

**Harbor Seal (*Phoca vitulina*) Social Dynamics: Behavioral Comparisons of Mother-Pup Pairs, Lone Pups, and Lone Adults in the San Juan Islands, Washington During Summer 2025**

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## **Abstract**

June to September are some of the most vulnerable months for harbor seals (*phoca vitulina*) in the San Juan Islands because of human disturbances during the pupping season. When threatened, mother seals may flush and abandon their pup until the disturbance is gone. Extended separations from mom can be fatal, and as anthropogenic disturbances increase, the amount of abandoned pups could also increase in the next upcoming years. Our research aims to provide information for harbor seal pup rehabilitation and conservation in the Salish Sea by observing mom-pup pair interactions and important social behaviors they do together. Additionally, our research provides knowledge on social behavior of lone pups and lone adults which can be used for further research to compare habituation of these animals. We found that lone adult seals spent the most amount of time resting/loafing, while lone seal pups spent the most amount of time being vigilant compared to other seal groups. We also found that mom-pup pairs spent 100% of flushing and swimming time together, revealing the importance of mothers showing pups how to flush and the necessity of giving seals the opportunity to swim in rehabilitation centers.

## **Introduction**

Harbor seals (*Phoca Vitulina*) are a common marine mammal found on solid substrates like rocks and beaches along the West and East Coast. Harbor seal populations in Washington dropped to around 5,000 in the 1940's but have since rebounded due to the Marine Mammal Protection Act in 1972 (Scheffer & Slipp, 1944). Today, the harbor seal stock in the Salish Sea is about 50,000 (Jeffries et al., 2003) and has remained at equilibrium since the mid-1990s (Ashley et al. 2020).

In Spring, harbor seal mothers give birth to a singular pup and pups are dependent on mom's milk for a month until they are weaned (Marine Mammal Stranding Network, 2025). Harbor Seal's are income breeders, they leave their pups for 24 to 48 hours to forage so they can maintain their energetic needs for themselves and for their pups (NOAA, 2022). June to September are some of the most vulnerable months

for harbor seals in the San Juan Islands because of human disturbances during the pupping season. When threatened, harbor seals “flush” into the water which can separate a mom-pup pair, and the mother seal may not return until the disturbance is gone. Extended separations from mom can be fatal, half of all pups born do not survive their first year of life (Marine Mammal Stranding Network, 2025).

The amount of harbor seal pups abandoned by their mom from anthropogenic effects is unknown. SeaLife Response, Rehabilitation, and Research (SR<sup>3</sup>) has received over 150 harbor seals in which many of these seals were abandoned pups due to human effects (Parker, 2025). As anthropogenic disturbances increase, the amount of abandoned pups could also increase in the next upcoming years. Increasing anthropogenic disturbances can also lead to habituation, a process where harbor seals become more comfortable around humans which decreases their vigilance and defense against predators. A study in 2013 found that harbor seals decrease vigilance to bald eagles at sites with more boat exposure (Olson et al., 2013). As predators for harbor seals like Bigg’s Killer Whales (*Orcinus orca*) increase in the Salish Sea, it may be important to analyze behavioral changes in association with human exposure to these animals.

Our research aims to provide information for harbor seal pup rehabilitation and conservation by observing mom-pup pair interactions and important social behaviors they do together. Additionally, our research provides knowledge on social behavior of lone pups and lone adults which can be used for further research to compare habituation of these animals in the Salish Sea.

## **Methods**

### *Study Site*

We collected data from August 10th through August 14th of 2025 on Yellow Island, a small island located near Friday Harbor in the San Juan Islands WA, USA. This site was chosen based on the clear and reliable view of the seal haul out with the ability to see mother-pup pair interactions in detail.

Data was collected late in the pupping season when pups were beginning to get weaned and were comparable in size to the adult harbor seals. Our observations were taken on the western side of the Island from a high vantage point inside of the dirt trail about 200m away from the haul out. The harbor seals were observed through binoculars and a spotting scope from this distance. We observed the seals 1 to 2 hours before low tide and 1 to 2 hours after low tide each day totalling 12 hours of behavioral observation.

