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# Nest Site Characteristics of Piping Plovers (Charadrius melodus) on the South Fork of Long Island, NY

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Nest Site Characteristics of Piping Plovers (*Charadrius melodus*) on the South Fork of Long Island, NY

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**Abstract**

To properly manage the populations of endangered birds it is important to understand the factors affecting nest survival. Ground nesting birds, such as the Piping Plover (*Charadrius melodus*), are at risk of nest loss from predation and tidal flooding, which varies among nesting sites. Nest site selection characteristics may affect those threats. I compared nests from the low-wave energy Peconic Bay shorelines (n=25) and the high-wave energy Atlantic Ocean shorelines (n=26) on the South Fork of Long Island, NY in 2013. I measured nest site characteristics including the substrate composition and vegetation cover as well as nest distance from vegetation and high tide line. Mean ± SE percent sand cover was greater for ocean nests (87.61%±1.63%) than bay nests (51.44±3.76%; $P < 0.001$), as was percent vegetation cover (Ocean-7.80±1.75%; Bay-1.34±0.68%; $P < 0.001$). Percent shell cover was greater for bay nests (10.34±1.54%) than for ocean nests (2.56±0.73%; $P < 0.001$). The distance to the high tide line relative to the width of the beach (distance/width) was 0.87 for ocean nests and 0.72 for bay nests. These findings can be used to assist land managers in the protection of the threatened Piping Plover. Understanding the nest site characteristics, land managers can use vegetation management on ocean beaches due to the large percent of vegetated nests, and continue predation management on both bay and ocean beaches. Also understanding the preferred nest sites, pre-nest fencing can be established to protect ideal nesting habitats from human disturbance.

*Key words*: *Charadrius melodus*; endangered; habitat; nest site selection; New York; Piping Plover

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I would also like to thank all of the professors at ESF that I have come in contact with. Throughout my time at ESF I have enjoyed my classes and have encouraged the growth of my love for my field. The professors have high standards of their students, which push us to excel in our field. I would especially like to thank Dr. Greg McGee who helped me find and accept an internship with the Nature Conservancy on Long Island for the summer of 2013. Dr. McGee has been a great mentor for me the past two years and I am grateful for all of his help. I would also like to thank Dr. Jonathan Cohen, my Honors Advisor, for all of his help and patience with my project. His expertise with Piping Plovers was a great help and was of great assistance throughout my project. Dr. Cohen was always willing to take time from his schedule to meet and discuss my thesis. I am very grateful for his advice and help throughout the whole process.

I would like to also thank Joe Jannsen of the Nature Conservancy and the Town of Southampton Plover Stewards for their help over the summer. Joe was very accommodating this summer allowing me to collect my Piping Plover data in addition to my work with the Nature Conservancy. The Town of Southampton was extremely helpful in showing me the location of the nests. They often went out of their way to help me and I am very thankful for that. My experience this summer was fantastic for collecting my data, but I also learned so much about the Nature Conservancy and about wildlife and natural resources policy.

Lastly, I would like to thank Dr. Shannon Farrell for being my second reader. Although she became involved on short notice, she was willing to take time from her busy schedule to help improve my thesis.

Advice to Future Honors Students

Completing my Honors project has been one of the most rewarding tasks that I have accomplished in my academic career. Having to complete a project in addition to excelling at a university such as ESF is not an easy task, but it has provided many lessons and I believe it has prepared me for my future. With the lessons I have learned there are a few suggestions that I would like to make for future honors students.

First I would like to say is this is not a requirement to graduate. It is designed for students who have excelled at ESF to challenge themselves further and complete a project that will benefit them. It is important to take on this extra assignment only if you desire to be challenged and to learn more about your field. It will take a lot of time from your schedule, and will bring a little more stress to your life, but if you play your cards right it will be an incredible experience and worth all of the work.

Second, choose a project that you are passionate about and something that will keep your interest for a long time. There will be many hours spent working on the project and since it is not required you should be enjoying most (if not all) of those hours. It will be a long and boring project if a topic you are not interested in is chosen.

