

# The Effects of Disturbances on Harbor Seals (*Phoca vitulina*) on a Haul-Out site Off Yellow Island, Washington

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**Abstract:**

Human induced disturbances affect harbor seals (*Phoca vitulina*) hauled-out off Yellow Island, WA. Disturbances, in this study, include sailboats, motorboats, wake height, and distance of boats to haul-out sites (0 to 200 m). Harbor seals are protected under the Marine Mammal Protection Act (MMPA) and regulations set by the National Marine Fisheries Services (NMFS), state that no vessels should approach closer than about 100 m to marine mammals. During our study, we observed 41/71 boats that passed within 100 m of the harbor seals on their haul-out site. We recorded disturbance behavior of harbor seals as vigilance and flushing and recorded their location on the haul-out site as low, waterline to 1 m, and high as any seals above 1 m. Our results indicate that in general, seals below 1 m are more vigilant. During wake disturbances, we recorded a mean vigilance of about 40.2% as compared to those about 1 m up on the haul-out site with a mean vigilance of 8.6% . Again, seals were more vigilant in low areas when comparing distances of boats to vigilance. Out of all the disturbances (i.e. sailboats, motor boats, and wakes), wakes causes the highest amount of vigilance. Our results indicate that regulations set by the NMFS and MMPA need to be revised; specifically the 100 m distance that vessels are required to avoid approaching marine mammals.

**Keywords:** Pinnipeds, harbor seal, *Phoca vitulina*, San Juan Channel, human disturbance, boat disturbance, haul-out sites, Salish Sea.

## **Introduction:**

The San Juan Islands (mainly the San Juan Channel) are a popular location for tourists and boating during the summer. As the local population and tourism of the San Juan Islands continues to increase, so does the amount of boat traffic. Human disturbances generally cause animal behavior to change. The effects can be mild or may cause displacement and even mortality, if struck by boats (Suryan and Harvey, 1999). However, reactions may vary to different disturbances depending on the amount of exposure resulting in either tolerance or avoidance by marine animals (Suryan and Harvey, 1999).

The Harbor Seal (*Phoca vitulina*) is the most common and widely distributed pinniped in the Salish Sea (Jeffries et al, 2000). The San Juan channel and surrounding islands provide habitat for the harbor seals, which prefer isolated beaches, offshore ledges, and bars for haul-out sites (Terhune and Brilliant, 1995). The harbor seals are protected under the Marine Mammal Protection Act (MMPA) of 1972, which has allowed their population to increase to carrying capacity (Jeffries et al, 2003). Although there is an abundance of harbor seals in the Salish Sea, it is not clear what effects increasing rates of human disturbances are having on harbor seal populations.

Harbor seals use haul-out sites for rest, thermoregulation, molting, and to avoid predation (Terhune and Brilliant, 1995). There have been many studies of harbor seals and the effects of human disturbance (e. g. kayakers, personal watercrafts, whale-watching boats, and ferries) on their behavior. When vessels approach closer than 100 m to harbor seal haul-out sites, the seals often become more vigilant by head raising and often move closer to the water line or enter the water (NOAA, 2013). We studied the impacts of

human presence on the behavior of harbor seals. Specifically, we studied harbor seal vigilance and flushing behavior as affected by different types of disturbance (i.e. boat type and wake height), distance of disturbance from haul-out sites (0-200 m), and height of hauled-out seals above the water level at Yellow Island.

## **Methods:**

### *Study Area*

Our study was conducted on rocky intertidal sites used as haul-out locations off the west side of Yellow Island, located in the central San Juan Channel, Washington (approximately N 43° 38' 19" and W 116° 14' 28") (Fig. 1). We conducted observations of these haul-out sites from a location 84 m away on Yellow Island. The island was bought in 1979 by the Nature Conservancy to become an ecological island preserve, making it an ideal location to study haul-out behavior.

### *Field Surveys*

Surveys were conducted on five separate days between 9 and 14 August 2014 with survey duration ranging between 1.5 and 3 hours during daylight hours. Tides needed to be relatively low (i.e. -0.56 to 0.89 m) for the rock islands to be visible and for harbor seals to haul-out. A University of Washington Friday Harbor Laboratories research vessel was used for transportation to and from Yellow Island.

