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DIURNAL ACTIVITY PATTERNS OF BLACK-NECKED STILTS (*HIMANTOPUS MEXICANUS*) DURING THE NON-BREEDING SEASON IN THE EASTERN CARIBBEAN

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Abstract: Diurnal activity patterns of resident Black-necked Stilts (*Himantopus mexicanus*) were observed on Guana Island, British Virgin Islands, during October 2010. Stilts were principally engaged in foraging and idle behaviors. The amount of time engaged in particular behaviors was relatively constant throughout the day, except during mid-afternoon when idleness increased and foraging decreased, with a subsequent increase in foraging in the evening. We speculate that the increase in foraging activity was a result of changing prey activity.

Key words: activity pattern, behavior, Black-necked Stilt, Guana Island, *Himantopus mexicanus*, wetlands

Resumen: PATRONES DE ACTIVIDAD DIURNA DE *HIMANTOPUS MEXICANUS* DURANTE LA TEMPORADA NO REPRODUCTIVA EN LAS ANTILLAS MENORES. Los patrones de actividad diurna de individuos residentes de *Himantopus mexicanus* fueron observados en la isla de Guana, Islas Vírgenes Británicas, durante octubre de 2010. Los individuos estaban ocupados principalmente en conductas de forrajeo e inactivos. La cantidad de tiempo dedicado a conductas particulares fue relativamente constante a lo largo del día, excepto a media tarde cuando se incrementó el descanso y disminuyó el forrajeo con un subsecuente incremento de este último al atardecer. Especulamos que este incremento en la actividad de forrajeo fue el resultado de un cambio en la actividad de las presas.

Palabras clave: conducta, isla de Guana, *Himantopus mexicanus*, humedales, patrones de actividad

Résumé : RYTHMES D'ACTIVITÉ DIURNE DE L'ÉCHASSE D'AMÉRIQUE (*HIMANTOPUS MEXICANUS*) EN DEHORS DE LA SAISON DE REPRODUCTION DANS L'EST DE LA CARAÏBE. Les rythmes d'activité diurne des Échasses d'Amérique (*Himantopus mexicanus*) sédentaires ont été observés sur Guana Island, aux Îles Vierges britanniques, en octobre 2010. La recherche de nourriture et le repos constituaient les principaux comportements des échasses. La durée consacrée à des comportements particuliers était relativement constante au cours de la journée, sauf en milieu d'après-midi où les durées de repos augmentaient et celles de recherche de nourriture diminuaient, suivies par une nouvelle augmentation du temps consacré à la recherche de nourriture dans la soirée. L'augmentation de l'activité de recherche de nourriture pourrait être le résultat de l'évolution des activités des proies.

Mots clés : comportement, Échasse d'Amérique, Guana Island, *Himantopus mexicanus*, rythme d'activité, zones humides

All animals perform a variety of activities, each of which consumes time and energy necessary for survival. Understanding how an organism distributes its time among activities is essential to understanding energy budgets and habitat use (King 1974). Many studies have examined avian activity patterns during the breeding season (Verner 1965, Dwyer 1975, Ettinger and King 1980) but fewer have focused on activity patterns outside of the breeding season.

We studied activity patterns and time allocations of Black-necked Stilts (*Himantopus mexicanus*; hereafter stilts) on Guana Island, located in the eastern Caribbean. Behaviors of this species have been documented in depth (Hamilton 1975) and are easily observed, but remain poorly studied during the non-breeding season (Cullen 1994), including the Caribbean (Wiley 2000). Guana Island provides an opportunity to study the ecology of Caribbean species in a relatively undisturbed and unchanged environment year round.

STUDY AREA AND METHODS

During October 2010, we studied activity patterns of stilts on Guana Island, a privately owned and mostly undeveloped 340 ha island in the British Virgin Islands. The primary vegetation on Guana Island is tropical dry forest (Lazell 2005). Guana Island contains several resident species of waterbirds, including stilts, which typically occupy a large saline pond (hereafter, salt pond) and breed in the surrounding vegetation, near the western shore

of the island (Lazell 2005). During our study the stilts occupied a shallow, ephemeral pond in a low-lying area connected to the larger salt pond, separated by vegetation. We did not measure water depth or salinity because we wanted to minimize disturbance and habituation to the stilts, which occupied the pond throughout the entire study duration. We assumed salinity of the ephemeral pond was greater than that of the saline pond, and decreased with distance. Our observations showed water height never went above the tarsometatarsus of the stilts, suggesting water depth in the ephemeral pond was approximately 25–35cm (Robinson 1999).

