ATTACHMENT C ***EVOSTC Annual Project Report Form***

1. Program Number: *See*, Reporting Policy at III (C) (1).

12120114-M

2. Project Title: *See*, Reporting Policy at III (C) (2).

Long-term killer whale monitoring in Prince William Sound/ Kenai Fjords

3. Principal Investigator(s) Names: *See*, Reporting Policy at III (C) (3).

Craig O. Matkin

4. Time Period Covered by the Report: *See*, Reporting Policy at III (C) (4).

February 1, 2015-January 31, 2016

5. Date of Report: *See*, Reporting Policy at III (C) (5).

March 1, 2016

6. Project Website (if applicable): *See*, Reporting Policy at III (C) (6).

www.whalesalaska.org

7. Summary of Work Performed: *See*, Reporting Policy at III (C) (7).

February–April 2015. The current killer whale photographic reference catalogue was updated with 2014 field data. Matriline diagrams were updated to reflect changes in structure based on 2014 data. The updated catalogue was provided electronically to all tour boat operators and to the Kenai Fjords National Park. Work was continued on a journal publication titled "Shifting Hot Spots: Seasonal and pod-specific habitat use by resident killer whales in the Northern Gulf of Alaska." Collaborative work with Dr. David Herman/NOAA/NWFSC continued, examining long term trophic changes in resident killer diet. This work involved the analysis of stable isotope, lipid, and contaminant data from blubber biopsies taken over the past 20 years. Preparation for the 2015 field season also occurred during this period. Current databases were uploaded to the AOOS Ocean Workspace for Gulf Watch Alaska.

May-October 2015. A total of 75 days of fieldwork was performed during this period, with 60 days aboard the R.V. Natoa,and 15 days contributed by other vessels. We logged 54 total encounters with killer whales; 41 with residents, 2 with AT1 transients, 11 with Gulf of Alaska transients, and 1 with offshores. Survey tracklines (with or without whales present), totaled 4922 km and encounter tracklines (with whales present) totaled 1084km.

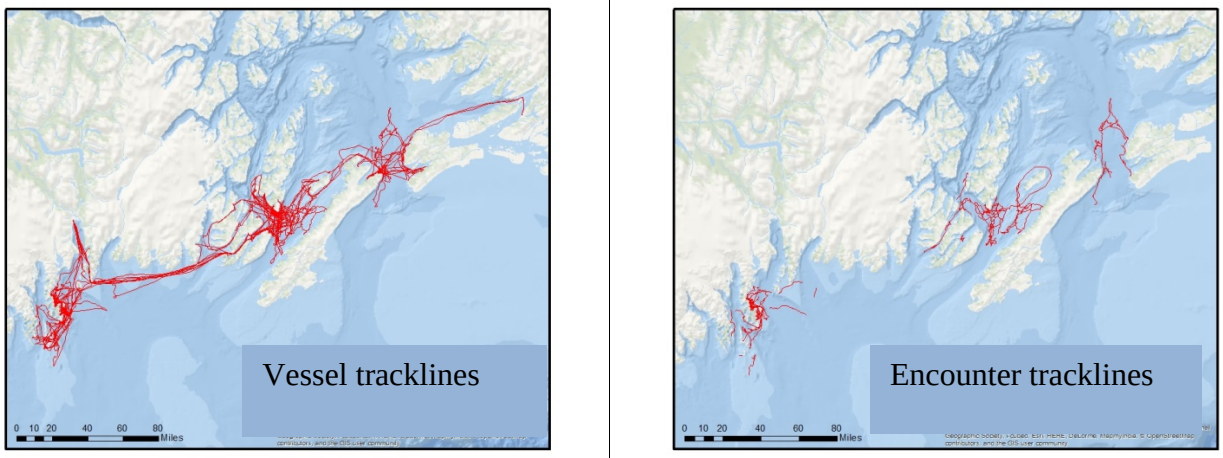

Figure 1. Vessel and encounter tracklines for sampling in 2015

We continued to emphasize photoidentification in this study year to complete our coverage of less frequently seen matrilines. During 2015 fieldwork we documented 264 resident killer whales in 17 pods, all of 7 remaining whales in the AT1 transient population, and 24 whales in the Gulf of Alaska transient population. As resident (fish eating) pods continued to grow, splitting of pods and some range changes have occurred. In the future, it will likely be necessary to examine population dynamics using resident matrilineal groups rather than pods. We improved our coverage of transient killer whales (both AT1 and GAT populations) in part by using contributed photographs from vessels of opportunity. We encountered Offshore ecotype killer whales once this year, as they are always encountered infrequently.

