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USE OF HAUL-OUT SITES BY HARBOR SEALS (*PHOCA VITULINA*) IN BELLINGHAM: IMPLICATIONS FOR FUTURE DEVELOPMENT

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Harbor Seals (*Phoca vitulina*) have been widely studied in the Pacific Northwest for over 60 y (Scheffer and Slipp 1944; Calambokidis and others 1979; Olesiuk and others 1990; Jeffries and others 2003). In the inland waters of Washington State, Harbor Seals are the most abundant and extensively distributed pinniped, numbering approximately 15,000 individuals and thought to be nearing carrying capacity (Jeffries and others 2003). As a result of this high abundance, numerous types of interactions between Harbor Seals and humans have recently been documented, including increased disturbance from a growing number of humans recreating in the inland waters of Washington (Suryan and Harvey 1999; Johnson and Acevedo-Gutiérrez 2007) and conflicts with commercial and recreational fisheries (NMFS 1997). However, little is known about the interactions of Harbor Seals and humans in Bellingham.

Bellingham is an industrial city in northwest Washington State, located along the east-southeast shore of Bellingham Bay (Fig. 1). The city has an estimated population of 75,150 and an annual growth rate between 2000 and 2006 of 11.5% (US Census Bureau 2006). According to Jeffries and others (2000), Harbor Seals used to haul out on floating log booms off the southeast shore of Bellingham Bay (Fig. 1). In this decade, many logs have been removed, and seals are now hauling out on logs in a nearby industrial pond (hereafter Log Pond) that was part of the former Georgia Pacific paper mill that closed in 2001. The paper mill has restricted access with very little disturbance, and no known terrestrial predation, 2 factors determining haul-out choice by Harbor Seals (Brown and Mate 1983; Watts 1992; Suryan and Harvey 1998; Nordstrom 2002). Although anecdotal evidence suggests that seals around the city of Bellingham haul out primarily at the Log Pond, there are no current estimates on the number of seals that haul out at this site or their seasonal variation.

The Log Pond is significant because it lies at the center of the proposed New Whatcom, a multistage remediation and development project to clean up and develop the Bellingham waterfront (Waterfront Futures Group 2004). The use of this site as a haul-out location by Harbor Seals presents the unique opportunity to gather baseline information to examine how seal numbers and their use of the area change, if any, after development is completed. The Log Pond is also located in the immediate vicinity of Whatcom Creek, an urban salmon stream that supports 3 main salmon runs from August through December, including Chinook (*Oncorhynchus tshawytscha*), Chum (*O. keta*), and Pink Salmon (*O. gorbuscha*). These runs return to the Whatcom Creek Hatchery, which in turn releases thousands of smolts every spring from March through May (Steele 2007). Anecdotal evidence suggests that seals prey on salmon in Whatcom Creek. There are, however, neither estimates on the numbers of seals involved in such events nor data on the seasonal occurrence of seals in the creek.

We gathered baseline data to elucidate the current status of Harbor Seals relative to human development and the potential impact of Harbor Seals on salmon runs. Specifically, we estimated the abundance of Harbor Seals in Bellingham, examined the seasonal variation in number of seals hauled-out, and described the number of seals foraging at Whatcom Creek relative to salmon runs.

We conducted observations of Harbor Seals between January 2007 and December 2007 from 6 land-based posts overlooking the study sites (Fig. 1). Sites 1 and 2 are water sections without haul-out sites at the northeast end of Whatcom