### *Behavioral Sampling*

We conducted focal surveys of lone pups, lone adults, and mother-pup pairs. Behaviors were categorized as resting/loafing, vigilance, interactions with other seals, nursing, locomotion, flushing, swimming, and maintenance. Behaviors were recorded every minute for 10 minutes for each Seal. After 10 minutes of observation we chose a new seal or pair to observe. We communicated which area of the haul out we were observing to avoid observing the same seal and observer bias. Mom-pup pairs were determined by proximity (pup laying directly next to mom) and nursing. Lone pups were also determined by proximity (5-6 feet away from other seals) and time (if they had been alone for a couple hours). Our recorded data was put into Excel where we calculated the average percentages of behavior for the seal type (lone adult, lone pup, mom, and pup). The percent of time mothers and pups exhibited synchronous behavior was also calculated, along with the type of behavior that was synchronized.

## **Results**

### *Lone Pups*

Overall, lone pups spent an average of 65.48% of their time resting/loafing, 30.35% of their time being vigilant, 12.52% of their time swimming/locomoting, and 2.8% of their time performing maintenance. Lone pups were the most vigilant out of all the other seal groups, and were second for being

the most active (swimming/locomotion). Lone pups were also found to be in near proximity to mother-pup pairs or groups of lone adults. Lone pups rarely interacted with other seals but stayed near the other seals in the haul out.

### *Lone Adults*

Our findings showed that lone adults spent an average of 75.27% of their time resting/loafing, 21.5% of their time being vigilant, 12.52% of their time swimming/locomoting, and 3.03% of their time performing maintenance. Lone adults spent the most time resting/loafing and doing maintenance compared to all other seal groups. Lone adults were found to rarely interact with other seals at the haul out site but had no apparent preference for their position on the site. Lone adults were found to be both completely isolated and in large groups on the haul out.

### *Mom-Pup Pairs*

We observed mothers with a pup spent 70.22% of their time resting/loafing, 24.7% of their time being vigilant, 4.15% of their time swimming/locomoting, and 0.09% of their time performing maintenance. Mothers with a pup spent the least amount of time locomoting, and were second for resting and vigilance out of all other seal groups. Pups with their mom present spent 57.54% of their time resting/loafing, 15.87% of their time being vigilant, 21.35% of their time swimming/locomoting, and 0.09% of their time performing maintenance. Pups with their mom present were the most locomotive, least vigilant, and rested the least out of all the other seal groups. Mother-pup pairs were also found to spend their time close to the water and isolated from other seals when there was available space. The pairs also spent little time interacting with other seals but were not bothered by lone pups that were typically found to be nearby.

### *Mother-Pup Synchronization*

Mother-pup pairs were observed exhibiting multiple behaviors at the same time. We observed mother-pup pairs flushing and swimming together 100% of the time. Mother-pup resting/loafing time was observed to be done 80% of the time synchronously. We observed locomotion found to be done 47% of the time together, vigilance at 44%, and maintenance at 20%. For the total synchronization of mother-pup pairs it was found that they shared their behaviors 76% of the time.

## **Discussion**

### *Social dynamics*

Our observational data reflects that mom-pup pairs spend the majority of time interacting together (nursing and resting) close to shore and near the water. A study conducted by researchers at the Royal Irish Academy in 2018 concluded that water is vital and a facilitator for socialization of harbor seals, revealing the important relationship seal pups have with water and the necessity of a body of water in seal rehabilitation (Wilson et al., 2018). Mom-pup pairs also spent 100% of flushing and swimming time together, revealing the importance of moms showing pups how to flush when there are predators or threats nearby. A study in 2001 concluded that pups will also often follow mom into the water (Wilson, 2001), and another study in 2022 observed mom-pup pairs flush together from anthropogenic effects (Guadalupe Ruiz-Mar et al., 2022). Flushing and swimming are both extremely important behaviors for harbor seal survival. There is little to no research on how flushing can be mimicked in rehabilitation centers, but there is evidence showing orphan pup pairs cause orphan pups to act as mother substitutes for each other. The orphaned pups showed very similar behaviours to wild pups with their mothers (Wilson, 2024).