Lastly, manage your time properly. I conducted all of my research in the summer prior to senior year and spent the entire fall semester working on my project. I met with my advisor, Dr. Cohen, once a week and would tackle a small portion of my project. Since I only worked on my project a few hours a week for the entire semester I was not overwhelmed with my other schoolwork and I never grew tired of my project. It was also always fresh in my mind since I didn’t take too long of breaks, and then realize I had a lot of work to be done. If you budget your time the project will be enjoyable and extremely successful.

I was hesitant at first about joining the Honors Program and completing the project. I am now extremely happy that I decided to accept the challenge and am proud of what I have accomplished. I recommend that you accept the challenge if you are looking to gain experience in your field and want to prepare yourself for life after college.

# INTRODUCTION

The Atlantic Coast population of the Piping Plover (*Charadrius melodus*) has significantly increased during the 1990s due to the intensive management efforts of multiple organizations (USFWS 1996). Piping Plover nesting habitat is crucial for their survival, and the intensive management of nests has helped with their nest survival. Piping Plover nests are located on sandy beaches between the dunes and high tide level with little to no slope (Cairns 1982). Studies in New York have found that the nest sites were sparsely vegetated and most often located on bare sand (Cohen et al. 2008). Reproductive success is influenced by nest site selection. Poor quality sites can lead to high predation rates, or flooding from storms or high tides (Sidle et al. 1992, Lauro and Tanacredi 2002, Roche et al. 2012). Piping Plovers often renest in the same season if their first nest is destroyed. Movement of the nest location is often in response to flooding or predation of the previous nest (Burger 1987). First nest sites and renest sites may differ in their substrate and vegetation characteristics, implying that a variety of substrate types should be protected from human disturbance to allow for alternate nest sites. By understanding the characteristics of first nests and renests, land managers will be able to better protect the nesting habitat of this threatened species.

Combining nest site characteristics (substrate and vegetation cover) with surrounding habitat features (distances to vegetation and high tide) can provide a more thorough understanding of the factors that define ideal nesting areas. By understanding nesting characteristics of Piping Plovers, organizations can continue directed intensive management actions and reach the recovery goal of 2,000 breeding pairs in the Atlantic Coast population (USFWS 2009). The purpose of this study was to 1) compare the percent sand, shell and basal vegetation cover between nests in low-wave energy but narrow bay shores and those in high-wave energy, broader ocean shores 2) Determine birds preference of proximity to vegetation or the high tide line, and if those distances differed between bay and ocean nests 3) Test if there is a relationship between shell cover percentage and the distance to the high tide relative to beach width of the nests.

## METHODS

### *Study Area*

I studied Piping Plover nests from May to August 2013 in two zones on the South Fork of Long Island, NY (40° 56' N, 72° 23' W). The nests were located along 29.4 km of Atlantic Ocean beaches, the Peconic Bay, and other nearby bays. Nesting habitat consisted of backshore, sparsely vegetated dunes, heavily vegetated dunes and developed areas. Ocean beaches tended to be wider between the high tide line and vegetation than bay beaches, with larger dunes. Bay sites consisted of smaller dunes with greater coverage of pebbles and shells. Piping Plover nests were monitored by the Nature Conservancy, Town of Southampton or Town of East Hampton following the USFWS guidelines. Some beaches were open for human recreation including swimming, and surfing. Other beaches were closed to the public.

### *Field Methods*

The Nature Conservancy, Town of Southampton, Town of East Hampton, and I conducted nest searching and monitoring during the summer of 2013. All potential nesting habitat was thoroughly searched throughout the breeding season. Nests were found by walking the beaches and observing the behavior of breeding Piping Plovers.

Piping Plovers would flush as we approached active nests. We would then leave the area to observe the nest to determine that the adult resumed incubation.

After the nests were located, I estimated the percent substrate cover of each nest using a 0.25m$^2$ quadrat (0.5 m X 0.5 m) with a string grid with 36 grid intersections and the center square over the nest (Cohen et al. 2008). The string grid had two layers 5cm apart to make sure my eye was directly over the substrate in question. I recorded the substrate cover under each intersection as sand (<2 mm), pebbles (2 mm to 64 mm), cobbles (>64 mm), shells, deadwood, or basal vegetation (if the stem of the plant was located at the intersection). Using a Garmin eTrex 20, I recorded the GPS coordinate of the nest, nearest high tide level, and closest dense vegetation (20 stems/m$^2$).

