Progress Report for Interim Funding 2009

Project Number: 090742

Project Title: Monitoring, Tagging, Feeding Studies, and Restoration of Killer Whales in Prince William Sound/Kenai Fjords in 2008-2009

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Time Period Covered by Report: September 2008-August 2009

Date of Report: 1 Sept 2009

Summary of Progress in Completion of Objectives

1. To provide photographic population monitoring of resident killer whale pods, including the non-recovered AB pod in order to determine status. Also monitor the depleted AT1 transient group which has lost over half its members since the spill. **Thus far in 2009 AB pod (except AB25 sub-pod) has been photographed, all members accounted for and one new calf attributed to first time mother, thirteen year old AB50. We hope to photograph the AB25 sub-pod this fall. The AB 25 group was partially enumerated from photographs submitted by the humpback whale assessment project this past winter. All 7 members of the AT1 group have been accounted for in 2009, with no new calves (Table 2).**

2. To use remotely attached satellite tags to aid in detailing habitat use and to allow relocations of pods for food sampling studies. Suggest restoration alternatives from feeding habit and habitat use data. **We deployed 9 satellite tags in 2008 and 5 thus far in 2009. We have had some problems with tags functioning properly: however, we believe that has been corrected in the current tags (all tags produced by Wildlife Computers). We have had attachment times of up to 2 months including data from an attachment that transmitted through late fall and early winter 2009. We expect to deploy several additional tags fall 2009.**

3. Examine seasonal feeding habits, particularly of AB pod and other resident type pods to determine specifics and timing and predation using observational methods based on collection of fish scales from kill sites and using stable isotope and lipid/fatty acid analysis to corroborate and/or extend field observations. To examine possible restoration through enhancement of particular salmon prey species. **We have collected 7 samples from predation events this year as fish kills and consumption have occurred at depth more frequently than in past years which may reflect distribution and scarcity of prey (Chinook, coho, and chum salmon primarily). This underscores the importance of our biopsy sampling and stable blubber analysis in long-term feeding habit work. We have collected a total of 20 biopsies this year which we have spread across the season to permit examination of temporal changes in prey. We expect to collect additional samples this fall (2009) in Prince William Sound.**

Contaminant/stable isotope/lipid fatty acid analysis has recently been completed for the 2008 season and will be examined this fall/winter.

4. To complete journal papers on the assessment of long-term effects of the *Exxon Valdez* oil spill on AB pod and the AT1 population on resident killer whale population dynamics. . Journal papers on tagging studies are also planned. **Published "Ongoing population-level impacts on killer whales *Orcinus orca* following the *Exxon Valdez* oil spill in Prince William Sound, Alaska"C. O. Matkin, E. L. Saulitis, G. M. Ellis, P. Olesiuk, and S. D. Rice (Marine Ecological Progress SeriesVol. 356: 269–281, 2008). It has been widely requested and formed the basis of a series of presentations given in the winter/spring of 2008-2009. Population dynamics paper was not completed due the inability of the primary analyst to complete his work. We have conducted a search and are prepared to hire a new analyst, however, the paper will likely need to be revamped using his techniques. Reanalysis will occur this winter (2009/2010)**

5. To provide data for assessment of the role of transient and resident killer whales in the near-shore ecosystem; to monitor any changes in feeding habits in this area based on previously published dietary information (Saulitis et al 2000). **This has been the most difficult of our objectives to complete for transients. Due to the small population size and limited number of encounters with the AT1 killer whales, and the increasing difficulty in approaching and following these whales. It has been possible to monitor numbers of AT1 whales and we record occasional encounters with GOA transients. However, examination of food habits has involved very small samples sizes, although for the AT1 transients, harbor seals and Dalls porpoise still appear to be primary prey items.**

6. To continue to work with local groups (Youth Area Watch, tour boat operators/industry) in providing community involvement with our work and promote restoration through education and reduction in harassment. **We put substantial effort into community involvement and education. We made presentations on long term oil spill effects on killer whales at different times and locations around Southcentral Alaska (including, Cordova, Homer, Girdwood, and Anchorage) as well as in Washington State. We established a new website for the tourboat clients to download their photographs and sightings <u>www.alaskawhalesightings.com</u> . This new web site and its advertisement in brochures on the tourboats has made it possible for participants in regulated whale watching cruises to contribute to the research efforts and actually provide valuable data for our research. We have continued our work of education and monitoring of tourboat and vessel operators. Our effort and encounter database is available via the Alaska Sealife Center for other researchers and collaborations.**

