Black Oystercatcher (Haematopus bachmani) behavior and prey selection in intertidal zones on San Juan Island, Washington

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Abstract:

The Black Oystercatcher (*Haematopus bachmani*) is a foraging shorebird with a year-long presence in the San Juan Islands that has a specialized beak, used to dislodge prey off rocks in the intertidal zone. Their role as ecological indicators means that shifts in their behavior and diet provide insight into ecosystem health, yet they remain an understudied species. There are no studies focusing on behavior, intertidal composition, such as algae cover, or prey availability of Black Oystercatchers in the San Juan Islands. We conducted a behavioral study using focal animal sampling to understand how Oystercatcher behavior changes across intertidal zones and employed quadrats to assess prey availability using systematic random sampling at two sites, Hunt Property and Third Lagoon on San Juan Island, WA, USA. We found that foraging behavior occurred more frequently at Third Lagoon than at the Hunt Property, likely due to differences in intertidal composition and increased prey availability. Our results indicate that Oystercatcher behavior and foraging success are dependent on intertidal composition and will vary across zones. These findings highlight the need for further research on Black Oystercatchers, their behavior, and prey availability, and may have important implications for management.

Keywords: Black Oystercatcher, *Haematopus bachmani*, San Juan Island, prey availability, behavior, habitat selection

Introduction:

The San Juan Islands are home to a variety of foraging shorebirds, including Black Oystercatchers (*Haematopus bachmani*), which can be found along rocky, intertidal shorelines (Tessler et al. 2010). Oystercatchers have a specialized beak that is laterally compressed and used to pry their prey off rocks. Their diet consists mainly of intertidal mollusks, such as limpets, chitons, mussels, and the occasional snails and worms (Johnson et al. 2010; Liebezeit et al. 2020). Intertidal composition has a strong impact on the foraging success of Oystercatchers by shaping prey diversity and abundance of potential food within foraging territories (McFarland and Konar 2010). A combination of physical factors (e.g., substrate type, intertidal slope, wave action) and ecological interactions (e.g., algae, competition, predation) shape the abundance of key prey that Oystercatchers forage on (McFarland and Konar 2010; Tessler et al. 2010; Gliesch et al. 2023). Algae cover and distribution have a prominent role in intertidal communities, influencing the foraging success of Oystercatchers (Andres and Falxa 2020; Lindberg et al. 1998).

Since Oystercatchers are known as indicator species (Tessler et al. 2014), their behavior and foraging success provide insight into the status of rocky, intertidal habitats (Stark et al. 2015). For example, altered foraging behavior and prey selection can indicate ecosystem stress, contamination, or disruption (Ware et al. 2023). Despite this important ecological role and their year-long presence in the San Juan Islands (Andres and Falxa 2020), Black Oystercatchers remain severely understudied. There have been no studies on Oystercatchers in the San Juan Islands, none on fine-scale habitat use, and none on long-term shifts in diet and prey availability. The lack of literature on these topics creates unanswered questions on how Oystercatcher behavior and prey availability/selection change across intertidal compositions.

We conducted an observational study using focal animal sampling to examine the behavior of Oystercatchers. Prey consumption data were opportunistically recorded when the Oystercatchers were observed handling prey. Then, we used quadrats to quantify prey availability. The objectives of our study were to (i) observe behavior and behavioral changes across different intertidal zones, (ii) assess prey availability in the intertidal zones, and (iii) compare prey availability with prey consumption. We hypothesized that Black Oystercatchers would exhibit differences in behavior, dependent on the zones they are present in, and predicted that prey availability would be greater in *Fucus*-dominated zones.