*Data Analysis*

I calculated the percent cover for sand, shells and basal vegetation as the number of grid intersections of the substrate component in question over the total number of intersections. I compared the mean percent cover of sand, shells and basal vegetation between nests located on ocean and bay beaches using a Student T-Test.

I used ArcGIS© "Measure" tool to measure the distance from the nest to the high tide level, and the nest to the vegetation (ESRI 2013). I calculated high tide distance by total beach width (h/w). Beach width was defined as the distance from the high tide line to vegetation. I used the Student's T-Test to compare this ratio between the ocean and bay sites.

Percent shell coverage of the nests may be influenced by the location of the nest on the beach. I used linear regression to determine if there was a relationship between the shell cover percentage and the h/w ratio of the nests. Since shell cover occurs in bands on the beach and the width of beaches varies across the study area, we controlled for beach width in the regression.

## RESULTS

We found and monitored 51 Piping Plover nests in 2013, 26 on the ocean and 25 on the bay study area. The nest site characteristic of percent sand cover around the nest was higher for nest sites at the ocean study area (87.61±1.63%) compared to the bay (51.44±3.76%; $P < 0.001$) (Fig. 1). The percent shell was higher for bay nests (10.33±1.54%) than ocean nests (2.56±0.74%; $P < 0.001$) (Fig. 2) and percent basal vegetation was greater for the ocean (7.80±1.75%) compared to the bay (1.33±0.68%; $P = 0.002$) (Fig.3). The local condition of h/w was greater on the ocean (0.87±0.03) than the bay (0.72±0.04; $P = 0.006$) (Fig. 4).

There was not a significant difference between bay and ocean nests in the shell cover percentage and h/w of nests. When comparing between narrow and wide beaches on ocean and bay study areas, the results of this analysis had different findings. On the ocean study areas, the nest sites had a greater shell percentage on the wide beaches compared to the narrow beaches ($P = 0.043$) (Fig.5). The shell percentage for bay nest sites did not differ between wide and narrow beaches ($P = 0.447$) (Fig. 6)

## DISCUSSION

The substrate matrix of the nest sites was highly variable throughout the study areas. Nests found on the bay had a greater coverage of coarse substrate and shells and an average of 51% of sand while the ocean was not as variable and had a high percentage of sand cover and small amount of coarse material. Cohen et al. (2008) found similar ocean results with high sand cover and minimal vegetation cover on ocean nests. Piping

Plovers were found to have nested on open sandy beaches and away from vegetation (Wilcox 1959). The Piping Plovers were found to nest in an open sandy area and when it became vegetated the Piping Plovers no longer nested in the area. I found that Piping Plovers on the ocean beaches often nested in dense vegetation with 13 of the 26 in a patch of vegetation. The high number of nests in vegetation that are found further away from the high tide may be a result of avoiding flooding from the ocean (Burger 1987). Shell cover has been found to be a significant part of nest selection in previous studies (Burger 1987, Flemming et al. 1992, Greenwald 2009). Shell coverage in this study was greater on the bay nest sites and minimal on ocean nests. Also, narrow or wide beaches had minimal influence on the presence of shells around the nest.

Nests in previous studies were found to be evenly spaced between the dunes and the high tide, but I found the nests to be closer to the vegetation on the dunes than the high tide (Greenwald 2009). Leading to the conclusion that Piping Plover nest location is a balance between two pressures. Although Piping Plover chicks have more cover from rain and wind in vegetation, nests are more likely to be predated upon by predators because predators can hide and learn how to find nests in vegetation (Lauro and Tanacredi 2002). Piping Plovers nests also cannot be near the water because flooding can cause nest failure and chick mortality. Therefore, the pressures from predators and overwashes may influence Piping Plovers nest site selections based on these selective pressures (Espie et al. 1996, Roche et al. 2012).