Scan samples of harbor seals were taken on an opportunistic basis for data collection. Behavioral observations of visible seals were collected 5-10 minutes after we arrived to allow the seals to acclimate to our presence. Bushnell 15-45X scopes were used to observe seal behavior. We documented disturbances according to: type (i.e. motor

boats, sailboats, kayaks and wakes), time, distance from seals, and percentage of seals being vigilant or flushing. Wake disturbances were recorded when they arrived at the haul-out sites  $\geq 0.3$  m. We defined vigilance as any movement that increases the ability for the seal to clearly scan its surroundings (Terhune and Brilliant, 1995). Flushing, for this study, was described as the retreat into the water during a disturbance. For observations of vigilance and flushing, we also categorized seals according to their distance above the waterline (i.e. high was  $>1$  m and low was  $<1$  m).

### *Analysis*

We assessed the effects of three factors on the vigilance and flushing behaviors of harbor seals. First, we looked at the relationships between harbor seal vigilance on high and low areas of haul-out site and distance of boats. Second, we looked at vigilance of seals compared to height above the waterline (high vs. low) during wake disturbances. Lastly, we looked at various types of disturbances (i.e. boat types and wakes) and assessed how they impacted harbor seal behavior. Mean percentages of vigilance were taken for each comparison with 95% confidence intervals.

### **Results:**

Our research revealed that the most common seal behavior in reaction to disturbance was vigilance. Boat disturbance and associated wakes were the most common forms of disturbance that we observed for hauled-out harbor seals at Yellow Island. Boats less than 50 m from haul-out site caused a higher percentage of vigilance among seals that were hauled-out less than a meter above the waterline (Fig. 2). There was also a general increase in vigilance of harbor seals hauled-out closer to the waterline (less than 1

m) than compared to those hauled-out higher on the rocks (above 1 m) during wake disturbances (Fig. 3). As shown in Figure 4, wakes caused the seals to be vigilant more than twice as much in the low area of the haul-out site than in the high. Wakes also caused a significant increase in vigilance when compared to motorized boats and sailboats (Fig. 4). However, motor boats caused a slightly higher percentage of vigilance in the low areas, whereas sailboats had a slightly higher percentage of vigilance in the high area of the haul-out site (Fig. 4).

### **Discussion:**

Our observations of harbor seal behavior on Yellow Island indicate modest levels of disturbance that depended on disturbance type and height of seals above water. Most responses to disturbance entail vigilance behavior (i.e. head lifts to scan surroundings). Conversely, flushing from the haul-out site was only seen once, in association with our only observation of kayakers. Disturbances caused by boats, kayaks and wakes had an adverse affect on seal haul-out behavior in low and high areas due to the amount of time seals needed to be vigilant. Because harbor seals will haul-out onto rocky substrate to rest, thermoregulate, molt and avoid predators, continually disturbing their haul-out behavior can be detrimental to their population in the San Juan Islands (Terhune and Brilliant, 1996). In our analysis, we determined that distance was not as big of a disturbance when compared to boat type and wakes, unless it was a kayak.

We saw only slight increases in vigilance behavior as boat distance to haul-out site decreased. The Marine Mammal Protection Act (MMPA) states that 100 m should be kept between boats and seals, yet we saw 41 out of 71 boats pass within 100 m of the

haul-out site. However, the seals seem to have acclimated to the high amount of boat traffic in the San Juan Channel, since we saw a lack of flushing behavior (NOAA, 2013). Our observations are supported by a study which found that seals can become acclimated to boats in areas of high traffic in the San Juan Islands, more specifically in the islands north of Orcas Island (Suryan and Harvey, 1999).

Although we only saw kayaks once, it caused a substantial disturbance; it is problematic because kayaking rates are increasing. Kayaks were seen within 10 m of seals on one occasion during our observation period. When kayakers approached the haul-out site, 100% of seals were vigilant and 63% flushed into the water. Causing the seals to flush into the water requires an increase in energy use and prevents them from being able to rest and thermoregulate. However, occasional disturbances may have little effect on harbor seal populations, but repeated disturbances may have a negative, long-term effect on populations (Richardson et al., 1995). Long-term effects are difficult to assess, and therefore more long-term research on the impacts of disturbances are needed.

