Movement Patterns of Wilson's Plover Chicks

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Abstract: The period between hatching and fledging is understudied for many bird species, including Wilson's Plover (*Charadrius wilsonia*). To monitor chick movements during the time period between hatching and fledging, Very High Frequency (VHF) radio tags were deployed on 13 recently hatched chicks, which were then tracked via radio telemetry daily. Locations and times were recorded for each successful re-location, and these data were mapped and used to calculate chick speeds. Four chicks traveled more than 20 meters per hour at ages varying from 2-5 to 13-14 days, which we classified as "*travel movements*". The other movements of those four chicks, as well as all movements of the remaining 9 chicks, were classified as "*foraging movements*", which made up 89% of the recorded movements. The mapped data show that chicks cluster together in common areas while foraging, despite their nests being spread out over a much larger area. The chicks that traveled the furthest hatched in nests far from the foraging sites, so it appears that Wilson's Plover chicks are capable of moving large distances necessary to reach common foraging sites, despite being only a few days old. This suggests a patchy distribution of good-quality foraging habitat and perhaps some benefit of foraging near conspecifics, e.g., group defense or information sharing. Given declines in bird populations worldwide, the importance of determining what constitutes a healthy habitat cannot be understated.

Introduction

For many shorebirds, the period between hatching and fledging is understudied, and the activities and locations of the birds during this time frame are largely unknown. This is due to difficulties in monitoring and tracking techniques, and significant progress can be made in avian ecology by improving these techniques. Szekely (2019) highlighted the importance of investigating the ecology of plovers and other shorebirds, given that they often have novel adaptations and behaviors. One such species that has been the subject of little research is Wilson's Plover (*Charadrius wilsonia*). Zinsser et al. (2017) showed that before hatching, the most common sources of Wilson's Plover nest failure are predation and washout (inundation by seawater or precipitation during storms), but after hatching very little is known about their survivorship, parental investment, location, movement patterns, and behavior. Our study tracks the intermediate growth period between hatching and fledging in Wilson's Plover chicks, which lasts about 28 days.

Related species like the Piping Plover (*C. melodus*) and Snowy Plover (*C. nivosus*) can be used as proxies to make predictions and generalizations. It is important to understand the factors that drive habitat selection, because as habitats change due to human influence, those factors may no longer correlate with increased fitness. Catlin et al. (2019) found evidence that the impact of nest-site selection on survival was largely dependent on the degree of habitat degradation and Catlin et al. (2011) found that engineered environments can offer even better habitats for Piping Plovers than managed natural sites. Understanding what constitutes a good habitat is key to preventing further losses in the populations and genetic diversity of plovers, as creating and maintaining those conditions may be the only viable remedy to habitat degradation. Habitat degradation due to environmental exploitation is unlikely to stop in the near future, so more immediate solutions are essential. By examining Wilson's Plover chick movement patterns to identify foraging sites, we can start to understand what constitutes a good foraging site.

This study occurred from April to July (the regional incubation time of Wilson's Plover) of 2019 on Elmer's Island, a barrier island in South Louisiana in a region home to 75-100 Wilson's Plover pairs. Wilson's Plovers eat primarily fiddler crabs (genus *Uca*), so foraging habitats for growing chicks require high concentrations of fiddler crabs (Zdravkovic 2013). This study seeks to investigate the movements and activities of Wilson's Plovers after hatching and before fledging.

Methods

Wilson's Plovers are beach-nesting birds that typically lay their eggs on the ground with moderately vegetated cover, although nest placement can vary dramatically. Nests typically house 2-3 eggs (3 being more common), and there is biparental care for both the eggs and the chicks. After hatching, the nest is abandoned as soon as the chicks are capable of walking, which can be less than an hour. Chicks forage for food themselves but are led and protected by their parents (Zdravkovic 2013).