*Management Implications*

There have been intensive management practices for the protection of Piping Plovers in recent decades (USFWS 1996). Our findings show that nest sites are variable, but that there are certain trends that could be applied in establishing suitable nesting habitat. To find the nests, land managers may search for areas where nesting habitat appears to be ideal for Piping Plovers, but they also must search areas where they may not expect a pair to nest. It is important for managers to find nests in order to properly monitor the Piping Plover pair, and also to erect a nest exclosure if predators are a pervasive problem in the area.

The Piping Plovers on Long Island nest closer to the dunes than they do to the high tide, but they are still at risk of sea level rising (Seavey et al. 2010). Rising sea levels may cause the Piping Plovers to shift the nests upland and will result in even greater conflicts with humans for space. Land managers in coastal areas might encourage natural overwashes, habitat shifting and discourage the development on these newly formed suitable nesting areas for the protection of the Piping Plover (Seavey et al. 2010). Deterrents and attractants have been used to direct nest selection of Piping Plovers in the Great Plains (Marcus et al. 2007). Marcus et al. (2007) used mylar flagging for deterring Piping Plovers and driftwood spread on bare sand as an attractant in gravel mines. These methods proved successful in the study area in the Great Plains and could be applied to beaches on Long Island to direct nesting in certain areas to prevent conflicts with humans and also areas where the nests may not be predated or overwashed.

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Appendix 1.

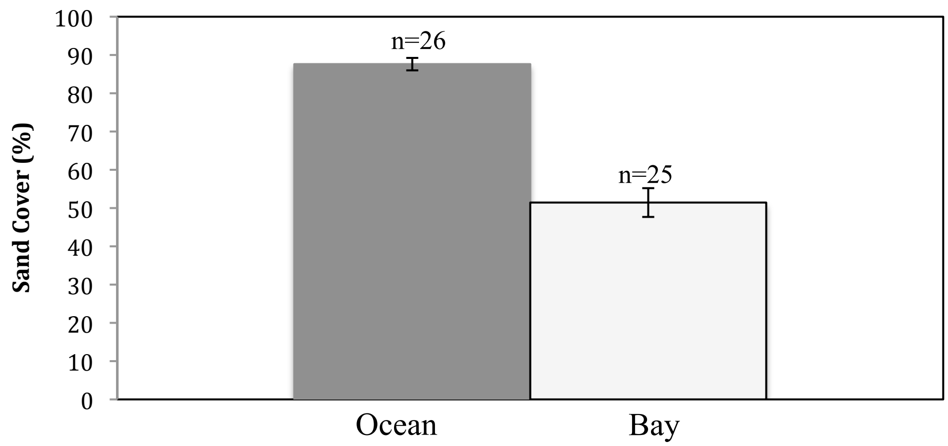


**Figure 1: Percent sand cover of ocean and bay nests of Piping Plovers on the South Fork of Long Island, NY 2013 with standard error. ($t_1$= 8.95, $P$<0.001)**

Appendix 2.

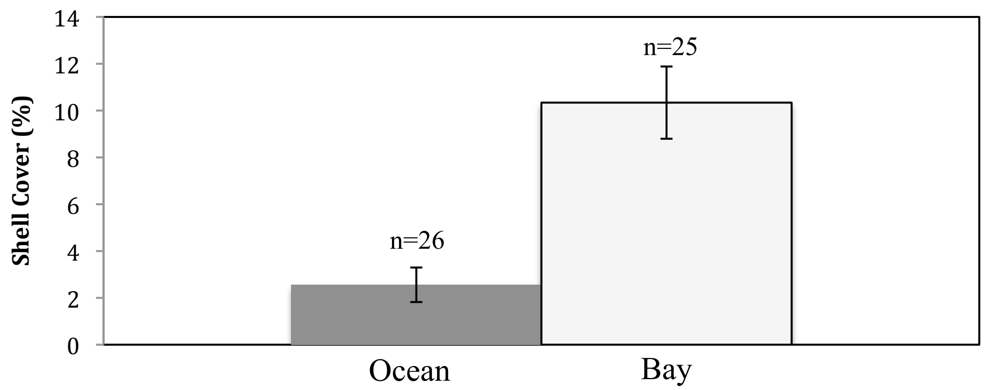


**Figure 2: Percent shell cover of ocean and bay nests of Piping Plovers on the South Fork of Long Island, NY 2013 with standard error. ($t_1$= 4.60, *P*<0.001)**

Appendix 3.