Work Performed:

The current project was initiated in 2007 and addresses the lingering effects of the *Exxon Valdez* oil spill in Prince William Sound. It includes a continuation of the monitoring of AB pod, other major resident pods, and the AT1 population of transient killer whales. It includes an innovative satellite tagging program that is being used to examine habitat preference and to aid in a more extensive examination of killer whale movements and habitat. We are using observational and developing chemical techniques to continue diet assessments. Results will allow us to more closely examine the potential for restoration for the non-recovered AB pod and the depleted AT1 population and assess potential for future perturbations.

In 2008 we applied 9 satellite tags (Table 1), however, 5 transmitted for seven days or less apparently due to tag construction problems that may have let to cracking. Males averaged 10 days of tag operation and females averaged 46 days of tag operation. There were problems with of the case and failure. In addition there appears to be a difference between attachment times between males and females. Initially we tagged primarily males due to the large size of the fin; however, attachments last much longer on average on females. We suspect this is due to rough social activity between males that may damage or dislodge the tag. In 2009 we are attempting to tag only females. Unfortunately, we needed to use the remainder of our 2008 production tags and attachment times have been less than optimal in early 2009 (not reported here). We are now using redesigned tags that will hopefully extend our attachment times. . The Oceanic Home Range area for whales tagged 30 days or more varied from 18,227 km^2 to 270,503 km^2, with the largest home range attributed to the transient whale, AT73 (accompanied by her juvenile offspring) who traveled from Prince William Sound to southern southeastern Alaska and back and then to Kodiak Island in a single month.   In 2009 we have deployed 5 tags and plan to deploy an additional 4 tags in late season. We used tag data last year to direct 2009 early season surveys to Hinchinbrook Entrance and the adjacent Gulf of Alaska which maximized early season encounters.

We continued our biopsy sampling program in order to examine temporal and pod specific differences in feeding habits. We collected 6 biopsy samples in 2008 and have collected 20 samples thus far in 2009 and expect to additional samples this fall.   Some initial analytical results of the lipid/fatty acid and stable isotope analysis is presented in Figure 2 and Figure 3 Although there is great overlap between pods in analytical results, there are noticeable differences, with the nearshore AK pod demonstrating the lowest stable isotope levels.   There is variation in fatty acid signatures within pods and we are examining the differences between matrilines which appear more consistent in blubber chemical composition.   Matrilines within a number of pods (including AD, AK, AE, AB, and AJ) have traveled more independently in recent years and may have prey preferences specific to the matriline. In recent years pods have tended to split and travel in matrilines much more frequently than in the past. We suspect that this may be in response to the increase in population size in recent decades and more challenging feeding conditions and dispersed prey that favors foraging in smaller groups.   As our sample size of tissue increases across pods and seasons, our ability to make comparisons will increase.

The following are the most recent census summaries for the primary resident pods of Prince William Sound/Kenai Fjords and two Southeast Alaska pods that regularly visit our area (AF22 and AG). These whales are used to track population trajectories:

AB   We have completely photographed the AB10 and AB17 subpods in 2009. There are no new mortalities and there is a new calf born to a first time mother, AB50   The AB25 subpod that travels with AJ pod was not completely photographed in 2008 and has not yet been photographed yet in 2009.

AD5 This pod has not yet been encountered and photographed in 2009, although they were photographed in 2008 and one member was tagged and tracked in late 2008.

AD16 All others members accounted for in 2009, no new calves.

AE All animals accounted for in 2009, no new calves.

AF22 Completely photographed last in 2007.   Pod was photographed in August 2009 in a large superpod, but photos have not been processed and we are not sure if we completely covered this group.

AG Completely photographed in 2008. Not yet encountered in 2009

AI All present and accounted for in 2009, no new calves.

AJ Only part of the pod has been encountered thus far in 2009.

AK No mortalities and one new calf for AK10.

In figure 1 we diagram the number of whales documented annually in AB pod since the beginning of the study as well as the number of whales documented in the other major resident pods of the Southern Alaska Resident population that have been monitored during the same period. In recent years the rate of increase of all pods seem to have declined, suggesting numbers of resident whales may have reached carrying capacity.

