AN EVALUATION OF INTERSPECIFIC INFORMATION EXCHANGE BY WADERS ON FEEDING FLIGHTS FROM COLONIES

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Introduction

It has been proposed that colonial nesting may be an adaptation for exploiting food, especially where food resources are spatially unpredictable (Krebs 1974, Ward & Zahaui 1973). The idea is that colonies serve as information centers, whereby birds that have been unsuccessful in obtaining enough food at a particular site may locate new feeding sites through cues from successful birds. Furthermore, both Krebs (1977) and Kushlan (1977) have suggested that due to overlap in food habits or feeding sites between several species of wading birds, that interspecific information exchange among waders may occur. If a wading bird can utilize a different species of wader to indicate location of feeding sites, then a value for mixed-species nesting colonies is apparent. Information exchange between birds in nesting colonies is a concept that is difficult to test, and most field studies to date have only provided circumstantial evidence of its occurance.

My study has also been circumstantial, as thus far I have only compared food habits and daily dispersal patterns from colonies between two similar-sized waders. The objective has been to determine if the observed pattern of dispersal was consistent with a predicted dispersal pattern, assuming that interspecific information exchange does occur. My assumptions are as follows:

1. That interspecific exchange between successful feeding birds and unsuccessful birds may occur at the nesting colony, as was suggested by Krebs (1977). Cues might be provided by successful birds while feeding nestlings, or when successful birds make direct departures from the colony to return to feeding sites.

2. That the decision by an unsuccessful wader about which successful wader to follow from the colony to a feeding site is a random choice with regard to the species of wader followed.

3. That this dispersal pattern will result in similar percentages of the total number of each species in each flight line in and out of a colony.

4. If two species of waders show similar patterns of dispersal from colonies, both in direction and distance, then interspecific information exchange could be occuring, but if different dispersal patterns exist, then interspecific information exchange in colonies either does not occur, or it is non-random between species.

Data and discussion presented here are certainly preliminary, as I plan to continue this investigation during 1978. This report is presented with the strong hope that it will stimulate discussion and constructive criticism of my approach to looking at interspecific information exchange.

Methods

I compared dispersal from colonies by Snowy Egrets (Egretta thula) and Louisiana Herons (Hydranassa tricolor), two medium-sized waders that often dominate spring colonies in south Florida, and as shown by Kushlan (1976), are capable of utilizing similar feeding behaviors.

Data on direction of daily flights were collected from three south

Florida colonies, the Lane River colony in 1975, and from Andytown and L-67 colonies in 1977. I also compared the distance that Snowy Egrets and Louisiana Herons flew from the Lane River colony in 1975. The food habits data were obtained as regurgitations from nestling birds in the same three colonies. Lane River contained approximately 850 Louisiana and 750 Snowy nests, Andytown East contained 1200 Louisiana and 1900 Snowy nests, and L-67 contained 850 Louisiana and 1500 Snowy nests.

Statistical tests used in the analysis of these data are from Sokal and Rohlf (1969). A test for equally of two percentages was used to analyze differences in the percentage of each prey species in the diets of Snowies and Louisianas, and for differences in the percentage of these two waders in flight-lines at colonies. Analysis of lengths of each kind of prey taken by the two waders was by an F-test for homogeneity of variances, followed by a one-way analysis of variance between prey with homogeneous variances ($P > 0.05$), and an approximate T-test for differences between two means for prey with heterogeneous variances ($P < 0.05$).

Food Habits

I compared Snowy Egret and Louisiana Heron food to determine if the two species of waders are likely candidates for interspecific information exchange. My assumption is that interspecific information exchange should be strongest between two waders that are capable of taking similar kinds or sizes of prey. I recognize that interspecific information exchange might also operate between species of waders that take different kinds of prey, if the waders feed at the same sites. Thus food habits information by itself does not provide support for the interspecific information exchange concept, although as I just suggested, the safest place to look for an example of interspecific information exchange is a pair of species of waders that feed on similar prey.