The study site, Elmer's Island, is a barrier island that has recently undergone restoration efforts to provide more habitat for the many species of birds that migrate through every

year. The chicks monitored were located within a 1 mile stretch of the island that included beach, sand dunes, rocky soil, and vegetated flats. One chick (#177) was tagged and monitored at Grand Isle State Park approximately 9 miles east of Elmer's Island.

In May and June of 2019, Wilson's Plover nests were monitored, and eggs were floated (Hood 2006) to determine estimated hatch date (EHD) so that chicks could be tagged shortly after hatching. Holohil Very High Frequency (VHF) tags, model LB-2X, were deployed on 13 chicks using super glue once they were hatched, dry, and weighed over 8 grams. The tags had an estimated battery life of 21 days (Holohil Systems Ltd.). To ensure a more secure glue adhesion, scissors were used to cut away a small patch of down feathers between the scapulars. Chicks were also banded with federal identification bands and a unique combination of color bands. The chick IDs used in this report are the last three digits of their federal band ID. Individuals were then tracked throughout the post-hatching period using a radio telemetry receiver. Weather permitting, chicks were tracked every day after tagging until no signal was detected, sometimes more than once per day. While using the receiver, researchers would walk through the study sites in a systematic manner, pausing approximately every 30 meters to scan all channels in every cardinal direction. Once a signal was detected, it would be followed until signal strength was high, at which point the detection strength would be lowered and the chick would be located via triangulation.

In addition to daily radio telemetry tracking, surveys were conducted at least twice a week at each site to record band resights of adults and older chicks. When individual chicks were located, several data points were recorded: site, observer(s), coordinates, time, how detected (present, absent, triangulation, resight), and suspected parents and parents' behavior.

To calculate distance traveled between sightings, and consequently speed, the distHaversine function in the R package "Geosphere" was utilized in Program R (R Core Team). Speeds below 20 meters/hour were categorized as "*foraging movements*", and speeds above 20 meters/hour were categorized as "*travel movements*". *Foraging sites* were identified based on a visual clustering of the most frequent locations of the foraging movements.

Results

Of the 13 tagged chicks, 10 were relocated at least once. Two foraging sites were identified: a "*Primary Foraging Site*" in the vegetated flats behind the beach where most chicks went shortly after hatching, and a "*Secondary Foraging Site*" used only by two chicks on the beach front (Figure 1b). 59 of the 66 chick movements (89%) were categorized as foraging movements (<20 meters/hour). Travel movements were rare and the seven observed were in four individuals (Table 2; Figure 1).

The mapped chick movements (Figure 1b) showed convergence on the foraging sites. Travel movements ranged from ~100 meters to over 1km (Table 2; Figure 2), demonstrating the scale of movement by Wilson's Plover chicks. 5 of the 7 travel

movements were made by four chicks at 2-5 days old. Chick #180 made additional movements at ages 13 and 14 days, moving 888 meters from the Secondary Foraging Site to the Primary Foraging Site after first making a movement of 839 meters from its nest to the Secondary Foraging Site at 4 days old. Siblings #155 and #158 moved 104 meters in the first 2 hours after tagging, and though they were moving toward the Primary Foraging Site, we cannot be sure of their destination because both tags failed. Chick #170 moved the furthest, traveling almost 2 km from its nest to the Primary Foraging Site between 4 and 5 days after hatching (Table 2; Figures 1, 2).

Four chicks were detected after fledging on the resighting surveys (#158, #142, #171, #170), and all such detections were within 300 meters of the previous known location (Figures 1a, 2). Chick #177, the individual at Grand Isle State Park, is excluded from the map in Figure 1b, but all other data are included.

