

DUCKS DECODED: GROUP BEHAVIORAL DYNAMICS IN PALO VERDE, COSTA RICA

ELEANOR B.R. PASCALL, BRIAN M. LAPPAS, ALANNA H. PURDY, AND DYLAN D. THOMAS

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Abstract: At daybreak, foraging groups of Black-bellied Whistling Ducks on the Palo Verde marsh in Guanacaste, Costa Rica, settle into groups of varying size. We examined how group size and time of day influence the behavior of individual ducks within these groups. Behavior changed significantly over the course of the day, with most ducks resting at midday and becoming more active at dawn and dusk. Group size was significantly associated with individual behavior, with more aggression in larger groups and more foraging in smaller groups.

Key Words: *Dendrocygna autumnalis*, *group dynamics*, *aggregation*

INTRODUCTION

Black-bellied Whistling Ducks (*Dendrocygna autumnalis*) are abundant in the marshland of Palo Verde, Costa Rica in early January. They break into small groups to forage at night and flock together during the day (Garrigues and Dean 2007). The benefits of daytime aggregation include dilution of predation, group vigilance, and the confusion effect, which minimize an individual's chances of being preyed upon (Parrish and Edelstein-Keshet 1999). However, grouping has its costs, including intraspecific aggression and competition for food. The costs and benefits of grouping, and its effect on individual behavior, have not been adequately investigated.

We hypothesized that group size affects individual duck behavior;

in particular we predicted that larger groups would have more aggression and less vigilance per duck. Less time spent alert for predators would allow individuals more time for feeding (Caraco 1979).

We hypothesized that time of day would influence individual behavior, and specifically that ducks would feed more at dawn and dusk, and rest at midday. Finally, we hypothesized that feeding and non-feeding ducks would be found on different vegetation types.

METHODS

On 16 and 17 Jan 2008, we sampled from an open section of freshwater marsh, 0.5 km from the OTS Field Station of Palo Verde National Park, Guanacaste, Costa Rica, with a high density of *D. autumnalis*. We observed 90

individual ducks from the end of the boardwalk between 0530 and 0630 (dawn), 1030 and 1130 (midday) and 1700 and 1800 (dusk) over two days. We randomly selected a focal individual within a random group. We defined a group as a cluster of individuals within 1 m of each other, and divided the marsh area into three habitat types: water, lilies and boundary (when a group spanned both habitats). We recorded group size, habitat, and the size of the habitat patch (xs, s, m, l and xl, ranging from 1m² to 20m²). A duck's instantaneous activity was noted at 20-second intervals for a 5-minute period. Activities were divided into five categories: foraging, resting, scanning, preening, and flying/walking/swimming. The occurrence of any spar, bite, or charge within the group was recorded as aggression.

We divided the groups into four size classes of roughly equal numbers (xs, s, m, l). To compare the behavior of ducks across different times of the day and group sizes, we ran a MANOVA and computed Wilks' Λ . To test for differences in aggression levels, we used a Wilcoxon/Kruskal-Wallis test to compensate for unequal variances. We compared the habitat selection of feeding and non-feeding ducks with a contingency table and a χ^2 statistic.

RESULTS

Behavior was significantly associated with the time of day (Wilks' $\Lambda = 0.46$, $df = 12$, 154 , $P < 0.0001$) but not with group size class (Wilks' $\Lambda = 0.77$, $df = 18$, 218 , $P = 0.27$). There was no interaction of group size class with time of day (Wilks' $\Lambda = 0.68$, $df = 36$, 341 , $P = 0.71$). Time of day did not significantly affect the mean group size ($F = 0.71$, $df = 2$, 91 , $P = 0.49$).

We observed very little foraging during any of the observation periods (9.1% of all behaviors). The three most common behaviors were resting (39.8% of all behaviors), preening (24.9%), and scanning (20.5%). Most resting occurred at midday, and most scanning and preening at dawn (Table 1).

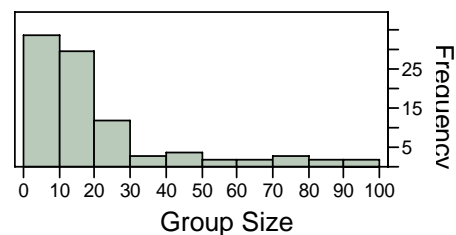


FIGURE 1. Frequency histogram of duck group sizes (16-17 Jan 2008) on the marsh at Palo Verde, Costa Rica.

Aggression level peaked in the largest groups (Table 1), and was affected by group size class (Wilcoxon/Kruskal-Wallis test, approx. $\chi^2 = 7.3$, $df = 3$, $P = 0.06$). Most foraging occurred in the smallest groups (ANOVA, $F = 4.3$, $df = 3$, 90 , $P = 0.007$). There was no difference in scanning ($F = 0.27$, $df =$

3, 90, $P = 0.84$) or preening ($F = 0.58$, $df = 3$, 90, $P = 0.62$) activity between group size classes.

Habitat selection depended on time of day ($\chi^2 = 11.9$, $df = 4$, $P = 0.02$). Ducks primarily rested on lilies (mostly at midday) and fed in open water. Habitat selection of feeding and non-feeding ducks was

significantly different ($\chi^2 = 10.9$, $df = 2$, $P = 0.004$).

TABLE 1. Counts of duck activity on the marsh at Palo Verde, Costa Rica, by group size classes and time of day.

Group size class	Time of day	Foraging	Resting	Preening	Walk/Swim	Scanning	Aggression
XS (2-7 ducks)	Dawn	19	8	65	2	27	3
	Dusk	37	31	37	3	27	0
	Midday	4	37	5	0	16	0
	Totals	60	76	107	5	70	3
S (8-12 ducks)	Dawn	6	0	53	3	17	2
	Dusk	11	59	18	7	28	8
	Midday	0	151	8	0	30	2
	Totals	17	210	79	10	75	12
M (13-21)	Dawn	13	22	57	2	42	10
	Dusk	6	43	22	4	18	1
	Midday	15	50	1	0	4	3
	Totals	34	115	80	6	64	14
L (22-95)	Dawn	4	20	50	3	35	10
	Dusk	10	35	28	5	29	10
	Midday	3	101	4	0	14	2
	Totals	17	156	82	8	78	22
	Overall Totals	128	557	348	29	287	51

DISCUSSION

Although time of day did not affect foraging, it influenced preening, scanning, and resting frequencies. Black-bellied Whistling Ducks spend much of the night flying in search of food, and spend time at dawn preening and scanning

for predators, after settling down to rest for the day. Future studies of *D. autumnalis* foraging should be done at night.

Duck behavior depends on group size and the time of day. Contrary to our prediction, most foraging occurred in the smallest size class, suggesting that intraspecific

competition for food might outweigh the benefits of increased protection in a large group. If predation risk is uniformly low or unrelated to group size (perhaps since an alarm call is audible to nearby groups), ducks may benefit more from being in small groups. This idea is consistent with the observed distribution of group sizes, which was skewed towards small groups throughout the day (Fig. 1).

LITERATURE CITED

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