Through our own encounters and submitted photos, the seven surviving AT1 whales have been accounted for in 2009, and none of the missing/dead AT1 whales have re-appeared (Table 2). These whales have become very difficult to approach, and although we have attempted to tag members of the group, we have not yet been successful. It is noteworthy that the two youngest males, AT 10 (born about 1980) and AT3 (born in 1984) still have not developed the larger dorsal fins associated with males, although both are certainly physically mature by this time (Figure 4). We suspect this inhibited development results from high contaminant load or nutritional stress or both. Although harbor seals numbers have apparently increased in recent years in the Sound, these two males matured during a period of historically very low harbor seal numbers and a period of possible nutritional stress.

During May-October 2008 we completed 51 survey days on the R.V. Natoa with a total of 32 encounters with killer whales. A total of 27 encounters were with fish-eating resident whales and 5 with mammal-eating transient whales. During May to August 2009 we completed 58 days of field work in Kenai Fjords and Prince William Sound have logged 42 encounters with killer whales. An additional 10 day trip is planned in mid September. We have completed photographic coverage of the AB17 and AB10 sub-pods in 2008 and we hope to finish the monitoring of the AB25 sub-pod this fall. This group does not travel with the rest of AB pod, but with AJ pod. AJ pod has been encountered infrequently in recent years and is often travels in sub-pods or matrilines making monitoring difficult.

Table 1 Tracking time, distance and area from satellite tags applied in 2008

Individual	Tracking Time Period	Duration In days	Distance Traveled (km)	Minimum Convex Polygon in km2	Land Area within the MCP (km2)
AB43	8/14/2008-8/20/2008	7	677	8354	1401
AB45	6/21/2008-7/26/2008	36	4052	21455	3228
AD19	6/15/2008-6/21/2008	6	630	3962	111
AD21	10/16/2008-12/30/2008	76	5735	35897	7179
AE16	9/15/2008-9/16/2008	1	101	262	89
AI7	10/3/2008-11/3/2008	32	3621	27604	4884
AJ21	6/20/2008-6/23/2008	3	471	5761	54
AT73	9/20/2008-10/19/2008	30	3839	278543	8040
AI2	8/16/2008-8/23/2008	7	755	9863	1229

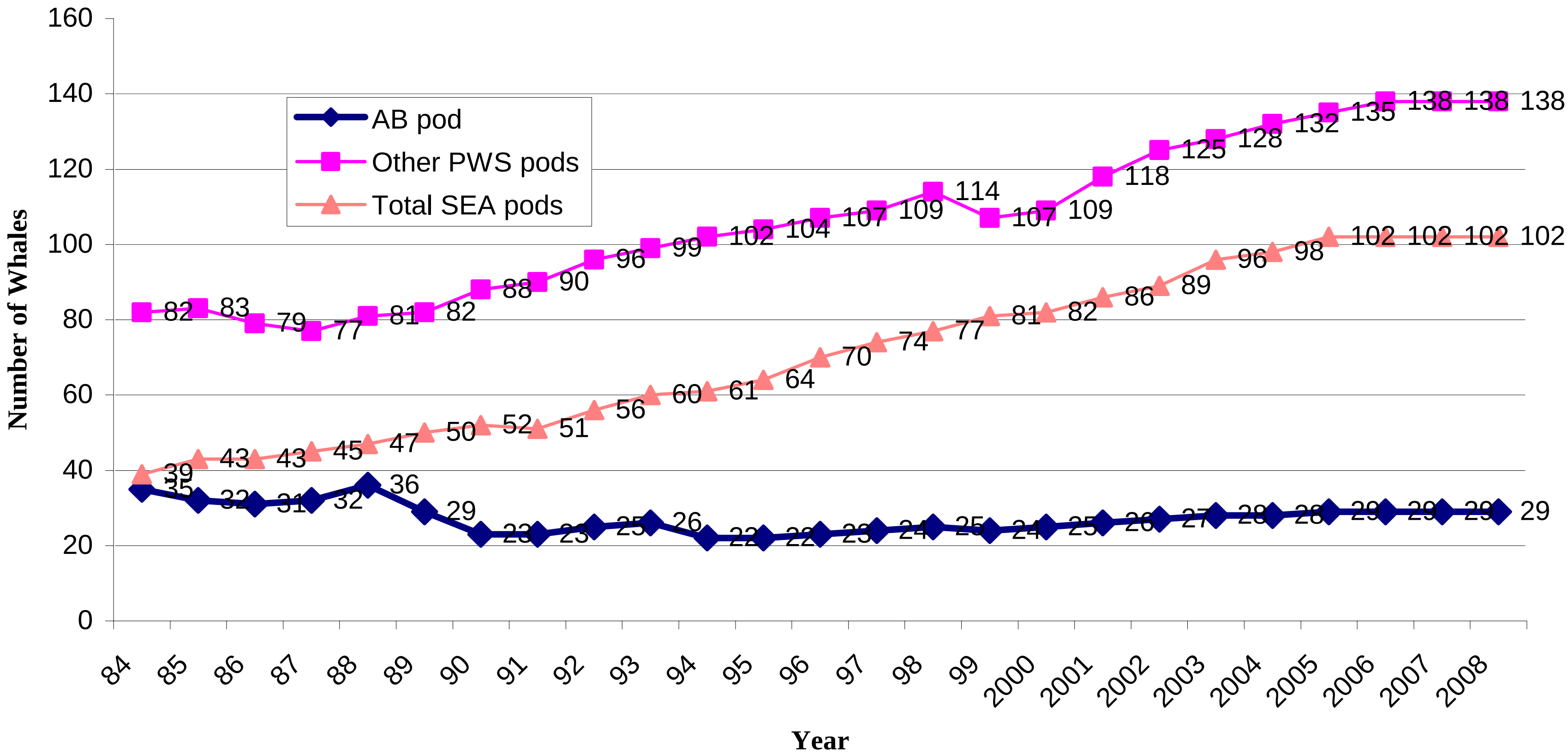
Note: Distance and area calculations based on GIS data stored in Alaska Albers Equal Area Conic map projection. The shoreline data used in the land area calculations for Alaska was at the 1:63,360 scale.

