Land-based versus water based observation of *Orcinus orca* near San Juan Island, Washington

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Abstract

Southern resident killer whales seasonally inhabit the Salish Sea waters of British Columbia and Washington and are unique in their feeding behavior. This endangered subpopulation is also a valued resource that has led to a large whale watch industry. Whale watch boats are potentially a threat to the orcas' well being. As a means of assessing alternative ways to view whales, I observed orcas from land, on the west side of San Juan Island, and from three vessels. Results showed no remarkable difference between platforms in ability to detect whales and behaviors, suggesting that whale watch boats are not the only way to see whales during summer. I also observed patterns in my data, correlating the whales' movement with tides and currents.

Key Words

Key Words: *Orcinus* orca, killer whale, San Juan Island, whale watching, Southern Residents, Endangered.

Introduction

In British Columbia and Washington, both resident and transient killer whales are present year round. Transients have a much wider range and do not follow predictable travel patterns. Residents may travel out to other areas of the Pacific during winter months when salmon, their primary prey, are less abundant (Heimlich and Boran, 1986). This reliability of whales in the area allowed a huge economy to be built, whale watching ecotourism.

When considering viewing whales, one has the choice to see them in captivity, in the wild from land or from a boat. Whale watch proponents claim it is beneficial to the whales for people to come see them in the wild, learn about them, and respect them. "We

believe that it is important to reduce the environmental impacts on the whales through science, education and action."(Prince of Whales 1998-2010) Many companies are now offering kayak wildlife viewing tours and land-based tours, which would eliminate the aspect of boat noise interference and propeller danger.

On San Juan Island, orcas can often be seen from land. The unique geography of the San Juan Archipelago and social structure of the resident orca community, provide opportunities to observe the behaviors of these complex and interesting animals. Many of the more exciting behaviors are breaches, tail slaps, spy hops, and upside down swimming. I began to wonder if one could observe and study orca behavior from land as well as from a boat. To begin to answer this question I conducted a field observation study from August 7, 2011, through August 18, 2011. First, I learned to recognize the different behaviors and movements of the orcas. Then, I quantified the orcas, group sizes, behaviors, and motions from one land site and three different vessels.

In this study, my overall objective was to learn to observe orca behavior and to assess any notable difference in the number of orcas and their behaviors as seen from the point of view of a boat versus an ideal shore based platform. Specifically, I compared the frequency of orca encounters, # of orcas seen, and frequency of surface-active behaviors (SAB) from land and water platforms. I will critique my methods and discuss what I learned through this process. Finally, I will propose recommendations for future studies.

Methods

Study Site

I conducted this field study in the San Juan Archipelago area of the Salish Sea, primarily in Haro Strait, west of San Juan Island (Fig.1). This is a preferred summer

season feeding habitat for the Southern Resident Killer Whales (SRKWs) due to its abundant prey (especially salmon), powerful tides, and complex bathymetry (Felleman et al. 1991).

Observation Platforms and Locations

Field observations were conducted for more than six hours over eight days in August 2011. Observational episodes were opportunistic, due to transportation constraints and the short study period.

Shipboard observations of SRKW were made from three different vessels, all of which allowed me to ride along without charge (Table 1). On August 7th, I went on a three hour trip aboard the San Juan Outfitters whale watch vessel (Captain Brian Goodremont). On August 14th, I went on a research cruise aboard a 21 ft. private motor boat, named Moja, with Deborah Giles, of UC Davis and Jessica Lundin, a UW PhD student, who were collecting whale scat for toxicity, hormonal, and genetic analyses. I stood near the back of the boat, except after a feces sample was found and processed at the stern, I then just stayed out of the way. We tracked the pod of whales north of San Juan Island along the west side of Stuart Island and further into the Strait of Georgia, all while trying to find the right wind and sea surface conditions for Tucker, the research dog, to detect the scent of any orca feces on or near the surface. Lastly, on August 18th, I spent six hours aboard the Soundwatch vessel, out of Snug Harbor, a non-profit organization whose primary mission was to monitor whale-watch vessels; the Aug 12th trip was cut short by dense fog.

