

Field Report - Cooperative Agreement CA-15-1

Pilot Study on intertidal ghost shrimp feeding by gray whales in N Puget Sound, WA

John Calambokidis, Cascadia Research, 218½ W 4th Ave., Olympia, WA 98501. Tel. 360-943-7325 (ext 104). Email: calambokidis@cascadiaresearch.org

This is a preliminary report on the research conducted in spring 2015 for a pilot project examining gray whale occurrence and feeding in northern Puget Sound by Cascadia Research under a cooperative agreement from the Department of Natural Resources. The DNR Aquatics Lands Program is implementing an adaptive management research approach to understand impacts from human activities that influence habitat and species on state owned aquatic lands (SOAL). One authorized activity that has recently been suspended on SOAL because of lack of information about impacts is the commercial harvesting of ghost shrimp. Ghost shrimp have been harvested historically from areas around Saratoga Passage to be used as live fishing bait. According to Washington Department of Fish and Wildlife estimates, the commercial harvest of ghost shrimp totals more than 50 tons annually. This harvesting was suspended in April 2014 when local anecdotal observations shared with DNR indicated that there has been change in frequency of foraging by the sub-population of Pacific gray whales in Saratoga Passage when the whales stop-over in their migrating from Mexico northward to summer off the coast of Alaska.

Around northern Puget Sound (NPS) a small but stable group of gray whales return seasonally primarily from March to May to feed prior to continuing their northern migrations (Calambokidis et al. 2002, 2010, Weitkamp et al. 1993). These whales have been individually identified and cataloged by Cascadia Research and a core group of just under a dozen of these individuals are documented returning each year including some of the individuals in the first years of directed research (1990 and 1991). One of their primary prey has been documented to be ghost shrimp in intertidal areas and they can be observed feeding at high tide in intertidal areas where there are dense aggregations of prey. While their feeding on ghost shrimp has been documented there is little quantitative data on which to calculate their consumption of ghost shrimp or the relative importance of this prey items.

The project would address a number of objectives related to key elements required to address gray whale consumption and reliance on ghost shrimp in the northern Puget Sound region. The following activities were conducted so far:

1. Conducted dedicated small boat surveys to get precisely identify and spatially document feeding locations at different times in the 2015 season (Figure 1).
2. Obtained opportunistic sightings and identifications from trips aboard whale watch vessels March-May 2015.
3. Assembly of individual whale identification sighting histories from 2015 and past years to help assess individual arrival and departure times each year (Table 1).
4. Compilation and entry of historical sighting data from multiple sources including Cascadia surveys and sighting reports, and sightings reported to Orca Network.
5. Deployment of suction cup attached tags to gather data and video on whale feeding behavior

Some of the key preliminary results from some of this research are summarized below with figures or tables highlighting some of the findings. Analysis of this data will take additional time and continue through 2015.

Surveys were completed aboard both whale watch boats as well as from dedicated small boat surveys (Figure 1) which covered large areas of the habitat used by gray whales for feeding. Dedicated small boat surveys were conducted on 1 March, 17-21 April, and 3-4 May 2015.

