Difference in Vigilance Rates Between Harbor Seal (*Phoca vitulina*) Mothers with a Pup and Lone Adults

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Abstract:

Knowing if rates of vigilance between mother harbor seals and lone adults (*Phoca Vitulina)* differ in any way is essential in moving conservation efforts in the right direction. We used focal individual and scan samples of harbor seals off of Yellow Island, WA to examine any possible differences in vigilance between the two seal categories at low tides. The result of overall vigilance rates for the seals was inconclusive. However, we did find that mother seals tend to be more vigilant the higher the tide goes, while lone adults had no change. This signifies that the less haul out space available, the more vigilant mothers become. Also, mothers spend less time loafing overall than lone adults and more time swimming, possibly due to the fact they are teaching their young feeding techniques. The data on vigilance rates being relatively equal between the two seal categories is inconsistent with prior studies, possibly due to smaller number of sample days. Overall, this study shows that while vigilance does not change much for mothers, they do spend more time exhibiting other active behaviors and less time resting than lone adults.

Keywords:

San Juan channel, Yellow Island, pinnipeds, harbor seal, *Phoca vitulina,* seal behavior, vigilance, pups, mothers with pups

Introduction:

Harbor seals (*Phoca vitulina)* are the only pinniped that actually breeds in Washington State (Jeffries 1985). Pupping season for harbor seals in the San Juan Channel occurs from June to late September (Huber et al. 2001). The harbor seal is one of few phocids that continues to feed during pupping season making them an income breeder (Bowen 1999).They are smaller than most other phocids and do not possess a large enough size to fast for the entire 24-day lactation period (Thompson 1994; Boness 1996). Harbor seal pups are the most precocial of the phocids, entering the water within hours of birth and continuing to spend a significant portion of their time during the lactation period in the water alone or with their mother (Thompson 1994; Renouf 1985).

Many seals use haul out sites to rest and lactate, spending as much time as possible on land during low tide to allow for maximum nursing time (Venables and Venables 1957). Mother seals have been shown to be much more alert and nervous than other seals (Newby 1973). At any signs of danger mothers and their pups tend to rush into the water. Panicky rushes into the water can increase the chance of mom and pup separations, leading to the pup's death (Osinga 2012). We saw that vigilance by seals can be caused by many different things: when other animals moved nearby, when humans caused a disturbance (e.g. boats, kayaks), and when large waves hit the haul out sites.

Knowing if mothers are more vigilant to disturbances or more vigilant overall than lone adults may help to reduce pup abandonment due to separation or

inability of mother to care for the pup due to increased energy expenditure from increased vigilance. This data may be helpful in determining conservation techniques for the species. If mothers tend to be more vigilant or remain vigilant for longer periods of time, enforcing distance rules during pupping season could increase their ability to save energy and reduce pup abandonment rates. Therefore, we focused our survey on whether or not mothers with pups show more alert behavior patterns than lone adults. We compared rates of nursing, loafing, vigilance, and swimming between the two categories of seals in relation to tidal heights to see if behaviors at the same tide vary. We hypothesized that because harbor seal mothers have pups to take care of they will spend more time being vigilant than lone adults at similar tidal heights.

Methods:

Location

We conducted this survey at Yellow Island in the San Juan channel just north of Friday Harbor, Washington. We surveyed a common harbor seal haul out location on the west coast of the island. We observed seals in the water near and hauled out on three separate rocks (approximately 48.591626 N and -123.033874 W). Seals were counted only if they were on or inside of the two outer haul out rocks. During tides >4 ft., these rocks were submerged meaning the only haul out location was on a rocky beach.

Survey procedures

Land-based surveys were conducted for 2 to 4 hrs. from 12-15 August 2014, near the end of the pupping season of harbor seals. 48x scopes and 10x binoculars were used to observe the seals from a distance of about 50-150 m. Surveys were done during daylight with relatively calm waters (Beaufort Sea State ≤ 3). Since seal counts in Washington are highest during the low tide of pupping and molting periods, we started surveys during ebb tide and continued through the start of flood tide (Jeffries 1985).

We conducted both scan and focal individual surveys. Scan surveys were done every 15 min. The scan surveys consisted of a total population count of all seals within each of six categories. Specifically, separately for land and for water, we counted the number of mothers with pups, lone pups, and lone adults. Scopes were used to identify which seals were pups and which were adults. Pups were classified on land as being much smaller than the adults. The mothers were identified on land as the closest seal that appeared to be showing maternal interest in the pup (i.e. nursing, bonding, or protective behavior). In water, mothers and pups were identified by showing bonding behavior while swimming (e.g. pup riding on mother's back). All other seals were considered lone adults.