I combined food data from different colonies and different years, since I wish to show the species and size of prey that Snowies and Louisianas are capable of taking in the Everglades region. Table 1 shows that Snowy Egrets and Louisiana Herons that nested in spring colonies in interior south Florida in 1975 and 1977 generally fed on the same species of prey. All important prey were small fish, except for the small freshwater prawn, Palaemonetes. I suspect that the one-sided difference in frequency of Cyprinodon in the diets of the two waders, shown by these data, is misleading. Cyprinodon is generally limited to estuarine habitats in the Everglades-mangrove region (Ogden et al 1976), and were more likely to be taken by Louisiana Herons than by Snowies at Lane River colony in 1975 because of differences in where the two waders were feeding, discussed below. Cyprinodon was unimportant in the diets of both waders at the more inland L-67 and Andytown colonies, where Cyprinodon is a relatively rare fish. The strongly significant difference in the frequency of Heterandria and Palaemonetes, however, may reflect real differences in food habitats between the two waders, as this relationship held true when the food data were seperated by colony.

Table 2 shows that Louisianas and Snowies largely fed on the same sizes of each species of fish. Only for a single fish, Jordanella, was there a significant difference between Louisianas and Snowies in the size taken. The discrepencies in sample sizes of Gambusia, Jordanella and Palaemonetes in the two tables are due to the presence of immeasurable but recognizable pieces of prey in the samples.

Table 1.

Prey items from food samples of Snowy Egrets and Louisiana Herons showing significance of differences in percentage of each prey species in total diet.

Prey Item	Snowy Egrets #	Snowy Egrets (% of total)	Louisiana Herons #	Louisiana Herons (% of total)	t_s	
Gambusia affinis	362	(24)	130	(25)	-0.781	ns
Poecilia latipinna	266	(17)	104	(20)	-1.46	ns
Jordanella floridae	124	(8)	56	(11)	-1.89	ns
Heterandria formosa	109	(7)	12	(2)	4.568	***
Lepomis sp.	52	(3)	18	(4)	-0.118	ns
Fundulus chrysotus	96	(6)	42	(8)	-1.46	ns
Cyprinodon variegatus	1	(0.07)	71	(14)	-13.907	***
Fundulus confluentus	85	(6)	50	(10)	-3.12	**
Lucania goodei	35	(2)	8	(2)	1.03	ns
Lepomis punctatus	5	(0.33)	1	(0.19)	0.544	ns
Lepomis gulosus	1	(0.07)	0	(0)	-----	--
Fundulus grandis	5	(0.33)	0	(0)	-----	--
Adinia xenica	2	(0.13)	1	(0.19)	-0.296	ns
Lepomis macrochirus	0	(0)	1	(0.19)	-----	--
Fundulus sp.	0	(0)	1	(0.19)	-----	--
Notropis maculatis	0	(0)	1	(0.19)	-----	--
Palaemonetes paludosus	389	(25)	12	(2)	14.68	***
Dragonflies, etc.	3	(0.20)	6	(1)	-2.309	*
	1535		514			

ns = not significant, ***P≤ 0.001, **P≤ 0.01, *P≤ 0.05

Table 2.

Lengths (in mm) of prey items taken by Snowy Egrets and Louisiana Herons showing significance of differences in length means between the 2 waders for each prey species.

Prey Item	Snowy Egrets n	Snowy Egrets $\bar{x}$	Snowy Egrets ± s.d.	Louisiana Herons n	Louisiana Herons $\bar{x}$	Louisiana Herons ± s.d.	Test statistic	
Gambusia affinis	359	20.97	6.00	130	21.53	4.22	-1.153	ns
Poecilia latipinna	266	29.19	5.81	104	28.63	6.59	0.63	ns
Jordanella floridae	120	26.38	4.73	56	24.41	4.84	6.49	*
Heterandria formosa	109	13.43	3.82	12	13.75	2.80	0.08	ns
Cyprinodon variegatus	1	21.00	----	71	19.89	6.26	----	--
Fundulus chrysotus	96	33.12	6.70	42	31.10	8.31	2.31	ns
Fundulus confluentus	85	38.29	6.52	50	35.38	11.85	1.615	ns
Lepomis sp.	52	34.96	9.10	18	30.39	6.75	3.80	ns
Lucania goodei	35	19.80	5.22	8	20.50	5.68	0.11	ns
Lepomis punctatus	5	44.60	4.28	1	44.00	----	----	--
Lepomis gulosus	1	69.00	----	0	-----	----	----	--
Fundulus grandis	5	42.40	8.56	0	-----	----	----	--
Adinia xenica	2	22.50	2.12	1	25.00	----	----	--
Lepomis macrochirus	0	-----	----	1	34.00	----	----	--
Fundulus sp.	0	-----	----	1	43.00	----	----	--
Notropis maculatus	0	-----	----	1	52.00	----	----	--
Palaemonetes paludosus	211	8.97	1.86	12	9.42	1.78	0.66	ns

ns= not significant, *P 0.05.

t_s for F. affinis and F. confluentus; Fs for all others.