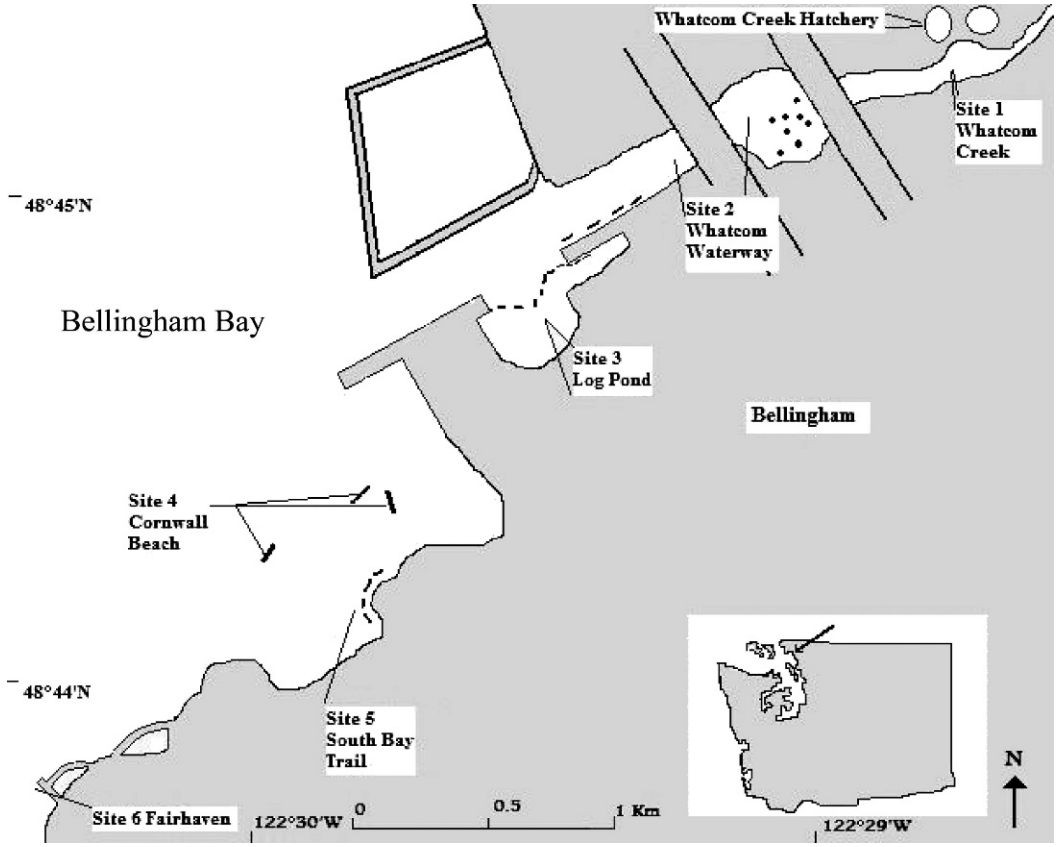

FIGURE 1. Southeastern Bellingham Bay and Whatcom Creek. Sites 1 and 2 indicate areas in Whatcom Creek where seals in water were counted; sites 3 through 6 indicate sites where hauled-out seals were counted.

Waterway near the mouth of Whatcom Creek (Fig. 1). Sites 3 through 6 are either current or historical haul-out sites: site 3 is the Log Pond which consists of approximately 25 log booms linked together by chains; site 4 (Cornwall Beach) consists of three 3-m log booms; site 5 (South Bay Trail) consists of multiple log booms linked together approximately 15 m from the shore; and site 6 (Fairhaven) is an historical haul-out site from which log booms were completely removed in 2003 and replaced with a public dock (Fig. 1). Counts at sites 1 and 2 allowed us to describe the numbers of seals foraging on salmon in Whatcom Waterway. Counts at sites 3 through 6 helped us examine the abundance and seasonal variation of hauled-out Harbor Seals.

We conducted counts between 3 to 6 d/mo depending on weather. In Washington, the number of hauled-out Harbor Seals during the day peaks between 11:00 and 19:00 (Jeffries and others 2003; Patterson and Acevedo-Gutiérrez 2008). In addition, the haul-outs in our study area consist of floating log booms that are unaffected by tides. Hence, we counted seals once between 11:00 and 18:00 using 10×40 binoculars. Because we were unable to distinguish among adult males, adult females, and immature seals on land or in the water, we classified all individuals as adults. We were, however, able to distinguish adults and recently born pups that were approximately a few weeks old by the much larger relative size of the adults.

For sites 1 and 2, we counted the number of seals in the water. We recorded the maximum number of seals observed within a 3-min period, followed by a 3-min non-counting interval, followed by a final 3-min counting period. This approach decreased the chance of counting the same seal twice (Brown and