The AB pod was photographed completely this year. There were no new deaths and two new calves were recruited. AB80 is a second calf to AB54, and AB81 is the fourth calf to matriarch AB26. There may have been a late season calf to AB59 (which would be her first), but this could not be concluded from photos. The AB pod now numbers 21 individuals. For the first time in several years we were able to document all remaining seven individuals of the AT1 (Chugach) transients. This was possible because of cooperative effort with tourboats in Valdez Alaska that focus on glacial areas (e.g. Columbia glacier) and are able to provide sightings/photos of AT1 transients. The AT1 transients, which are the only transients we have observed that specialize in glacier fjord foraging, appear to have retreated from historic open water and rocky shoreline foraging area and in recent years appear focused on glacial foraging areas.

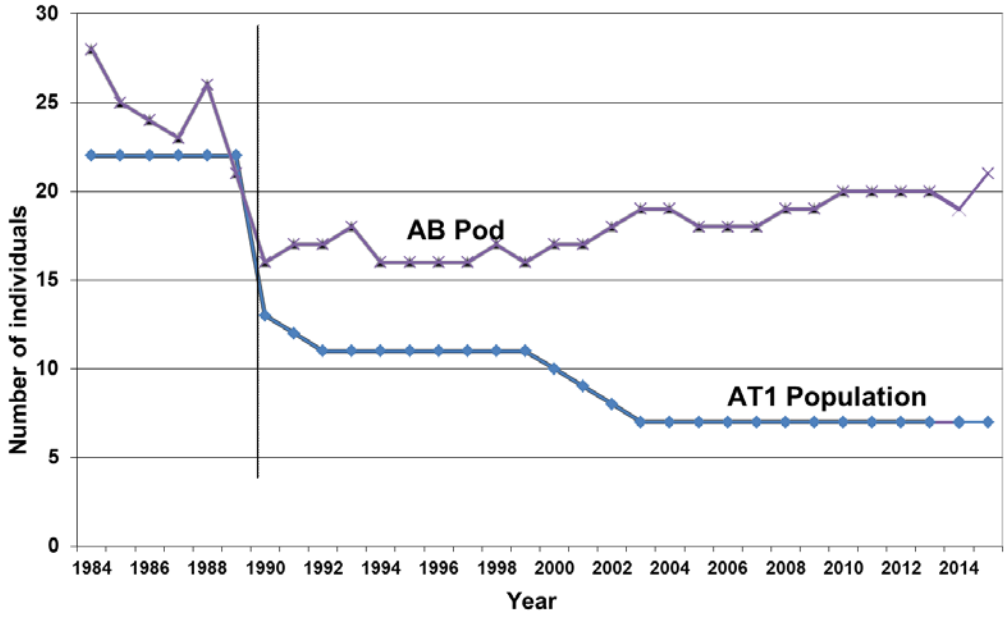

Figure 2. Number of whales in AB pod and AT1 population from 1984 to 2015

We collected 8 biopsy samples with temporal spacing in 2015 to examine seasonal and long-term changes in food habits, using stable isotope, lipid, and contaminant analysis. All samples were sequenced for mtDNA, and were analyzed for stable isotope ratios, lipids, fatty acids, and a suite of environmental contaminants. Analysis of 2014 samples was completed and results are held in a database at NOAA/NWFSC. The analysis over the past 12 years has revealed a long-term trend of declining C13 and N15 stable isotope values (Figure 3.) and contaminant levels (Figure 4.) that suggest a change in diet to lower trophic level. The typical reduction in contaminant (mainly PCBs and DDTs) values due to natural attrition is approximately 2%, yet in southern Alaska residents has been 8-10%. The concurrent decline of both stable isotope and contaminant values suggest a decrease in chinook salmon in diet and increase in coho and chum salmon, which may represent a reduction in Chinook availability.

