East Bay Regional Park District

Healthy Parks Healthy People

The Importance of Oyster Shells in Breeding Success of Western Snowy Plover

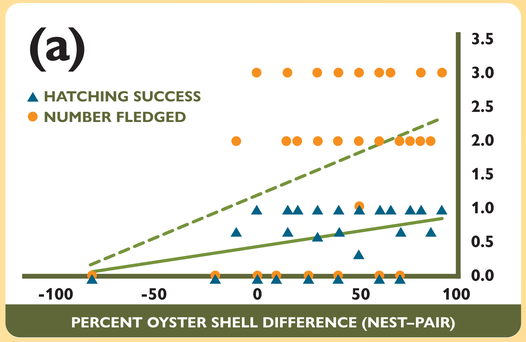
Point Blue Conservation Science

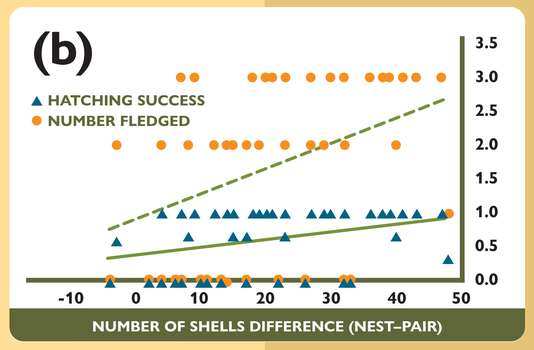
Abstract

The Pacific Coast population of the western snowy plover (*Charadrius alexandrinus nivosus*) is a federally threatened species and is a California Species of Special Concern. Knowledge about their nest site selection requirements is important to this species' management in the San Francisco Bay area. We measured the percentage of sand, percentage of crushed oyster shells, number of shells, and total shell surface area for 56 nests of western snowy plover at the California least tern colony at Hayward, California, over a 14-year period (2008-2021). Using pairwise t-tests, we compared these measurements to those obtained from 56 randomly chosen non-nest sites. Results indicate that plovers select nest sites with a greater percentage of crushed oyster shell substrate, more oyster shells, and a greater surface area of shells than paired random sites. The contrast in the shell-related nest metrics (i.e., the difference between the nest site and the paired site) showed significant, positive relationships with both hatching success and number of fledglings using linear regression analysis. These results, supporting federal species recovery, suggest that the western snowy plover may improve their nesting success through oyster shell enhancement, which may provide more camouflage for the eggs and chicks than locations with fewer shells.

Figure 1 — Western snowy plover (Charadrius alexandrinus nivosus) nest with chick at the Hayward Regional Shoreline, California.

Left — Wildlife volunteer's "Colony Caretakers" patch is earned by helping to monitor, protect, and educate about these shorebirds.





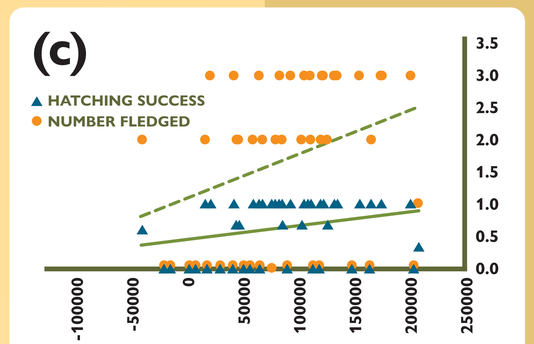


Figure 4 — Relationship between breeding success metrics and differences in shell-related metrics between nest and paired sites. Linear regression lines shown for hatching success (dashed) and number of fledged (solid); shell-related metric differences include percent oyster shell area **(a)**, number of oyster shells **(b)**, and shell surface area **(c)**.

Methods

The East Bay Regional Park District manages California least tern, western snowy plover and black skimmer nesting habitat at the Hayward Regional Shoreline (37°37'47"N 122°8'46"W) located along the eastern shore of San Francisco Bay (Riensche 2007; Riensche et al. 2012b Riensche et al. 2015). We conducted this study on Island Five (also known as "Tern Town").

Data Collection

Nests were found by systematically walking through the colony during the breeding season (Marschalek 2005). In a 1-m^2 area surrounding each nest site, we recorded: percentage of area containing crushed oyster shell, percentage of area containing sand, number of oyster shells (>8 cm^2 surface area), shell surface area, average surface area. These same five variables were measured at a randomly chosen non-nest site within a 5-m radius of each nest site Riensche et al. 2015). Hatching and fledging success data were collected for each western snowy plover nesting site (***Figure 1***).

Analysis

We conducted paired t-tests to compare metrics of nest sites and paired sites.

Using linear regression, we examined the relationships between breeding metrics (hatching and fledging success) at each site to the differences of the nest site metrics (i.e., [nest site metric] – [paired site metric]).