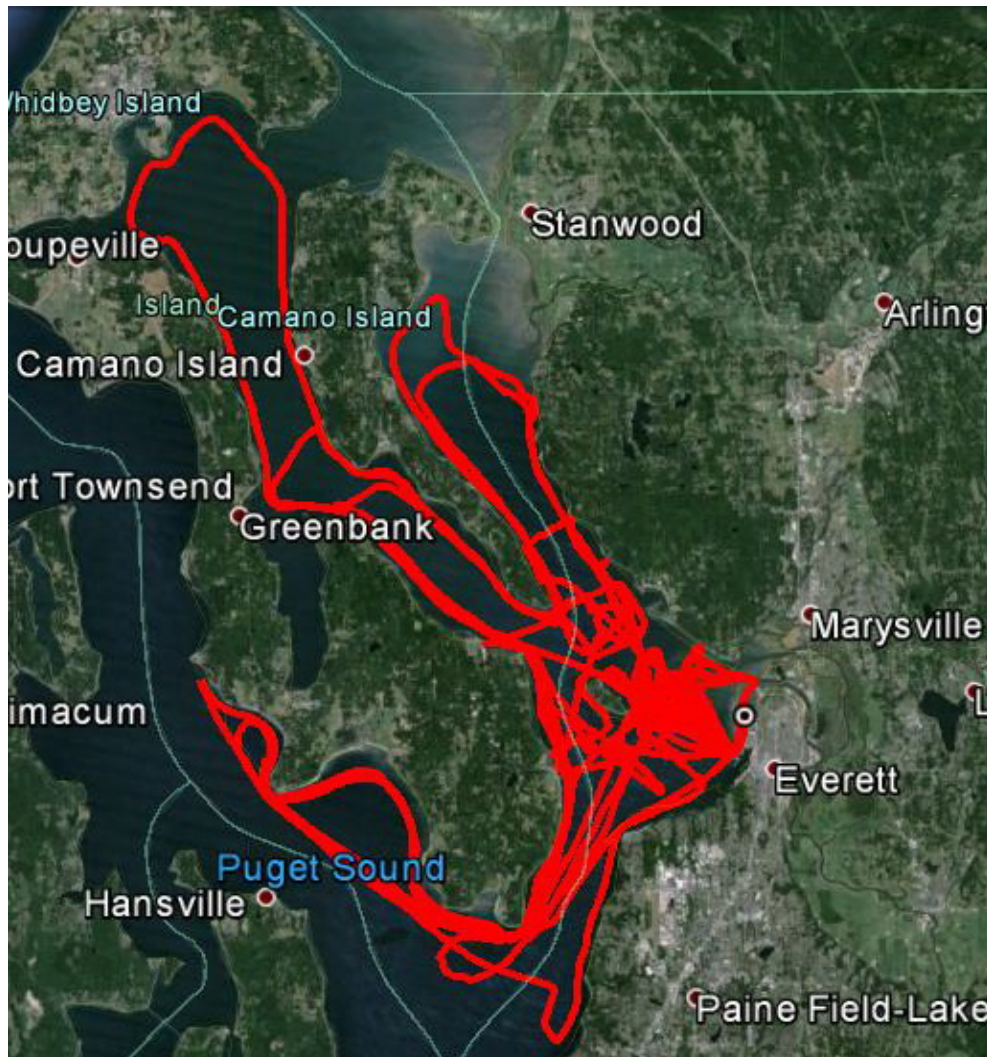


Figure 1. Tracks of dedicated small boat surveys conducted in Northern Puget Sound by Cascadia Research March- May 2015.

Identifications made from surveys, whale watch boats, and provided by naturalists and the public revealed at least 8 different individuals whales (a 9th was reported but not confirmed) using northern Puget Sound from March to May 2015 (Table 1). All of these whales were known individuals seen in past years based on natural markings including both individuals (21 and 22) first identified in Cascadia's initial effort in 1990 and all four others that were first identified in 1991. No individuals were identified that had not been seen in a previous year reinforcing the

loyalty of this small group of animals to this region and their almost exclusive use of these waters. First confirmed sighting in 2015 for most individuals was from 7 March to 4 April 2015.

Table 1. Annual sightings of identified gray whales seen multiple years in N Puget Sound. Number times seen shown and for 2010-13 first date identified.

