

**Habitat structure and preference of harbor seals (*Phoca vitulina*)
during the summer in the San Juan Islands, Washington.**

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Abstract

Surveying the habitat, interactions between harbor seals (*Phoca vitulina*) and the habitat and also their behavior is important to better understanding these seals. The number of seals hauled out on each site was compared to tide height and the number of seals in the water was compared between those in the fast current and those in the slow current. Distance was also measured from the lookout point to each site and compared to the number of seals on each haul out site. As the tide height increased, the number of seals hauled out on sites A and F decreased dramatically, while those on B, D and E remained the relatively the same, which shows that those from A and F did not move to the closer haul out sites. The tide height and what time of day seemed to have an effect on the number of seals in the water and the proportion of how many were in the fast current compared to those in the slow current. Also, distance may be an important factor because more seals were hauled out on A and F, which are much further away from observers on land than other sites. The closer sites were used mainly by nursing mom-pup pairs.

Key Words

Harbor Seals, *Phoca vitulina*, sustainable habitat, habitat usage, behavior, San Juan Island, Yellow island.

Introduction

In the Pacific Northwest, the harbor seal (*Phoca vitulina*) population was greatly reduced by hunting in the beginning of the 20th century; only 2000 to 3000

harbor seals were present in the early 1970s (Huber et al. 2010). After the Marine Mammal Protection Act, populations of harbor seals have increased in the Pacific Northwest (Huber et al. 2010), but there is evidence that there have been declines in other regions (Twiss 1999). Thus it is important to continue to monitor the population status and behavior of these animals.

Harbor seals are one of the most widely distributed marine mammal in temperate coastal waters (Zamon 2001), so knowing the types of habitat they use and also the interactions between habitat and tide could be important to their conservation. A typical harbor seal habitat should provide suitable haul out sites, shelter during parturition and lactation periods and sufficient food within reach of the haul out sites to sustain the population throughout the year (Evans 2001).

Diurnal haul-out patterns and limited traveling speed indicate that harbor seals forage within a few kilometers of their haul out sites. In addition, interactions between tidal currents and topographic characteristics are important mechanisms for increasing prey availability for these seals (Zamon 2001).

During the summer of 2011, I studied the habitat use of harbor seals on Yellow Island, a site known to be a popular haul out area. I determined how harbor seals used different haul out sites on the island and how this use varied over different times of day and tides. Preferences of swimming seals for fast and slow current speeds were also examined. I also considered the effect of observer distance on harbor seal distribution patterns

Methods

Survey Site

This survey was conducted in the San Juan Islands, Washington, on Yellow Island, (48° N, 123° W). Land-based observations of harbor seals were made from the west side of Yellow Island using 8X binoculars and a 15- 60X spotting scope.

Surveying Seals

Trips to Yellow Island were made at different times of the day (9:00 am to 5:30 pm) and also during different tide levels (low, medium, and high). From the look out point on the west side of Yellow Island, the area was sectioned into six major haul out regions. The currents were distinguished between fast and slow; currents near sites A and F were considered fast, while the currents near sites B, C, D and E were considered slow. Every 10 to 15 min, I counted the number of seals in each region, noting how many were on land and how many were in the water. Currents were distinguished between fast and slow by their appearance. Currents that were choppy and had more wave action were fast currents, while slow currents were calm and smooth. I made observations of female pup-pairs, the physical attributes of haul outs, and what the seals in the water were doing (foraging behavior, playing, observing us,), which I will use in the discussion.

Analysis

Comparisons of different haul out sites, observations of seals and physical attributes of the ocean were made. I compared the number of seals on each haul out sites relative to tide height. In addition, the average number of seals hauled out over the entire survey period was contrasted among three to tide categories;; low (-1 to 1.5

feet), medium (1.6 to 4 feet) and high (4.1 to 6.5 feet). Also, I made comparisons between the number in the fast currents to the number in slow currents. Measurements from the lookout point to each haul out site, which was estimated using Google maps, were used to assess whether distance from humans might have altered number of seals hauled out.

Results

The distribution of seals hauled out on land varied with tide height. On August 17, the tide height ranged from medium to low. From two hours, the number of seals hauled out on site A, which is one of the more popular haul out sites, went from a maximum of 23 to 0 seals (figure 1). Also, during a low to medium tide time span, the most drastic change happened on site F from a maximum of around 57 to 0 seals, while those on site A stayed constant (figure 2). Though the data shows that the average number of haul outs on B, C, D and E remain somewhat constant throughout the day. The only sites that change drastically are sites A and F which both decrease from an average number of around 24 seals to 0-5 seals (figure 3). Along with tide height affecting those on land, the number in water is also connected to tide height.