Land-based observations were conducted from cliffs of the west side of San Juan Island, at the Westside Preserve and Lime Kiln State Park (otherwise known as Whale

Watch Park). This park, established in 1984 by the Washington State Parks and Recreation Commission for the purpose of watching killer whales, has become very popular (Ford et al. 2000).

Field Observations

All observations of whales were done with the unaided eye or 8 x 42 Nikon Monarch binoculars. For each encounter, I recorded time, number, direction, SABs, gender, and other notable accounts of the surrounding conditions, on a handmade data sheet.

I collected data at the following platforms, dates and times:

Table 1.

Platform	Date	Time
Land	08/07/11	11:21-11:57
Boat - Whale watch	08/07/11	15:56-17:56
Land	08/12/11	15:00-15:06
Land	08/13/11	14:21-16:05
Boat - Research	08/14/11	16:03-18:34
Land	08/15/11	15:18-16:05
Land	08/16/11	13:54-15:37
Boat - Soundwatch	08/18/11	10:55-11:53

Data collection was limited to an approximate 160° field of view, roughly calculated by what I could see from my point of view along the coast, along with the limits of my peripheral eyesight in detecting movement aboard a boat. While using binoculars, this was decreased to a 6.3°angle, capable of including only a focal group of animals. This method was designed to simulate the average viewer's whale watching experience.

For each sighting of orcas, I also recorded weather, tidal conditions, current speed and direction, and other movement and activities of the whales. These included milling (a

multidirectional movement), foraging (2-3 shallow dives followed by a deeper dive of 1-3 minutes), resting (slow group swimming), travelling (unidirectional group movement), and socializing (physical intermixing of whales) (Ford 2002). This data was not always obvious, nor easy to distinguish for this study. Tidal information was obtained from the Kanaka Bay reporting station data listed on The Seattle Times website.

Results

During this study, observations of orcas from land were more effective for collecting some kinds of data, especially large-scale movement and activity patterns. Boat-based observations were more effective for others, such as specific individual behaviors. For example, land-based observing was slightly better at detecting the presence of orca groups (0.20 vs. 0.17; Fig 2). Land-based observation was considerably better for detecting individual orcas; I recorded more than twice as many individual orcas per minute (0.58 vs. 0.23; Fig 2) from land than from the boat.

Alternatively, boat-based observations were more effective at detecting surface-active behaviors. The three most commonly observed behaviors - breach, tail slaps, and spyhops - were seen much more frequently from boats (Fig 2). The other behaviors recorded - pec slap, rolling over, and swimming upside down - were seen approximately equally from both platforms.

During the six land-based observations along the west side of San Juan Island, whales were detected on five of the attempts. All five of these whale encounters occurred during flooding tides, suggesting that this may be the best time to look for whales at this site. Whales were seen on all three boat trips, which covered a range of locations and tidal conditions. Clearly, the mobility of the vessel provides a greater likelihood of

encountering whales regardless of tide. Successful viewing attempts were much greater during rising or flooding tides for land, but only slightly greater for boats. Successful views from boats were approximately the same for slack, low, high, and ebb tidal sea states (Fig 3).

Analysis of the tidal times and heights in comparison to orca direction of movement, indicate that the majority of feeding and northward travelling took place at tidal heights over five feet, and during rising tides (Table 3). In the location where the observations were made this corresponds to the northward flowing currents, meaning that whales were often traveling in the same direction as currents. Alternatively, whales moving south from the northern part of their range on ebb or falling tides mainly corresponded to southward flowing currents (Tables 3 and 4).

Discussion

Orcas are visible by land or by boat on most days. To properly time successful viewing, a few vital points of information are necessary. During rising or high tides, orca-feeding pathways are often along the southwest side of San Juan Island, making that a prime viewing spot. However, during ebb tides, a preferable viewing location is in the northern waters across the Canadian borders, where the orcas may have moved to follow their prey. Being clued in by spotters and the network of orca watchers involved in whale watching or whale research can also be helpful. Lastly, tuning in to the VHF radio channels used by captains gave me an advantage. It would be interesting to see what success whale watching would be if such communication between whale watchers did not exist. On any given day, if you want to know where orcas are, just look for the fleet of private and commercial boats, herding around the orcas. It is possible, however, that I

was coincidentally successful in my attempts at orca observations, with only one unsuccessful land attempt and one unsuccessful boat attempt (due to thick fog).

