This explains decreased capture rates during full moon. The anomaly of a total lunar eclipse in 2004 caused an uncharacteristic increase in capture rate.

Increased light may prompt increased predator vigilance. Our results indicate owls are less likely to be moving or respond to an acoustic lure, when it was bright or dark. The Northern Saw-whet Owl has difficult trade-offs as they must assess risk and combine feeding with predator vigilance. Increased predator vigilance was shown with lower capture rates during the full and new moons. The Northern Saw-whet Owl apparently waits for a low risk situation to continue on migration and feeding. Significant differences in capture rates during each lunar event suggest the full moon effectively interrupts typical migration patterns.

There was a total lunar eclipse during the full moon in 2004 which was associated with a substantial increase in number of Northern Saw-whet Owls captured. This small natural experiment provides further evidence that migratory movements by Northern Saw-whet Owls are influenced by lunar illumination.

Moonlight is an exogenous factor that effectively decreases nocturnal activity in a variety of prey species. Alvarez-Castaneda et al (2004) found that number of rodents in Barn Owl (*Tyto alba*) pellets decreased during the full moon. In our study, body mass (unpubl. data) was lowest in the third quarter, suggesting a period of decreased foraging may occur prior to that interval. Further study may provide more insight into Northern Saw-whet Owl foraging behaviors during migration. Studies incorporating use of telemetry may enhance our understanding of flight patterns of this species. Combining data from multiple studies will be a valuable resource in understanding the overall influence of lunar conditions on nocturnal migratory owls.

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