One focal animal survey was conducted between each pair of consecutive scan samples. We rotated between surveying a lone adult and surveying a mother with a pup in order to get data for both categories near the same tide heights. Selection of an individual was done randomly by moving the scope across the population and choosing the lone adult/mother that was closest to the center of the field of view. Due to inability to track seals well in water, only seals that were already

hauled out were chosen for focal sampling. If they entered the water we continued surveying them there. We then surveyed activity of our chosen seal every 30 sec. for 10 min.. For each scan and focal individual survey we recorded time, weather, and tide height. To avoid bias, we maintained the same observer throughout the sampling process.

There were four different behaviors that we measured for each focal animal survey. Vigilance, nursing, swimming, and loafing were used to describe seal activities. Vigilance was considered any time the seal had its head up checking its surroundings while hauled out on land. Nursing was used only when the pup was witnessed feeding from the mother on land. Swimming was used for any time a seal spent in the water since exact seal behavior in water was not viewable. Loafing was used any time a hauled out seal was not being actively vigilant or was performing normal activities unbothered (e.g. grooming, scratching, social behavior).

Analysis

We assessed correlation of seal abundance and behavior with tide height in the following ways. First, to calculate the abundance of each type of seal on land, we divided the number of seals in each category on land (e.g. mothers with pups, lone pups, and lone adults) by the number of seals in each category overall. We used a line graph to represent this relationship of seal abundance on land and tide height (Fig. 1). Second, to determine which behavior showed the most interesting relationship to tide height, we made one scatter plot diagram each for the seals

hauled out and for those in the water to allow us to compare all four behaviors at the same time (Fig. 2 and Fig. 3). Third, we compared the average percent of time that mothers with pups and lone adults spent performing each behavior. We calculated the average amount of time each seal spent doing each behavior and then calculated the mean using these averages (Fig. 4). To determine if our hypothesis was correct, we then made a bar graph comparing what percent of the time mother seals and lone adult seals spent being vigilant at low and high tides (Fig. 5). Finally, in the case that the amount of times per 10 min that a seal changed their behavior was significant, we made a bar graph representing the comparison between mothers and lone adults (Fig. 6).

Results:

Abundance

Our abundance data showed that mothers with pups and lone pups spent more time hauled out in comparison to lone adults. While at times 100% of mothers with pups and lone pups were hauled out, our data showed that hauled out lone adult seal levels never reached above 98% (Fig. 1). Our data also showed that lone pup seals did not haul out until tides were at a height of about 0.34 m (Fig. 1).

Behavior

The behavioral data showed several differences between mother seals and lone adults. First, the data showed that both mothers with pups and lone adults spent the majority of their time loafing, with vigilance, nursing, and swimming

behavior levels significantly lower (Fig. 4). This data also showed that mothers with pups spent significantly more time swimming than lone adults did (Fig. 4). The comparative data of vigilance levels between mothers and lone adults showed that lone adults were significantly more vigilant at low tides than mothers (Fig. 5). However, the data also showed that while lone adult vigilance levels stayed about the same at low and high tides (25% and 26% respectively), mother seal vigilance levels were raised at higher tides (11% and 30% respectively) (Fig. 5). The final comparison shown in the data was how many times per minute each respective group of seals (i.e. mothers and lone adults) changed their behavior (Fig. 6). This data was inconclusive, showing no significant difference between the number of behavior changes between mothers and lone adults (Fig. 6).

Discussion:

Abundance

The abundance data showed that mothers with pups and lone pups are the only categories that were 100% out of the water at any point (Fig. 1). This could suggest that perhaps seal pups do not have the same amount of swimming endurance as an adult, and that with or without a guardian, they must exit the water to rest more often. It could also be due to the fact that mothers have to nurse their young on land, so a good portion of time is spent hauled out. This correlates with the study done by Venables and Venables (1957) which states that mother pup pairs want to have maximum nursing time on land. Lone pup seals were not shown hauled out until the tide was in at least 0.34 m. Mothers also seem to spend

a significantly less amount of time in the water at tide heights below 0.34 m. This could suggest that lower tide height could make it easier or safer for mothers to spend time in the water feeding away from their pups.