Seals also showed variability in their use of water habitats. In this survey, the average number of seals on land surpassed the average number of seals in the water (figure 4). However, when comparing those seals only in water, the proportion of those in fast current compared to those in slow current depend on tide height.

During high to medium tides, the percentage of those in the slow current was equal

to or greater than the fast current, except at the very beginning of the time period (figure 5). When comparing even the raw numbers of seals in fast current to seals in slow current, it is clear that there are more seals in the slow current than fast current (figure 6). However, during low to medium tides, the number of seals in the fast current was extremely close to the number of total seals in the water, which means that there were very few seals in the slow current; only two seals were counted in the slow current during that day (figure 7). Clearly, the number of seals in the fast and slow currents correlate with differences in time of day and tide height.

The number of hauled out seals also varied considerably among the different sites. Higher numbers of seals were seen on sites farther from shore, when those sites were available, not covered by tides. Sites A and F were the farthest away from the shore, with A measuring at around 401 feet and F at 563 feet from the shore. Sites B, C, D, and E, especially E were much closer to the shore; B = 194 feet, C = 160 feet, D = 310 feet, and E = 280 feet. Throughout the day, from low to high, the average number hauled out on sites A and F decreased drastically; A from an average high of 24 to a low of 6, and F from an average high of 24 to 0 harbor seals (figure 8). However, the average number of harbor seals hauled out on sites B, D and E somewhat increased, with B having the biggest increase of six seals from low tides to high tides (figure 8). The only site that did not have any significance was site C because the average stayed at 0 seals from low to high tide.

Discussion

The variation in distribution of seals hauled out can be explained by availability of space and also the locations of the sites. First of all, each site had a different topography. Sites A and F had a much larger, flatter area than sites B, D, and E. Site C had a different substrate makeup, which could have been a factor to their preference. Since harbor seals prefer space, a site with a bigger area allows more seals to haul out. A flatter area would make it easier to transition between land and water. Location could also be a major factor in their preference of habitat. Prey distribution in faster currents could cause seals to forage further offshore, potentially using haul-out sites nearer those resources to reduce travel costs (Cordes et al 2011) (Orr et al. 2004). In addition, sites A and F were farther from the coast near faster currents. Seals aggregate near areas with topographic relief and strong currents (Zamon 2001), thus sites A and F would be ideal compared to sites B, C, D, and E.

The trend of variability of seals in different currents could be a result of behavior. The data showed that the number of seals in the fast current was lower than the number of seals in the slow current. Seals in the faster current are using that site mainly for foraging and from what I saw, swam alone. Those in the slow currents are not usually foraging. This time of the year is the harbor seals breeding time, so most of those seen in the slow currents were seen in groups of 2 or 3 and evidence of playful activity was also seen. Also, this is when pups begin to wean, which means that they will spend up to 70% of their time in the water (Jansen et al. 2010), and we saw them swim with other seals. During our surveys, I did witness a feeding above water, which was located in fast moving currents. This was between

4:45 – 5:00 pm (figure 6), which was the only time when there were more seals in faster currents than in slower currents. However, it was hard to track the exact number of those in the water and what exactly their behaviors were, especially at sites A and F since they were further away and most foraging occurs underwater.

In addition to variability of seals in different currents, a variability of the number of seals on different sites because of distance was also observed. I believe that this trend occurred because of how close each site was to the shore and what they were used for. The biggest numbers of seals on a site were those that were farther away (sites A and F). When tide height increased and covered sites A and F, there most did not move to the closer sites, which could have happened because those sites were too close. Those sites that were closest to the observation point were used mostly for nursing and the only time site C was used was for nursing. Harbor seal pupping sites are used consistently in, despite high levels of disturbance (Cordes et al. 2011). When entering the observation site, I noticed some seals that would flush in the water from the closest sites (B, D and E), though it was mostly adult seals or juvenile seals that were on their own. It has been shown that shorter term disturbance stimuli (for example, park visitors) were not related to reduce pup:adult ratios at subsites, however, when disturbed, adult seals shift to alternative habitats away from disturbance sources (Becker et al. 2011). In addition, since phocids fast during lactiation, nursing pups and mothers do not need to be near fast currents to forage (Boness et al. 1994), therefore, they can stay on sites closer to the slower currents (B, D and E). Clearly, most seals congregated on haul out sites

farther away from disturbances while those that were on the sites closer to shore were used mainly for mom-pup nursing pairs.

