

# Western Snowy Plover Macro-Invertebrate Prey Availability at Robert Crown Memorial State Beach

## Abstract

The Western Snowy Plover (*Charadrius alexandrinus nivosus*) is a federally threatened species and California Species of Special Concern. Habitat choice and prey availability are vital to wintering Western Snowy Plovers. Since 2014, they have overwintered at Robert Crown Memorial State Beach in Alameda, CA. The East Bay Regional Park District, which manages the site, implemented a plover protection zone (PPZ), to minimize disturbances to roosting and foraging plovers. The purpose of this study was to examine the potential prey abundance within the PPZ, and in areas directly north and south. Horizontal transects were set up to collect macro-invertebrates in core samples and sticky traps. A total of 71 organisms (amphipods, beetles, unidentified worms) were found in the core samples. The percent of organisms found within the PPZ and areas north and south were 50.7%, 21.1% and 28.2%, respectively. A total of 533 organisms were caught in the sticky traps. Organisms caught within the PPZ and areas north and south were 55.5%, 26.5% and 18.0%, respectively. Using a one-way ANOVA, macro-invertebrate abundance in the core samples and in the sticky traps showed no significant statistical difference. The fact that the PPZ had greater than 50% of organisms shows that macro-invertebrate prey availability is one of many important factors for wintering Western Snowy Plover habitat choice.

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**Figure 2.** Wrackline with roosting Western Snowy Plovers. Photo: Daniel I. Riensche

## Introduction

The Western Snowy Plover (*Charadrius alexandrinus nivosus*) is a small light gray-brown bird with dark legs, an incomplete band around the breast, and a black, narrow bill (**Figure 1**). The Western Snowy Plover is listed as threatened by the United States federal government and as a California Species of Special Concern (Federal Register; 2012, Page et al.; 1986). As of 2012, the Fish and Wildlife Service estimated 2,500 breeding Western Snowy Plovers are dispersed along the Pacific coastline. The number of wintering Western Snowy Plovers varies at different sites along the California coast (Page et al.; 1986).

Wintering site choice is vital to shorebirds (Brindock and Colwell; 2011). Piping Plovers are similar in size to the Western Snowy Plover and are found along the Atlantic and Gulf coasts of the United States. During wintering months, piping plovers forage near ponds, on sandflats and along the shore. Foraging efficiency can affect fat reserves needed for migration and reproduction (Burger; 1994, Evans; 1976). Disturbances can negatively impact plover foraging (Staine and Burger; 1994). Food abundance can also influence Western Snowy Plover habitat choice (Rose and Nol; 2010).

Food availability is one of the important factors for shorebirds (Brindock and Colwell; 2011, Evans; 1976). A study in Humboldt County found varying invertebrate taxa in sand and wrack (Beeler; 2009). Wintering plover invertebrate prey items can be found at depths ranging from 0.5cm to 20cm (Nicholls and Baldassarre; 1990, Orluck; unpublished Master's Thesis from Humboldt State University). During the non-breeding season along Humboldt County, Western Snowy Plovers chose sites that had a higher abundance of brown macroalgae with associated invertebrates such as flies and amphipods (Brindock and Colwell; 2011). The amount and type of wrack as well as the abundance of invertebrates can possibly change daily due to storms and other influences (Beeler 2009). Reeder (1951) observed that fecal pellets of snowy plovers in southern California consisted primarily of sand crabs and other invertebrates. Competition from other shorebirds during wintering months may reduce the food abundance for Western Snowy Plovers (Evans 1976).

The East Bay Regional Park District (EBRPD) manages Robert Crown Memorial State Beach in Alameda, CA. Western Snowy Plovers were observed to stay in a specific area along the 3.2km (~2 miles) of sandy beach. Since 2014, plovers overwinter at this site from August to March or April. The purpose of this study was to examine the potential prey availability within the protection zone (PPZ) set up by EBRPD along Crown Beach and the areas to the north and south. Food availability in the snowy plover habitat can influence the breeding season (Brindock and Colwell; 2011, Evans 1976). Therefore, we tested the hypothesis that there will be no significant difference in prey abundance within the protection zone (PPZ) than in the areas to the north and south.

## Study Area

The study took place within Robert Crown Beach Memorial State Beach (37.76034N Lat., 122.26661W Long.), located on the east side of San Francisco Bay in Alameda. The plover protection zone consists of a roped-off rectangle of sandy beach adjacent to the bay and tidal areas. This fenced off area (also known as symbolic fencing) is designed to dissuade public access and provide plovers with roosting and foraging habitat on the beach. The beach sand composition and weather conditions during sampling were recorded. The size of sand grains were between 0 and 42mm. Air temperatures were between 43.0°F - 60.1°F. Wind speeds were between 0 and 9mph.