In order to minimize recording disturbances caused by our presence, we waited 10 min after arriving at the freshwater pond before starting observations. We monitored the behavior of individual stilts from 0600–1800 for 5 consecutive days. Approximately 15–20 individuals occurred at the freshwater pond each day during this period. We observed focal animals from ~20 m using binoculars and recorded individual behavior every 60 sec during a 10-min sample interval, producing 10 sample points per focal animal (Altmann 1974); we sampled a total of 1530 sample points. Our categorized behaviors followed that of Hamilton (1975) and Robinson *et al*. (1999): (1) foraging behaviors which include pecking, plunging, scythe-like sweeps, and walking as part of searching; (2) walking behavior which includes an individual walking from one location to another, or to interact with another bird as opposed to moving as a part of foraging activity; (3) maintenance behavior which includes preening, stretching, head scratching and foot-shaking; (4) idle behavior which includes sleeping and loafing on the shore or in the water; (5) other, which consisted of all activities not included in the above categories; and (6) not visible, which was when an individual was shielded from view by vegetation. Because stilts were unmarked, each observer arbitrarily chose a bird and then sequentially scanned to the left or right to select the next individual for the following sample interval. To minimize pseudoreplication, observers notified each other of which bird was sampled in the previous 10-min sample. Nonbreeding plumages prevented us from determining the sex of individuals. We calculated the percentage of the total time spent in each behavior by all observed.

Foraging behavior and other activity patterns, such as idleness, can be affected by tidal patterns that affect prey availability and behavior (Evans 1976, Connors *et al*. 1981, Wilson 1990). Consequently, we examined tidal charts for the area to assess if tidal patterns may have affected any behavioral categories of stilts during our observation period. Even though all of our observations occurred at one pond, interhabitat and interisland movements on and off Guana Island may have affected our stilt observations at the ephemeral pond.

In addition to observations of behaviors of undisturbed individuals, periodic roadside passage of golf carts nearby (5–20 m) allowed us to assess stilt response to this form of disturbance. We recorded the number of vehicle passes per 10-min sample interval and used a chi-square test (Zar 2010), comparing behaviors recorded within 1 min before the vehicle passed to behaviors within 1 min after the vehicle passed, excluding observations where stilts were not visible, to determine if the passage of vehicles influenced the behavior of stilts.

RESULTS

BEHAVIOR

We sampled a total of 153 birds and collected a total of 1530 sample points (Fig. 1). During diurnal hours stilts spent the majority of daytime foraging (41%) or being idle (32%; Fig. 1). Less time was spent in the four other activities combined (27%): walking between locations (14%); engaging in maintenance behavior (7%); other behaviors (~2%); and not visible (2%). The most pronounced difference in behavior occurred from 1500–1700, a large reduction in foraging and a large increase in idle behavior, followed by a sharp increase (53%) of foraging behavior and a sharp decrease (63%) in idle behavior (Fig. 2). The hourly frequency of walking and activities in the "other" category varied little whereas maintenance behavior fluctuated mildly (Fig. 2). Foraging behavior can be affected by tidal patterns which affect prey availability and behavior. Examining tidal charts for the area (NOAA / NOS 2011) showed, during diurnal hours, high tide occurring at 1200 (~0.27 m) after which tidal levels declined steadily throughout the day until low tide at 1800 (~0.182 m). The frequency of walking and activities in the "other" category varied little throughout the day and maintenance behavior increased somewhat during the hours of 0700, 1300 and 1600, but otherwise remained relatively constant hour to hour (Fig 2).