Observing variability in trends in numbers of harbor seals can help understand their behavior and maybe their ecology. Marine mammals have been found to choose habitats that provide resources necessary for survival and reproduction; use of an area reflects quality or abundance of resources available in that area (Grigg et al. 2009). Although this study supports the idea that harbor seals live in a habitat that includes resources to sustain their way of life, more should be done to get more accurate data and results.

There are a few suggestions I want to make for further studies. There were a few spots on the sites, especially site D, that we couldn't see so getting a more accurate count of the seals would be an improvement. Also, to simplify my results, I combined sites A and F to be the fast current, while the other sites were slow current, though there were sometimes slow current near site A. I would suggest a more precise count of how many were in the fast current versus slow and also to get a better reading of their behavior while in each current speed, especially seals on the farther sites (A and F). To get a more accurate reading of mom and pup behavior, I would suggest taking precise counts of moms and pups versus adults, especially on sites A and F.

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Appendix

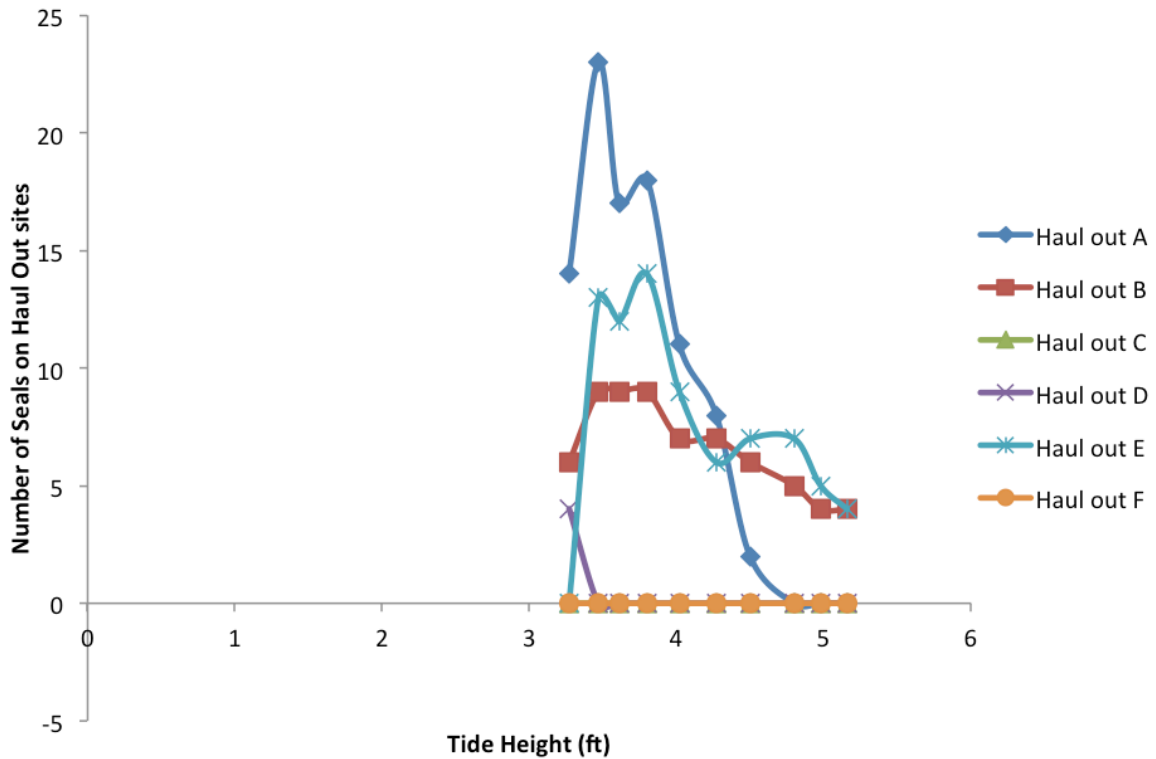


Figure 1. Compares the number of seals on each haul out site (A-F) to tide height in feet. This data was taken on August, 17, 2011 from 3:30 to 5:30. Tide height ranges from 3.27 ft to 5.16 ft.