Table 1: Radio Tagged Wilson's Plovers Chicks 2019. Groups of chicks from the same nest, i.e. siblings, are highlighted together. *Chick #177 was tagged in Grand Isle State Park while all others were tagged in Elmer's Island

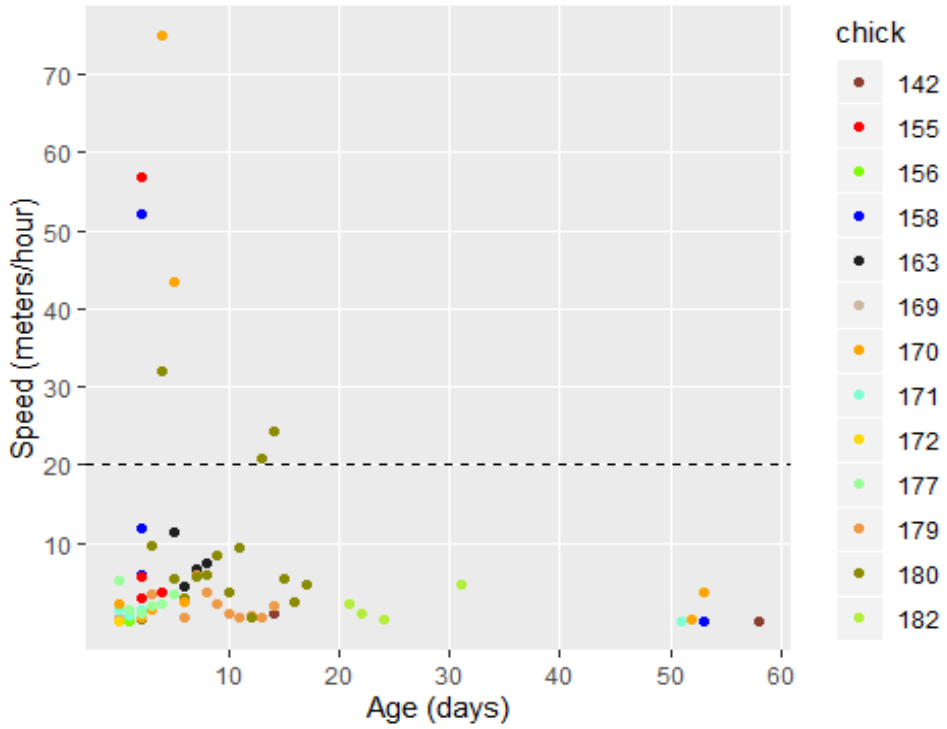
Chick ID	Date Tagged (2019)	Age Tagged (days)	Age at Final Resight (days)	Resighted as Fledgling?	Number of Times Located (including fledgings)	Number of Foraging Movements	Number of Travel Movements	Nest Location Known?	Distance of Nest from Primary Foraging Site (meters)
142	6/4	12	46	Yes	3	2	0	No	N/A
155	5/26	1	4	No	5	4	1	Yes	810
156	5/26	1	1	No	1	0	0	Yes	810
158	5/27	1	51	Yes	5	4	1	Yes	810
163	6/21	5	8	No	4	4	0	Yes	730
180	6/17	2	17	No	16	13	3	Yes	730
169	6/9	0	0	No	1	1	0	Yes	280
170	6/11	2	50	Yes	8	6	2	Yes	280
171	6/10	0	49	Yes	3	4	0	Yes	280
172	6/10	0	0	No	1	0	0	Yes	500
177*	6/15	0	5	No	6	6	0	Yes	N/A
179	6/16	2	15	No	13	11	0	No	N/A
182	6/23	20	31	No	5	4	0	No	N/A

Table 2: Travel movements

Chick ID	Speed (meters/hour)	Distance Traveled (meters)	Time Between Sightings (hours)	Age (days)
155	56.94	104	1.8	2
158	52.2	104	2	2
170	74.99	961	12.8	4
170	43.44	1024	23.6	5
180	31.88	839	26.3	4
180	20.76	315	15.2	13
180	24.37	573	23.5	14

Figure 1: (a) Wilson's Plover chick speeds by age. The dashed line indicates classification of foraging and travel movements. (b): Map of Chick Movements. Colors correspond to same chicks as in (a), and lines between points represent movements. The orange outlined area is the Primary Foraging Site and the blue outlined area is the Secondary Foraging Site.