Results

- We collected 14 years (2008-2021) of data on a total of 56 nests.
- Nest sites differed significantly from paired sites on the following metrics:
  - Higher percentage of crushed oyster shell (t=9.9659, df=55, P<0.0001; ***Figure 2***)
  - More oyster shells (means: nests=36, paired=14; t=12.2273, df=55, P<0.0001)
  - Greater shell surface area (t=11.8691, df=55, P<0.0001; ***Figure 3***)

There were no significant relationships between hatching success or number fledged and any of the nest metrics.

All relationships between breeding metrics and differences in shell-related nest metrics were significant and positive. These include:

- Percent of area with oyster shell (hatching success: B=0.0046, R2=0.1020, P=0.0164; number fledged: B=0.0127, R2=0.0957, P=0.0203; ***Figure 4a***)
- Number of oyster shells (hatching success: B=0.0109, R2=0.0995, P=0.0179; number fledged: B=0.0375, R2=0.1460, P=0.0037; ***Figure 4b***)
- Shell surface area (hatching success: B<0.0001, R2=0.0786, P=0.0364; number fledged: B<0.0001, R2=0.0978, P=0.0190; ***Figure 4c***)

Discussion

- Western snowy plovers at the Hayward Regional Shoreline site appear to choose sites to nest that contain a greater number of oyster shells and a greater area that is covered by oyster shells.
- While there are no direct relationships between breeding success and the nest metrics, there were significant relationships between breeding success and the difference between the shell-related metrics at nest and paired sites.
- This contrast in oyster shell metrics at the nest site compared to the paired site suggests the importance of oyster shell enhancements to the western snowy plover.
- Western snowy plover breeding success at Hayward Regional Shoreline has varied over the 14-year time period (***Figure 5***), with depredations, vegetation, and nest destruction by other species nesting on the island being reasons for reduced breeding success in some years.

While this species experiences many stressors, oyster shells may provide camouflage for eggs and chicks, thereby improving breeding success.

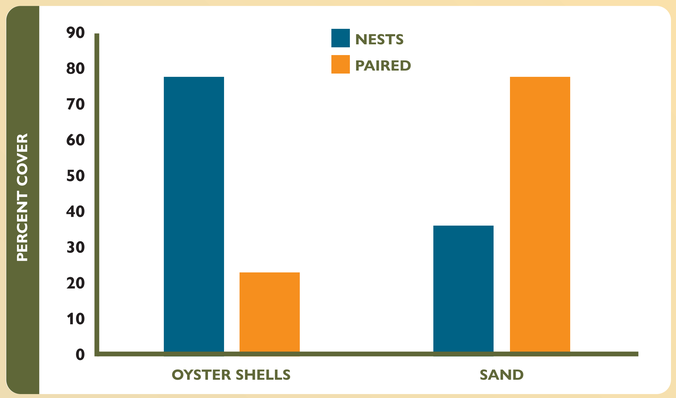


Figure 2 — Mean percent cover of crushed oyster shell and sand within a 1-m^2 area around nest sites and paired sites. (Error bars=95% confidence interval).

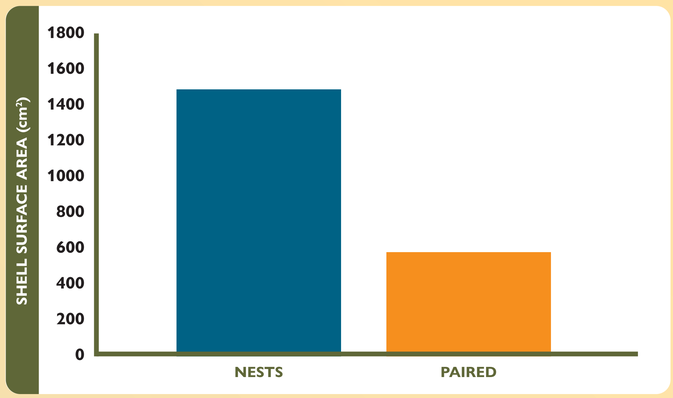


Figure 3 — Mean shell surface area within a 1-m^2 area around nest sites and paired sites. (Error bars=95% confidence interval).

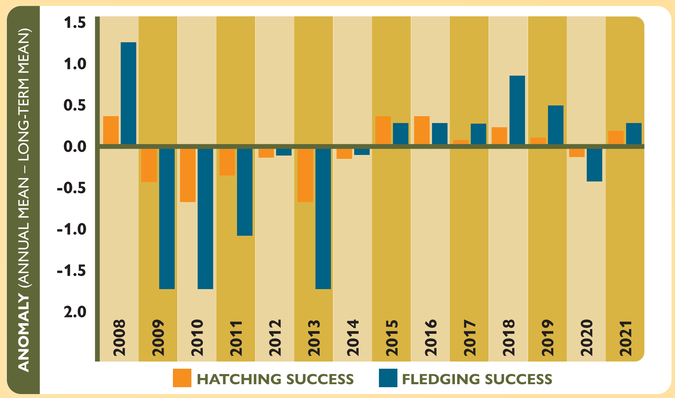


Figure 5 — Hatching and breeding success annual anomalies, 2008-2021. Anomalies are calculated by subtracting the long-term mean from the annual mean.

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