

## Documentation of a Polygynous Gray Catbird

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**ABSTRACT.**—Polygyny occasionally occurs in passerine species that are generally socially monogamous. We document the second case of polygynous mating in the Gray Catbird (*Dumetella carolinensis*) and provide the first detailed account of this behavior. Daily provisioning rates of the polygynous male documented this male provisioned one nest more than the other ( $5.9 \pm 2.2$  trips/hr vs.  $1.7 \pm 1.1$  trips/hr). The difference between the male's provisioning rates diminished when standardized for the number of chicks per nest. Polygyny appears to be an alternative mating strategy for the Gray Catbird in certain situations. Received 5 July 2006. Accepted 19 November 2006.

Polygyny is a mating system in which a single male forms long lasting breeding associations with more than one female at the same time (Searcy and Yasukawa 1989) and is uncommon in birds (Alatalo et al. 1981). Where polygyny does occur in birds, it is generally in only a subset of a population, with most individuals exhibiting social monogamy (Secunda and Sherry 1991, Ford 1996). Seventy-one species of passerine birds (26%) within the United States and Canada have been reported to exhibit some form of polygyny (Ford 1996). The polygyny threshold model (PTM) stipulates that females should only engage in polygynous mating if the benefit of mating with an already mated male outweighs the costs associated with such a mating (Verner 1964, Verner and Willson 1966). An alternative to the PTM is the “deception hypothesis” (von Haartman 1951, 1956; Alatalo et al. 1981). The mating status of the polygynous male under the deception hypothesis is unknown to females mating with him because the male is polyterritorial and possesses two territories usually separated by territories of

other males (Alatalo et al. 1981). The cost to females associated with this form of polygyny is not compensated.

In either the polygyny threshold model or the deception model, secondary females have a greater cost than primary females and the most likely cost is reduction in male parental care. However, polygyny is not always costly for a female. Possible benefits include mating with a genetically superior male, having access to a high quality territory, nest protection, and enhancement of foraging success, which are applicable only when the polygynous mates share a single territory. Polyterritoriality has been reported for only 11 of the 71 North American passerines known to practice polygyny (Ford 1996).

The Gray Catbird (*Dumetella carolinensis*) is a common monomorphic North American songbird that exhibits bi-parental care, and is believed to be both genetically and socially monogamous. The male contributes most of the nestling feeding during the early nestling period, while the female does most of the brooding. However, the Gray Catbird may not always be monogamous. Johnson and Best (1980) reported the only known case of a single male catbird tending two nests. Few details of this observation were documented. In that particular instance there was one competing territory between the two nests. We document another such case in the Gray Catbird in this paper.

## METHODS

We conducted observations during a study of paternal care of the Gray Catbird in East Buffalo Township, Pennsylvania (40° 59' N, 76° 56' W). The study site is 24 ha and is comprised of forested, grassy, and edge habitat. Twenty-five male and 13 female Gray Catbirds were mist netted and banded with U.S. Government metal bands and unique color combinations before the laying period. Body condition measurements ( $100 \times$

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[ $\text{mass}^{-3}/\text{tarsus length}$ ]) and blood samples were taken for each bird. We monitored the fate of Gray Catbird nests and made daily measures of paternal effort through approximately 1.5 hrs of observations of provisioning using digital video cameras (Sony DCR-TRV22) positioned approximately 1.5 m from the nests. Gray Catbirds acclimate relatively quickly to this type of camera at this distance (Dolby et al. 2005). Each nest used was observed at least 4 days during the nestling period.

The two nests discussed in this paper (#50 and #78) were cared for by the same male, and were filmed seven and six times, respectively. Five video observations were included for both nests from 31 July to 4 August between 1000 and 1400 hrs EDT. Observations of the two nests were not entirely synchronous and the video records were truncated to include only overlapping times to facilitate comparison of differences in paternal investment between the two nests. The data are presented as means  $\pm$  SD.

### RESULTS

A male Gray Catbird (#433) was banded on 23 May 2005 and his body condition measurements were taken. This male had a body condition score ( $6.2 \times 10^{-5}$ ) lower than the population average ( $7.3 \times 10^{-5} \pm 2.0 \times 10^{-5}$ ). He aggressively guarded two nests (#50 and #78 with respective clutch sizes of 3 and 2), 69.5 m apart. These nests were in an area which appeared to have the highest amount of shrub, thorny, and fruiting species within the study site. There appeared to be a high density of catbirds in this general area but we did not detect an active intermediate territory. All eggs in both nests hatched. On 28 July two eggs had hatched in both nest #50 and nest #78. The following morning an additional egg hatched in nest #50.

The frequency of male provisioning visits was higher at nest #50 ( $5.9 \pm 2.2$  trips/hr) than at nest #78 ( $1.7 \pm 1.1$  trips/hr). This difference could be a result of the difference in brood size between these nests. The difference between the two nests diminished after standardizing for brood size. However, the frequency of male provisioning visits was still higher at nest #50 ( $1.9 \pm 0.8$  trips/hr) than at nest #78 ( $0.8 \pm 0.5$  trips/hr) (Fig. 1).

### DISCUSSION

Polygynous mating is known to occur in some passerine birds (Searcy and Yasukawa 1989, Ford 1996) but typically does not occur in Gray Catbirds (Cimprich and Moore 1995). Gray Catbirds have a high level of male care (Slack 1976, Cimprich and Moore 1995) and polygyny would not be expected to occur through female choice unless male or territory quality is sufficiently variable (Verner 1964, Verner and Willson 1966, Temrin 1984). However, females may not recognize the prior mating status of males in all polygynous matings (Alatalo et al. 1981). Although polygyny is unexpected in this species, under the polygyny threshold model, one may predict that a female Gray Catbird would prefer to mate with an already mated male if he was of higher quality than other males. However, our measurement of body condition for male #433 was within one standard deviation of the mean.