ID	Sex	1990	1991	1992	1993	1994	1995	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014*	2015*	Yrs	Other areas
21	M	1	16	5	2	7	6	4	5				1	13	1	9	3	12	10	1	2	2	3	12-Mar	2-Apr	21	
22	F	1	1	2	1	5	7	4	3				4	2	14		9	7	13			4	11		15-Mar	16 Off Victoria in June 90	
44	M		14	9	3	3		1	1	1			1	15	2		5	1	4	2	2	1	2	7-Apr	4-Apr	19 SPS in 91	
49	M		6	4	2	2	2	5	1	1	5	2	2	11	2	5	5	15	14	12	18	5	8	7-Apr	14-Mar	23 South Vancouver Island May 2012	
53	M		12		2	2	2		1	2		2	5	9	2	9			10	6	22	10	12	18-Mar	8-Mar	18	
56			2				1		5	2		1	6	2	7	2	9	1	1	4	5	12	10-Apr	14-Mar	17		
356							1		1		1	1	1	1	1		2	2	2					7-Apr	?	9 OR Oct 99	
383							2		1		1	7	1	7	6	4	9	4	1	3	9	9	7-Apr	21-Mar	15		
396	F						4		1										2							3 Off Victoria April 07	
531	F								2					2	3	8	10	4	12	11		1	9-Mar		10	Kod Aug 02, WVI Mar 07	
543									4	3																2	
723	M								1					19	3	5			4	2	11	5		9-Mar	7-Mar	10	
1193																			5	3						2	
1213																				3	4						2
Count		2	6	4	5	2	5	4	8	10	6	2	8	8	9	9	6	8	12	12	9	8	8	9	8		8

During surveys were conducted focal follows to monitor behavior and exact positions of whales and behaviors conducted (Figure 2). Most of the data on positions was gathered in our primary period of field effort from 17-21 April 2015, whales had not arrived yet during the first survey in March and were the process of leaving with only one whale remaining (ID 22) during the final period of surveys on 3-4 May 2015, which were cut short due to the departure of even this animal (she was sighted a little after our last observation headed west past the S end of Vancouver Island.