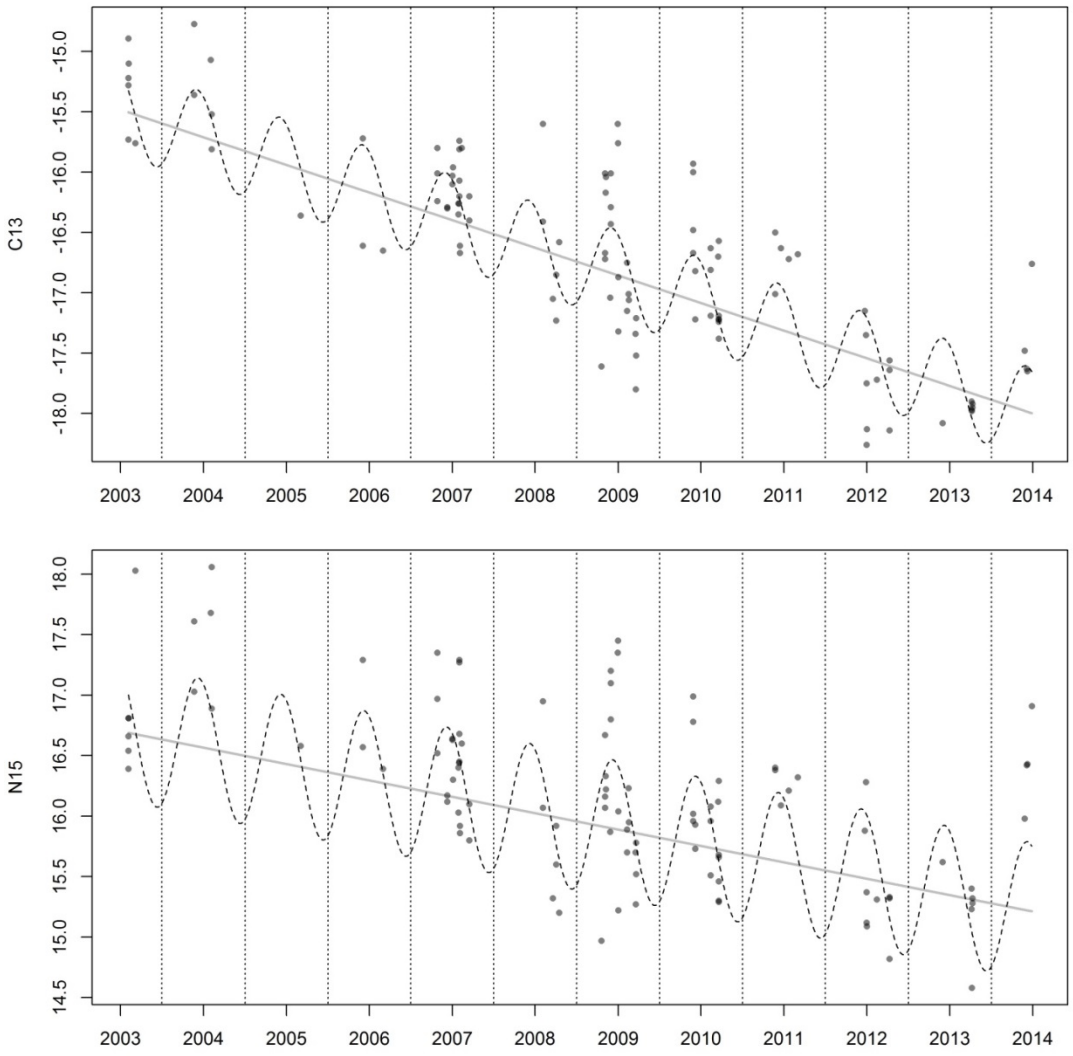

Figure 3. Changes in carbon and nitrogen stable isotope levels from skin biopsy samples of Southern Alaska resident killer whale (2003-2014). Dotted lines represent seasonal pattern of change within years.