Table 2. Sighting histories for all AT1 transient whales for years with effort greater than 40 days.

YEAR	*AT1*	**AT2**	**AT3**	**AT4**	*AT5*	**AT6**	*AT7*	*AT8*	**AT9**	**AT10**	*AT11*	*AT12*	**AT13**	**AT14**	*AT15*	*AT16*	**AT17**	**AT18**	*AT19*	*AT20*	*AT21*	*AT22*
84	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
85	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
86	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X
88	X	X	X	X				X	X	X	X	X	X	X	X		X	X		X	X	X
89	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
90	X	X	X	X	-	X	-	-	X	X	X	X	X	X	-	-	X	X	O	-	-	-
91	X	X	X	X	-	X	-	-	X	X	-	X		X	-	-		X		-	-	-
92	X	X	X	X	-	X	-	-	X	X	-	-	X	X	-	-	X	X		-	-	-
93		X	X	X	-	X	-	-	X	X	-	-			-	-	X	X		-	-	-
94	X				-		-	-	X	X	-	-		X	-	-		X		-	-	-
95	X	X	X	X	-	X	-	-	X	X	-	-	X	X	-	-	X	X		-	-	-
96	X	X	X	X	-	X	-	-	X	X	-	-		X	-	-		X		-	-	-
97	X	X	X	X	-		-	-			-	-	X		-	-	X			-	-	-
98	X				-	X	-	-	X	X	-	-	X	X	-	-	X	X		-	-	-
99		X	X	X	-	X	-	-	X	X	-	-			-	-		X		-	-	-
2000	O				-		-	-			-	-	X	X	-	-	X			-	-	-
2001		X	X	X	-	X	-	-	X		-	-	X		-	-	X	X		-	-	-
2002		X	X	X	-		-	-	-		-	-	O?	X	-	-	-			-	-	-
2003		X	X	X	-	X	-	-	X	X	-	-	-	O?	-	-	-	X		-	-	-
2004		X	X	X	-	X	-	-	X	X	-	-	-	-	-	-	-	X		-	-	-
2005		X	X	X	-	X	-	-	X	X	-	-	-	-	-	-	-	X		-	-	-
2006		X	X	X	-	X	-	-	X	X	-	-	-	-	-	-	-	X		-	-	-
2007		X	X	X	-	X	-	-	X	X	-	-	-	-	-	-	-	X		-	-	-
2008		X	X	X	-	X	-	-	X	X	-	-	-	-	-	-	-	X		-	-	-
2009		X	X	X	-	X	-	-	X	X	-	-	-	-	-	-	-	X		-	-	-

X whale present
O whale dead (stranded) (probable identify of AT1 carcass denoted by: **O?**)
- whale missing presumed dead