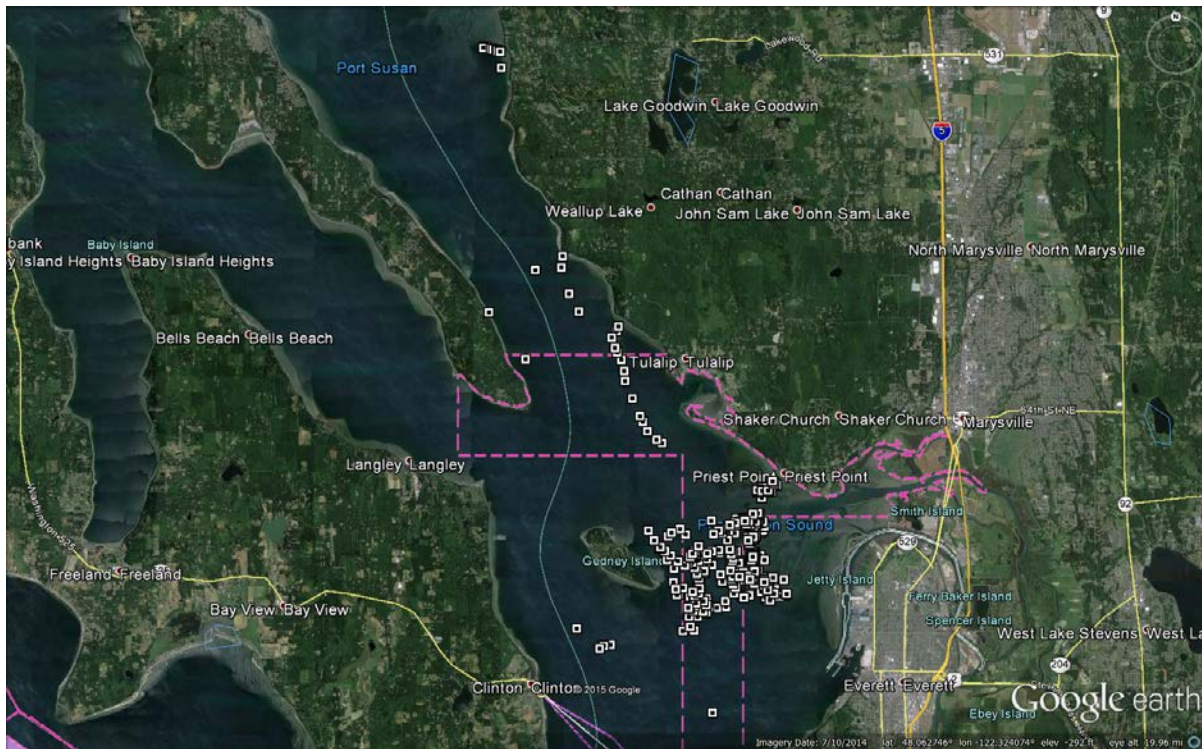


Figure 2. Locations of gray whales based on 2015 focal follow positions from dedicated small boat effort in April and May 2015.

Whales were directly observed in engaged in feeding in intertidal areas on multiple occasions during April and May 2015 primarily on the Snohomish Delta and to a lesser degree in NE Port Susan (Figure 3). While feeding in shallow intertidal waters was reported and documented with feeding pits in other areas, this was not the case during the main period of our surveys from 17-21 April 2015 and certainly the extent of the pits and overall sighting locations indicated Snohomish was one of the primary areas of whale feeding in 2015 and appeared to be much more the case than in previous years. The Snohomish Delta is a much wider and broader area than the other areas gray whales have been seen feeding and may represent a riskier area for whales to access since they are much greater distances from deeper waters and could more easily get trapped if they misjudged depths or tides.

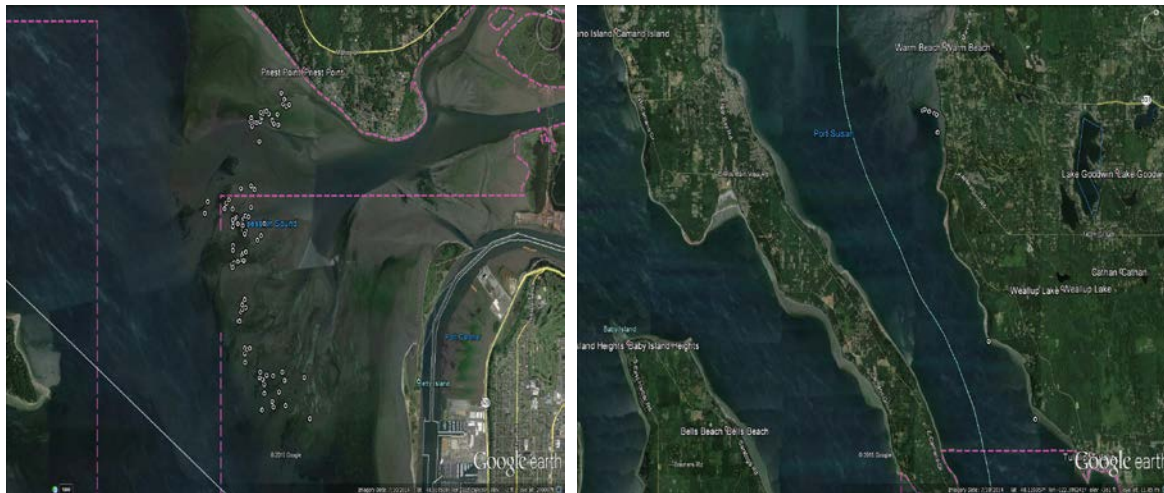


Figure 3. Locations where intertidal feeding was documented with precise positions during focal follows from dedicated small boat surveys in April and May 2015.