The synchrony and proximity of the two nests make it less likely the two females paired with the same male without detecting each other; if the females knowingly chose to settle polygynously, the benefits of pairing with this particular male should outweigh the cost of being polygynous. Johnson and Best (1980) reported the nests they observed were further apart (160 m) and the clutches were laid asynchronously. This fits the polyterritorial deception model better than our example. These separate cases of polygyny present the possibility of multiple breeding strategies in Gray Catbirds. Male #433 appeared to provide similar care for his nests when standardized for brood size, contrasting with polyterritoriality and the predictions of deceptive polygyny (Smith et al. 1982, Secunda and Sherry 1991).

It has been accepted that the Gray Catbird is socially monogamous and it is now evident there are situations when some birds mate polygynously. Future studies should consider the reproductive strategies of this species.

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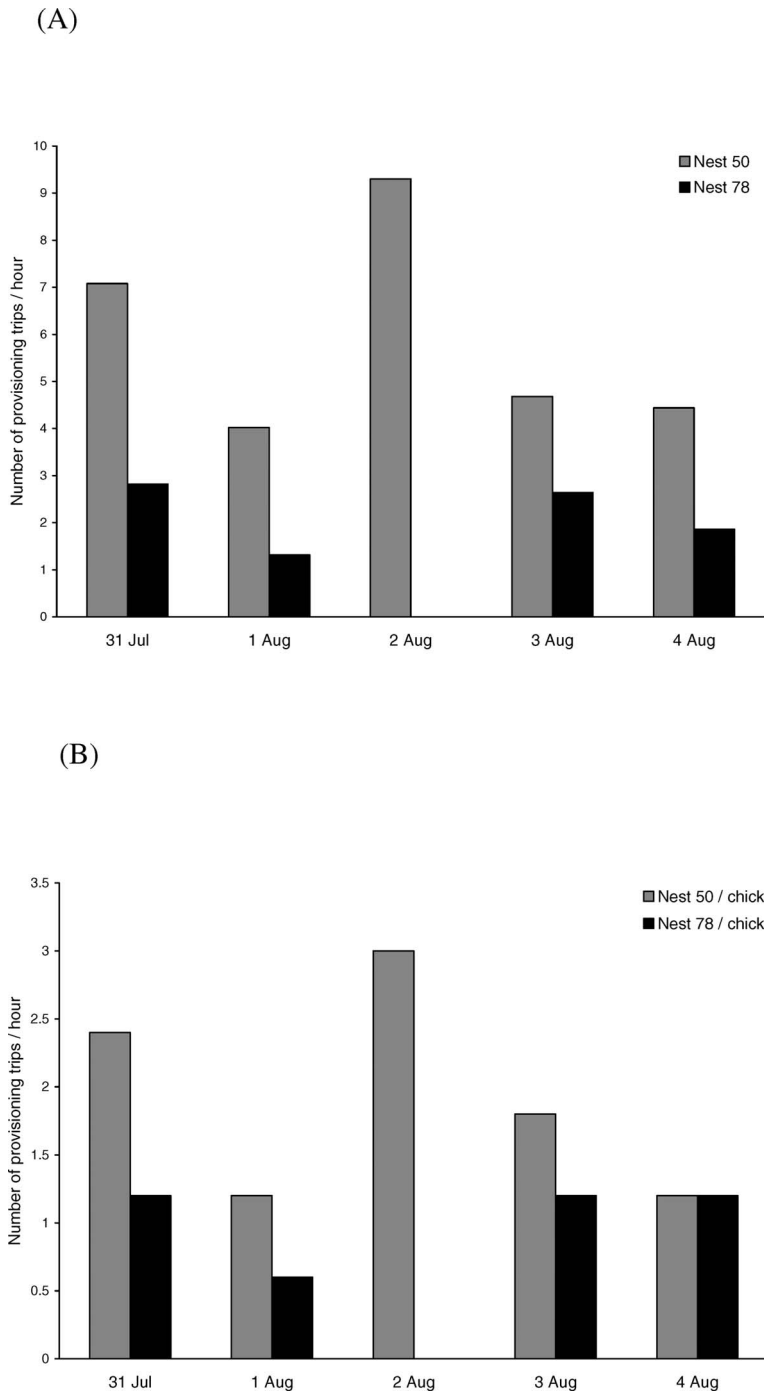


FIG. 1. (A) Number of daily provisioning trips/hr to each of two nests tended by the same male Gray Catbird and (B) the number of daily provisioning trips/hr standardized for number of nestlings.