### *Habituation*

Our research found that habituation to vessel traffic may be affecting the behaviors of lone adult harbor seals. We found that lone adults spent the least amount of time being vigilant whilst being at the haul out. We also found that lone pups spent the most time being vigilant out of the seal types. However we also found that the adults reacted more to vessels and the pups would mimic the flushing behavior of the group. Habituation can be a serious harmful cause for marine mammals as it disturbs their natural behaviors. Thus our findings aid in the timeline for harbor seal habituation and the resulting effects that may be found through continued research of seal behavior and habituation.

### *Implications*

Our findings imply that mother seals will be less active and more vigilant so they can store their energy, provide, and protect their pup. We observed mothers being vigilant while the pups rested, which likely gives the offspring the greatest chance of survival as the pup is able to get needed rest. Lone pups were observed to be more vigilant. Our findings indicate that it is due to the mother not being present to do it for them. This is significant because we are able to begin to understand how seals learn when to do behaviors and how abandoned pups are affected by not having their mother. Which in turn allows better care and understanding of abandoned pups. Particularly in what abandoned pups have lost socially and behaviorally due to the loss of their mother.

We also found that mother-pup pairs were highly synchronized in swimming, flushing, and resting. These may be learned behaviors as to the timing of exhibiting them. These behaviors can be greatly risky to pup survival if not done with the correct timing. This contrasts with the observations of vigilance, maintenance, and locomotion not being heavily synchronized implying that these are more natural behaviors. We hypothesize that pups are not dependent on mom for doing these behaviors and therefore focusing on replicating these behaviors in rehabilitation and conservation is not a pressing issue. We also hypothesize that lone pups are more vigilant without their mother since vigilance is a key element

to their survival. Knowing this, it is concerning that we observed many adult harbor seals lacking vigilance, rather than regularly scanning like lone pups and mother seals.

### *Further Research*

From our findings we concluded that mother-pup pairs always flush and swim together. However, we know this is not always the case as mother harbor seals must leave their pups to go and forage as they are income breeders. It would be significant to observe when a pup does not follow their mother into the water and what indicators there are in the behavior of the mother-pup pairs. Finding an action by the mother that indicates she is going to forage would be beneficial in the care and identification of abandoned pups. In addition to this if the mother left just while the pup was sleeping it would also be beneficial to observe how the pup reacts to finding itself alone, which could help to understand how abandoned pups behave.

As Bigg's Killer Whales become more abundant in the San Juan Islands and specifically Friday Harbor, it is important to understand how habituation affects the vigilance of harbor seals. A lack of vigilance can lead to an increase in predation which could greatly affect the harbor seal populations if the abundance of their predators increase. Our data was able to add to the timeline of harbor seal vigilance and habituation, especially the habituation caused by kayaks and low speed vessels as it potentially mimics the hunting strategy of Bigg's Killer Whales. Research must be continued to determine the overall trend of lone adult seal vigilance and the impact on their population as a whole in the San Juan Islands.