Methods:

Location and Site Selection

We collected data from 10 August 2025 through 13 August 2025 at Hunt Property (48° 27’ 52.1” N, 122° 57' 40.8” W) and Third Lagoon (48° 27’46.7” N, 122° 58' 20.3” W). Both locations are on the southeastern end of San Juan Island and were chosen as they are known to have reliable Black Oystercatcher sightings. Hunt Property is located on the San Juan Channel and consists of two steep, gravel beaches and a grassy point surrounded by rocky, intertidal outcroppings. Third Lagoon, a public park along Griffin Bay, is located ¾ km west of Hunt Property. It has shallow-sloped sandy flats, rocky intertidal outcroppings, and a diverse intertidal community. Both sites have comparable intertidal compositions, including the three distinguished zones in this study: bare rock, *Fucus* algae (*Fucus vesiculosus*), and *Ulva* algae (*Ulva lactua*). These zones are fine-scale habitat features used by the Black Oystercatcher, each with unique compositions of prey diversity and abundance.

Behavior Sampling

Focal animal sampling was used to measure behavior. We recorded the behavior of one Black Oystercatcher at 20-second intervals for 3-minute periods, with a 30-second rest period between each interval. This yielded nine behavioral data points for each period. In addition to behavior, at each interval we recorded date, time, location, and zone. We were present at each site for 2-3 hours between low tide (-0.36 m) and high tide (1.33 m). One person was the timer and recorder while the other was the observer, and we frequently switched roles. Using 10x 42 mm binoculars, we observed the Oystercatchers from inshore vantage points. Behaviors were categorized into the following: (a) foraging, (b) handling, (c) maintenance, (d) social, (e) head bobbing, (f) flying, and (g) non-foraging. We distinguished foraging from handling behaviors based on the presence of a prey item in the beak of the Oystercatcher, or in the active removal of prey from their shells. Search and lateral movement were denoted as foraging, and any behavior other than social, maintenance, head bobbing, flying, and handling was noted as nonforaging.

Predation and Prey Availability

During behavioral sampling intervals, we opportunistically recorded predation data, noting prey type and estimated size, as well as the intertidal zone where the Oystercatcher was located at the time of prey removal. We used 10x 42 mm binoculars to observe predation behavior.

Using a 25 cm x 25 cm quadrat (A = 625 cm^2), we assessed prey availability from 13 August 2025 to 14 August 2025. Quadrat sampling methods were specialized to each site due to differences in the size and shape of the intertidal zone. First, we randomly selected an intertidal zone using a random number generator. Then we randomized the starting location at the periphery of the zone, and followed the sampling design according to the site we were at. The designs are as follows: at Third Lagoon (Fig. 1), we proceeded seven paces from the starting point, marked a spot, then placed our quadrat three paces in front, behind, and to the left and right of that spot. We continued seven paces forward and repeated until 20 quadrats were collected. A similar pattern was followed at Hunt Property, with ten paces between spots and five paces only to the left and right (Fig. 2). Prey items fell into one of the following classifications: mussels, limpets > 1.5 cm, limpets < 1.5 cm, or worms. Total abundance of each prey item in each quadrat was recorded, along with the zone. To standardize our quadrant counts to represent a full square meter, they were multiplied by 16.

Data Analysis

We used Microsoft Excel exclusively for data analysis, entering data from field journals into designated spreadsheets. Using Excel, we calculated means, standard deviations, and 95% confidence intervals, then generated graphs.

Results:

Location and Study Sites

We gathered a total of 396 observations, 297 of which were at Third Lagoon and 117 at Hunt Property. We observed far more Black Oystercatchers at Third Lagoon compared to Hunt Property. The Oystercatchers observed at Hunt Property were solely in the *Fucus*-dominated intertidal zone. A greater diversity of intertidal zones was used by Oystercatchers spotted at Third Lagoon (Fig. 3), where 90% of observations were in *Fucus*-dominated zones, followed by 9% at *Ulva* and1% at bare rock.