Tag deployments were attempted on 17-19 April 2015 (Table 2) and three tags were deployed successfully (Figure 4). One deployment gathered little data because it was damaged by whale-whale contact shortly after deployment which resulted in damaging the tag and breaking of the portion with instrumentation and cameras. The other two deployments gathered valuable data on two different whales engaged in both social and feeding behavior (Figure 5). Video data revealed a number of surprises including a higher than expected level of social behavior underwater among whales showing up to three whales following closely behind and next to the tagged whale which was one of the few females in this group (ID 22).

Table 2. Tag deployments conducted in 2015 with comments.

Deploy time	S #	ID	TagType	Tag #	Comment
4/17/15 10:15	3	22	Platypus -R-L dual video	4	Impact with another whale turns tag to face backwards, good video of interactions with other whales. Extended intertidal feeding documented late in evening and into night from on-board sensors
4/19/15 8:56	1	22	Platypus -R-L dual video	3	Short deployment due to impact with another whale shortly after deployment breaking tag in half
4/19/15 13:37	2	383	Minion F-B dual video	5	Deployment documents subtidal feeding by both tagged and associated whale. Video terminates early due to premature start of recording

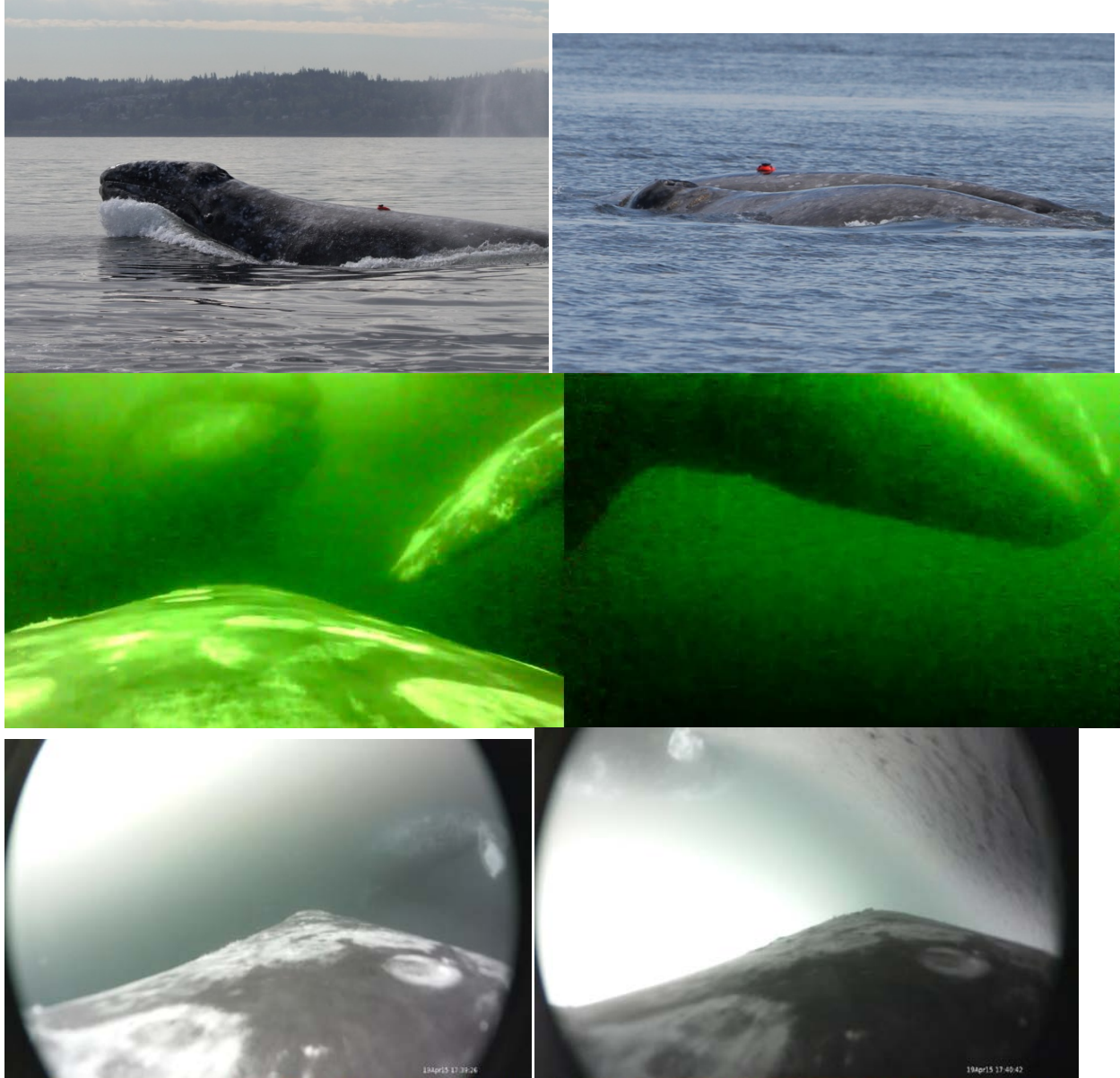


