

Annual residency patterns of southern resident killer whales in the inland waters of Washington and British Columbia

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The advent of photo-identification of killer whales has allowed a number of in-depth studies to assess movements and habitat use. The regular occurrence of the three pods of piscivorous killer whales, “southern residents” in the inland waters of Washington and BC during the summer months is well established by photo-ID (Balcomb et al 1979, Bigg 1982, Osborne 1999) and this population’s occurrence patterns has been the subject several detailed analyses (Osborne 1999, Hauser et 2007, McCluskey 2006). However, while this area has been designated Critical Habitat, the whales only spend the summer months here, ranging to the outer coast during other times of the year and during portions of the summer (Krahn et al. 2004 NWFSC unpubl. data). In addition, within this overall pattern there is inter-annual and between pod variability. Here we examine the annual residency patterns of Southern Resident killer whales (SRKW) in the inland waters of Washington and BC.

Methods

Southern resident Killer whale sighting reports that were made to Orca Network from January 2003 to December 2009 were compiled by pod. This time period was chosen due

to a marked increase in year-round sighting effort compared to the years prior to 2003. Sighting reports with uncertain pod identifications were compiled separately in the category of “possible”. For a given day the whales’ location was assigned to one of four general areas (Fig 1). This location represents the area in which they spent the majority of their time on that day based on sighting reports. Occurrence of any of the SR and for each SR pod in each area was estimated by counting the number of days each month that the whales were present on a given day.

Results

At least some members of the southern resident killer whales (SRKW) were reported in inland waters an average of 166 days per year (46%) between 2003 and 2009 (Table 1). However, occurrence varied by year, month, area, and pod.

Overall, there was a decline in the number of days the whales spent in inland waters through 2006, with 206 days in 2003 and only 142 days in 2006 (Figure 2) but since then occurrence has fluctuated between 156 and 162 days. In addition, occurrence within the areas was not distributed equally. The vast majority of sightings occurred in the San Juan Island area across all years. All areas are visited in all seasons with the exception of Puget Sound which is visited only in the fall.

In general, SRKW are relatively rare in inland waters from January to March (<20 % of days per month) (Figure 3). Occurrence increases substantially from April to May,

peaking in June (sighting of members of at least one pod occurred 75-100% days/month) before gradually declining through December to levels somewhat greater than January. Although this trend generally holds on a monthly basis a substantial amount of interannual variability occurs (Figure 4). In particular, during the past 2008 and 2009 occurrence in April and May was at its lowest levels for this seven year time series. These two years also had a lower level of occurrence in June except for 2006. Conversely, residency in August was higher in these two years than all previous years but 2007.

Residency also varied between pods. In general, J pod occurred more often in inland waters than the other pods (Figure 5a,b,c). The months that J pod was most commonly present were May – July (75-80%) compared to K and L pod who were most commonly present June- Sept. (>35-55%, and >50-55% respectively). J pod was also present at low levels in inland waters during January – March, but was generally more common in April and particularly May than K and L pods. From October to December, residency varied from about 10 to 30% for all pods. Sighting in Puget Sound itself (as opposed to other inland areas) occurred only from October through January.

Discussion

In general, southern resident killer whales can be found in the inland waters of Washington and British Columbia for nearly half of the year. Sightability likely varies between areas (in some areas whales typically occur closer to land) which might have

biased the result, but the high occurrence in the San Juan Island area is consistent with core area analysis (Hauser et al 2007). Although their whereabouts during these other times is unclear, the majority of their time is likely in the western Strait of Juan de Fuca or coastal waters but further analysis of daily travel trajectories and absence durations are required to fully assess their potential extent of their range to the west.

However, there are strong seasonal patterns that are punctuated by inter-annual variability, particularly in spring and fall. Recently observed late arrival and fewer days present in April, May, and June may be related to weak returns of spring and early summer Chinook salmon to the Fraser River. Similarly, relatively high August occurrence may be related to higher than average returns of South Thompson.

Southern resident killer whales appear to have a relatively consistent seasonal pattern of occurrence in the inland waters, although the variations observed between pods suggest that there may be some temporal and spatial niche separation. In addition, there are pod specific use patterns, i.e., J pod is present earlier and more often than K or L pods.