Figure 1. The number of resident killer whales in AB pod, in seven other Prince William Sound pods, and in three Southeastern Alaska pods (All pods belong to the southern Alaska resident population). 1984-2008



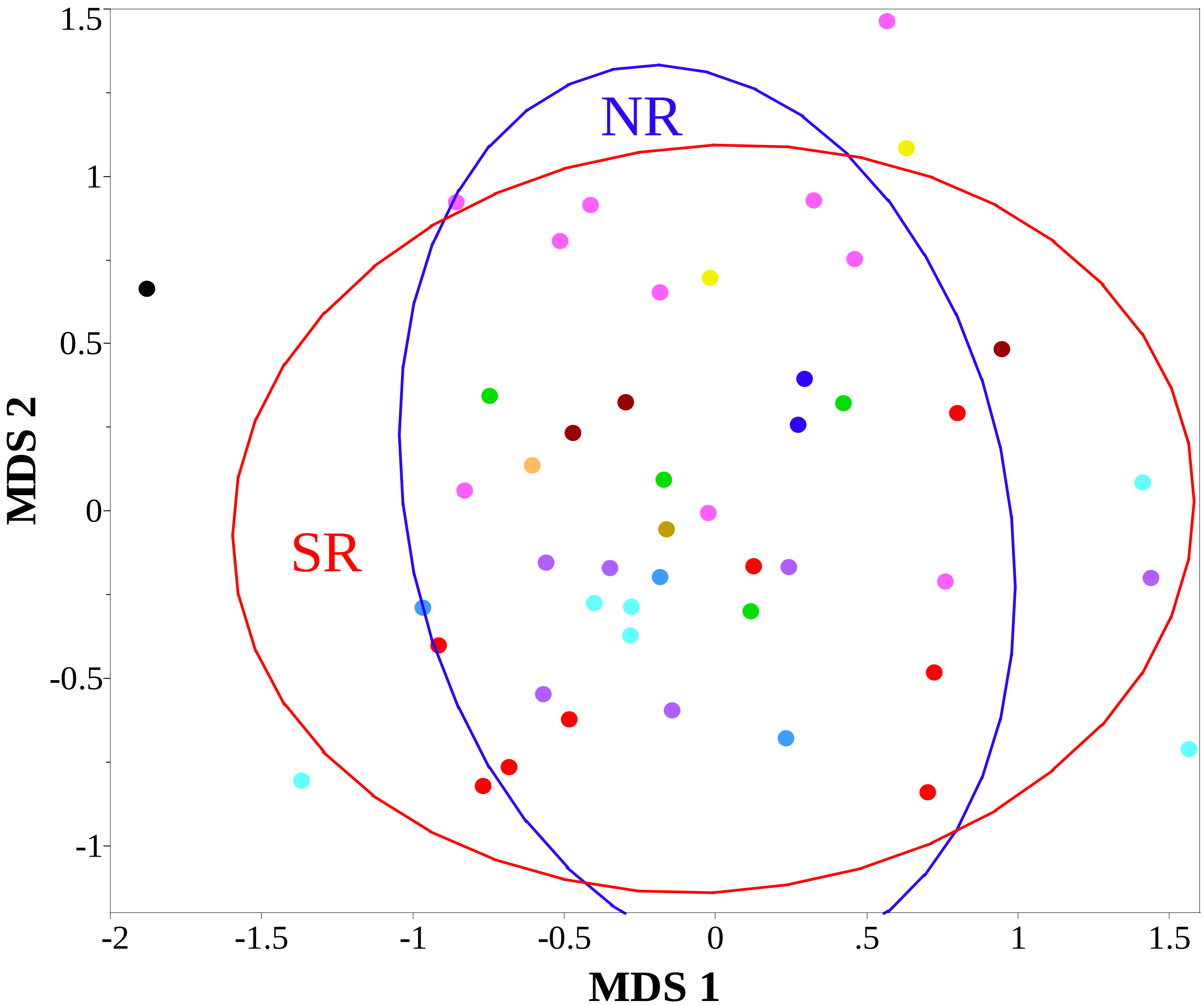


Figure 2 . Same as in Figure 1 above where killer whales are color-coded by pod associations but grouped instead by haplotype. Ovals represent the 80% probability density functions for the "SR" and "NR" haplotypes. Not shown by this plot is the observation that the two haplotypes differ significantly ($p<0.10$) from one another with respect to sum Omega-6, sum saturated, and sum branched-chain fatty acids. This suggests a difference in diet, at least during some periods, and may reflect the more nearshore orientation of the SR haplotype groups.