Behavior sampling

We found unique differences in Black Oystercatcher behavior between the two sites (Fig. 4). Notably, all instances of prey handling were observed at Third Lagoon, with handling accounting for 13.3% of recorded observations. We observed foraging behavior over 6.5x more often at the Third Lagoon compared to the Hunt Property. One of our observed behaviors, head bobbing, is nonexistent in published literature. This behavior is notable because it accounts for 13.6% of all observations at Third Lagoon and around 4% of behavior at the Hunt Property. It consists of a rhythmic bobbing of the head and neck, a slight bend in the ankle, while lifting its tail repeatedly. With no published scientific literature on the behavior, we are unable to subsume this behavior into any category other than itself.

Predation and Prey Availability

During observations, we recorded one Oystercatcher feeding during a one-hour period at the Third Lagoon. The observed bird preyed on four classes of prey across *Fucus* and bare rock intertidal zones only. Figure 5 displays the composition of prey items chosen by the foraging bird and in which zones they were foraged. *Fucus* and *Ulva*-dominated zones were combined into a single, vegetated category for the sake of comparison with unvegetated, bare rock. In vegetated zones, we observed both size classes of limpets consumed, along with mussels and worms. In bare rock zones, we observed solely limpets greater than 1.5 cm. In vegetated zones, mussels were the most frequently selected prey, accounting for more than half of all opportunistic predation data. The next most selected prey item was the larger limpets, followed by worms, and smaller limpets were the least frequently selected prey items at 6% each.

For prey availability, our quadrat data (Fig. 6) shows varying abundance compositions across the *Ulva* and bare rock zones at the Third Lagoon, and the same across the *Fucus* and bare rock zones at Hunt Property. At Hunt Property in *Fucus*-dominated zones, we only found limpets, with 38x more small limpets than large. In bare rock zones, we found far fewer limpets, with nearly 6x as many small limpets compared to large. At Third Lagoon, we observed 56x more mussels, 3x more small limpets, and 2x more large limpets in *Ulva*-dominated zones compared to bare rock.

Discussion:

Our study yielded captivating results on Oystercatcher behavior, predation, and prey availability. Overall, we observed higher Oystercatcher numbers at Third Lagoon, where they exhibited a wider range of behaviors and diverse zone usage. Within this, foraging and handling accounted for most behavior at Third Lagoon, whereas we observed no handling at Hunt Property. This is consistent with the literature that found Oystercatchers are more successful in habitats where resources are clumped together (McFarland and Konar 2010). This is likely because resources are more predictable over time, and when food is unreliable, their foraging efficiency and reproductive success can decline. Furthermore, intertidal composition, such as slope, may impact foraging success (Weinstein et al. 2014). Hunt Property has a steeper slope with less diverse intertidal composition, but Third Lagoon has a gradual slope with highly diverse intertidal composition. The gradual slope at Third Lagoon increases the foraging area that the Oystercatchers rely on, increasing foraging success. These differences in composition between the two sites suggest that no handling was observed at Hunt Property because it is not diverse enough to support a large population of prey items.

We also observed a unique behavior, identified as head bobbing, which accounted for a significant amount of our behavioral observations. However, we were unable to determine the purpose of this behavior, as there is no scientific literature that discusses the potential applications of head bobbing. Some hypotheses for this behavior include depth perception, balance, or social behavior. Since there is no available literature, assumptions on the conditions of this behavior cannot be made. We also found that Oystercatchers foraged the most during a flooding tide, however, literature suggests that Oystercatchers forage at low tide, as the intertidal zone is more exposed and food accessibility increases (Ware et al. 2023). During a rising tide, Oystercatchers will target mussels in the splash zone that begin to gape, making it easier for them to consume (Miller and Dowd 2018). This indicates a behavioral adaptation that exploits the vulnerability of mussels at the onset of a rising tide.