## LITERATURE CITED

- ALATALO, R. V., A. CARLSON, A. LUNDBERG, AND S. ULFSTRAND. 1981. The conflict between male polygamy and female monogamy—the case of the Pied Flycatcher *Ficedula hypoleuca*. *American Naturalist* 117:738–753.
- CIMPRICH, D. A. AND F. R. MOORE. 1995. Gray Catbird (*Dumetella carolinensis*). The birds of North America. Number 167.
- DOLBY, A. S., C. E. CLARKSON, E. T. HAAS, J. K. MILLER, L. E. HAVENS, AND B. K. COX. 2005. Do song-phrase production rate and song versatility honestly communicate male parental quality in the Gray Catbird? *Journal of Field Ornithology* 76: 287–292.
- FORD, N. L. 1996. Polyterritorial polygyny in North American passerines. *Journal of Field Ornithology* 67:10–16.
- JOHNSON, E. J. AND L. B. BEST. 1980. Breeding biology of the Gray Catbird in Iowa. *Iowa State Journal of Research* 55:171–183.
- SEARCY, W. A. AND K. YASUKAWA. 1989. Alternative models of territorial polygyny in birds. *American Naturalist* 134:323–343.
- SECUNDA, R. C. AND T. W. SHERRY. 1991. Polyterritorial polygyny in the American Redstart. *Wilson Bulletin* 103:190–203.
- SLACK, R. D. 1976. Nest guarding behavior by male Gray Catbirds. *Auk* 93:293–300.
- SMITH, J. N. M., Y. YOM-TOV, AND R. MOSES. 1982. Polygyny, male parental care, and sex ratio in Song Sparrows: an experimental study. *Auk* 99: 555–564.
- TEMRIN, H. 1984. Why are some Wood Warbler (*Phylloscopus sibilatrix*) males polyterritorial? *Annales Zoologici Fennici* 21:243–247.
- VERNER, J. 1964. Evolution of polygyny in the Long-billed Marsh Wren. *Evolution* 18:252–261.
- VERNER, J. AND M. F. WILLSON. 1966. Influence of habitats on mating systems of North American passerine birds. *Ecology* 47:143–147.
- VON HAARTMAN, L. 1951. Successive polygyny. *Behaviour* 3:256–274.
- VON HAARTMAN, L. 1956. Territory in the Pied Flycatcher *Muscicapa hypoleuca*. *Ibis* 98:460–475.

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## Rockhopper and Macaroni Penguin Colonies Absent from Isla Recalada, Chile

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**ABSTRACT.**—Macaroni (*Eudyptes chrysolophus*) and Southern Rockhopper penguins (*E. c. chrysocome*) have been classified as Vulnerable due to decreasing populations in recent decades. We report on a survey of Isla Recalada, Chile, a site described historically as containing an estimated population of 10,013 ( $\pm 570$ ) Rockhopper and 559 Macaroni penguins. Our survey was conducted on 14 and 15 November 2005 to coincide with peak colony attendance. No Rockhopper or Macaroni penguins were observed on Isla Recalada during this period. This survey suggests the population of these penguins has dispersed due to possible anthropogenic pressures or climate variation, and that

both species of penguins have been extirpated from Isla Recalada. *Received 26 July 2006. Accepted 4 December 2006.*

The Southern Rockhopper Penguin (*Eudyptes c. chrysocome*) and Macaroni Penguin (*Eudyptes chrysolophus*) along the coast of Chile are restricted to the southern islands with estimated populations of 75,000–150,000 and 25,000–75,000 individuals, respectively (Schlatter 1984, Woehler 1993). Both taxa have been classified as Vulnerable by the IUCN/BirdLife International Red List (BirdLife International 2004) because of declining populations of at least 30% over the last 30 years and continued anthropogenic pressures (e.g., fisheries activities) and changes in the marine environment.

Breeding sites for Southern Rockhopper Penguins are restricted mostly to the islands

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TABLE 1. Survey of Rockhopper and Macaroni penguins at Isla Recalada, Chile, 1989–91 and 2005.

|                    | 1989   | 1990  | 1991  | 2005 |
|--------------------|--------|-------|-------|------|
| Rockhopper Penguin | 10,013 | 6,777 | 3,304 | 0    |
| Macaroni Penguin   | 599    | 421   | 0     | 0    |

off southern Chilean fiords between 47° and 56° S (Williams 1995) with egg production occurring from November to early December. The world population estimate for this subspecies has been placed at 475,000 breeding pairs at 51 sites (Bingham and Mejias 1999). Recent surveys indicate a population of 272,000 breeding pairs occurs on the Falkland Islands. These same surveys suggest the Falkland Island population has been stable since the mid 1990s, but has declined from 1.4–1.8 million pairs, a decline of over 80%, since the initial surveys in 1932/33 (Clausen and Huin 2003, Pütz et al. 2003). Recent surveys in Argentina involving the inventory of 180,000 pairs of Rockhopper Penguins on Staten Island indicate numbers have dramatically increased from a few thousand pairs to 167,000 pairs at Bahía Franklin and may indicate a shift of birds from the Falkland Islands (Schiavini 2000).

The number of Southern Rockhoppers in Chile was estimated to be 175,000 pairs with the largest colonies of 70,000 and 13,000 pairs on Isla Noir and Diego Ramirez Islands, respectively. However, there is no comprehensive program to monitor long-term population trends (Venegas 1984, 1991; Woehler 1993). The colony of 70,000 pairs on Isla Noir was estimated to contain 35% of the total number along the coast of Chile (Venegas 1998). Six colonies of Southern Rockhopper Penguins and three colonies of Macaroni Penguins have been described on Isla Recalada, Chile (74° 20' S, 53° 17' W).

The overall objective of our survey was to gather and summarize data on Southern Rockhopper and Macaroni penguins, based on breeding pairs, obtained during an assessment of coastal islands from Isla Noir (54° 20' S, 73° 10' W) to Isla Recalada (Fig. 1). This paper reports on the absence of these two penguins from Isla Recalada.

## METHODS

We surveyed known locations of the Rockhopper and Macaroni penguin colonies on Isla Recalada on 14 and 15 November 2005 using maps and Global Positioning Satellite (GPS) coordinates from previous studies. Four investigators, using stratified random sampling techniques, conducted land-based systematic sampling of all geographic areas known to be used by penguins as described by Venegas (1984, 1991, 1998), Soto (1990), and Venegas and Soto (1992). The goal was to collect data from each colony site to estimate total penguin population size. We also used coastal searches by boat, based on historic data for reference, to expand the survey. Study sites on Isla Noir and Leonard Island (74° 04' W, 53° 23' S), the latter 4 nautical miles southeast of Isla Recalada, demonstrated that timing of our survey coincided with peak colony attendance for the two species (MM and DAO, unpubl. data).