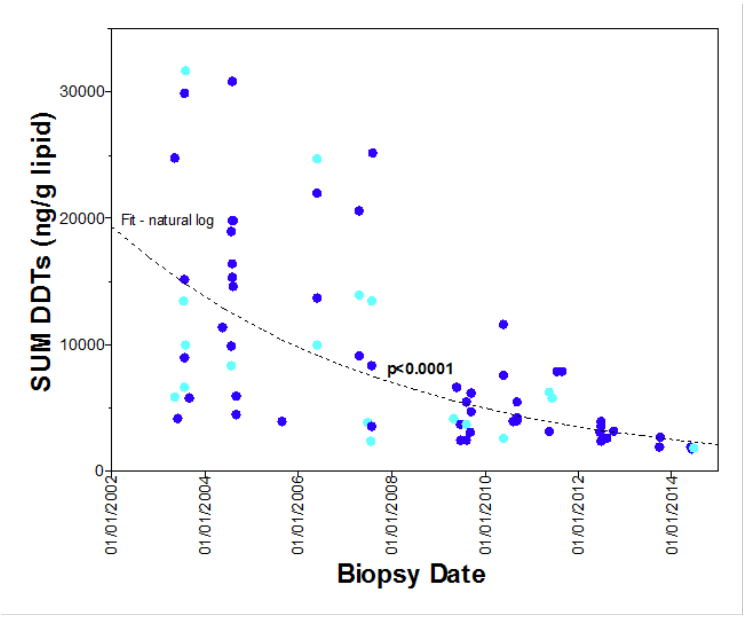

Figure 4. Decline in DDTs from skin biopsy samples of Southern Alaska resident killer whale (2002-2014).

These declines have not been as dramatic for the endanged Southern Resident killer whale population of Puget Sound for either C13 and N15 levels (Figure 5). The contaminant levels for the Southern Resident population declined closer to the 2% which is the expected natural attrition rate (Figure 6). This combination of factors suggests a relatively stable diet in the Puget Sound region over this period.

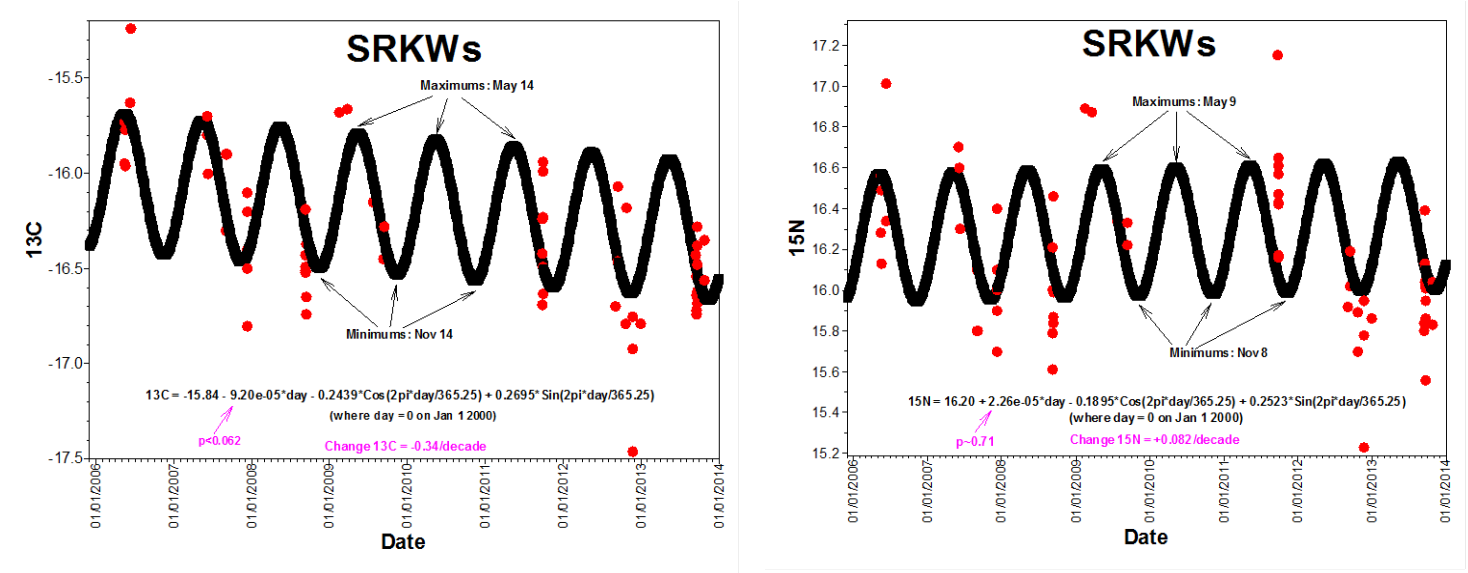

Figure 4. Changes in carbon and nitrogen stable isotope levels from skin biopsy samples of Southern resident killer whales (2006-2014). Dark lines represent seasonal pattern of change within years.