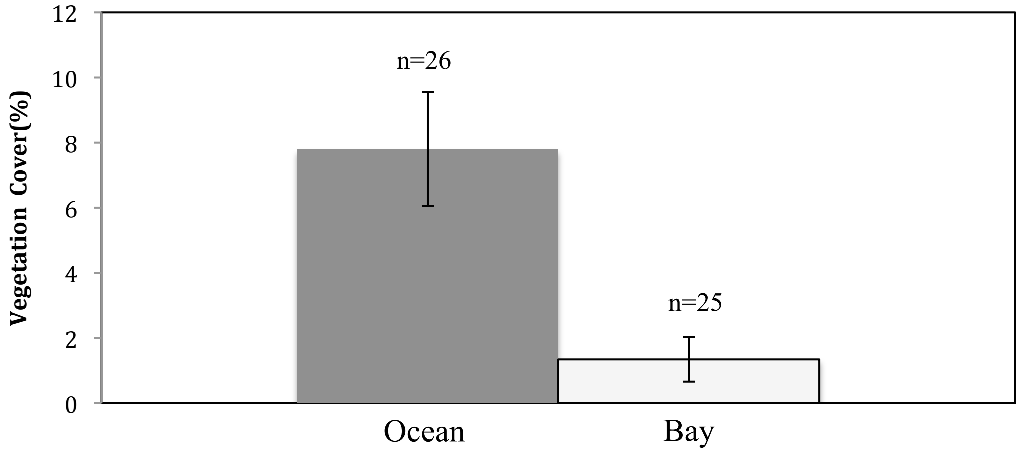


**Figure 3. Percent basal vegetation cover of ocean and bay nests of Piping Plovers on the South Fork of Long Island, NY 2013 with standard error. ($t_1$= 3.39, *P*=0.002)**

Appendix 4.

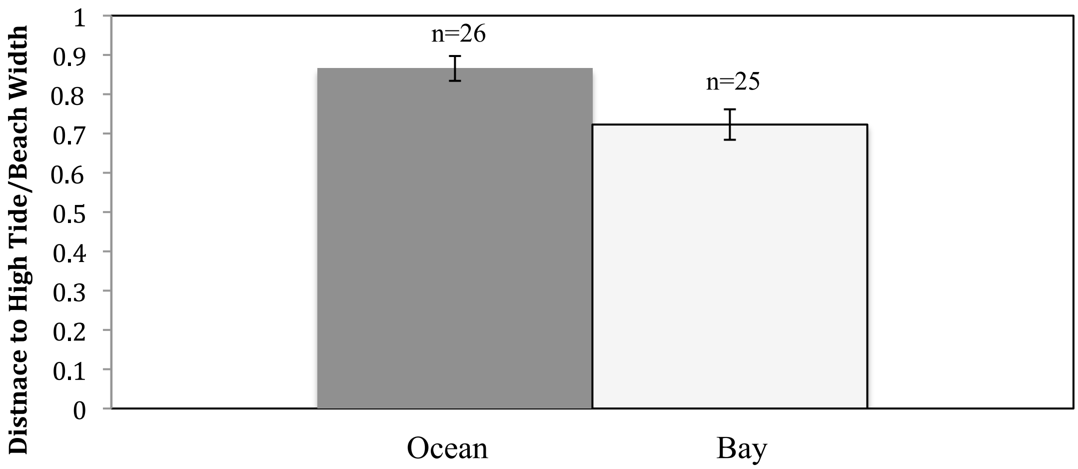


**Figure 4: Distance from the nest to high tide line/beach width for ocean and bay nests of Piping Plovers on the South Fork of Long Island, NY 2013 with standard error. ($t_1$= 2.87, $P$=0.006)**

Appendix 5.