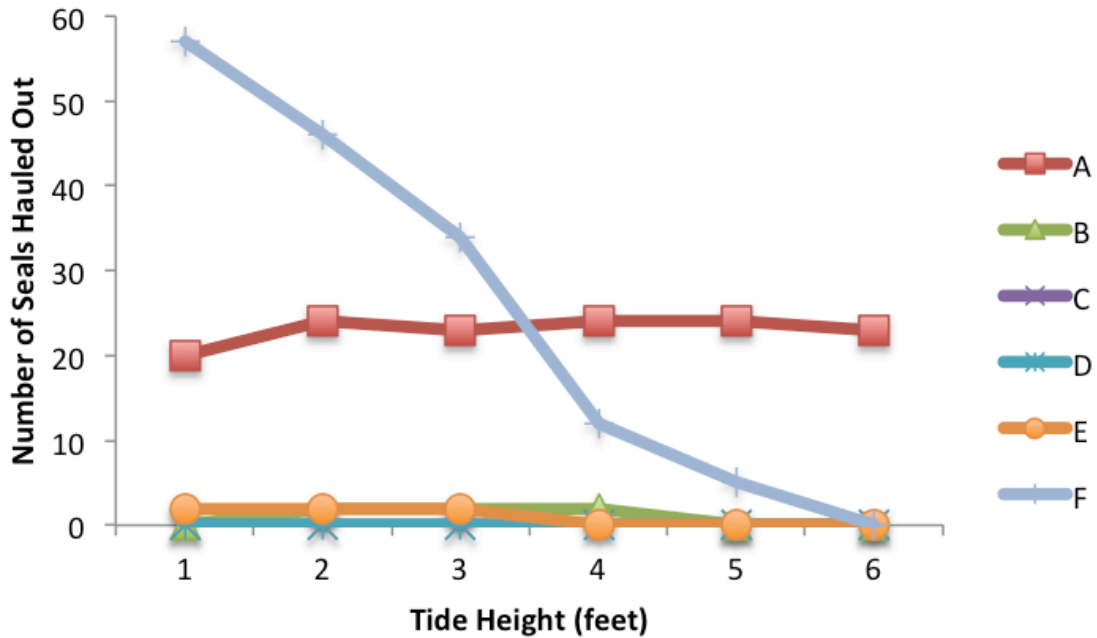


Figure 2. Compares the number of seals hauled out for each side to tide height. This data was taken on August 10, 2011 during low and medium tides.

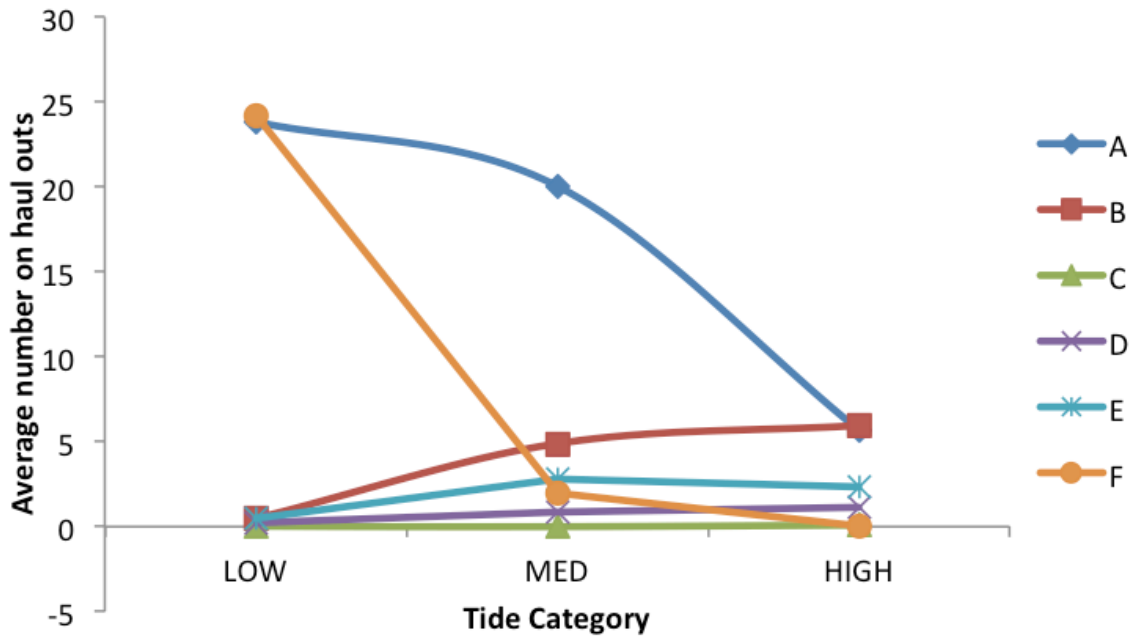


Figure 3. Compares average number on each haul out to tide category. Low = -1 to 1.5 feet, medium = 1.5 to 4 feet, and high = 4.1 feet to 6.5 feet. Average numbers are of all samples taken.