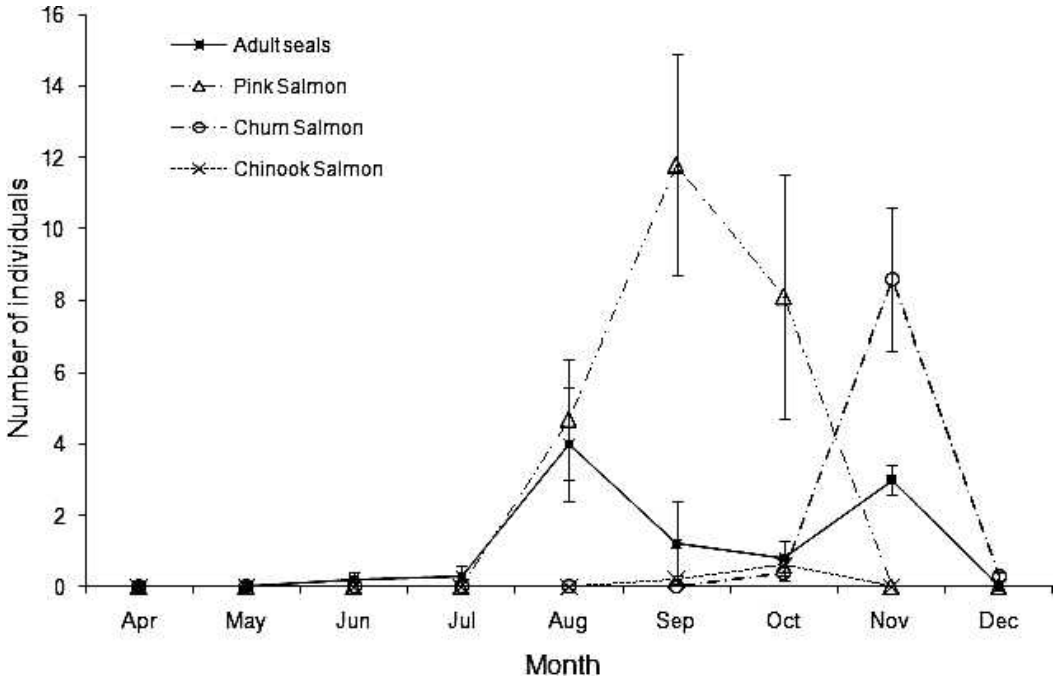

FIGURE 2. The $\bar{x}$ ($s_{\bar{X}}$) number of seals in the water at sites 1 and 2 in Whatcom Creek relative to salmon occurrence and month.

Terhune 2003). The number of seals/d was averaged by month and compared with the number of Chinook, Pink, and Chum Salmon reported daily by the Whatcom Creek Hatchery (Steele 2007).

Counts conducted at sites 3 through 6 included adults and pups hauled out or at the water surface within 100 m of the haul-out location. For hauled-out seals, we reported the number of seals observed within a 10-min period. For seals in the water, we followed the same approach as described for sites 1 and 2. We added the total daily abundance for sites 3 through 6 and calculated a mean and standard deviation for each month. Our counts were minimum estimates of the abundance of all seals in the study area because seals away from the site during the count were not included.

Forty-eight counts were conducted April through December 2007 along Whatcom Creek at sites 1 and 2. Data from both sites were combined because there was no difference in seal numbers between the sites. We observed seals in the creek only during the months that salmon were running (Fig. 2). However, during the largest salmon run in 2007 (Pink Salmon in September and October), the number of seals in the water decreased (Fig. 2). The maximum number of seals observed in any 1-d period was 14; however, the average number of seals/d was no higher than 4 in any month (Fig. 2). We also observed seals foraging on salmon while in the creek.

Fifty-nine counts were conducted January through December 2007 at seal haul-out sites 3 through 6. The highest numbers of seals were recorded during July through September (Fig. 3). Pups were first observed in mid-June, with the highest numbers observed in August (Fig. 3). The maximum number of total seals (adults and pups) observed in any 1-d period was 73 (3 August). Most of the adult seals (88%) were observed at site 3 (Log Pond), and 11% of seals were observed at site 4 (Fig. 1). Although no seals were recorded using the booms at site 5, during 6 counts at this site we observed 1 to 2 seals on the water surface within 100 m of the site. Only a single seal was sighted on the water surface near site 6. Pups were only observed at sites 3 (96%) and 4 (4%). These results suggest that the presence and abundance of Harbor Seals were seasonal and site-related and, to a