Dispersal Patterns

Flight-line direction

My objective was to look for evidence that supports the third assumption previously mentioned, that if interspecific information exchange does operate in colonies as a mechanism where unsuccessful birds locate feeding sites by randomly following successful birds from the colony, then similar percentages of the total number of Snowy Egrets and Louisiana Herons in the colony will be in each flight-line in and out of the colony. Similar flight-line patterns between the two waders would support but not prove random interspecific information exchange, but if the two species show different flight-line directions, then either interspecific information exchange does not occur in the colony, or it is non-random between species.

The movement of Louisianas and Snowies in and out of both the L-67 and the Andytown colonies was on two well-defined pathways, which I call flight-lines, each a rather broad front of birds moving to and from the colony in generally similar compass directions. At these two colonies I counted the number of each species in each flight-line during 15 or 30 minutes on several different days. Birds at Lane River were moving in all compass directions, so I divided the colony along east-west and north-south compass lines, and counted birds for set periods of time in each quarter section.

Results of the counts are shown in Figure 1. The question asked was what percentage of the total number of Louisianas leaving and entering the colony were in each flight-line, and were these percentages significantly different from similarly computed percentages of Snowies in each flight-line? At Andytown East, on three different days, the percentage of each wader in each flight-line was significantly different at the 0.001 level, thus Snowies and Louisianas were following different patterns entering and leaving that colony. The percentage of these two waders in each flight-line was also significantly different at the L-67 colony, although only at the 0.01 level. Comparisons between the percentage of each species in most Lane River flight-lines were either not significantly different, or different only at the 0.05 level.