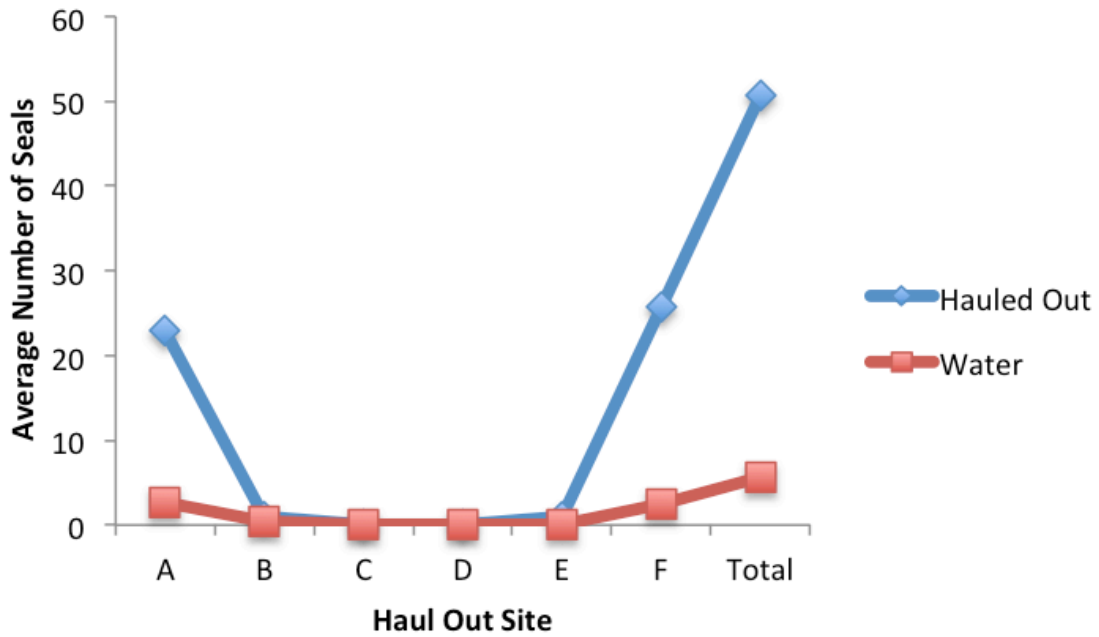


Figure 4. Compares the average number of seals on each site when hauled out to average number of seals on each site in the water. This data was taken on August 10, 2011 during low and medium tides.