Behavior

The behavioral data showed that both categories of seals spent the majority of their time loafing rather than being vigilant, nursing, or swimming (Fig. 4). This could be because loafing is a resting activity, while the other three activities all require some amount of energy. The data also showed that mother seals spent more time swimming than adult seals did and there could be several explanations for this. First, the mother seals could be out feeding and teaching their young to feed. Second, the mother and pup have specific bonding behavior that only in the water (e.g. riding on mothers back and nuzzling). Lastly, perhaps mother pup pairs abandon haul out position more quickly in the case of disturbance (e.g. boats, waves, and kayakers) and so spend more time swimming.

Our vigilance comparison showed that mother seals were more vigilant at high tide than at low tide (Fig. 5). We think this is due to the rising water level and the possible threat of being separated from the pup. A panicked rush into the water can increase the risk of separation (Osinga 2012). We witnessed seal pups sliding off of the rocks into the water multiple times, as well as showing difficulty hauling out on the rocks from the water, so separation anxiety could easily be a factor for heightened vigilance at high tide. We expected to see a difference in the number of behavior changes between mother seals and lone adults, but our data

was not significantly different (Fig. 6). Our estimation was that since the amount of time each group of seals spent being vigilant was not significantly different, that perhaps the mothers were spending more of their time changing their behavior than the lone adults. However, our data showed no significant difference and our data proved inconclusive.

Bias

Data may be biased toward seals being hauled out because seals in water are much harder to see. A correction factor by Huber et al. (2001) for the San Juan Islands during pupping season states total population is actually 1.53 times total seals hauled out and could be used in future studies to help reduce population bias. Also, since our focal samples only selected from seals that started out on land, amount of swimming recorded in our behavioral analysis may be lower than true numbers. Only going during low tides instead of at all tide heights may have biased results as well and may be relevant for future studies.

During both a scan and a focal survey we had a group of paddle boarders come within 25 ft. of the rocks, flushing all seals from the haul out sites and possibly creating bias in both behaviors and total scan count at that time. We did not notice any significant behavior change due to our presence but it is possible seals were more vigilant with us watching them than other times of the day.

Conclusion:

In our study, we did not find conclusive evidence to support our hypothesis, but we did find some compelling differences between mother seals and lone adults.

First, mothers with pups and lone pups spent slightly more time on land, which could be due to a couple of biological reasons. Second, while our data did not show higher levels of vigilance in mothers compared to those of lone adults, mothers were considerably more vigilant as the tides came in while lone adults did not seem to be bothered by the change.

Future studies could include studying behavior at all tide heights and not just low tides along with possibly studying seal behavior all throughout the pupping season instead of just toward the end of the season.

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Figures:

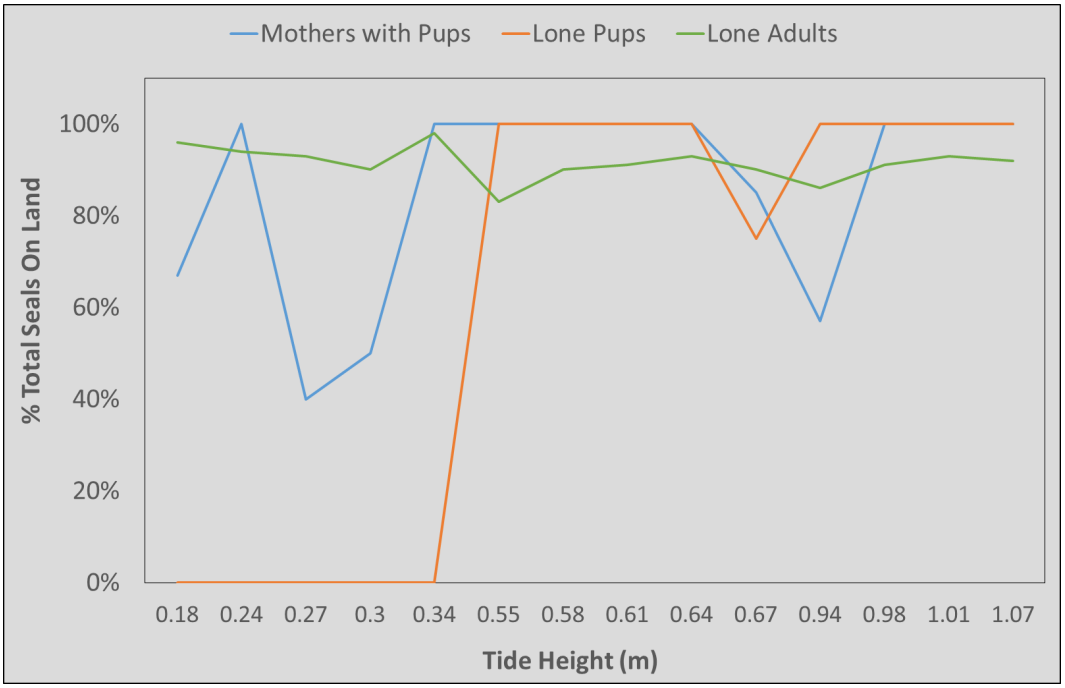

Figure 1: Total percent abundance of seals on land in comparison to tide height collected between 12-15 August 2014 on Yellow Island, WA. Each colored line represents a different seal type in total abundance count. If percentage is less than 100%, seals in water are represented by the remaining leftover percent.

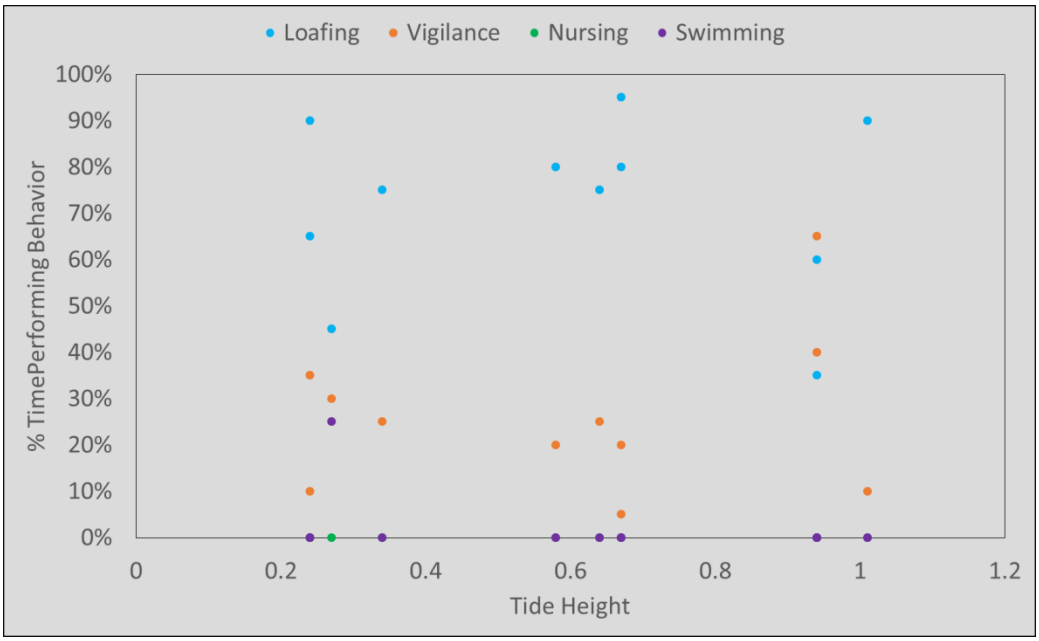

Figure 2: Scatter plot for percent of time lone adult seals spend doing the four different behaviors listed at specific tide heights. Each point represents average behavior time by one individual. Behavior sample was taken in ten minute intervals.