## RESULTS

No active nest sites or individual crested penguins were found in any of the Rockhopper or Macaroni penguin colonies on Isla Recalada in 2005. Evidence of historic nesting colonies was present with clearly defined paths and remnants of individual nest cups within areas of tussock grasses. Active burrows, excavated by nesting Magellanic Penguins (*Spheniscus magellanicus*) were present within the former Rockhopper Penguin colonies within 50–100 m of the shoreline. Recent tracks and guano were evident in areas only associated with Magellanic Penguin nests.

## DISCUSSION

No Rockhopper or Macaroni penguins were observed in 2005 within historical breeding colonies on Isla Recalada. Venegas and Soto (1992) abandoned efforts to survey the area in 1992 due to poor weather conditions. Suitable nesting areas, primarily tussock grasses, remained in 2005 with little or no evidence of recent human activities.

Surveys of penguin colonies on Isla Recalada documented a decline in Rockhopper Penguin colonies from 1989 to 1991; 10,013 ( $\pm 570$ ) to 3,304 (Soto 1990, Venegas 1991, Venegas and Soto 1992). Macaroni Penguins declined from 599 in 1989 to 421 in 1990

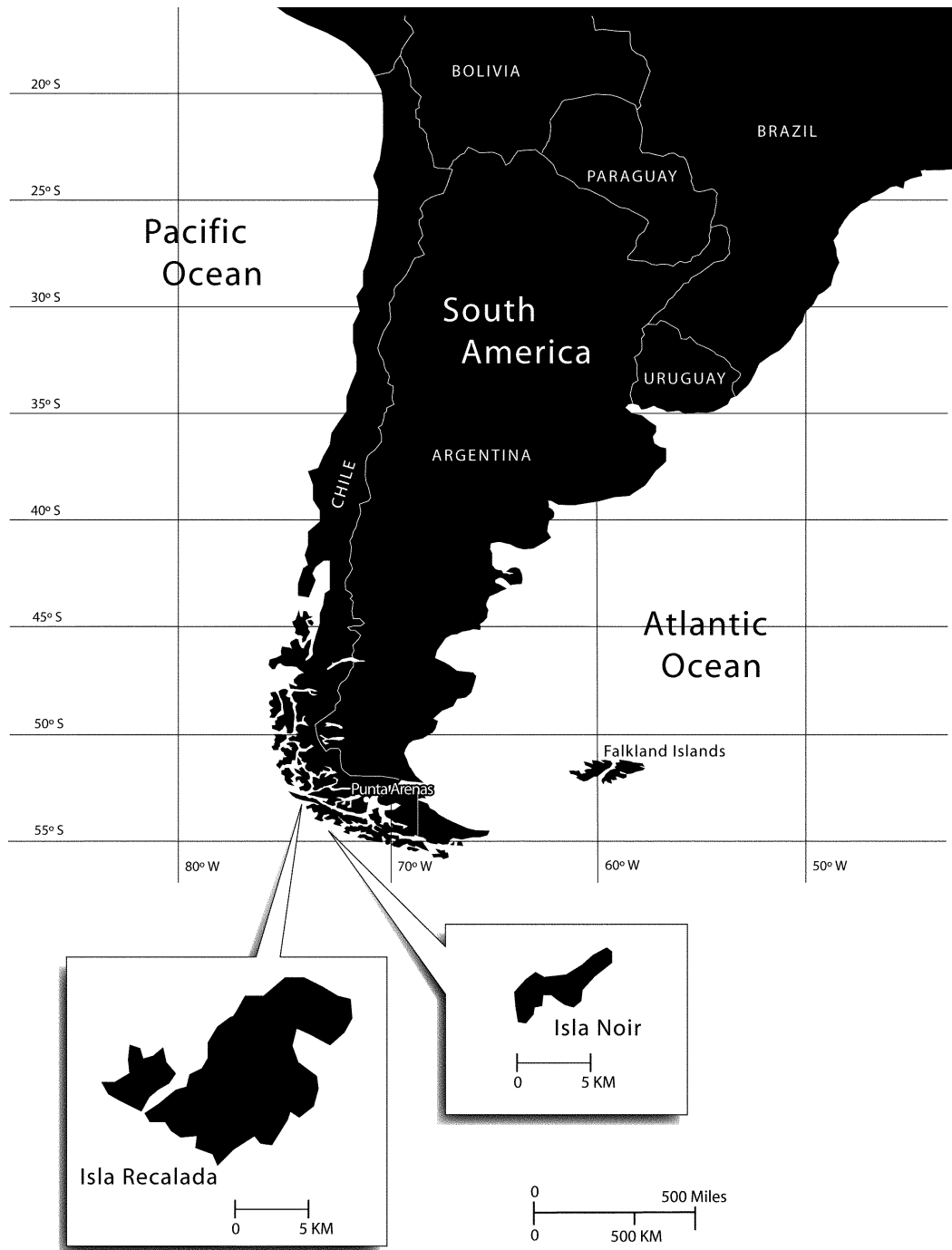


FIG. 1. Isla Noir and Isla Recalada along the coast of Chile.

with no Macaroni Penguins observed within these colonies in 1991 (Soto 1990, Venegas 1991, Venegas and Soto 1992). The number of active nests within the Rockhopper Penguin colonies also demonstrated a marked decline, e.g., colony #5 had 602 active nests in 1989 and 68 nests in 1991 while colony #1 had 135 nests in 1991 versus 739 during the 1989 season (Venegas and Soto 1992).

One possible explanation for this decline is collection of adult penguins for export to zoological parks from 1984 to 1992. These activities, which probably created a disturbance within the breeding colonies, may have caused adult penguins to move to other colonies (Venegas 1991, Venegas and Soto 1992). Interviews with local fishermen revealed that from 1992 to 1997, shortages of fish-based bait for crab pots led some fishermen to sites such as Isla Recalada to procure alternative sources of bait, including adult penguins.