We looked at the relationships of haul-out height and vigilance and compared it with type of disturbance (i.e. boat type and wake). Our results indicate that seals are more vigilant on the lower (<1 m) portion of the haul-out site during wake and boat disturbances than they are when hauled-out on higher (>1 m) portions. Seals hauled-out on low areas of the haul-out site were 31% more vigilant than seals that were hauled-out above 1 m during wake disturbances. In general, seals were more vigilant in the lower areas of haul-out sites, but seemed to be more vigilant during wake disturbances than during boat related disturbances (Figs. 3 and 4). Another study found that seals at the edge of the group tend to have a higher risk of predation than those in the center, or

higher on the rock, making the individuals at the waterline more vigilant, which correlates with our findings (Terhune and Brilliant, 1995).

### **Conclusions:**

During our study, we observed several recreational boats and whale watching vessels come within 100 m of the haul-out site studied. Because wakes had a substantial affect on haul-out behavior, we would suggest implementing speed limits in areas closest to known haul-out sites for harbor seals. Additionally, we would also suggest a revision of the MMPA to increase the distance vessels are required to avoid approaching marine mammals, from 100 m to 200 m. The decrease of speed and increase in distance would prevent wakes from causing substantial disturbances on harbor seal haul-out sites.

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**Figures and Tables:**



Figure 1: Map of study site on Yellow Island in the San Juan Islands, WA. Observations were taken from the west side of the island.