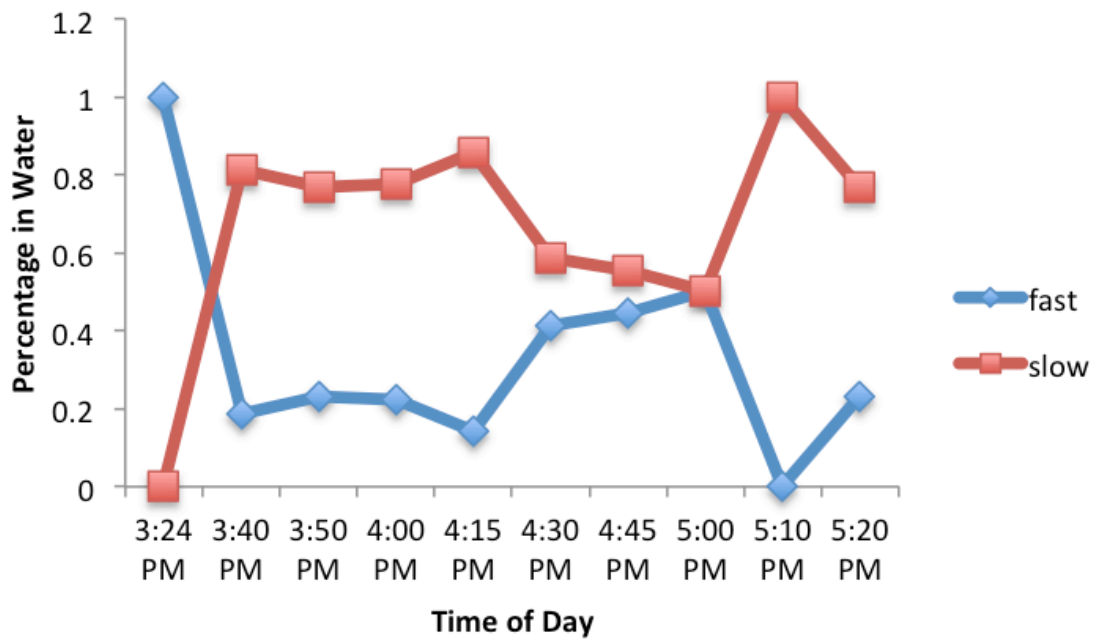


Figure 5. Compares the percentage of harbor seals in the fast current to the slow current. This was data was taken on August 17, 2011 during medium and high tide.

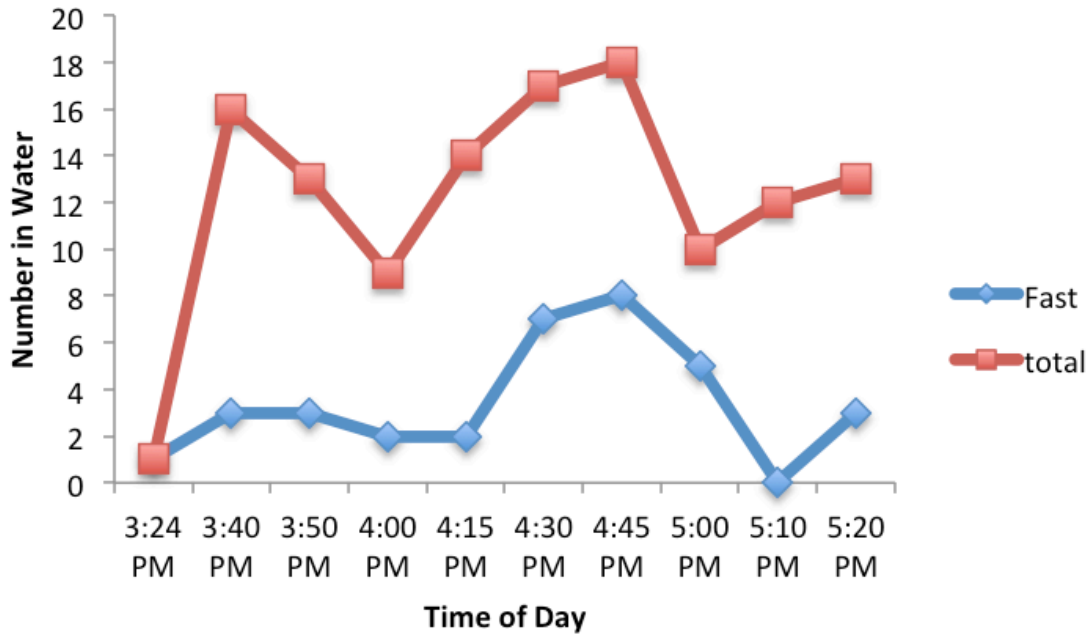


Figure 6. Displays number in the fast current compared to the total number of seals in the water at that given time. Fast current includes both A and F sites. The area between the Fast and the Total lines gives the number of seals in the slow current. This data was taken on August 17, 2011 during medium and high tide.

