

Form Rev. 9.14.17

1. Project Number:

17120114-N

2. Project Title:

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

3. Principal Investigator(s) Names:Craig O. Matkin, North Gulf Oceanic Society
Dan Olsen, North Gulf Oceanic Society**4. Time Period Covered by the Report:**

February 1, 2017-January 31, 2018 (Year 6)

5. Date of Report:

March 2018

6. Project Website (if applicable):www.gulfwatchalaska.org**7. Summary of Work Performed:**

Both resident ecotype (AB pod) and transient ecotype (AT1 population) killer whales suffered significant mortalities following the *Exxon Valdez* oil spill. AB pod is recovering after 26 years but has still not reached pre-spill numbers. The AT1 population is not recovering and may be headed toward extinction. This project has determined that killer whales are sensitive to perturbations such as oil spills, but has not yet determined the long-term consequence (which may include extinction) or the recovery period required. As an apex predator, this species (both fish and mammal eating types) has important role in the ecosystem; additionally, they are a primary focus of viewing by a vibrant tour boat industry in the region.

The core project is the photo identification-based monitoring of population parameters, annual monitoring of contaminants, feeding, and trophic changes using blubber biopsy sampling and observation of predation and prey sampling. In addition, we are developing remote acoustic techniques that will allow monitoring geographic and temporal use patterns of resident killer whales. Additionally, when not compromising the core project, we use time/depth/location tags to examine details of feeding ecology and explore the use of morphometrics obtained from drone captured, low altitude photos to develop an annual index of individual and population health and possibly determine pregnancy rates.

We completed 66 survey days in 2017 with timing and geographic components of effort similar to all other years of the Gulf Watch Alaska (GWA) program (Fig. 1). We had thirty-one encounters with resident ecotype killer whales, 5 encounters with transient ecotype killer

whales, and two encounters with offshore ecotype killer whales (Fig. 2). A total of 157 individual resident whales, 13 Gulf of Alaska transients, and 7 AT1 transients were identified.

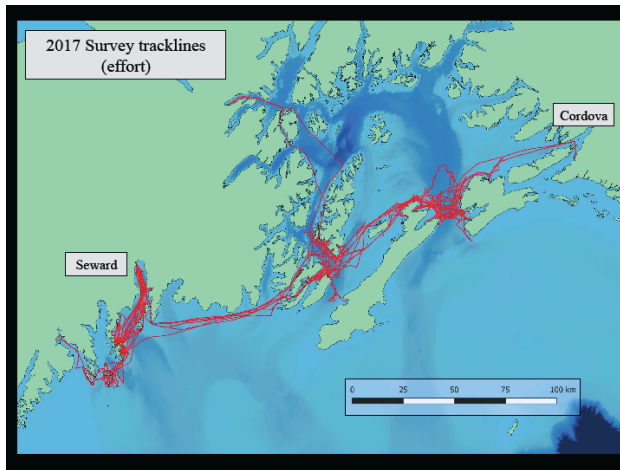


Figure 1. Effort tracks.

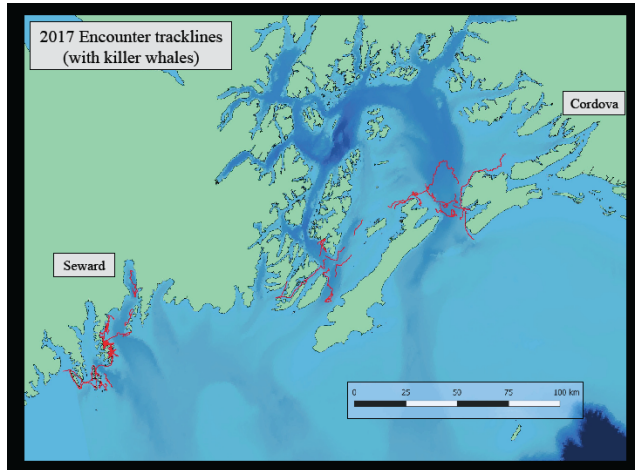


Figure 2. Encounter tracks.

Feeding Ecology

We collected 38 samples of fish scales and flesh from sites of kills made by resident whales and collected 17 scat samples from resident killer whales as part of our killer whale feeding ecology work focused on resident killer whales. These samples are currently being analyzed at the fish scale and genetics lab at the Pacific Biological Station, Nanaimo, British Columbia, Canada.

For over 20 years, we have collected fish scale and tissue samples from killer whale predation sites to determine prey species, but recently (2015-2016) we have begun to determine stream of origin for those salmon. Fifteen of the Chinook prey samples analyzed at this point were collected from the Kenai Fjords, Alaska region in May and June and two from Prince William Sound in August. All nine samples from Kenai Fjords that originated in Alaskan spawning grounds were from the Situk River near Yakutat. Of the remaining eight, four were from northern British Columbia spawning sites, three from southern British Columbia River, and one from a Columbia River tributary. Additional samples are available and in the queue for analysis.

Population status

The number of unique resident killer whales identified by year (Fig. 3) declined in 2016 and 2017 and may be related to changes in fish distribution leading to changes in distributions of whales in areas and times where our surveys occur. This seems to be the case in Hinchinbrook Entrance in spring and particularly Montague Strait in fall. This may be a result, in some part, of the exceptionally warm water and low productivity period (“The Blob” and El Niño) as described by oceanographers and other GWA investigators.