However, it is important to note that although K and L pods appear occur at similar levels, L pod regularly splits into several subunits. The result is that this pod's occurrence may be over-represented because the other subunits may be outside the study area, yet the reliability of reporting subunits is very low such that it is assumed in many cases that if one subunit is present, all are present. However, another situation that may occur that results in over-representation is pod fragmentation, where both portions of the pod are observed in the study area. Based on anecdotal reports, pod fragmentation

appears to have recently become more common in all three pods. Some of these episodes were observed in spring of 2009 and 2010 when pods were also described to be commonly very spread out, which has previously been thought to be a response to low fish availability. Spring and early summer Fraser Chinook have exhibited weak returns for the past 3 years. The degree to which pod fragmentation is related to low fish availability, or other factors, such as loss of key pod members, e.g., matriarchs, is currently unknown.

Over the seven years SRKW occurrence in inland water has been analyzed there appears to be a relatively consistent overall pattern of time spent in this area by the whales. The degree to which this should be considered normal remains unclear. In particular, the ongoing use of Puget Sound only during the months of October to January, compared to relatively equal use of the other inland water areas within the annual pattern, may be anomalous. Although the degree to which Puget Sound was used historically cannot be similarly quantified, it is clear that the whales were regularly present there in the past during the summer months (Scheffer and Slipp 1948, Hoyt 1981) as well as the fall and early winter. This historic information suggests that Puget Sound may have played a more prominent role than it does today for southern resident killer whales.

Literature Cited

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Table 1. Number of days southern resident killer whales were confirmed to occur in areas of inland waters of Washington and British Columbia 2003-2009.

Year	Total	Juan de Fuca	San Juan Islands	Gulf Islands/ Fraser River	Puget Sound
2003	206	16	148	16	26
2004	171	15	124	16	16
2005	164	22	100	20	22
2006	142	16	107	8	11
2007	162	13	118	10	21
2008	163	31	93	21	18
2009	156	23	98	20	15