When looking at prey availability across the zones, bare rock only supported larger limpets, while vegetated zones supported a greater abundance of diversity and key prey. As aforementioned, Third Lagoon has a more diverse landscape, and highly textured and creviced substrates promote growth and stability of not only small invertebrates, but also algae (Tessler et al. 2010; Tessler et al. 2014). This increases habitat complexity and prey resource availability for foraging birds. Algae provide habitat, food, and shelter for various marine invertebrates, such as limpets, mussels, and chitons, that Oystercatchers prey on (McFarland and Konar 2010). Specifically, *Fucus*-dominated areas contribute to a healthy intertidal ecosystem that supports food webs and provides essential resources (Miller and Dowd 2018). However, *Ulva*-dominated zones had lower prey abundance, as *Ulva* commonly covers sandy or muddy substrate that does not provide structural complexity (MacKenzie and Clyde 2021). Studies have shown that few invertebrates grow on the surfaces or under *Ulva* mats because it can inhibit their growth due to toxins released by the algae and restricted access to light and oxygen (MacKenzie and Clyde 2021; Coffin et al. 2017). This supports our hypothesis that prey availability would be greatest in *Fucus*-dominated zones, as Third Lagoon hosted an abundance of mussels and limpets. Contrary to what we found, Craig and Folz (2013) found an abundance of mussels at Hunt Property and witnessed high levels of foraging and handling. The lack of mussels present at Hunt Property presently may be a result of overconsumption by the Oystercatchers, and the site cannot support the population anymore.

Understanding the differences in habitat use of Black Oystercatchers is critical for understanding how they will adapt to changing environments. As climate change alters intertidal composition, there are concerns regarding how Oystercatchers and other shorebirds will adapt. Algae blooms may increase the presence of *Ulva*-dominated zones, which could not only alter foraging success, but their survival. There remains very little research on Black Oystercatchers and whether or not they will be able to shift their diet as prey availability becomes more limited. Future studies should focus on understanding fine-scale habitat use across the intertidal zones and determining the purpose of the head bobbing behavior. A study with a larger sample size would be valuable to better understand trends in behavior, predation, and prey availability across intertidal zones.

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Figures

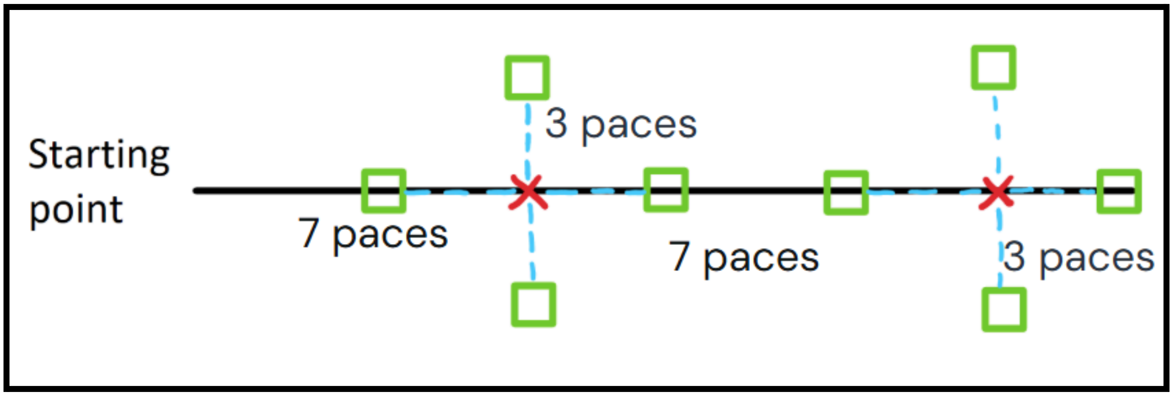

Figure 1. The quadrat sampling plan used at Third Lagoon.