DISTURBANCE

Vehicles passed by the pond at a rate of 12 / hr. Although a few stilts responded to vehicles by mov-

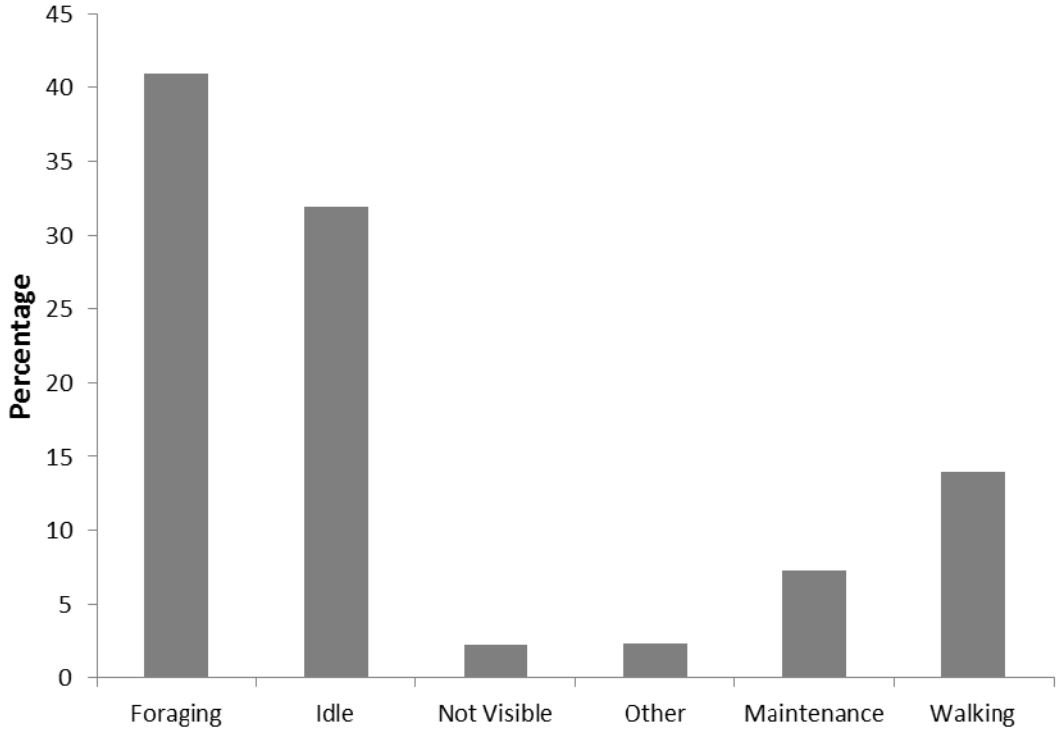

Fig. 1. Composite daytime activity patterns of Black-necked Stilt as a percentage of six behavioral categories during October 2010 on Guana Island, British Virgin Islands. See text for descriptions of behaviors.

ing away or assuming an alert posture, which was recorded as either "walking" or "other," the proportions of five observable activities (foraging, idle, maintenance, walking, and other) performed before and after disturbance were not significantly different ($\chi^2 = 7.12$, df = 4, $P = 0.13$).

DISCUSSION

Regardless of pseudoreplication in our study, Black-necked Stilts on Guana Island during the non-breeding season in autumn clearly spent most daytime hours foraging or idly resting. This result is consistent with an evolutionary strategy of maximizing uptake of energy and minimizing expenditure of energy during the non-breeding season (King 1974). The majority of the behaviors (i.e., walking, maintenance behavior, and those in the "other" category) remained relatively constant throughout the day. The one major change in the frequency of behaviors occurred mid-afternoon when foraging decreased and idling increased, which reversed itself in late afternoon. A number of explanations are available for this behavioral change, including a resource flush and tidal influence (Burger *et al*. 1977, Connors *et al*. 1981, Cullen 1994).

We investigated the possibility that the tidal cycle influenced stilt behavior through prey availability. The closest tidal station to our study area is at St. John Island in the Virgin Islands, approximately 22.5 km SW of Guana Island. Foraging activity among shorebirds usually increases around low tide, due to increased availability of habitat and exposure of prey items (Burger *et al.* 1977). The high spike in foraging activity among stilts occurred at 1700, an hour before low tide. Stilts are visual hunters and are less successful after sunset (Hamilton 1975), which occurred at approximately 1750 during the days we were sampling. The activity lull at 1500 and 1600 could be a necessary rest and digestion period before the large spike in activity at 1700 (Evans 1976). This increase in activity may be correlated to an increase in prey availability in response to tidal influence, which the stilts take advantage of before sundown.