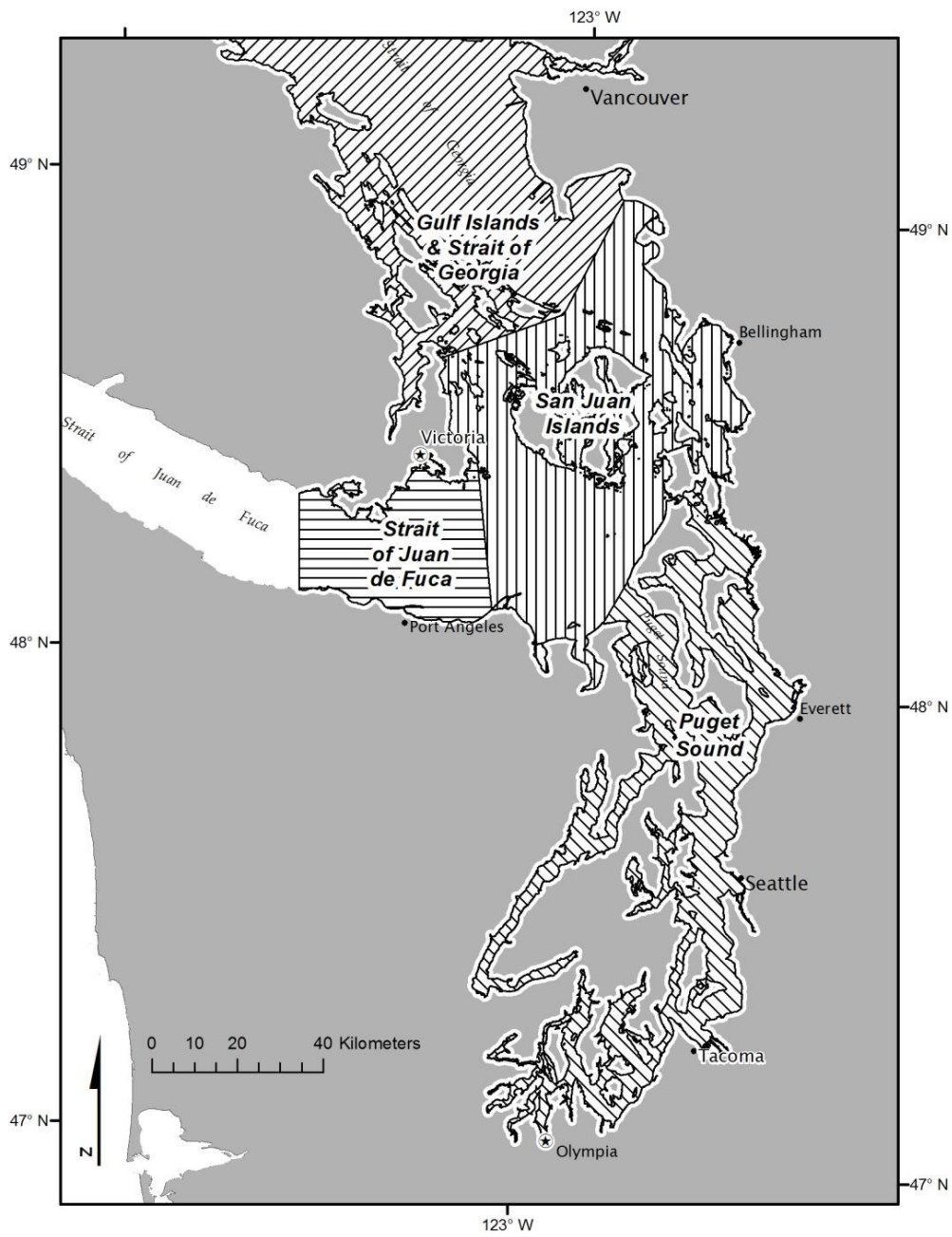


Figure 1. Study area showing four areas where locations were assigned.