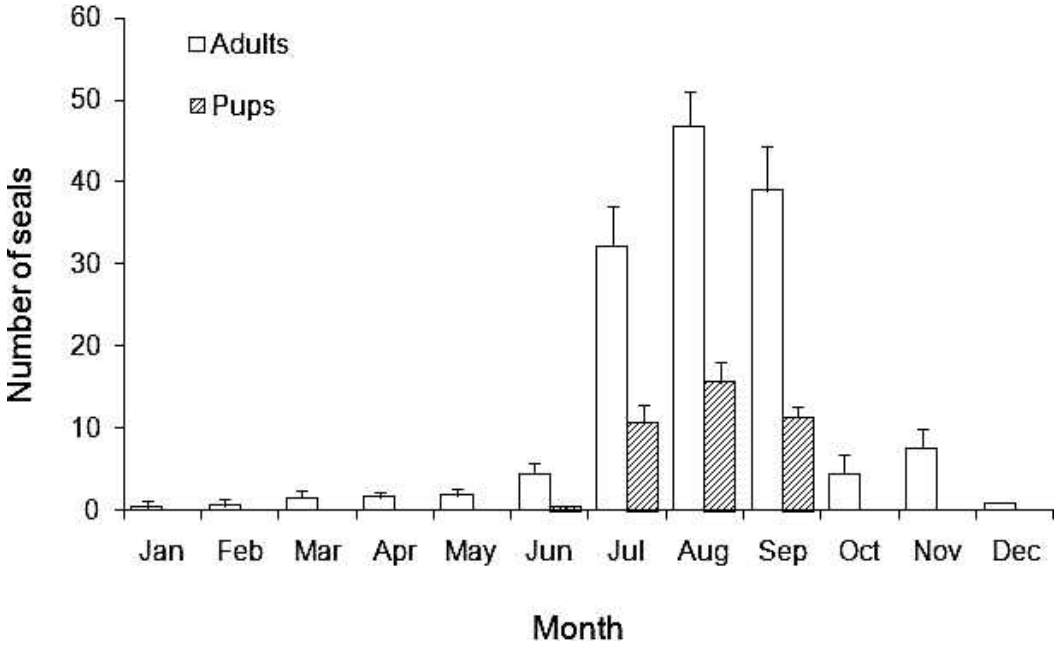

FIGURE 3. The $\bar{x}$ ($s_{\bar{X}}$ number of seals in sites 3 through 6 in southeastern Bellingham Bay relative to month and age class.

lesser extent, associated with the presence of prey. Seals were observed when salmon runs were occurring; however, the maximum number of seals was not related to the largest runs.

Pupping, breeding, and molting seasons may contribute to seasonal variation in the abundance of hauled-out Harbor Seals (Huber and others 2001; Reder and others 2003). Pups were seen in Bellingham between 14 June and 28 September, and the number of adult seals hauled-out peaked between July and September (Fig. 3), coincident with the pupping and breeding seasons of other inland waters in Washington (Huber and others 2001). Fewer seals were observed later in the year, a time coinciding with the molting season in other inland waters of Washington (Huber and others 2001). Therefore, the seasonal variation in seal abundance observed in Bellingham can be attributed, at least in part, to the Harbor Seal pupping and breeding season.

Harbor Seals were not sighted in Whatcom Creek until late July and early August, which coincided with the onset of the Pink Salmon run (Fig. 2). Although the presence of seals was related to the salmon runs, the numbers of seals did not match, as one would expect, the abundance of salmon in the creek (Fig. 2). Two explanations are possible: salmon runs in the creek are not an important food source for seals in Bellingham or our methodology was appropriate to record occurrence of seals but not their numbers. Salmon are an important prey item of Harbor Seals in the San Juan Islands during the summer (Lance and Jeffries 2007), and salmon are known to attract Harbor Seals to river mouths (Middlemas and others 2006). In addition, we observed seals foraging on salmon and received many anecdotal reports from fishers about seal predation at the creek. Based on these observations and reports, we expect that surveys conducted throughout the day rather than at one time of the day, which is how we conducted our surveys, will provide a more accurate estimate of the number of seals consuming salmon at Whatcom Creek. Because the Whatcom Creek salmon runs are very small, one aim of the development of the Bellingham waterfront is the enhancement of salmon runs in the creek (Waterfront Futures Group 2004). Given that seals were present in the creek even with such small salmon numbers (Fig. 2), if the

salmon recovery plan is successful and salmon numbers increase, it is probable that the number of seals will also increase in response to increased availability of prey. Our results, therefore, suggest that salmon runs and seal predation of salmon in Whatcom Creek be monitored in the future.

We conducted our surveys during mid-day, a time when numbers of hauled-out Harbor Seals peak (Yochem and others 1987; Huber and others 2001; Johnson and Acevedo-Gutiérrez 2007; Patterson and Acevedo-Gutiérrez 2008). However, opportunistic observations suggest that more seals were hauled-out in the early evening and even at midnight than during the day. If this pattern holds true, it would suggest that the seasonal variation in numbers of hauled-out seals in Bellingham could be explained in part by variations in proportion of time hauled-out rather than movements of seals in and out of the area. This explanation matches our understanding of haul-out patterns for seals in the state of Washington (Huber and others 2001), and suggests that Bellingham is a year-round haul-out site for Harbor Seals.

The results of this study indicate that Harbor Seals use Bellingham, specifically the Log Pond, as a pupping site, and at least some seals use Whatcom Creek as a foraging site during salmon runs. In the near future, human development will increase significantly at the study sites: for example, plans show the complete removal of the log booms that form the Log Pond, although it is unknown if this will be the final design (Waterfront Futures Group 2004). If this happens, it appears certain that seals will move to another site to haul out and give birth. Future studies should determine the location of such a site, the number of seals involved, their use of the area, and whether the proposed development plan for salmon recovery will result in increased numbers of seals foraging at Whatcom Creek.

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