El Niño Southern Oscillation (ENSO) events, particularly in 1996–97, may have had a role in altering prey availability, although the effects of these events were greatest between 5° and 15° S (Shaffer et al. 1999). The 1996–97 ENSO event was the strongest in modern history and resulted in a decline in Humboldt Penguins (*Spheniscus humboldti*) (BirdLife International 2003, Paredes et al. 2003). Warming of ocean temperatures during ENSO events may result in lower annual production within penguin colonies (Fortescue 1999, Taylor et al. 2004).

Monitoring of penguin colonies must continue to be implemented along the coast of Chile to estimate population size, status, and population trends. These efforts will allow for implementation of conservation efforts within specific areas involving important penguin populations during possible shifts in populations due to prey availability and detrimental anthropogenic activities. There is a need to immediately establish procedures and to control collecting expeditions as suggested by Venegas (1991).

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#### LITERATURE CITED

- BINGHAM, M. AND E. MEJIAS. 1999. Penguins of the Magellan Region. *Scientia Marina* 63: Supplement 1:485–493.
- BIRDLIFE INTERNATIONAL. 2003. BirdLife's online world bird database: the site for bird conservation. Version 2. BirdLife International, Cambridge, United Kingdom. <http://www.birdlife.org>
- BIRDLIFE INTERNATIONAL. 2004. *Eudyptes chrysocome* and *E. chrysolophus*. 2004 IUCN Red List of Threatened Species. BirdLife International, Cambridge, United Kingdom. <http://www.redlist.org>
- CLAUSEN, A. P. AND N. HUIN. 2003. Status and numerical trends of King, Gentoo, and Rockhopper penguins breeding in the Falkland Islands. *Waterbirds* 25:389–402.
- FORTESCUE, M. 1999. Temporal and spatial variation in breeding success of the Little Penguin (*Eudyptula minor*) on the east coast of Australia. *Marine Ornithology* 27:21–28.
- PARADES, R., C. B. ZAVALAGA, G. BATTISTINI, P. MAJLUF, AND P. MCGILL. 2003. Status of the Humboldt Penguin in Peru, 1999–2000. *Waterbirds* 26:129–256.
- PÜTZ, K., A. P. CLAUSEN, N. HUIN, AND J. P. CROXALL. 2003. Re-evaluation of historical Rockhopper Penguin population data in the Falkland Islands. *Waterbirds* 26:169–175.
- SCHIAVINI, A. C. M. 2000. Staten Island, Tierra del Fuego: the largest breeding ground for Southern Rockhopper Penguins? *Waterbirds* 23:286–291.
- SCHLATTER, R. P. 1984. The status and conservation of seabirds in Chile. Status and conservation of the world's seabirds (J. P. Croxall, P. G. H. Evens, and R. W. Schreiber, Editors). ICBP Technical Publication 2. ICBP, Cambridge, United Kingdom.
- SHAFFER, G., S. HORMAZABAL, O. PIZARRO, AND S. SALINAS. 1999. Seasonal and interannual variability of currents and temperature off central Chile. *Journal of Geophysical Research* 104:29951–29961.
- SOTO, V. N. 1990. Proyecto de protección y manejo de las colonias de pingüinos presentes en isla Rupert (72° 13' W, 53° 40' S) e isla Recalada (74° 20' W, 53° 17' S). Reserva Nacional Alacalufes. Informe de temporada 1989/1990. CONAF—XII Region, Punta Arenas, Chile.
- TAYLOR, S. S., M. L. LEONARD, D. J. BONESS, AND P. MAJLUF. 2004. Humboldt Penguins (*Spheniscus*

- humboldtii*) change their foraging behaviour following breeding failure. *Marine Ornithology* 32: 63–67.
- VENEGAS, C. 1984. Estado de las poblaciones de Pingüino de Penacho Amarillo y Macaroni en la Isla Noir, Chile. Informe Instituto de la Patagonia, Punta Arenas, Chile 33:25.
- VENEGAS, C. C. 1991. Estudio de cuantificación poblacional de pingüinos crestados en isla Recalada. Convenio CONAF-UMAG. Informe de Investigación, Instituto de la Patagonia, Punta Arenas, Chile 55:23.
- VENEGAS, C. 1998. Pingüinos crestados (*Eudyptes chrysocome* Forster 1781, *E. chrysolophus* Brant 1837) y de Magallanes (*Spheniscus megellanicus* Forster 1781) en Isla Noir, Chile. *Anales del Instituto de la Patagonia* 26:59–67.
- VENEGAS, C. AND N. SOTO. 1992. Estudios de pingüinos eudyptidos en isla Recalada, R.N. “Alacalufes,” Chile. Informe de temporada 1991–1992. Convenio UMAG-CONAF, Punta Arenas, Chile.
- WILLIAMS, T. D. 1995. *The penguins: Spheniscidae*. Oxford University Press, Oxford, United Kingdom.
- WÖHLER, E. J. 1993. The distribution and abundance of Antarctic and subantarctic penguins. SCAR/Scientific Committee on Antarctic Research, Cambridge, United Kingdom.

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## Nocturnal Migrants Foraging at Night by Artificial Light

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**ABSTRACT.**—Artificial lights can have detrimental effects on nocturnal migrant birds and other wildlife, yet some species of typically diurnal insectivorous birds are capable of foraging at night under artificial illumination. Here, we report observations of at least 15 wood-warbler species (Parulidae), one tyrant-flycatcher (Tyrannidae), and one mimid (Mimidae) foraging at night in areas illuminated by powerful artificial lights. To our knowledge, our observations represent the first report of a mixed-species flock of birds foraging on insects attracted to artificial lights or within foliage illuminated by artificial lights at night. *Received 2 October 2006. Accepted 14 December 2006.*

Artificial light sources can have negative effects on birds and other animals (Le Corre et al. 2002, Bird et al. 2004, Rich and Longcore 2006). However, some diurnal bird species are capable of using artificial lighting to forage at night. Here, we report observations

of at least 15 wood-warbler species (Parulidae), one tyrant-flycatcher (Tyrannidae), and one mimid (Mimidae) foraging at night in areas illuminated by powerful artificial lights.