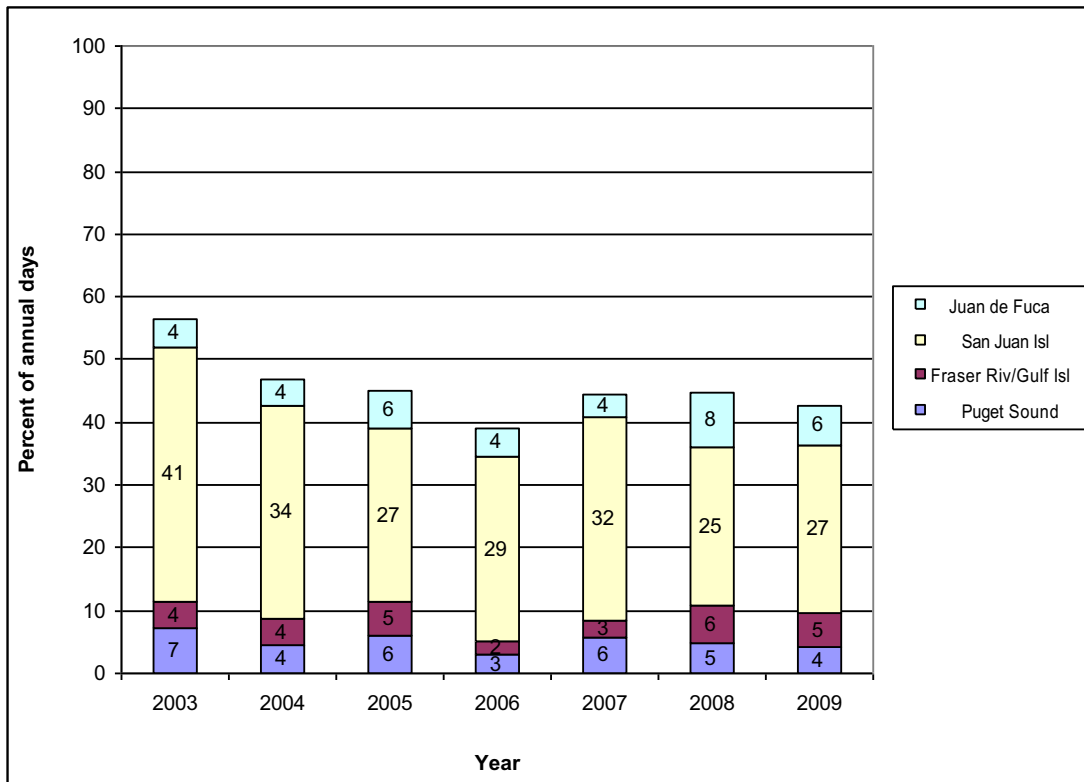


Figure 2. Percent occurrence of all SRKW pods by region for each year

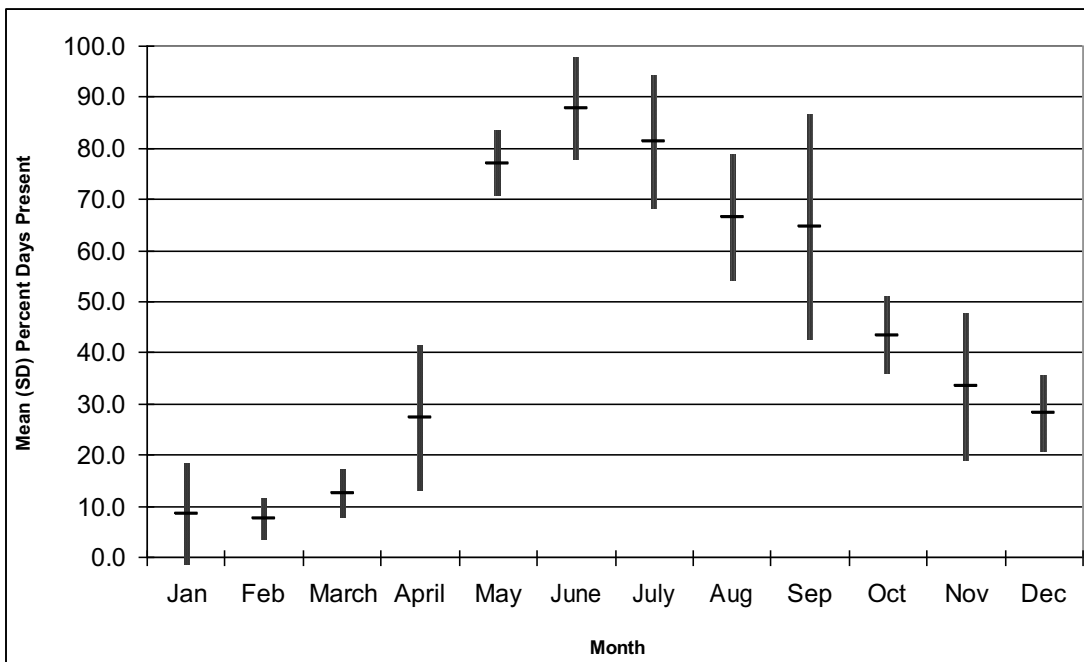


Figure 3. Monthly sighting occurrence of J, K, or L pod southern resident killer whales in the inland waters of Washington and BC 2003-2009.