I believe the elevation of the viewing platform is important as well. While in a small boat, my view was slightly limited by the angle of perspective. For instance, it was more difficult to distinguish small dorsal fins from choppy surface waves. I suggest being up above the sea surface, on a cliff or on the second level of a taller boat, can increase viewing success. Perhaps a more thorough study done every day from moving and non-moving platforms; from various sites; different elevations, during varying tides, currents, and times of year, would offer a higher probability of viewing whales. Of course, it probably would only maintain higher probabilities if the salmon continue to move in the same abundance and direction. Perhaps focusing on fish that orcas eat would prove a more accurate predictor of the orcas movements.

It appears from my data, that movements of the orcas may correspond to directions of tidal currents. If within Puget Sound, an immense influx of tidal height produces a strong swift current through and around the San Juan Islands, it would be interesting to determine any relationship between salmon movement data, tidal current, and orca sightings. Perhaps a possible hypothesis would be: If salmon or their prey, are forced along the west side of the San Juan Island coast, then you would see orcas feeding or following the salmon along the same path as the tidal current. Conversely, if the salmon are carried away by strong ebbing tidal current, salmon would then be taken southward through Haro Strait and orcas would move south as well in order to feed. Perhaps a further study of water movement, oceanography, and underwater topography around the islands would be a useful predictor of orca movement. I would like to be able

to identify areas where the currents run into or against the coast, perhaps acting as salmon traps and concentrating them for easy foraging by the orcas, so that that these areas can be protected for use by the endangered SRKW.

In conclusion, this study did allow me learn that there may be some trends to orca movement and that if one wishes to see them, they have a fairly good chance to do so in a safe, low-impact and economical way, from the west side of the San Juan Island. However, I must point out that results of this study may be relevant only to the summer season when orcas spend much time close to shore. According to Baird and Dill (1995), the pods of the SRKW usually spend more time away from shore during fall through spring. However, I believe that instead of using boats around the whales, it is more ethical and logical, in the interest of conservation of this rare and unique subpopulation, to do as much as we can away from them and on land. I also believe, that as more thorough studies are done on the complex ecological relationships between the SRKW's and their environment, the more effective our cooperative conservation work will be at the public, private, academic, and governmental levels, towards promoting the health and survival of SRKW and all species with which they are ecologically intertwined.

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Tables and Figures

Fig. 1. Map of San Juan Island, highlighted area of view from land (A), as well as approximate at sea locations (B) of orcas throughout study.