### METHODS

MGH and TCL noticed a large number of flight calls at 2130 hrs EST on 11 October 2005 near the house of MGH, ~1 km from Schoellkopf Field within Cornell University's football stadium in Ithaca, New York (42° 26' N, 76° 26' W). MGH and TCL contacted additional observers and about a dozen people gathered at the stadium. Powerful artificial lights (156 1,500-watt metal halide bulbs mounted in 2 groups of 30 bulbs and 4 groups of 24 bulbs) illuminated the stadium following an evening athletic practice and for the duration of our observations. We recorded observations within and along the periphery of the stadium until the lights were turned off shortly before 0200 hrs on 12 October 2005. The group searched the stadium area with individuals or small groups of observers at times separating to cover different areas simultaneously. Winds conducive to migration occurred across much of the northeastern United States during this period and several days prior, while a stalled cold front caused light precip-

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itation during the night of observation (Dinsmore and Farnsworth 2006).

#### OBSERVATIONS

We heard thousands of migrants calling from inside the stadium, creating a constant background noise of bird calls. These calls came from birds flying low overhead and birds that had landed in and around the stadium. Near the start of observations, MGH and TCL counted 26 flight calls belonging to a variety of species in one 10-sec period (extrapolated to 156 calls/min). Numbers for each species (Dinsmore and Farnsworth 2006: 16 [Table 1]) were difficult to estimate because of apparent high call rates and the potential for double-counting circling birds. Large numbers of Savannah Sparrows (*Passerculus sandwichensis*), Yellow-rumped Warblers (*Dendroica coronata*), and other migrants were immediately apparent. Some species actively foraged among the foliage of illuminated trees and a few species sallied into the air to capture insects attracted to or disoriented in the stadium lights. Most insects pursued were moths, although birds also captured non-Lepidoptera. A Gray Catbird (*Dumetella carolinensis*) made one long ~10 m sally to hawk an insect from the air under a stadium light. Both Eastern Phoebe (*Sayornis phoebe*) and Nashville Warbler (*Vermivora ruficapilla*) were observed by MJA sallying after moths. Northern Parula (*Parula americana*), Blackburnian (*Dendroica fusca*), and Palm warblers (*D. palmarum*) searched for food among the foliage of illuminated trees. Black-and-white Warblers (*Mniotilta varia*) foraged creeping along large branches of illuminated trees and Common Yellowthroats (*Geothlypis trichas*) foraged among the foliage of lower bushes, but also frequently perched higher in the canopy of trees with other birds. Black-throated Blue (*Dendroica caerulescens*), Black-throated Green (*D. virens*), and Bay-breasted warblers (*D. castanea*) made aerial sallies after insects and appeared to glean insects from foliage. Yellow-rumped Warblers and American Redstarts (*Setophaga ruticilla*) were seen mainly using aerial sally maneuvers to take insects from foliage or the air. We suspected that six other wood-warbler species, including Ovenbird (*Seiurus aurocapillus*), Tennessee (*Vermivora peregrina*), Chestnut-sided (*Den-*

*droica pensylvanica*), Magnolia (*D. magnolia*), Blackpoll (*D. striata*), and Hooded warblers (*Wilsonia citrina*), were also foraging by artificial light but could not confirm these behaviors. Many individuals and species of warblers foraged simultaneously within the same trees interacting with each other as is typical in mixed-species flocks during daytime. We did not observe foraging behavior in less insectivorous species such as Rose-breasted Grosbeak (*Pheucticus ludovicianus*) and Savannah Sparrows. These species simply perched in trees, on bleachers, or on the artificial turf field. A single Red-tailed Hawk (*Buteo jamaicensis*) perched on the roof above the stadium and made at least one flight across the stadium. However, we could not confirm whether this bird attempted to attack potential prey or attempted to hunt nocturnally within the artificially illuminated area.

#### DISCUSSION

To our knowledge, this is the first report of a mixed-species flock of diurnal insectivorous birds actively foraging both in artificially illuminated vegetation and on insects attracted to artificial light sources. We observed additional events of mixed-species warbler flocks foraging late at night under the artificial lights at this location during 29 August and 15–16 September 2006 including light-aided nocturnal foraging among Yellow (*Dendroica petechia*), Magnolia, Blackpoll, and Cape May warblers (*D. tigrina*) sallying from the top of an illuminated conifer. Our observations may also represent the first examples of artificial light-aided nocturnal foraging for all species reported here except Gray Catbird, American Redstart, and Eastern Phoebe (Latham 1936; Bakken and Bakken 1977; Robert DeCandido, pers. comm.).

We suspect the lights caused problems for birds orienting in the sky, but most of the birds appeared to have no trouble orienting in trees and near the ground below the lights. We observed few mortalities during 11–12 October 2005, although one dead Ovenbird and one dead female Black-throated Blue Warbler were recovered from the stadium and nearby buildings. We captured four Common Yellowthroats trapped in open lit doorways and released them away from buildings after the stadium lights were turned off. We were sur-

prised that we encountered relatively few thrushes on or near the ground, despite the number and diversity of flight-calls from thrushes passing overhead. We are unable to explain why few thrushes landed during this event while so many warblers and other species were grounded.