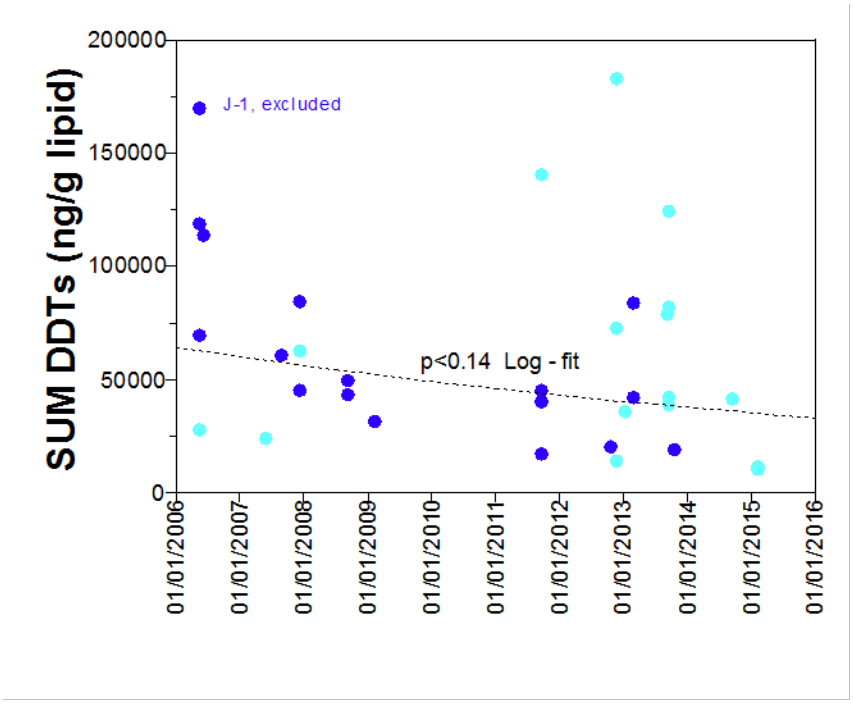

Figure 5. Changes in DDT levels from skin biopsy samples of Southern resident killer whales (2006-2014)

This year was exceptional for coho and chinook salmon abundance in Prince William Sound. By Fall, whales had noticeable fat deposits behind the blowhole and on the body behind the jaw. When nutritionally stressed, the reverse is often the case with a depression forming behind the blowhole ("peanut head" condition), and a narrow appearance in the area behind the jaws. The fat deposits were so noticeable that we termed it a "doughnut head" condition. In the future we hope to develop the use of overhead cameras in drones (hexacopters) to quantitatively determine body condition (morphometrics) and pregnancy rates. The downside of their fat condition in September was that whale aggregations in Montague Strait/Knight Island Passage lacked concerted feeding activity and their behavior was dominated by socializing and resting which eliminated focused feeding studies and resulted in no deployment of time/depth/location tags.

October 2015-January 2016. Field equipment was cleaned and stored. Preparation was made for the annual Gulf Watch meeting in November. Craig Matkin and Dan Olsen attended this meeting and presented updates on current projects. We updated numerous databases at NGOS with 2015 field data including survey and encounter database (ACCESS) and biopsy summaries. Analysis was completed (Dan Olsen) for preparation of a journal publication on habitat use and pod range, based on tagging location and encounter data. In October 2015, samples of tissue and scales were sent to NWFSC for analysis (described above). We supplied our humpback whale photo-identification and encounter data to Project 12120114-N (Humpback Whale Predation on Herring in Prince William Sound). Photo analysis of all 2015 data was completed during this period, which included identification of all individuals in each digital photograph for every encounter. Encounter tables were updated to summarize the presence of all individuals in each encounter

We followed our list of objectives as stated in the original proposal, although this year did not permit use of time/depth tags due to whale behavior in Fall (see above). With limited field time and the

single vessel it was difficult to complete all aspects of the project, especially prey sampling during deep diving behavior, when focal follows are required due to infrequent prey samples at the surface.

Public outreach was enhanced through the updates of Facebook and the North Gulf Oceanic Society website. The Facebook page for the North Gulf Oceanic Society allows timely posting of events and more direct interaction than the website. It has become an extremely popular and effective way of engaging the public in our work with a reach of up to 20,000 people.

We are continuing to update our databases on the AOOS Ocean Workspace, through GulfWatch Alaska. These updates will be completed by May, 2016.

Table 1. Status of project milestones for year 2

Deliverable/Milestone	**Status**
Update of photographic catalogue, population database, mapping database, NWFSC tissue analysis	Completed May 1 (for 2014 data)
Field work: PhotoID, behavioral observations, biopsy, prey sampling, tagging.	07 May through 1 October 2015
Annual meeting Gulf Watch AMSS Poster	November 2015 January 2016

8. Coordination/Collaboration: *See,* Reporting Policy at III (C) (8).

A. We collaborated closely with the Humpback Whale and Herring Predation project (Moran/Straley). Our field work in 2015 provided photographic and other data from 23 humpback whale encounters with humpback whales. We also received data from two killer whale encounters from their project. The Nearshore program (Dan Monson) opportunistically provides killer whale identification photographs to our project as well.