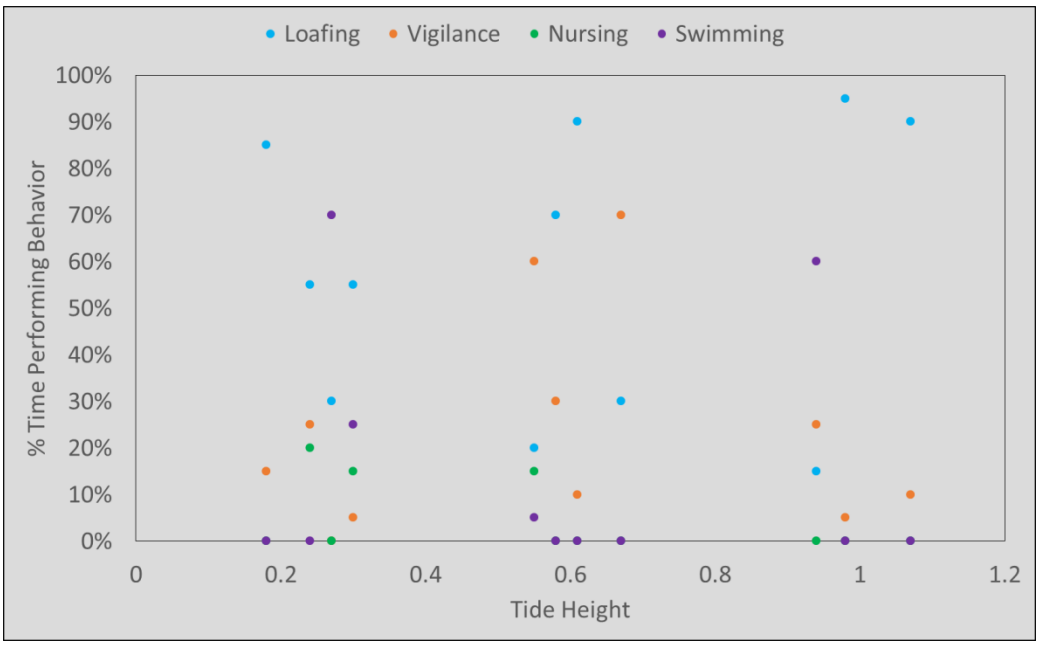

Figure 3: Scatter plot for percent of time mothers with pups spend doing the four different behaviors listed at specific tide heights. Each point represents average behavior time by one individual. Behavior sample was taken for ten minute intervals.

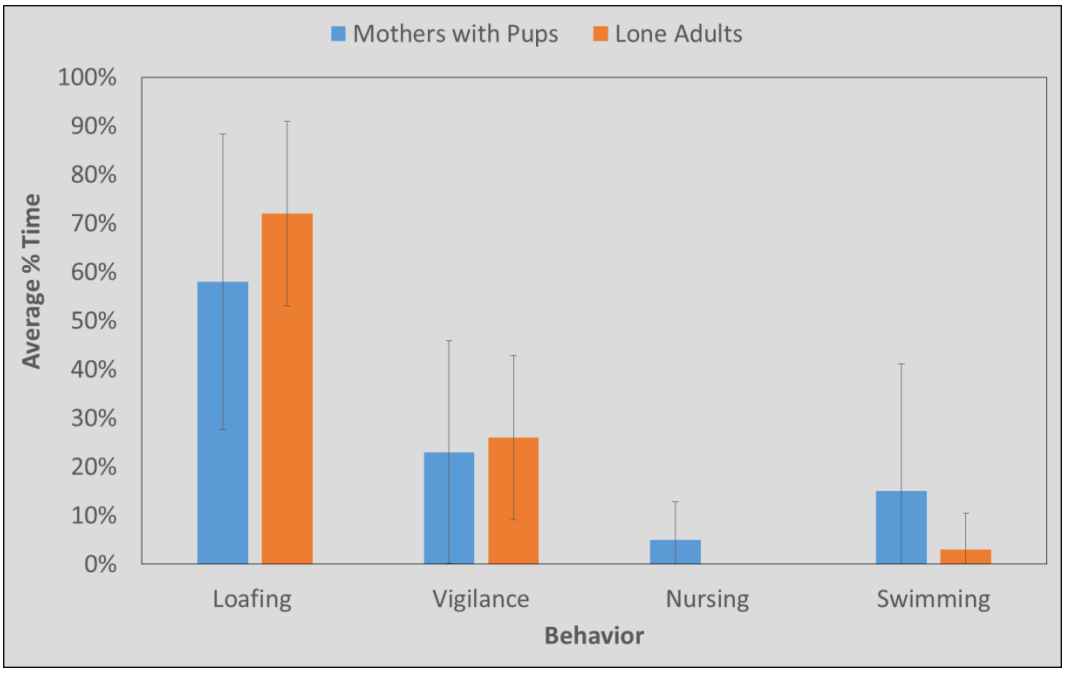

Figure 4: Average percent of time that all lone adults and mothers spend doing each behavior. Error bars show mothers with pups loafing (±30% SD), vigilance (±23% SD), nusing (±8% SD), and swimming (±26%). For lone adults loafing (±19%), vigilance (±17% SD), and swimming (±8% SD).