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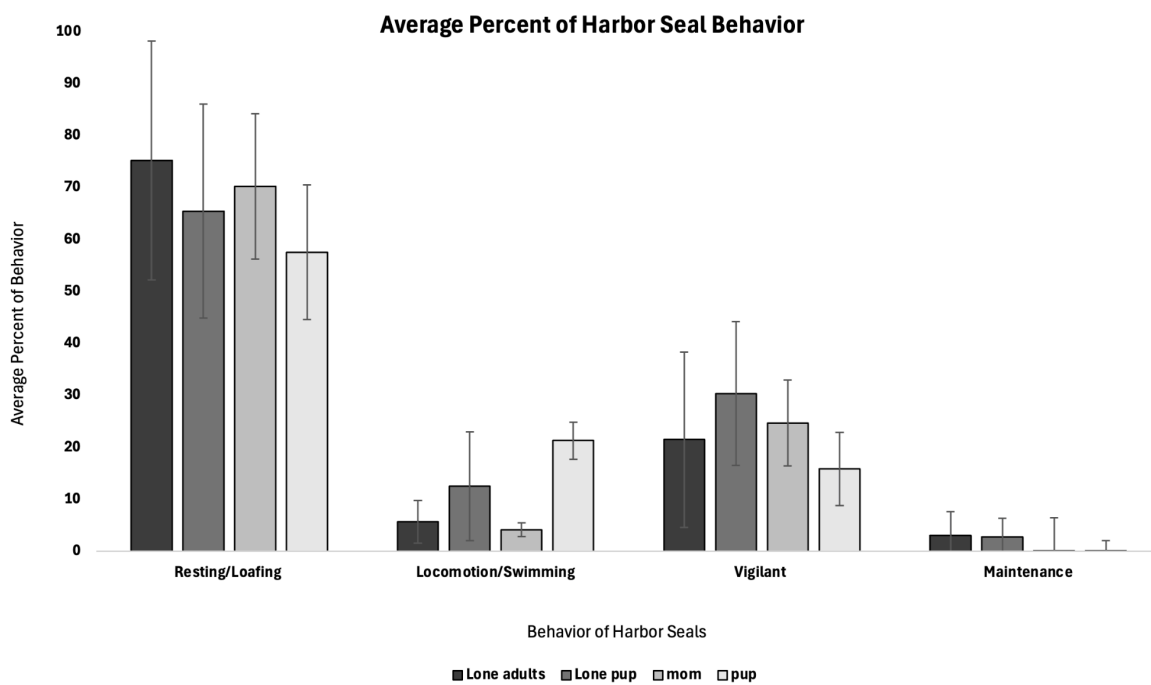
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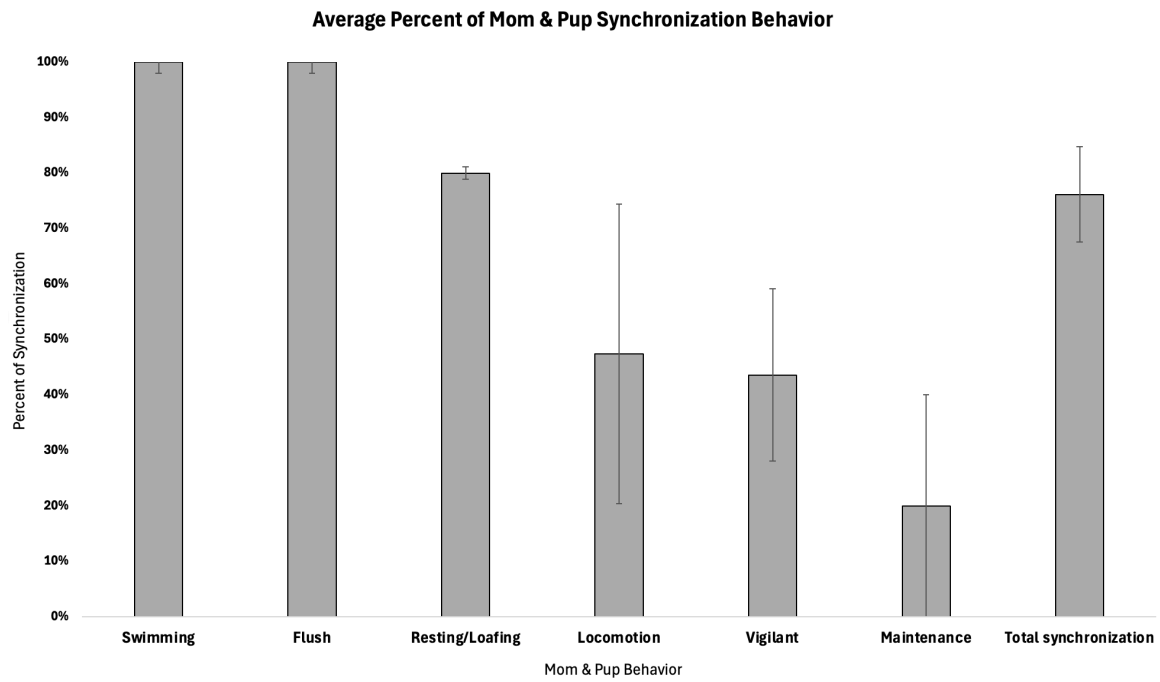
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## Figures



**Figure 1:** Lone adult harbor seals, lone pup harbor seals, and mom-pup harbor seals were examined for about 12 hours on Yellow Island. Behavior was put into percentages for every seal, then averaged for each seal group.



**Figure 1:** Mom-pup pair behavior was observed every minute for 10 minutes and the synchronization of each behavior was noted. Mom-pup synchronization was then averaged for each behavior they did at the same time as well as total behavior they did together.