(a)



(b)

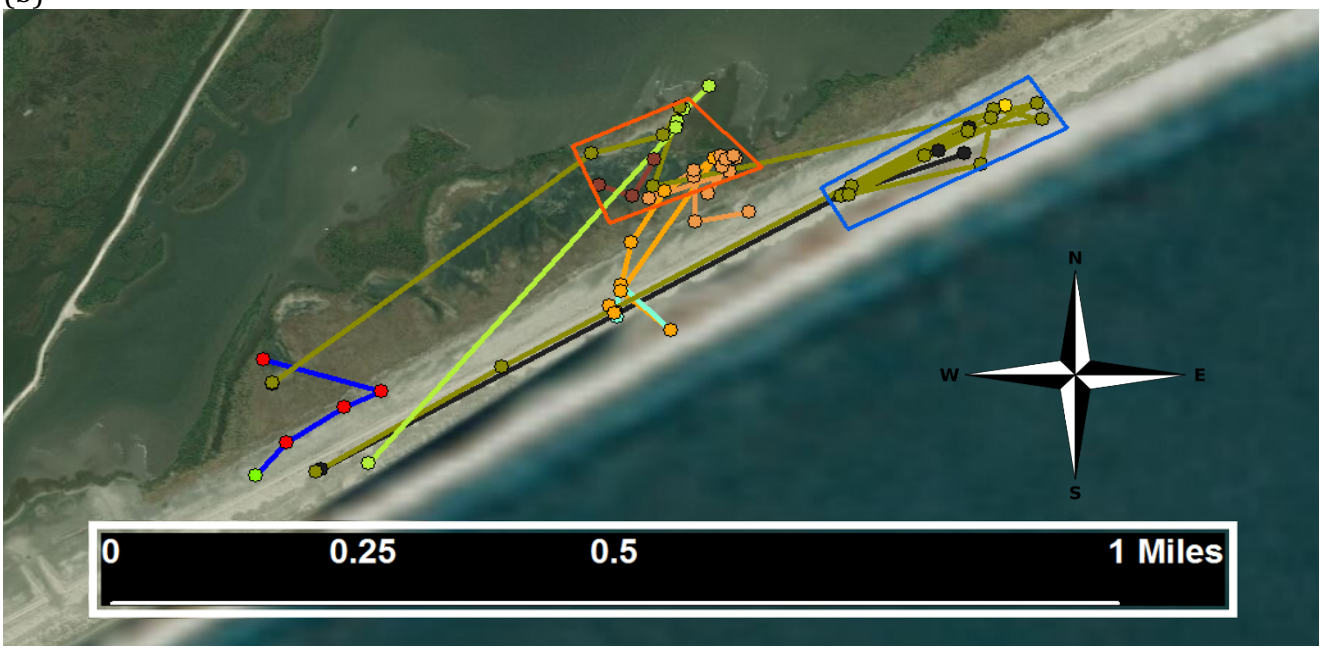
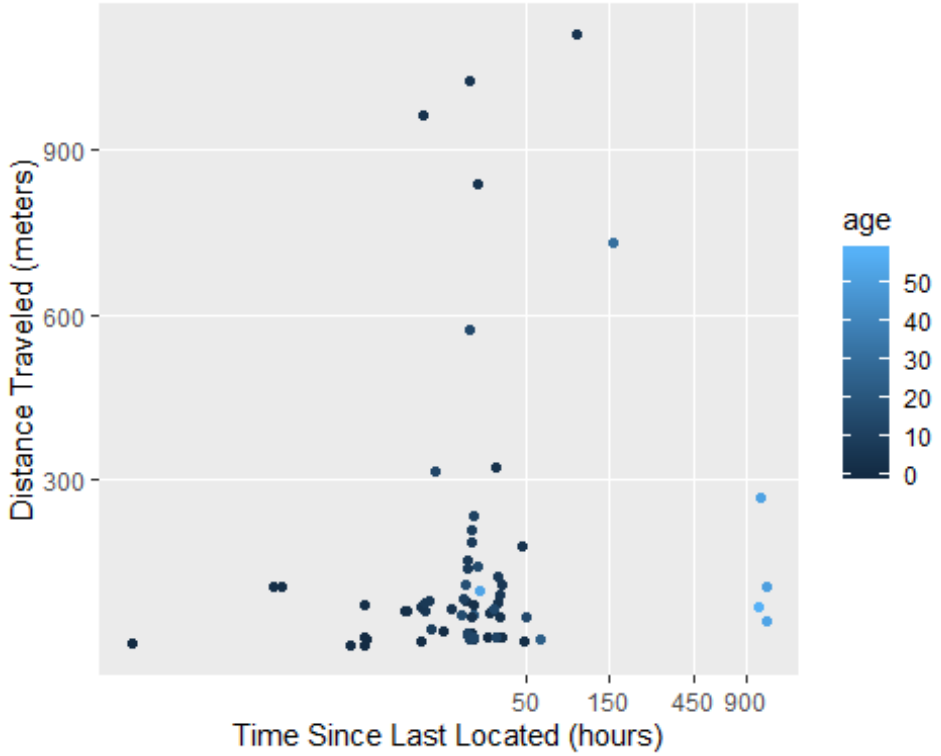