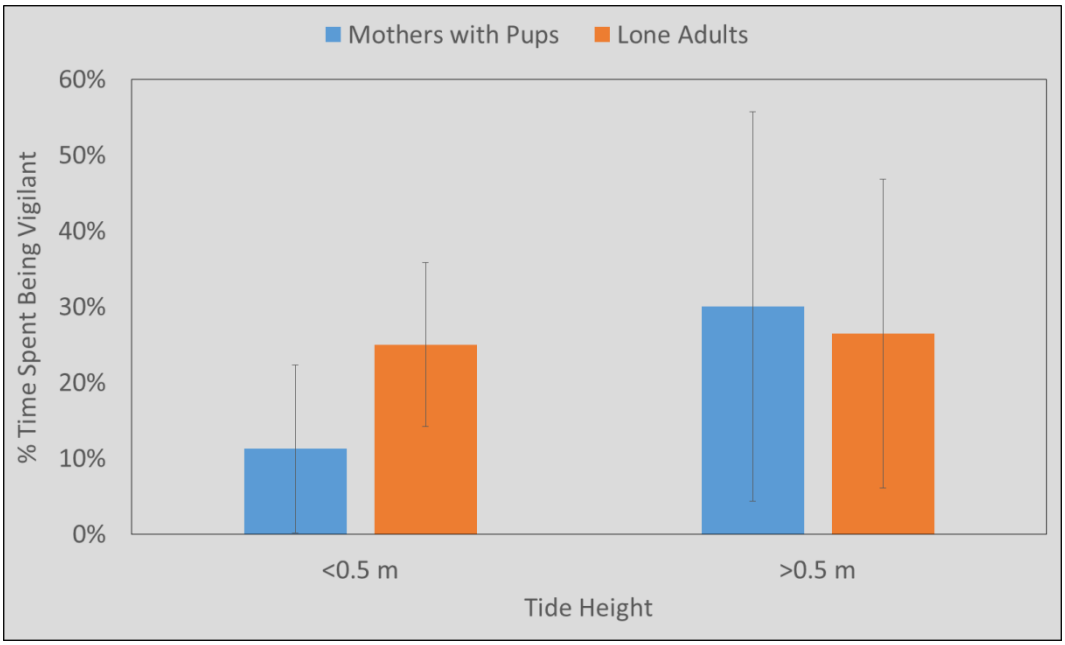

Figure 5: Percent time our two seal categories spent being vigilant in relation to low and high tide heights. Vigilant lone adults at low tides (±11% SD) and high tides (±20% SD) are about equal. Mothers are much more vigilant at high tides (±26% SD) than low tides (±11% SD).

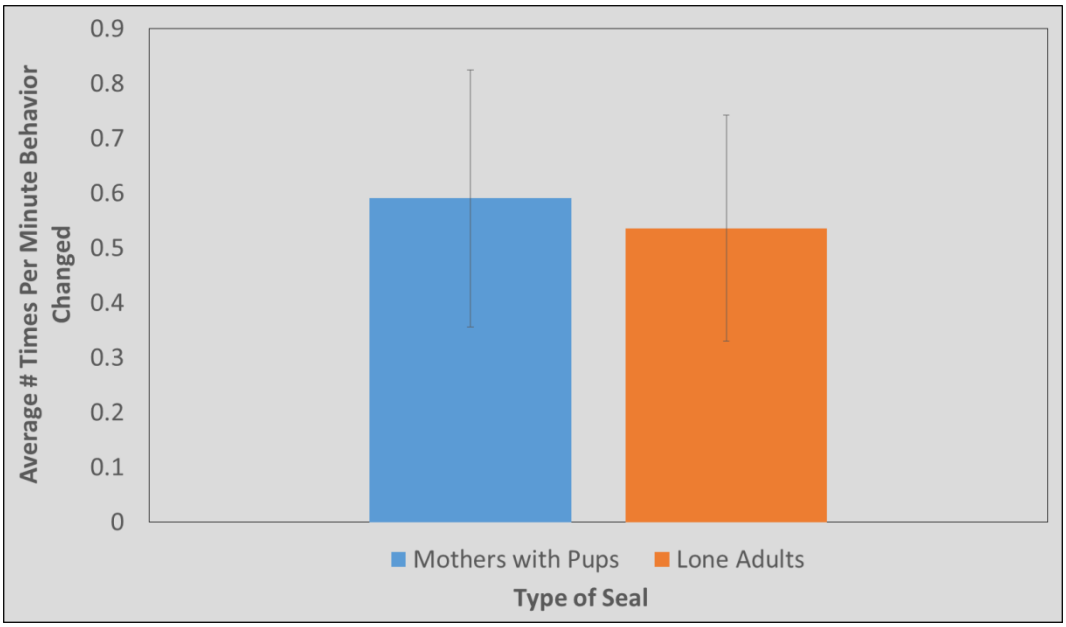

Figure 6: Average number of times per minute that each seal category changed its behavior. Mothers (±23% SD) changed behavior a small amount more than lone adults (±21% SD) but not enough to show significance.