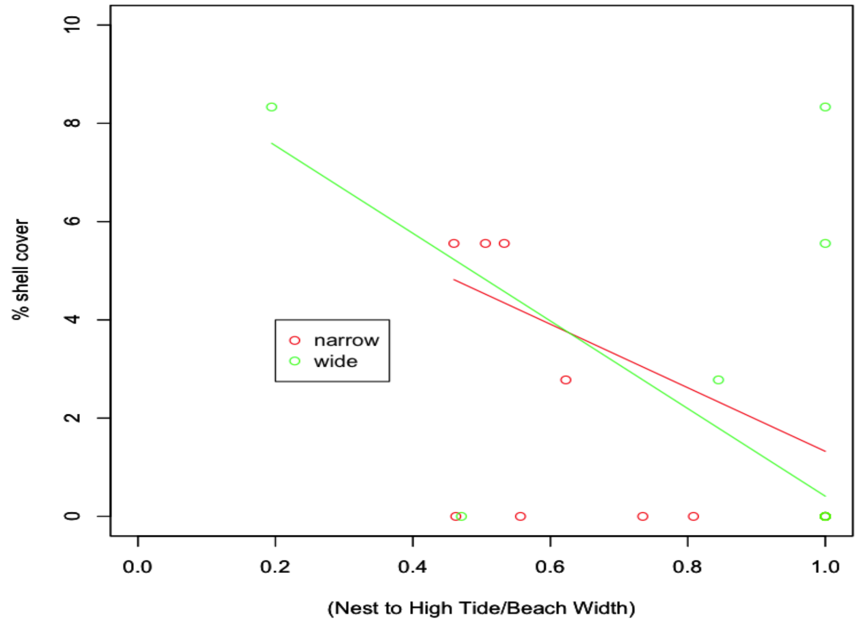


**Figure 5: Percent of Shell Cover vs. ratio of nest-high tide and nest-vegetation distance for ocean nests of Piping Plovers on the South Fork of Long Island, NY 2013, by beach width category. (% Shell= 7.793-6.469 h/w+1.536wide-2.450 (h/w)*wide; and P=0.043)**

Appendix 6.

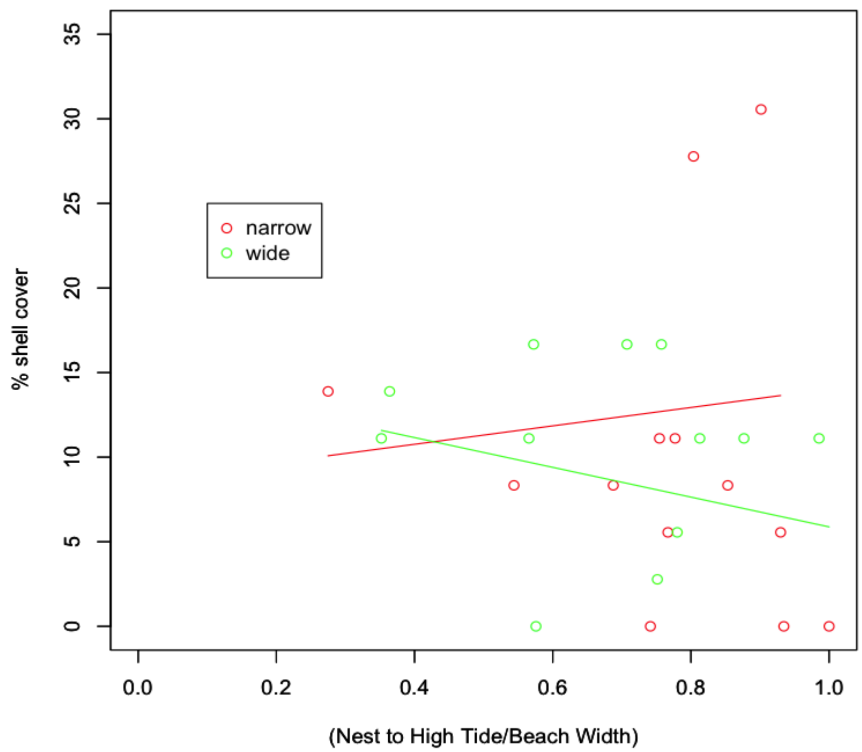


**Figure 6: Percent of shell cover vs. ratio of nest-high tide and nest-vegetation distance for bay nests of Piping Plovers on the South Fork of Long Island, NY 2013, by beach width category. (% Shell= 8.585+5.439 h/w+6.093wide-14.239 (h/w)*wide; and *P*=0.447)**