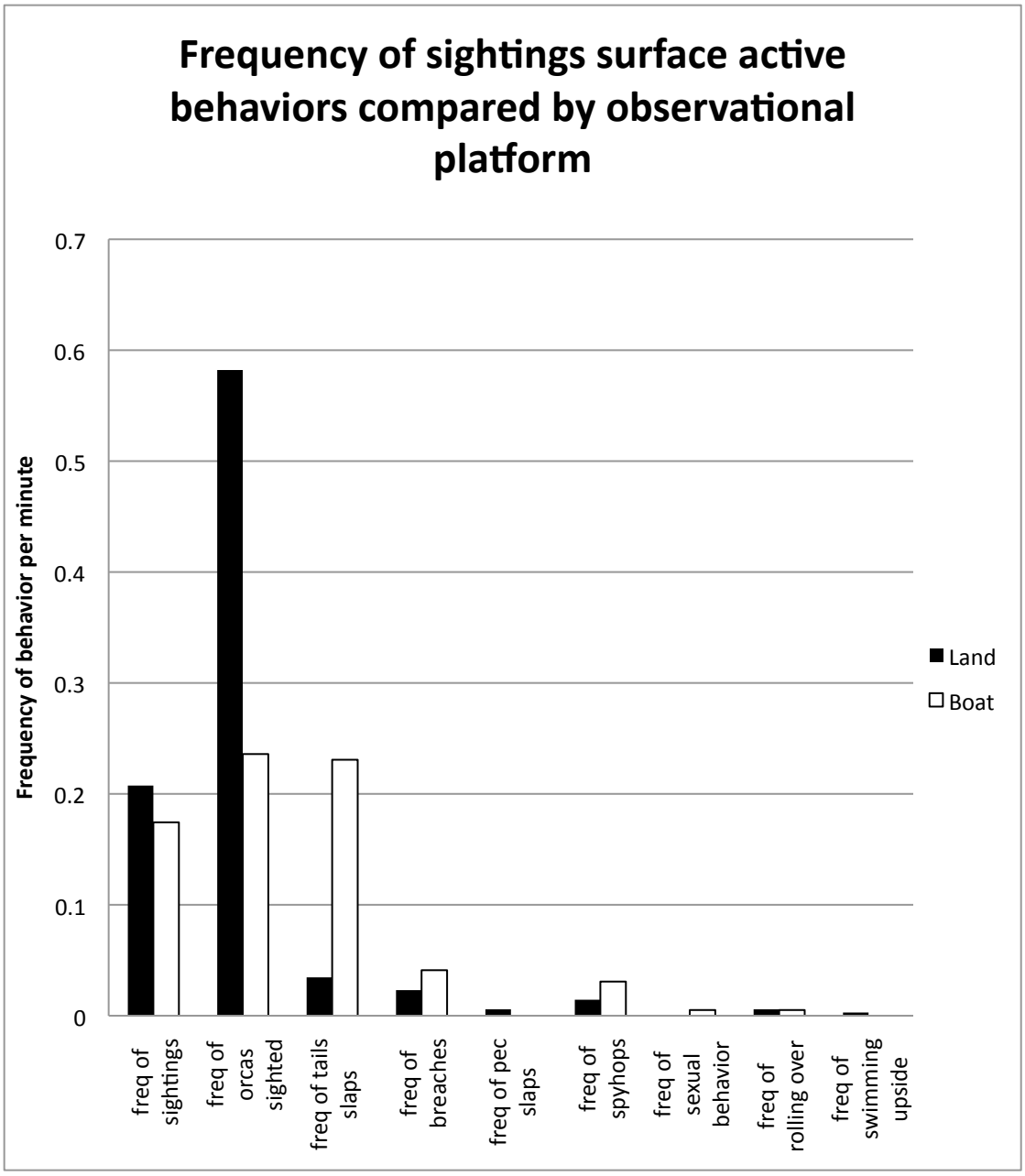

Figure 2. Land vs. Boat comparison for frequency of sightings, orcas sighted, and surface behaviors. Calculated frequencies, based on the totals of each observation category for land and boat, divided by the time they were viewed from each platform.

Table 2. Comparison of the number of orca observations made from land and boat by tidal phase near San Juan Island, Washington. Tide data from Kanaka Bay reporting station, listed on Seattle Times' website.

Tide type	# of times observed land	# of times observed boat
Low	1	1
Rising	5	2
High	0	1
Ebb	0	2

Table 3. Information about tides, water and whale movement on dates of observations, consolidated from Kanaka Bay data (Seattle Times), observation data sheets, and fieldwork log of events.

Date & Viewpoint	Time	Tide	Height in feet	Orca Sightings	Direction of Orca Movement	Direction of Water current at location	Type of Activity
7-Aug-11	5:09:00	Low	-0.3				
Land		Rising		Yes	South	North	Travel
	13:30:00	High	5.7				
Boat		Ebb		Yes	South	South	Feeding,
Boat	16:47:00	Low	5.1	Yes	Still	Still	Feeding,
Boat		Rising		Yes	South	North	Feeding,
	22:31:00	High	7.2				
12-Aug-11	9:38:00	Low	-0.8				
Land		Rising		Yes	North	North	Fast travel
	17:27:00	High	7.2				
	22:23:00	Low	4.5				
13-Aug-11	3:23:00	High	6.3				
	10:17:00	Low	-0.5				
Land		Rising		Yes	South, north	North	Feeding,
	17:54:00	High	7.1				
	23:00:00	Low	4				
14-Aug-11	10:53:00	Low	-0.1				
Boat		Rising		Yes	North	North	Slow travel
Boat	18:17:00	High	7.1	Yes		Still	
	23:37:00	Low	3.4				
15-Aug-11	11:29:00	Low	0.5				
Land		Rising		Yes	North	North	Travel,
	18:37:00	High	3.4				
16-Aug-11	6:02:00	High	5.8				
Land	12:04:00	Low	1.2	Yes	North	Still	Travel,
Land		Rising		Yes	North, south	North	Travel,
	18:57:00	High	7				
18-Aug-11	7:50:00	High	5.4				
Boat		Ebb		Yes	South, west	South, west	Travel,
Canada-	13:18:00	Low	2.8				
	19:43:00	High	6.9				