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#### LITERATURE CITED

- BAKKEN, L. E. AND G. S. BAKKEN. 1977. American Redstart feeding by artificial light. *Auk* 94:373–374.
- BIRD, B. L., L. C. BRANCH, AND D. L. MILLER. 2004. Effects of coastal lighting on foraging behavior of beach mice. *Conservation Biology* 18:1435–1439.
- DINSMORE, S. J. AND A. F. FARNSWORTH. 2006. The changing seasons: weatherbirds. *North American Birds* 60:14–26.
- LATHAM, R. 1936. Catbirds and moths. *Oologist* 53:69–72.
- LE CORRE, M., M. OLLIVIER, S. RIBES, AND P. JOUVENTIN. 2002. Light-induced mortality of petrels: a 4-year study from Réunion Island (Indian Ocean). *Biological Conservation* 105:93–102.
- RICH, C. AND T. LONGCORE (Editors). 2006. *Ecological consequences of artificial night lighting*. Island Press, Washington, D.C., USA.

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## Yellow-throated and Red-eyed Vireos Foraging on Green Anoles During Migration

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**ABSTRACT.**—Yellow-throated (*Vireo flavifrons*) and Red-eyed vireos (*V. olivaceus*) were observed feeding on green anoles (*Anolis carolinensis carolinensis*) at two localities in Florida and one in South Carolina. Vireos are long-distance migrants that require foods high in fatty acid content, especially when engaging in migration. It is not unlikely that vireos have an opportunistic foraging strategy to obtain the necessary food requirements, including attacking and consuming prey items such as small lizards. This note provides the first published reports of lizards taken as prey by these two species. *Received 24 November 2006. Accepted 20 March 2007.*

The diets of North American vireos have been well described (Chapin 1925, Tyler 1950, Williamson 1971, Graber et al. 1985,

Ridgely and Tudor 1989, Rodewald and James 1996, Cimprich et al. 2000). The diet of the Yellow-throated Vireo (*Vireo flavifrons*), based upon analysis of 160 stomachs from specimens collected from April through September in breeding areas throughout North America, consists of 98.3% animal matter and 1.7% plant material (including small fruits and seeds). Insects (Insecta; eggs, instars, and adults of at least five Orders) comprise 95.8% of the animal food with the remainder being spiders (Arachnida) 2.4% and small snails (Mollusca) 0.06% (Chapin 1925). Butterflies and moths (Lepidoptera) accounted for 42%+ of the insects taken and vegetable matter was primarily consumed in fall and winter (Chapin 1925, Rodewald and James 1996). The diet of the Red-eyed Vireo (*Vireo olivaceus*) has been summarized by Chapin (1925), Tyler (1950), and more recently by Cimprich et al. (2000). Food items consist of insects (Insecta; eggs, instars, and adults of at least eight Orders), spiders (Arachnida), small snails (Mollusca), a large variety of small fruits, and occasion-

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ally flowers and leaf buds (Chapin 1925, Cimprich et al. 2000). Contents of 569 stomachs (Apr–Oct) within the breeding range included 85% animal matter and 15% plant material (Chapin 1925). Small fruits were most frequently taken in late summer and fall in breeding areas (Chapin 1925, Tyler 1950, Williamson 1971, Graber et al. 1985). The species is almost entirely frugivorous while wintering in northern South America (Ridgely and Tudor 1989).

Vireos kill larger prey by crushing, shaking vigorously, or beating against a branch (Southern 1958, Rodewald and James 1996). Smaller prey is swallowed whole. Larger prey are held with a foot against a branch and eaten piecemeal (Williamson 1971, Rodewald and James 1996). The objective of our paper is to report two species of vireos feeding on *Anolis* lizards during migration in South Carolina and Florida, USA.

#### OBSERVATIONS

On 21 September 2006, while searching for neotropical migrants in the maritime forest at Myrtle Beach State Park, Horry County, South Carolina, PWS observed an adult Red-eyed Vireo feeding on a brown-colored green anole (*Anolis carolinensis carolinensis*). This abundant small arboreal lizard has: (1) the ability to change color (green to brown and vice versa), (2) a wide range in the southeastern United States, and (3) attains a length up to 19 cm, 60–65% of this length being the tail (Conant 1958). The bird had apparently just captured the anole, ~ 12–13 cm in length and still limp, but the event was not witnessed. The bird held the lizard with its left foot against a branch and was steadily pecking the head, removing and swallowing small pieces of tissue. PWS watched this procedure for 15+ min with binoculars at an estimated 6 m with the bird clearly illuminated in direct sunlight. The bird was perched in a sweetgum (*Liquidambar styraciflua*) at a height of 5 m. The body and head of the anole were still intact, further indicating recent capture. When the vireo changed position on the branch, it continued to hold the anole with its left foot. When PWS left the site, the vireo was still actively feeding on the anole.

LSA and RLP observed a migrant Yellow-throated Vireo eating a green anole at 0900

hrs EDT at Key West, Monroe County, Florida on 13 April 1987. The vireo, perched in a strangler fig (*Ficus aurea*), was observed feeding on the lizard for 35 min. It first pulled pieces of flesh from the head, eating the eyes and what appeared to be the brain. After tearing the remains of the head from the body and dropping the head to the ground, the bird fed on the tissue of the neck region. The vireo bit off the legs and tail, and discarded them while feeding on the anole's abdomen. LSA later watched a migrant Red-eyed Vireo for 5+ min at 7 m eating a green anole at Ft. DeSoto County Park (Mullet Key), Pinellas County, Florida in mid morning on 27 April 1987. The bird was perched 3 m above ground in a woman's tongue tree (*Albizia lebbbeck*).