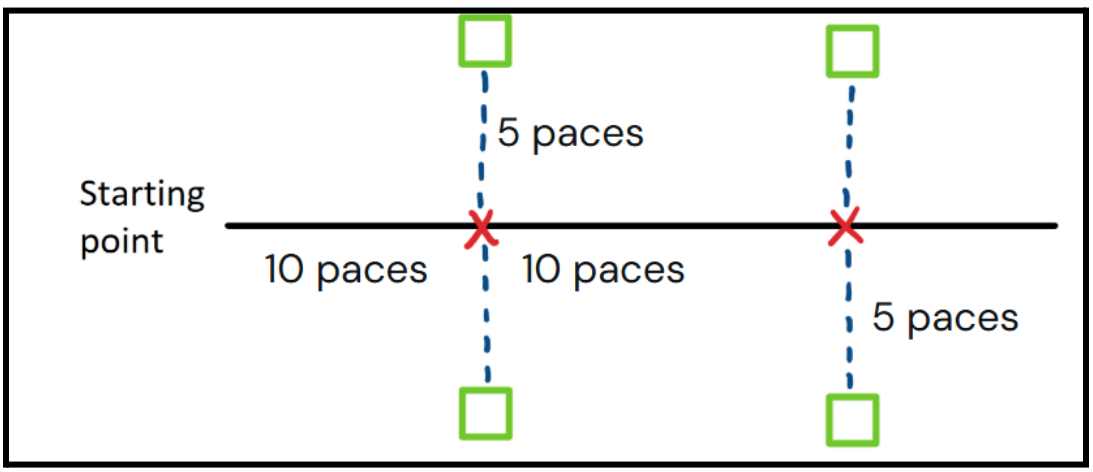

Figure 2. The quadrat sampling plan used at Hunt Property.

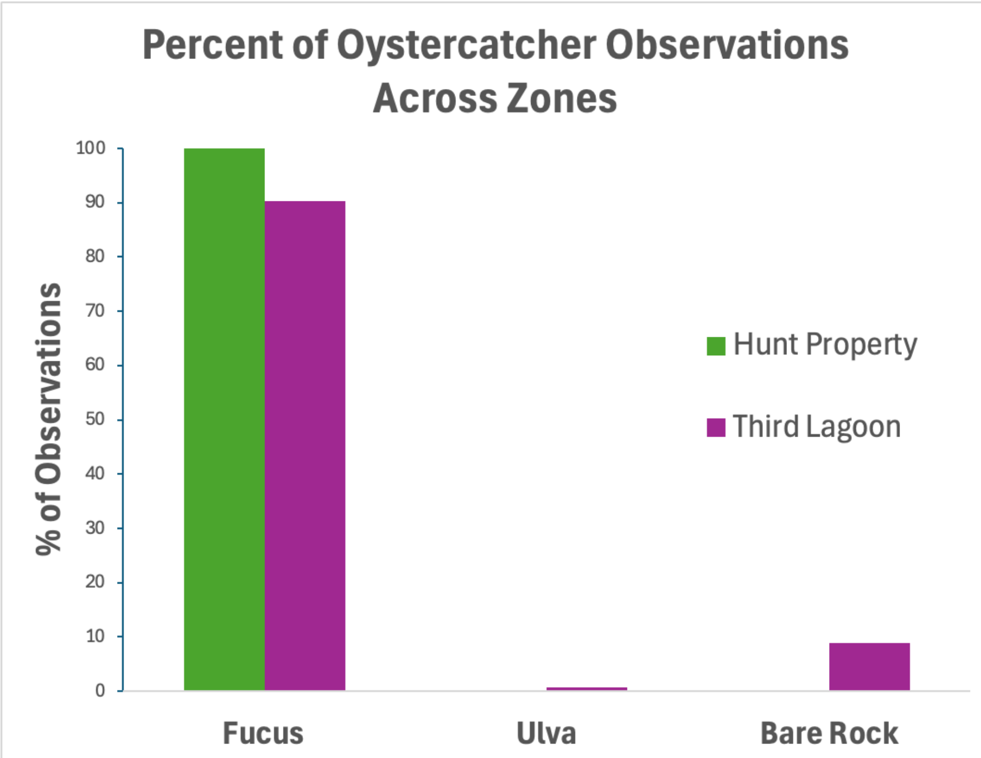

Figure 3. Mean proportion of Oystercatcher observations across intertidal zones in August 2025 at Third Lagoon and Hunt Property on San Juan Island, Washington.