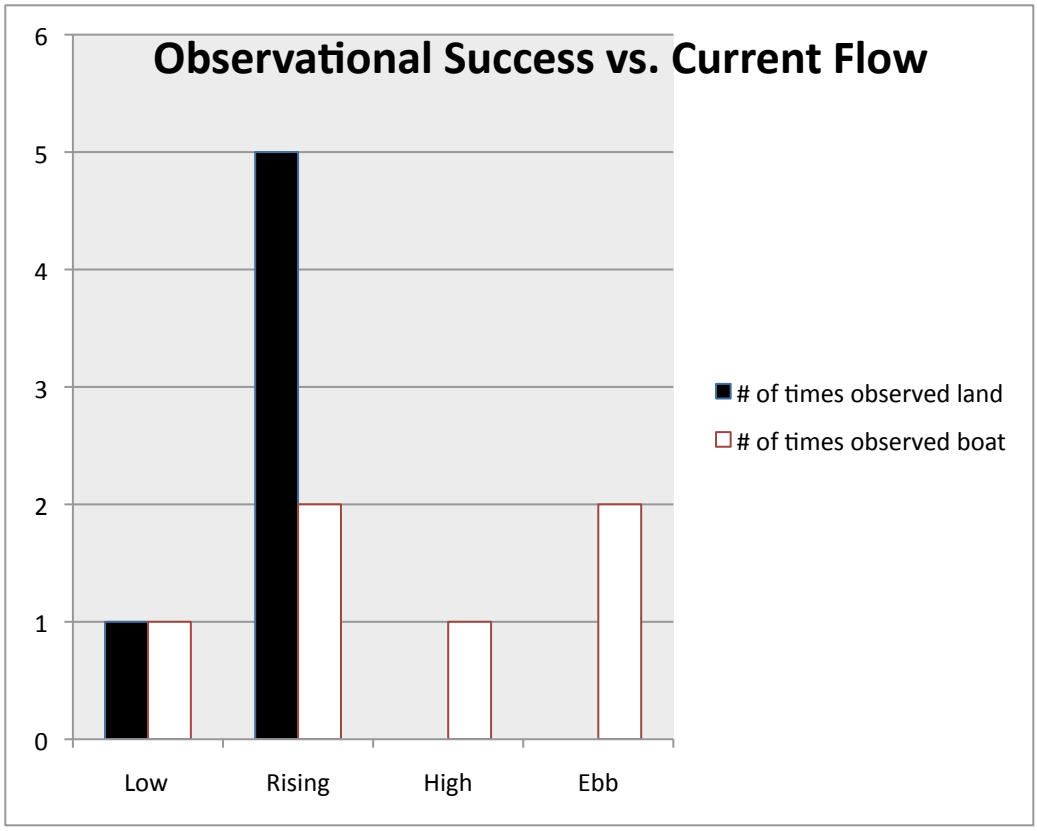

Figure 2. Relationship between tidal state and the number of orcas observed from land versus from boats. Orcas were mainly seen during rising tides.

Table 4. Relationship between tidal current direction and orca movement direction.

Tide	Direction of Orca Movement	Direction of Water current at location	Movement of orcas in relation to tide
Rising	South	North	against
Ebb	South	South	with
Low	still	still	with
Rising	South	North	both
Rising	North	North	with
Rising	south, north	North	both
Rising	North	North	both
High		still	with
Rising	North	North	with
Low	North	still	neither
Rising	North, south	North	both
Ebb	south, west	south, west	with