Figure 2: Distance traveled by time since last sighting



Discussion

Movements below 20 meters/hour were defined as foraging movements and those faster than 20m/hour as travel movements. The fastest foraging movement recorded was 11.94 meters/hour. All seven of the travel movements are toward foraging sites, and five of these occurred in the first 5 days after hatching. Chick #180, which initially moved to the Secondary Foraging Site, made 2 later movements at ages 13 and 14 days to the Primary Foraging Site. Chick #180's sibling, #163 was located with #180 at the Secondary Foraging Site 5 days after hatching, but it was never relocated moving toward the Primary Foraging Site. This could be the result of the VHF tag detaching or mortality. The reason for the use of the Secondary Foraging Site is unclear, as it is further from the nest of 180 and 163 than the Primary Foraging Site.

While all travel movements were detected in young chicks, not all young chicks moved so quickly. The majority of young chick movements were classified as foraging movements, which leads to the question of why some young chicks move so far while other remain relatively stationary. Since the greatest chick movements were by chicks far from the foraging sites, chick speed is likely determined not only by age, but also by proximity of the

nest to a suitable foraging site. Future research could investigate possible fitness benefits associated with nesting nearer to a foraging site.

Another important question is what defines the bounds of the foraging sites? An easy assumption would be a high concentration of fiddler crabs, but this may not be the case. Schulz and Leberg (2019) found no difference in Piping Plover prey abundance between foraging and random sites, and the same trend could apply to Wilson's Plovers. Wilson's Plovers are known to engage in group defense while protecting nests, and they may do the same when protecting chicks. Additionally, a Least Tern (*Sternula antillarum*) colony was adjacent to the southwest side of the Primary Foraging Site, which could limit foraging activity due to territoriality on the part of the Least Terns. This effectively cut off the Wilson's Plovers from the rest of the vegetated flats, which could have potentially also been suitable foraging habitat.

Only four chicks were tracked and located more than five times, primarily because the VHF tags tended to fail. We do not fully understand why this happened. It could be that the parents pulled the tags off, or the glue could have deteriorated over time. One of the original intentions of this study was to estimate survival rates of Wilson's Plover chicks, but the lack of data made this impossible. Despite this, the conclusions drawn could guide future research questions, and further research could improve the methods. In the upcoming season, we plan to place cameras on nests, which could determine if parents are playing any role in removal of tags as well as determining causes of nest failure. Aside from reducing tag or glue failure, another improvement could be placing radio telemetry towers throughout the habitat to constantly track chicks. This would require more resource investment but, if done correctly, could provide an accurate triangulation update every few seconds, and provide more clarity as to the fates of the chicks. This would also reduce the disturbance otherwise caused by researchers walking through the habitat every day.

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