Figure 4. Images captured on video on video tag deployments on gray whales in May 2015. Top two photos show initial tag deployment of tag with side by side cameras on ID #22, middle images show the right and left view from that tag capturing three whales traveling behind and on the right side of the whale after the tag got turned by contact with another whale, and bottom images show two forward facing images from 3rd tag deployment showing forward image of 2nd whale apparently feeding in subtidal area off Hat Island and image from same whale of it turning on its right side and going down to bottom.

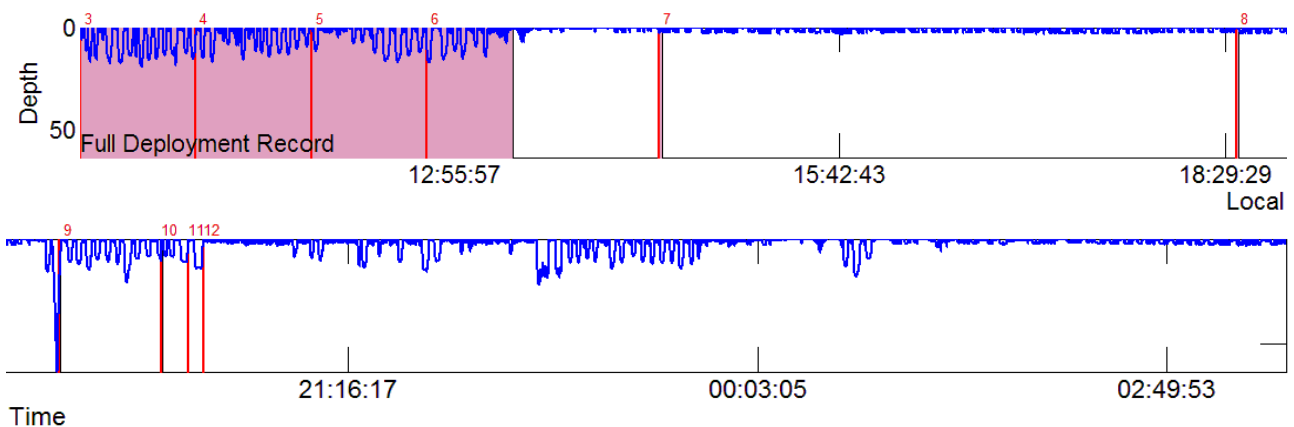


Figure 5. Part of the dive record from tag deployment on 17 March 2015 showing deeper dives after initial deployment around Hat Island (including shaded area when video was recording) and transition to shallow feeding on the intertidal area of the Snohomish Delta at high tide which continued into darkness. Lower panel showed continuation of record during darkness until early morning of the next day.

Four fecal samples were collected from whales including one confirmed from one of the whales that had been tagged. All of these had visible carapices of ghost shrimp in them. Samples have been frozen for more detailed identification of prey by visual and possible genetic means in future months.

References

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