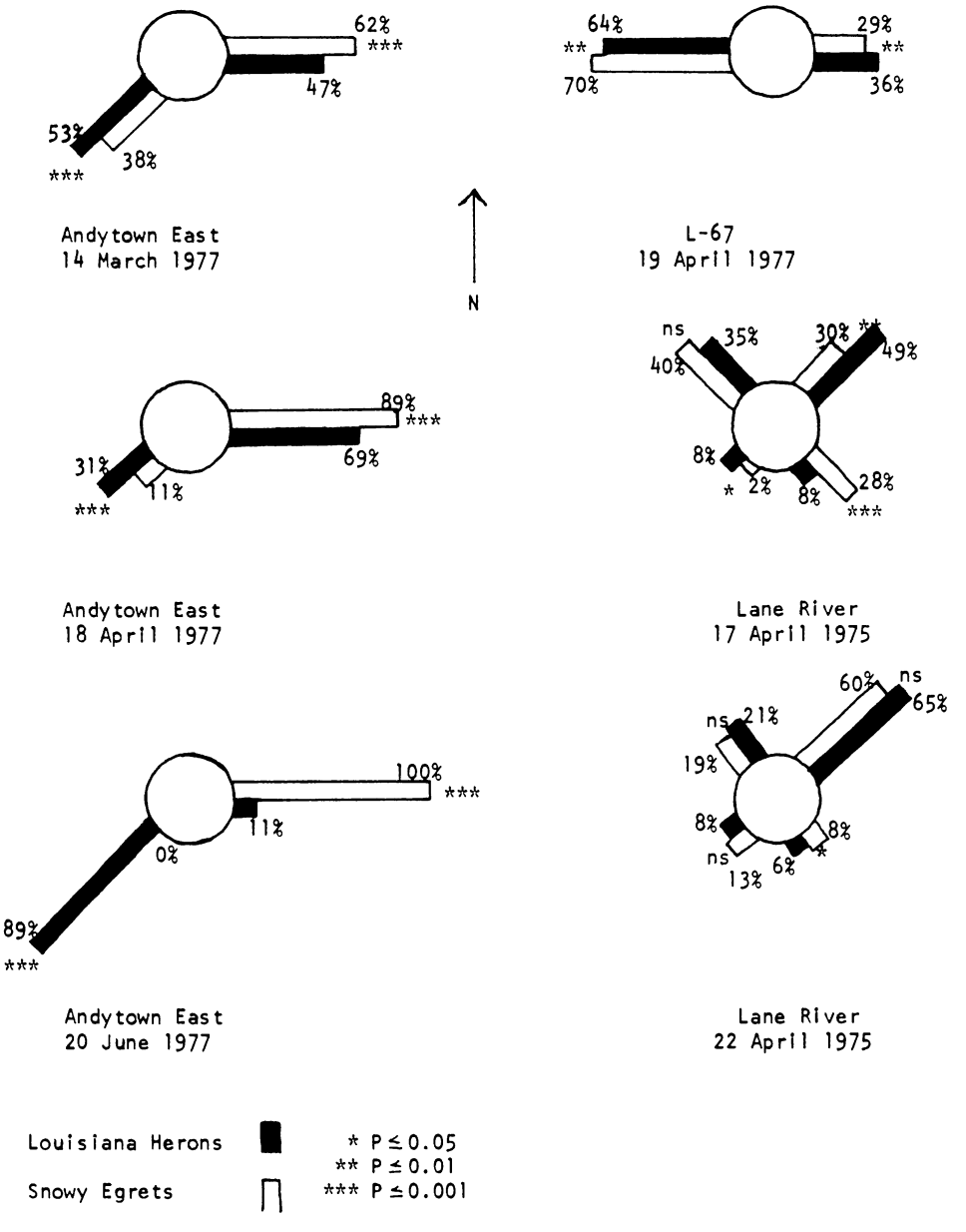
Flight distance

I was able to quantitatively compare distances that Snowy Egrets and Louisiana Herons traveled to feeding sites at the Lane River colony. These data are shown in Fig. 2. In this figure I compared on three or four different days the ratio (expressed as percentage) of Louisianas and Snowies in the southeast flight-line leaving the colony with the ratio of these two species feeding along a transect one mile out from the colony in the same quarter, and with the ratio of each species still in the same flight-line six miles out. These data show that Louisiana Herons were traveling shorter distances from the colony than were Snowies. In this case, the different distances traveled by most individuals of the two species resulted in the two feeding in different habitats. Louisianas, which stopped closer to the colony, fed around mangrove ponds, while Snowies fed further inland in freshwater marsh.

For logistical reasons I was unable to make similar comparisons on the other 3 quarters of the colony, except for a single day on the northeast flight-line. On that day 52% of the birds leaving the northeast quarter of the colony were Snowies and 48% were Louisianas, while eight miles out along the same flight-line, during a 15 minute count of 75 birds, 97% were Snowies and 3% Louisianas. Thus it appears that while there was not a strong difference between the two waders in the direction they left the Lane River colony, the two did travel different distances.

Figure 1

Flight line directions for Snowy Egrets and Louisiana Herons at three South Florida colonies.



Discussion

Thus far it appears that random interspecific information exchange between Snowy Egrets and Louisiana Herons does not occur at the south Florida colonies. Although the two species fed on similar prey, they tended to disperse in different directions from the colonies, and at one site, traveled different distances from the colony.

Due to the preliminary nature of this project, I do not presently wish to discuss or speculate at length on the data. As food for thought, however, two comparisons between Louisiana Herons and Snowy Egrets are of interest, based on my observations at the three colonies. Both comparisons, if valid, exclude the possibility that interspecific information exchange between the two waders is important.

I noted a distinct difference in levels of sociality during feeding and flocking between Louisianas and Snowies, with the Snowy tending to be the more social. I compared percentages of birds leaving Lane River in groups of two or more on 17 April 1975, and found 29 percent of Snowies and 15 percent of Louisianas leaving in groups. My impression of dispersal at this colony was that Snowies more often tended to travel in groups via well defined flight-lines to feeding grounds, while Louisianas showed a pattern of broad dispersal of single birds feeding closer to the colony. A similar pattern was found at the Lake Alice colony in north Florida by Jenni (1969), who reported that Snowy Egrets "were more social in their feeding than were Little Blue Herons and Louisiana Herons, and many individuals fed together in small areas, ..." By comparison, Jenni described Louisianas as "normally solitary feeders... feeding individuals were widely scattered..."