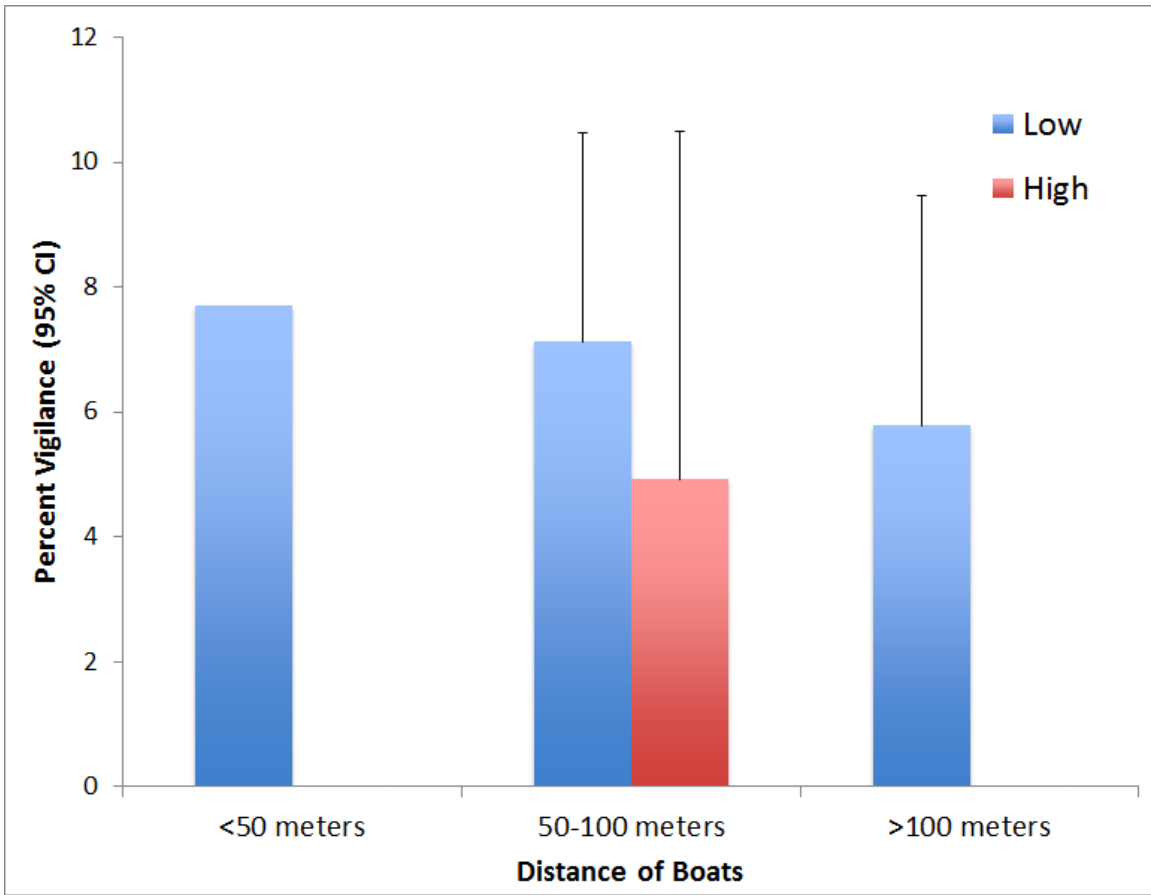


Figure 2: Percent vigilance (with 95% CI) of hauled-out seals on low and high areas compared to distance (0-200 m) of boats (not including kayaks) on a haul-out site off Yellow Island, WA in August 2014.

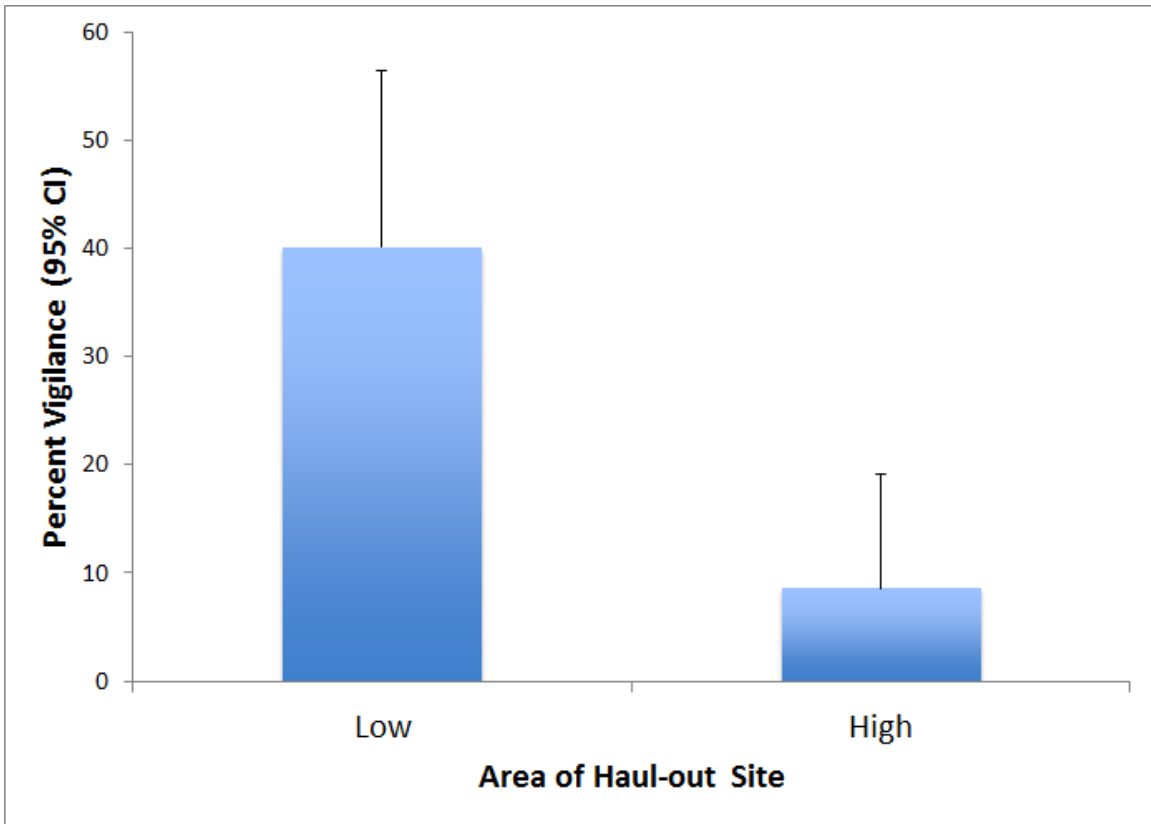


Figure 3: Percent vigilance (with 95% CI) of hauled-out seals in low and high areas of the haul-out site during wake disturbances off Yellow Island, WA in August 2014.