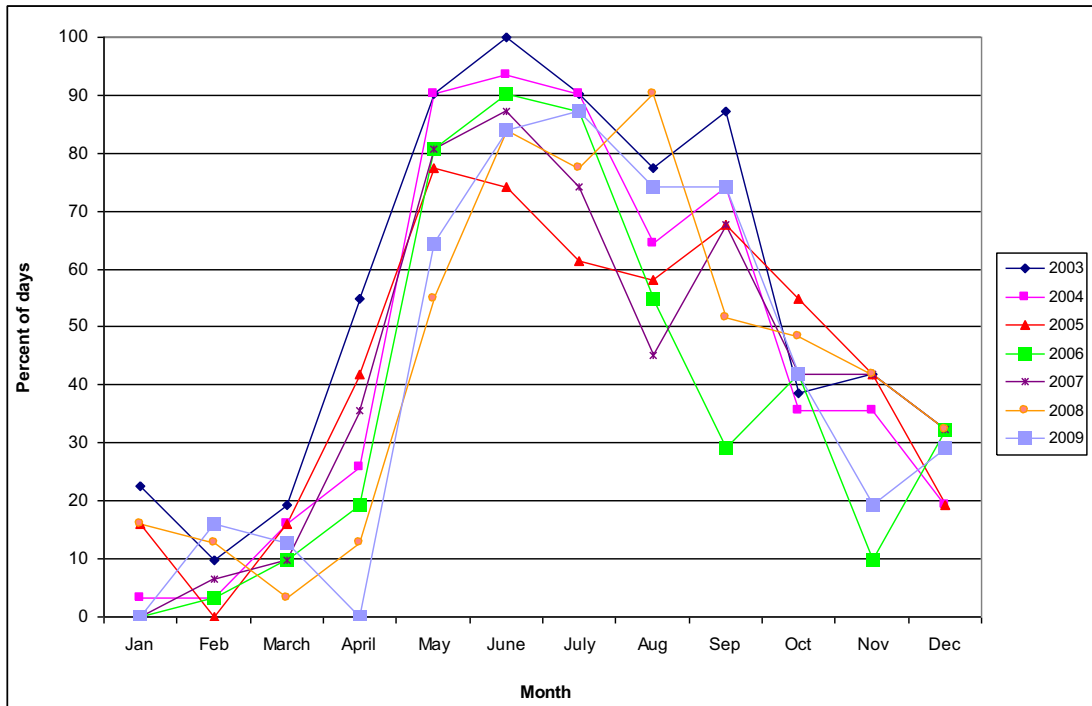


Figure 4. Monthly variability in percent days present of all SRKW pods in all areas from 2003-2009.

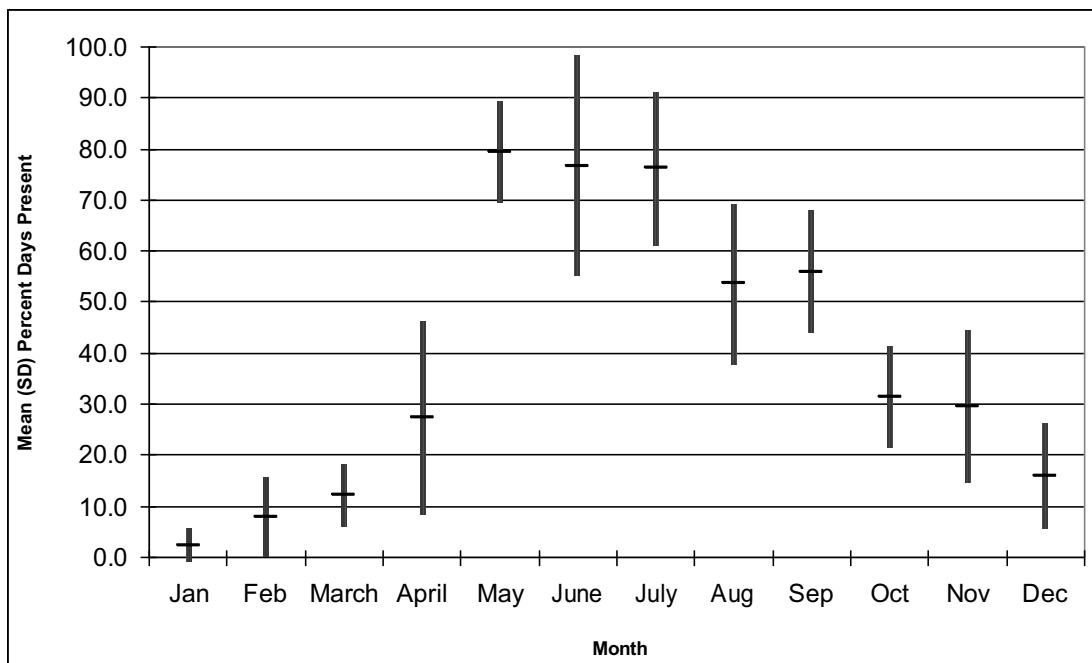


Figure 5a. Monthly sighting occurrence of J pod southern resident killer whales in the inland waters of Washington and BC.