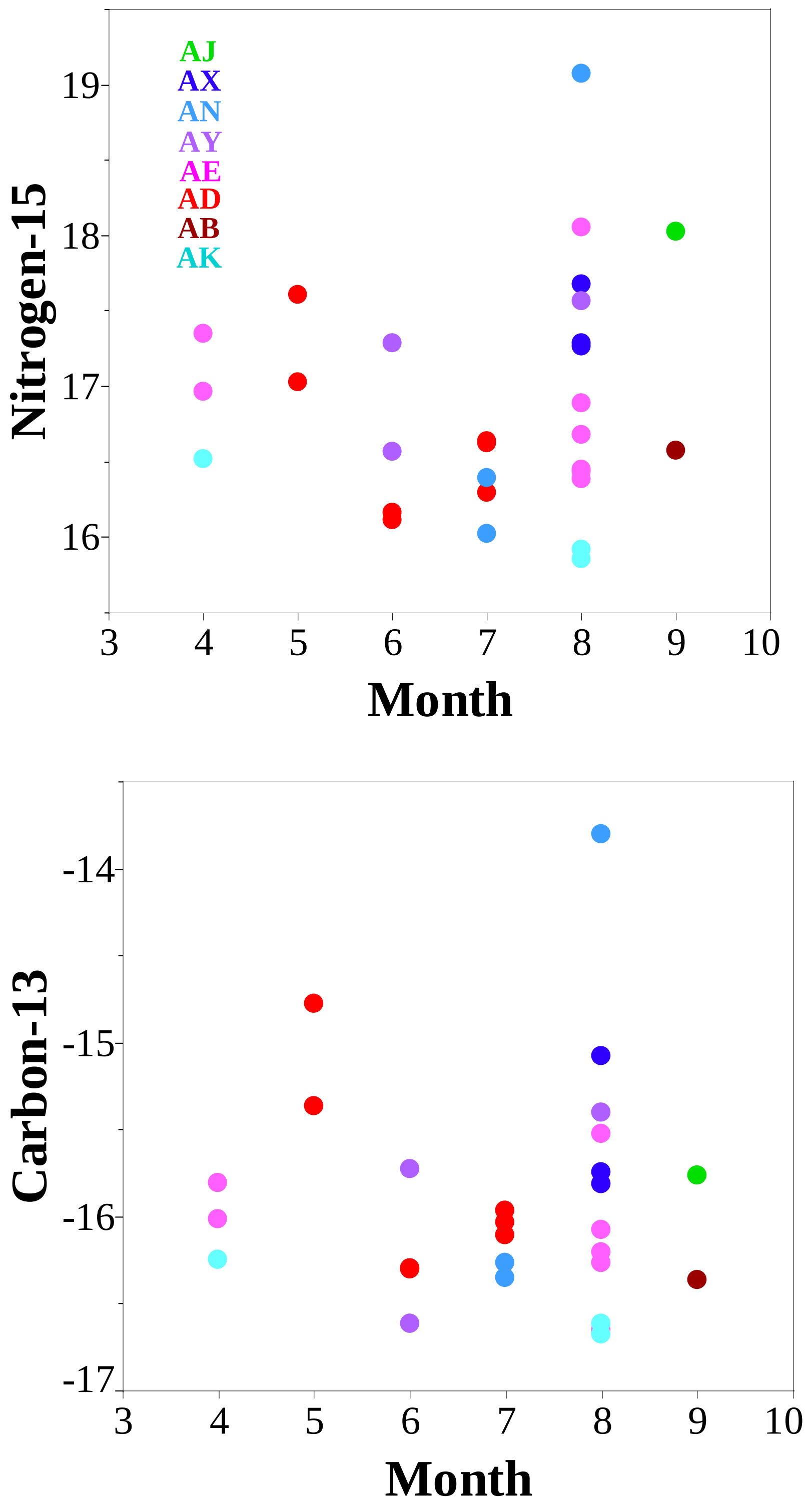


Figure 3. Variation of δ15N and δ13C values with sample collection month for Gulf of Alaska resident killer whales with individual whales color-coded by pod association indicating some change in diet over season. Additional samples and lipid are needed to resolve these potentially significant differences.

Figure 4. Structure of the depleted AT1 population of transient killer whales September 2009.