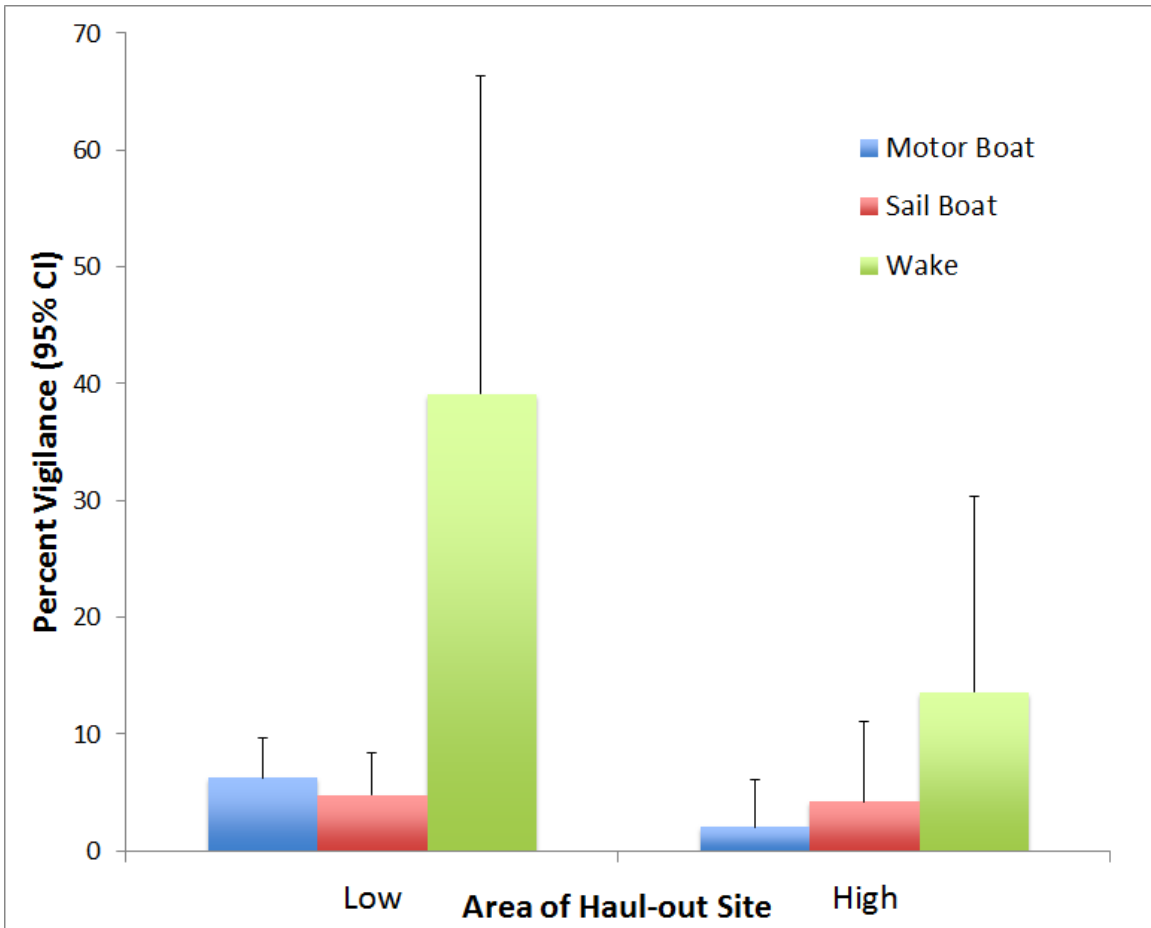


Figure 4: Percent vigilance (with 95% CI) of hauled-out seals in low and high areas of the haul-out site when compared to disturbance type (motor boat, sailboat and wakes) off Yellow Island, WA in August 2014.