Differences in feeding location between Snowy Egrets and Louisiana Herons would reduce competition between two species with similar food habits (competitive exclusion), a factor that may be important in regions where food is limited. Jenni (1969) reported that "...differences in feeding behavior coupled with differences in preferred feeding areas tended to reduce competition for food between..." Louisiana Herons, Snowy Egrets and Little Blue Herons. My impression of food availability in the Everglades, after ten years of observation, is that most waders are flexible enough in selection of nesting and feeding sites so that food is not likely to be an important limiting factor except in years when water levels are unusually high or low in the marshes. It is not known just how high or how low regional water levels in the Everglades need to be before most medium-sized waders have difficulty obtaining food, although the present work by James Kushlan should provide these data. So the frequency of adverse food years remains unknown, and the significance of "competitive exclusion" in the Everglades region is undetermined.

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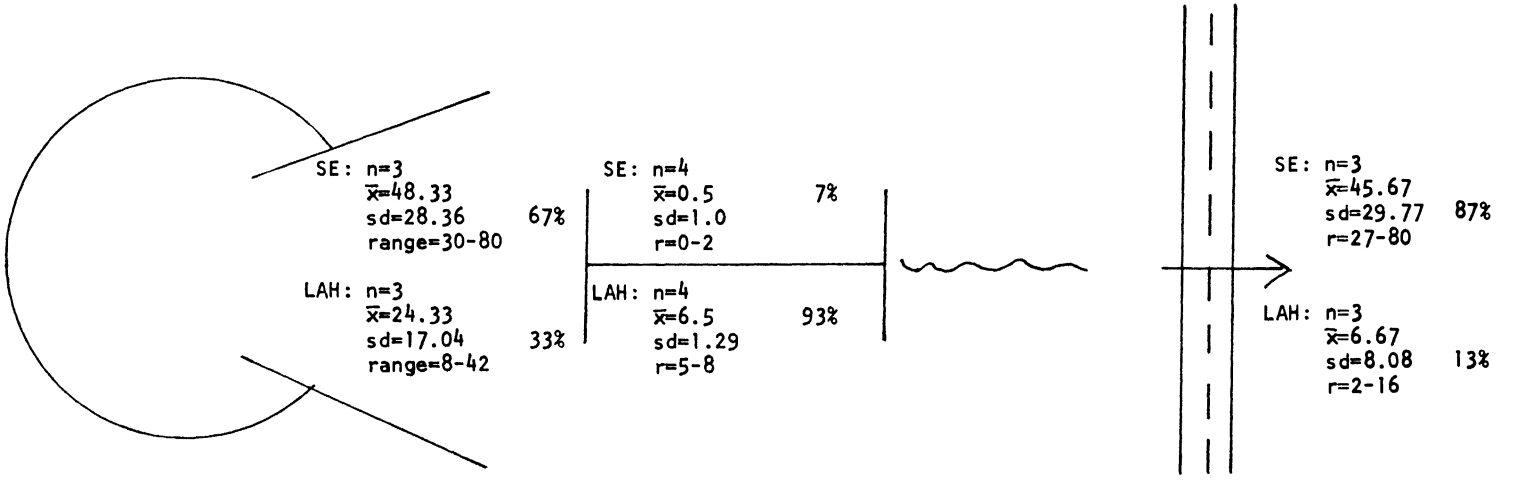
Summary

It has been proposed that colonies of nesting birds serve as information centers, whereby birds that have been unsuccessful in obtaining enough food at a particular feeding site may locate a new site through cues from successful birds in the colonies. Further, information exchange may be interspecific in mixed-species colonies with generalized food requirements, such as



Lane River Rookery flight lines leaving colony in eastern quarter.

1 mile feeding transect along Lane River.

Highway at 9 mile Pond - Birds counted as they flew over.

Figure 2.
Observations for Lane River Rookery, April, 1975.

wader colonies. I looked for evidence of interspecific information exchange between Louisiana Herons and Snowy Egrets in south Florida mainland colonies, primarily by examining daily patterns of dispersal from the colonies by the two waders. I found that the two waders have very similar diets, both in percentage and size of each prey species, but that they may disperse in different directions or different distances from colonies. These data suggest that interspecific information exchange between these two waders in the south Florida colonies either was not important during the two years that I collected information, or that it is non-random between the two waders.

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