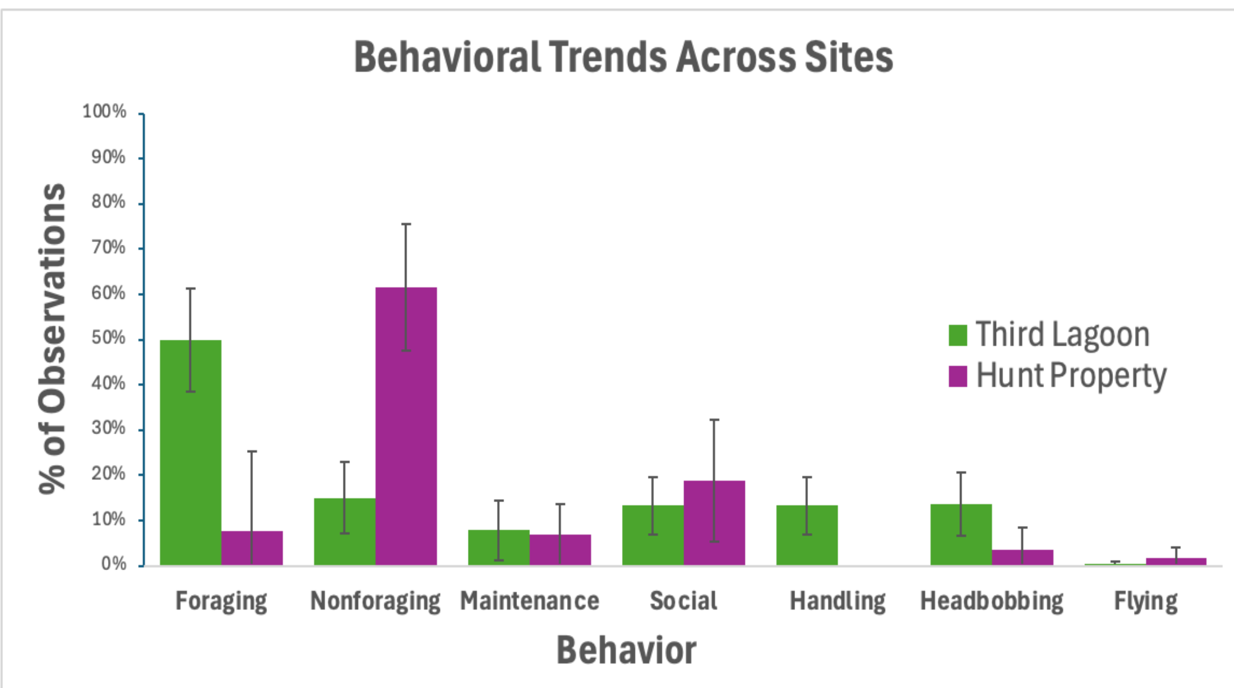

Figure 4. Mean proportion (95% CIs) of observations for each of seven behaviors for Black Oystercatchers during August 2025 at Third Lagoon (*n* = 297) and Hunt Property (*n* = 117) on San Juan Island, Washington.