#### DISCUSSION

These appear to be the first reports of Yellow-throated and Red-eyed vireos feeding on lizards; literature searches did not reveal reptiles or amphibians having been reported taken by these two species. There is a record of a White-eyed Vireo (*Vireo griseus*) feeding on a small *Anolis* (Chapin 1925, Hopp et al. 1995). This appears to be the only previously published account of a vireo feeding on a lizard. Prior to the 1987 observations, the late Larry Hopkins (pers. comm., with LSA) reported watching a migrant Yellow-throated Vireo feeding on an introduced Cuban brown anole (*Anolis sagrei sagrei*) (Conant 1958) at Ft. DeSoto County Park, Pinellas County, Florida. All three vireos are long-distance migrants that possess the ability to greatly increase fat stores in preparation for migration (i.e., become hyperphagic), especially before a trans-Gulf flight (Moore et al. 1995). The energetic costs of migration require high levels of fatty acid in the diet of Red-eyed Vireos (Pierce and McWilliams 2005). Moreover, numerous nutritional requirements of individual vireos during the breeding season (Pierce et al. 2004, Pierce and McWilliams 2005) likely result in these species exhibiting opportunistic foraging behavior. Vireos are almost completely insectivorous requiring at least 75–85% animal matter in their diets (Cimprich et al. 2000, Pierce and McWilliams 2005). Red-eyed Vireos in laboratory tests routinely chose diets with higher fatty acid content (Cimprich et al. 2000, Pierce et al. 2004). Thus, it is like-

ly that vireos will attack and consume numerous animal species, including small lizards, when the opportunity arises.

Two of the vireos we observed (Apr) were in migration. One vireo observed (Sep), was likely preparing for migration to wintering areas in South America. It is likely the three birds were in an energetic state that required a highly nutritious food resource. Vireos are known to be opportunistic foragers during migration (Woodrey and Moore 1997). It is possible that at least the two species of vireos we observed take small lizards as prey with greater frequency than current evidence indicates. We did not observe captures of the lizards by the vireos and do not know the specifics as to how vireos actually obtained these prey, the physical condition of the prey at time of capture, or other circumstances involved.

Recent accounts of other small insect-eating birds taking small vertebrate prey include: (1) a migrant Summer Tanager (*Piranga rubra*) at Horn Island off the coast of Mississippi on 3 April 1993 eating a green anole (Aborn and Froehlich 1995), and (2) a House Wren (*Troglodytes aedon*) eating a juvenile house gecko (*Hemidactylus frenatus*) in Golfito, Costa Rica on 22 May 2002 (Barquero and Hilje 2005).

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#### LITERATURE CITED

- ABORN, D. A. AND D. FROEHLICH. 1995. An observation of a Summer Tanager attempting to eat an *Anolis* lizard. *Journal of Field Ornithology* 66: 501–502.
- BARQUERO, M. D. AND B. HILJE. 2005. House Wren preys on introduced gecko in Costa Rica. *Wilson Bulletin* 117:204–205.
- CHAPIN, E. A. 1925. Food habits of the vireos: a family of insectivorous birds. U.S. Department of Agriculture Bulletin 1355.
- CIMPRICH, D. A., F. R. MOORE, AND M. P. GUILFOYLE. 2000. Red-eyed Vireo (*Vireo olivaceus*). *The birds of North America*. Number 527.
- CONANT, R. 1958. The Peterson field guide series. A field guide to reptiles and amphibians of the United States and Canada east of the 100<sup>th</sup> meridian. Houghton Mifflin Company, Boston, Massachusetts, USA.
- GRABER, J. W., R. R. GRABER, AND E. L. KIRK. 1985. Illinois birds: vireos. *Biological Notes*, Number 68. Illinois Natural History Survey, Urbana, USA.
- HOPP, S. L., A. KIRBY, AND C. A. BOONE. 1995. White-eyed Vireo (*Vireo griseus*). *The birds of North America*. Number 168.
- MOORE, F. R., S. A. GAUTHREUX JR., P. KERLINGER, AND T. R. SIMONS. 1995. Habitat requirements during migration: important link in conservation. Pages 121–144 *in* Ecology and management of neotropical migratory birds (T. E. Martin and D. M. Finch, Editors). Oxford University Press, New York, USA.
- PIERCE, B. J. AND S. R. MCWILLIAMS. 2005. Seasonal changes in composition of lipid stores in migratory birds: causes and consequences. *Condor* 107: 269–279.
- PIERCE, B. J., S. R. MCWILLIAMS, A. R. PLACE, AND M. A. HUGUENIN. 2004. Diet preferences for specific fatty acids and their effect on composition of fat reserves in migratory Red-eyed Vireos (*Vireo olivaceus*). *Comparative Biochemical Physiology* 138:503–514.
- RIDGELY, R. S. AND G. TUDOR. 1989. *The Birds of South America*. Volume 1. The oscine passerines. University of Texas Press, Austin, USA.
- RODEWALD, P. G. AND R. D. JAMES. 1996. Yellow-throated Vireo (*Vireo flavifrons*). *The birds of North America*. Number 247.
- SOUTHERN, W. E. 1958. Nesting of the Red-eyed Vireo in Douglas Lake region, Michigan. *Jack-Pine Warbler* 36:105–130,185–207.
- TYLER, W. M. 1950. *Vireo olivaceus* (Linnaeus) Red-eyed Vireo. Pages 335–348 *in* Life histories of North American wagtails, shrikes, vireos, and their allies (A. C. Bent, Editor). U.S. National Museum Bulletin 197.
- WILLIAMSON, P. 1971. Feeding ecology of the Red-eyed Vireo (*Vireo olivaceus*) and associated foliage-gleaning birds. *Ecological Monographs* 41:129–152.
- WOODREY, M. S. AND F. R. MOORE. 1997. Age-related timing differences in stopover of fall landbird migrants on the coast of Alabama. *Auk* 114:695–707.