B. There was no coordination with other EVOS projects outside of the Gulf Watch program

C. We annually provide our data to the National Marine Fisheries Service/NMML (Paul Wade) to update the killer whale stock assessments for Alaska and we provide a review of current Alaska stock assessments, in part based on data collected in this project. Our genetic/contaminant/ and lipid and fatty acid data that spans two decades is held at the NOAA/NWFSC Contaminant Laboratory (Gina Ylitalo) where it has been used in various projects and publications. Genetic samples/ data generated by this project have also been provided to Southwest Fisheries Science Center (Phil Morin) for examination of worldwide killer whale stock structure.

9. Information and Data Transfer: *See,* Reporting Policy at III (C) (9).

Craig Matkin:

- Presentation/workshop at Alaska Zoo in Anchorage(AprilMatkin
- Presentation at Southern Resident killer whale health workshop in Seattle, WA (April)
- Collaborated on killer whale predation segment in Kenai Fjords for National Geographic film on salmon (May)
- Daily field updates on North Gulf Oceanic Society Facebook page with other research information regularly posted with some posts reaching up to 40,000 people (entire field season)
- Participation in Discovery Lab at Islands and Oceans, Homer, AK including lecture on killer whale populations in the Gulf of Alaska (July)
- Collaborated on killer whale predation segment in Kenai Fjords for National Geographic film on salmon (May)
- Meeting and presentation to Kenai Fjords Tour Boat Association (June)
- Worked with National Geographic Investigation Explorer Series to create web based film on lingering effects of the Exxon Valdez oil spill with focus on killer whales
- Data sets for 2014 field season on Gulf Watch site updated

Dan Olsen:

- Poster Presentation, SMM biennial Conference, December 13-18, 2015
- Poster Presentation, AMSS Conference, January 24-28, 2016
- "Killer whales of the world", Antarctic tourism trip, February 3, 2015
- "Seasonal and pod-specific variation in habitat use, AFS student conference, April 3, 2015
- "Killer Whales of Alaska", Seward Naturalist Guide Training, May 19, 2015
- "Recent research on Alaskan Killer Whales", ASLC Captain Training, May 22, 2015
- "Killer Whale natural history", Kenai Peninsula college Marine Mammals class, October 8, 2015

10. Response to EVOSTC Review, Recommendations and Comments: *See,* Reporting Policy at III (C) (10).

We have responded to all past comments and recommendations

11. Budget: *See,* Reporting Policy at III (C) (11).

Our budget and billing typically runs about 6 months behind the EVOS/Prince William Sound schedule because of our offset with fiscal year (the NGOS fiscal year ends June 1). This has been the case for many years and is the reason our cumulatives (see attached spread sheet) tend to run behind by approximately 6 months.

Attached budget form reflects the notification and acceptance of changes in annual budget category amounts and proposed changes the current fiscal year (FY2016). There was no change in total project budget for any year of the project. At this time there has not been more than 10% deviation in for projected budget category amounts.

12. Research highlights

- AB pod was completely photographed in 2015 and two new calves were recruited. The pod has increased to 21 whales but has not recovered to prespill numbers.
- All of the 7 remaining AT1 (Chugach transients) were photographed for the first time in several years. These whales appear to now focus their foraging in glacial fjords where we seldom operate so we have fewer encounters with them. However, we receive photos and sightings from tourboats that operate in these glacial areas.
- Photographic identification was emphasized in 2015 fieldwork, with which we documented 264 resident killer whales in 17 pods, the 7 remaining whales in the AT1 transient population, and 24 whales in the Gulf of Alaska transient population. This has substantially strengthened our population dynamics database.
- From blubber chemistry results, it appears that there has been a change in diet for resident killer whales over the past 15 years, with animals eating at a lower trophic level. The whales could likely switching from a diet dominated by chinook salmon, to a diet containing more coho and chum salmon.
- For resident (fish eating) killer whales this season presented exceptional feeding opportunities with a large return of coho salmon to inshore waters and significant king salmon activity. Whales appeared robust in late season with fat deposits behind the blowhole and jaws, indicative of good nutritive condition.