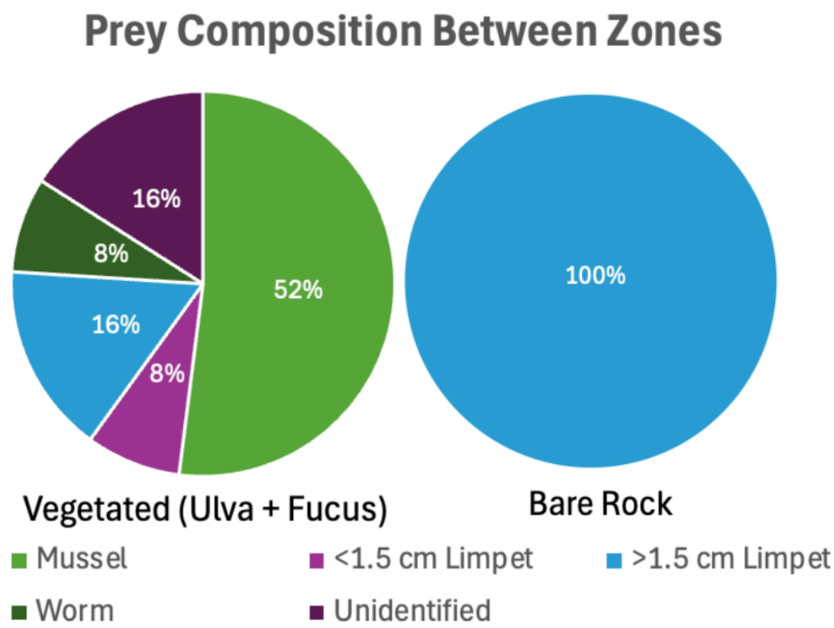

Figure 5. Proportion of prey items selected by an Oystercatcher foraging on 08/13/25 across vegetated (*n* = 25) and bare rock (*n* = 5) intertidal compositions at Third Lagoon, San Juan Island, Washington.

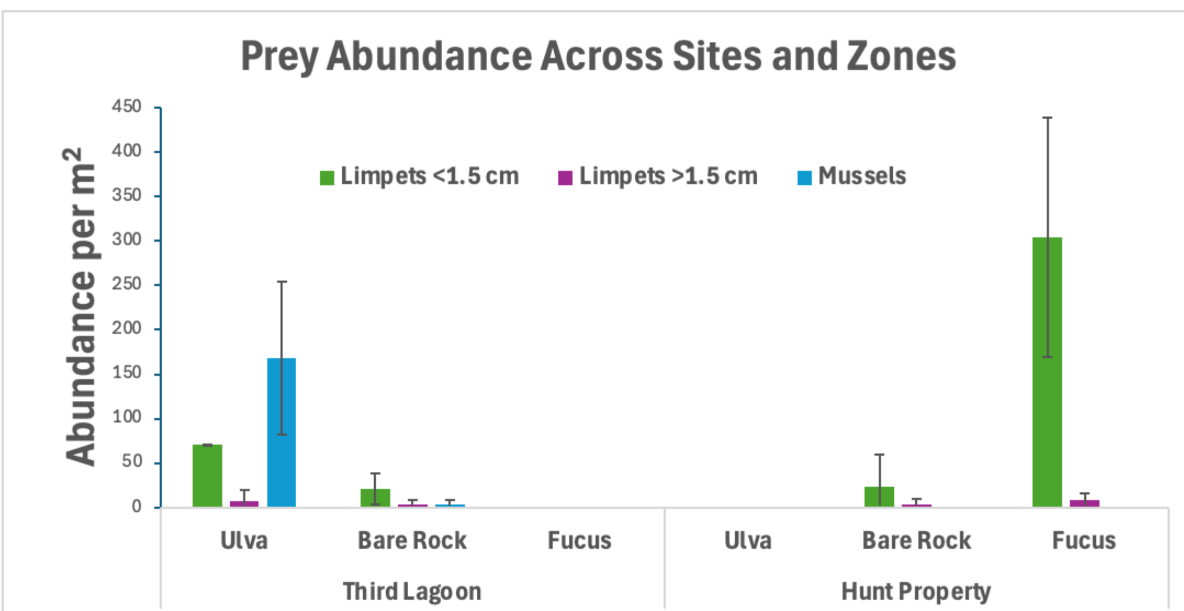

Figure 6. Mean prey abundance (95% CIs) from quadrat sampling on 13/14 Aug 2025 across bare rock (*n* = 11) and *Fucus*-dominated zones (*n* = 8) at Third Lagoon and bare rock (*n* = 20) and *Ulva*-dominated zones (*n* = 20) at Hunt property on San Juan Island, Washington.