**Figure 1.** Western Snowy Plover at Robert Crown Memorial State Beach. Photo: Daniel I. Riensche

## Methods

Invertebrate sampling was performed from December 2016 to February 2017 during daylight (0700 – 1430 PST). A 50-m horizontal transect was placed along the wrackline within, north and south of the protection zone (PPZ) (**Figure 2**). GPS coordinates along the 50-m transects were determined with the Garmin GPS eTrex 10. Random numbers were generated to assign three sampling points for the sticky traps and five points for the core sampling locations along this transect using integers between 0 and 50.

**Core Sampling:** An aluminum Danielson clam gun, marked a 10-cm depth, was used for macro-invertebrate sampling along the horizontal transect within the PPZ, north and south. Five 5-m vertical transects were distributed along the horizontal transects. Samples were collected in the center, 2.5-m above and below the wrackline. The wrack was moved aside before core sampling. 45 core samples were processed and sorted daily.

**Sticky Traps:** Sticky traps were placed in horizontal and vertical orientations near the wrack following methods in Anteau and Sherfy (2010). Setups were left undisturbed for approximately one hour (Pearl; 2015). The sticky traps were monitored during core sampling to minimize disturbances. After about an hour, we carefully placed the sticky trap setups into a plastic bag for further analysis.

**Photographs and Identification:** Macro-invertebrates caught in both sticky traps and core sampling were brought into the lab. Organisms were identified to their respective taxa under a Nikon SMZ800 microscope.

**Data Analysis:** A one-way ANOVA (IBM SPSS Statistics 23) was done to compare the abundance of organisms within the PPZ and areas to the north and south.

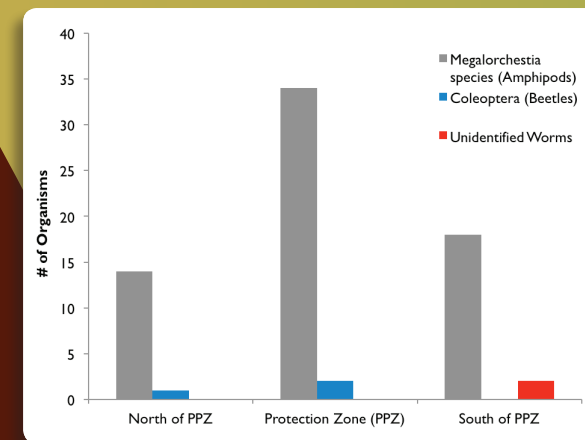
## Results

**Core Sampling:** Core samples produced a total of 71 organisms (**Figure 3**). Amphipods from the genus *Megalorchestia* were the most abundant in the core sediment sampling (**Figure 4**). We found 50.7% of the organisms caught in the core samples were from the PPZ. There was no significant difference among the sites along the beach (all organisms:  $F = 0.5829$ ,  $p = 0.6671$ ,  $\alpha = 0.05$  and amphipods only:  $F = 1.4274$ ,  $p = 0.2623$ ,  $\alpha = 0.05$ ).

**Sticky Traps:** We caught 533 organisms in the sticky traps (**Figure 5**). Flies from the order Diptera were the most abundant organisms followed by beetles from order Coleoptera. The number of organisms caught among the sites was not significantly different ( $F = 1.1336$ ,  $P = 0.3408$ ,  $\alpha = 0.05$ ).

## Management Implications

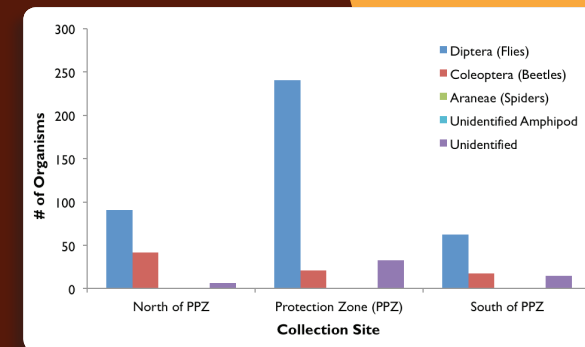
These findings can be used for better managing of wintering Western Snowy Plover habitat. This study shows that macro-invertebrate prey availability is one of many important factors for wintering Western Snowy Plover habitat choice.



**Figure 3.** Total abundance of *Megalorchestia* species (amphipods), Coleoptera (beetles) and unidentified worms from core sediment sampling along the north side of the protection zone (PPZ), along the PPZ and south of the PPZ (All organisms:  $F = 0.5829$ ,  $P = 0.6671$   $\alpha = 0.05$  and amphipods only:  $F = 1.4274$ ,  $P = 0.2623$   $\alpha = 0.05$ ).



**Figure 4.** Example of *Megalorchestia* species (amphipod).



**Figure 5.** Number of organisms caught in sticky traps in north side of the protection zone (PPZ), along the PPZ and south of the PPZ. The order Diptera (flies) had the highest abundance ( $F = 1.1336$ ,  $P = 0.3408$   $\alpha = 0.05$ ). One organism from the order Araneae (spider) was caught in the PPZ. One unidentified amphipod was caught in the north.

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