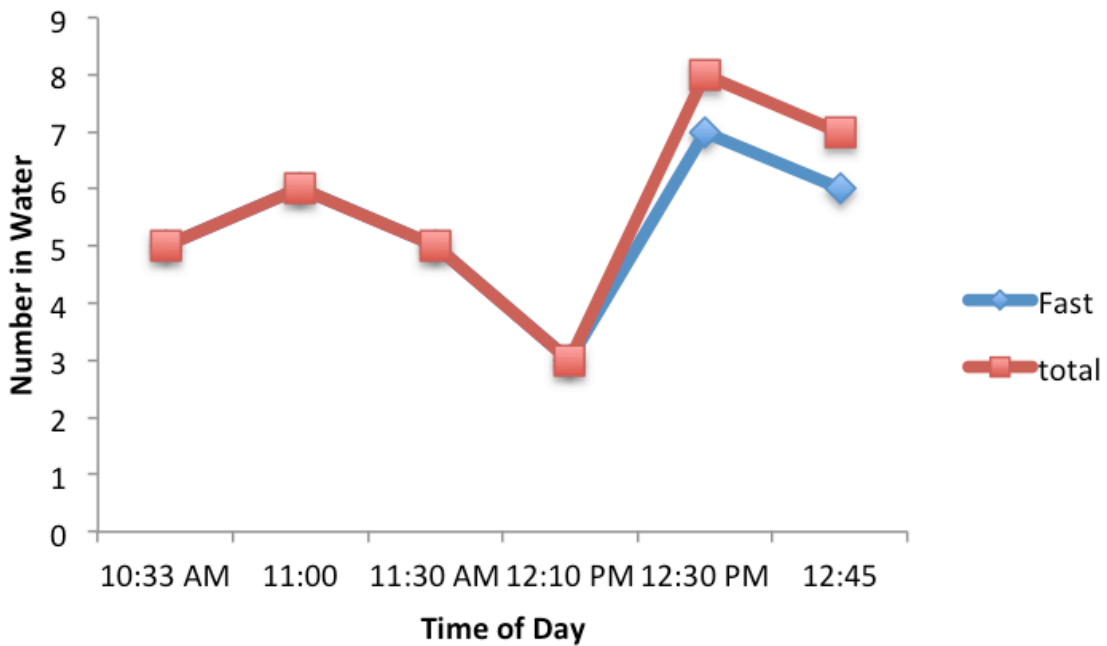


Figure 7. Compares the number of harbor seals in fast current to the total number during a certain time of day. The area between the fast and total lines equals the

number of seals found in the slow current. This data was taken on August 10, 2011 during low and medium tides.

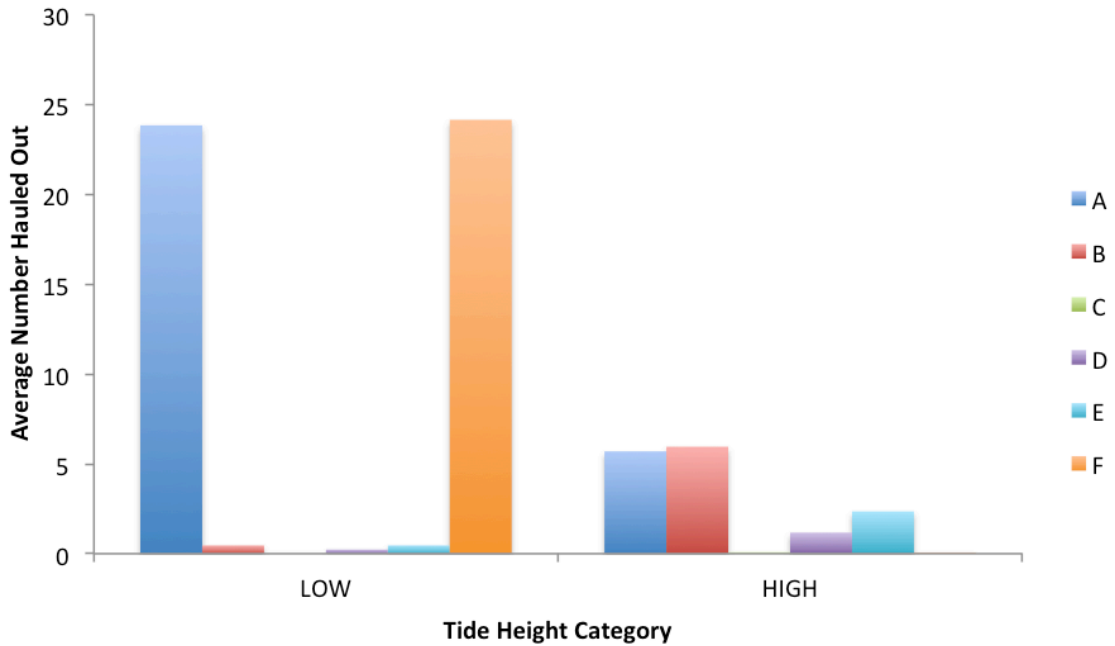


Figure 8. Shows the average number on each hauled out site for low and high tide categories. Low = -1 to 1.5 feet and high = 4.1 to 6.5 feet. The average numbers are of all samples taken.