Stilts are known to be aggressive towards people when disturbed during the breeding season (Sordahl 1990, 1996). We expected to see differences in their behavior when disturbed by the vehicles that passed very close to their foraging area at a rate of about 2

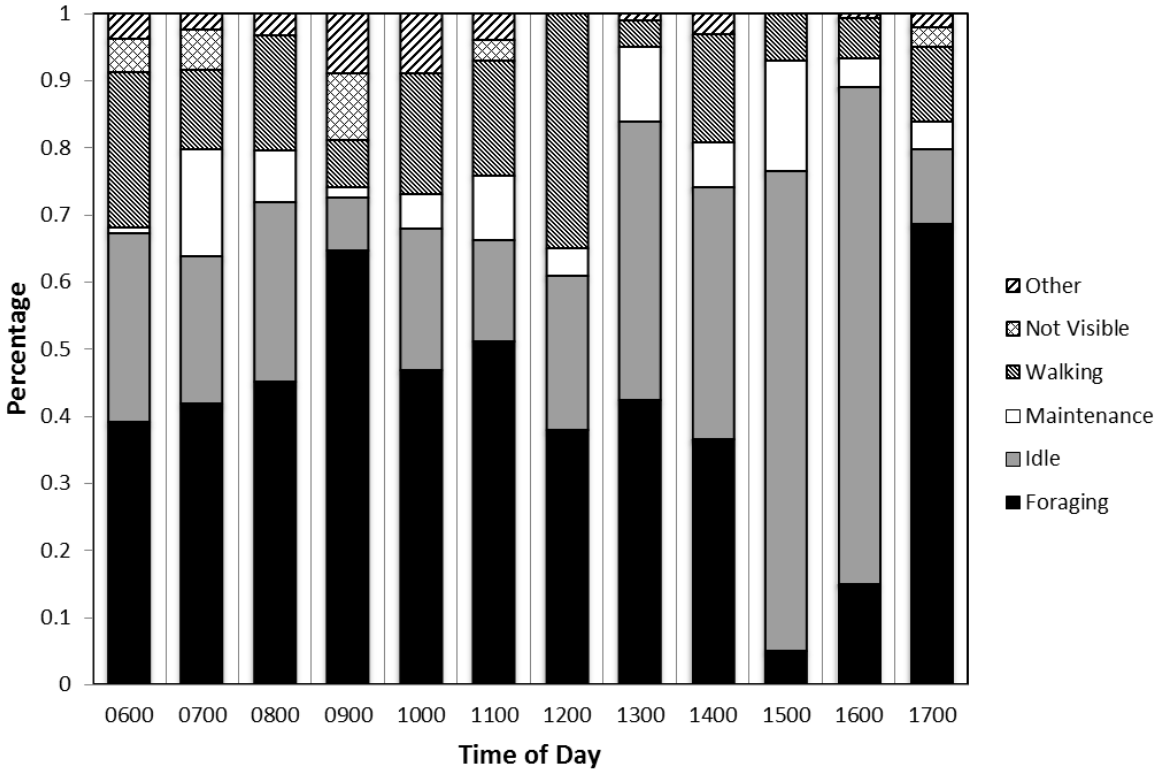

Fig. 2. Hourly daytime activity patterns of Black-necked Stilts as a percentage of six behavioral categories during October 2010 on Guana Island, British Virgin Islands. See text for descriptions of behaviors.

vehicles every 10 min. However, we found no evidence of the birds being disturbed suggesting that the stilts had habituated to the frequent presence of the vehicles.

Understanding how stilts allocate time among different activities during the non-breeding season is very important to understanding their year-round habitat requirements within the context of seasonal interhabitat use and movements. We assume the stilts were found in the smaller overflow pond because the larger pond where they are normally seen became too deep for successful foraging. The results of this study can be used to further investigate the energy budgets of stilts in the non-breeding season.

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