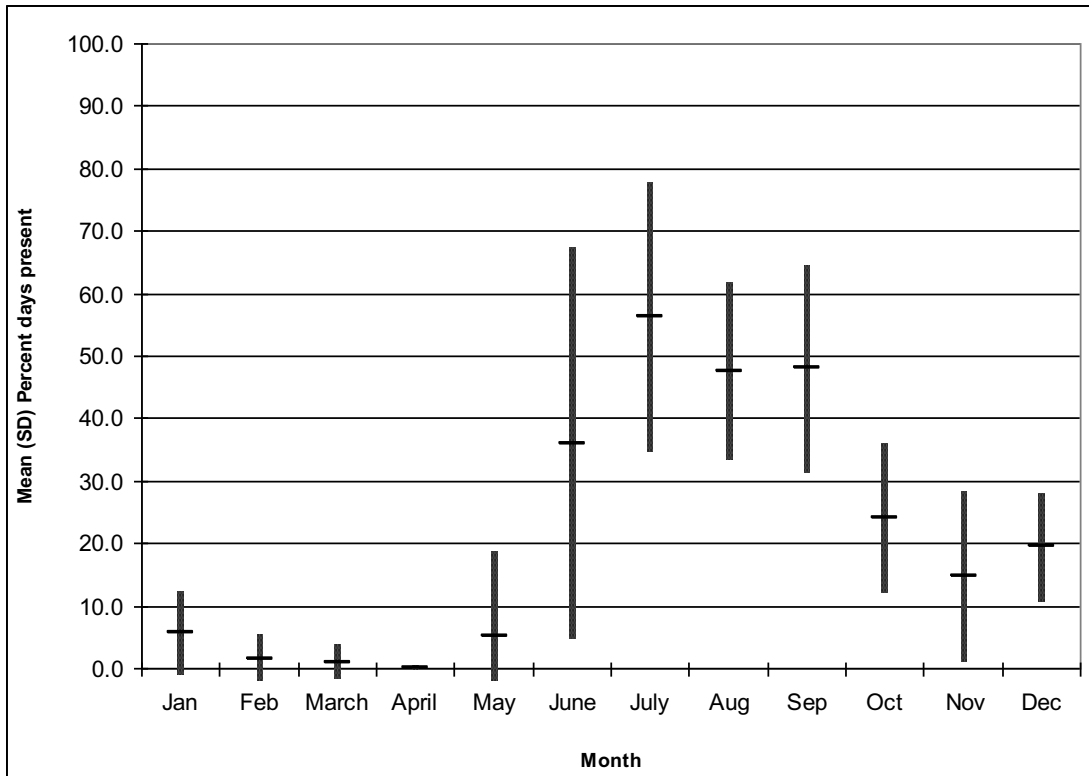


Figure 5b. Monthly sighting occurrence of K pod southern resident killer whales in the inland waters of Washington and BC

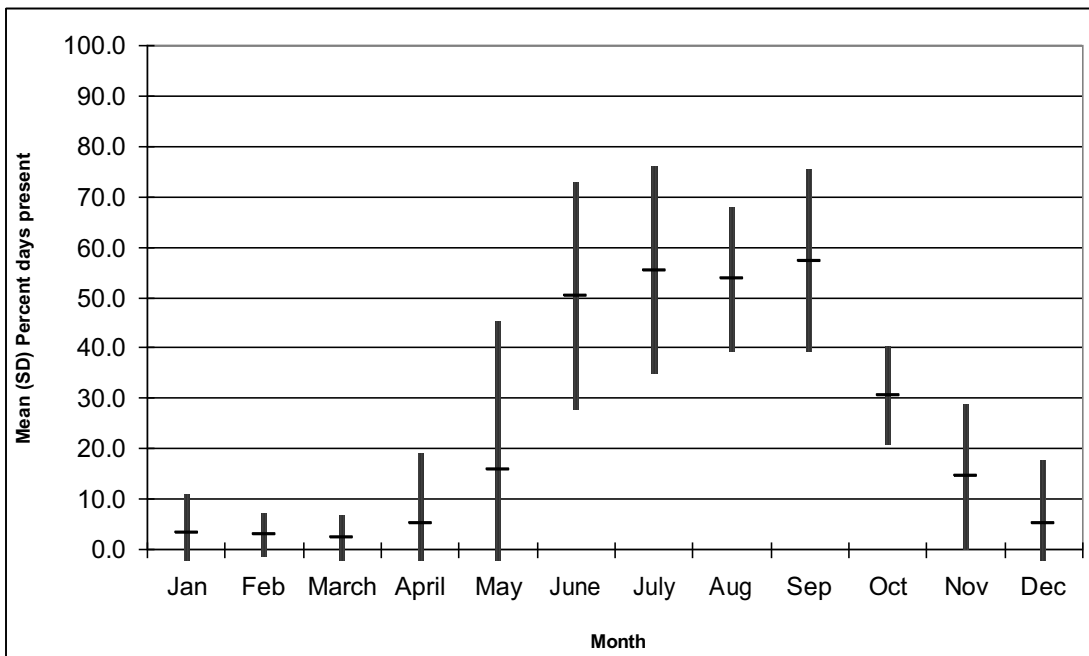


Figure 5c. Monthly sighting occurrence of L pod southern resident killer whales in the inland waters of Washington and BC.