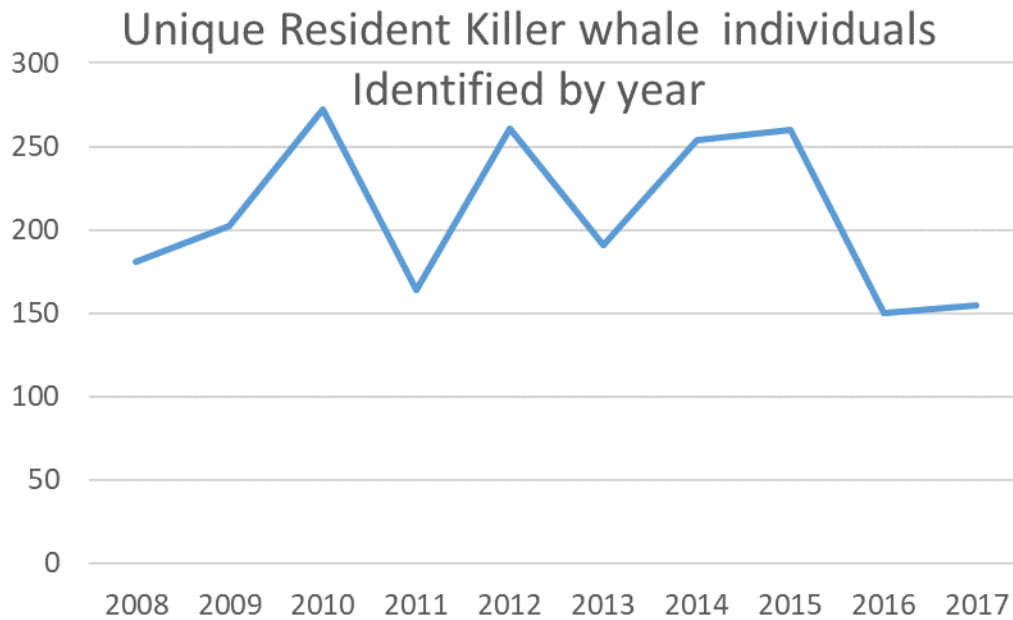


Figure 3. The number of unique resident killer whales (y axis) identified during 2008-2017 (x axis).

Particularly telling is the decline in killer whale individuals encountered in the fall of 2016 and 2017 following the unique ocean warming event. (Fig. 4). This does not necessarily indicate a decline in the population as a whole (mortalities) but more likely a change in distribution due to change in food (salmon) abundance and distribution in what have been historical feeding areas.

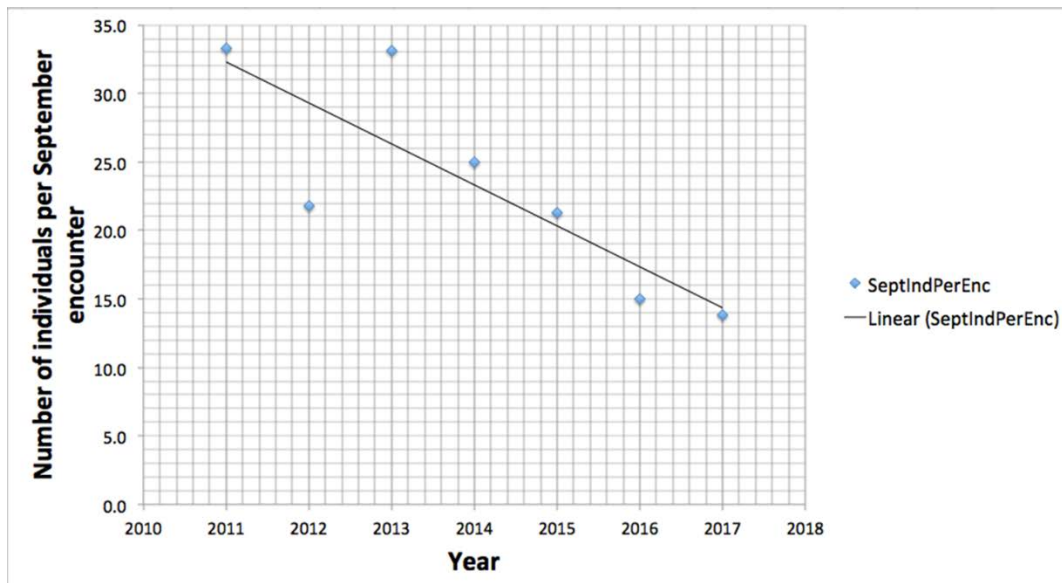


Figure 4. Number of individual killer whales encountered in the fall of 2016 and 2017.

The AB pod was not completely photographed in 2017. Oddly, all three matriline that contain all adult males and their mothers (AB14, AB17, AB22) were not encountered. It is unlikely that all of these whales have suddenly perished although these matriline contain the oldest individuals in the pod. It is most likely that there are feeding separately from other matriline in the pod and in areas outside (offshore) of Prince William Sound and Kenai Fjords. At this time we are uncertain of the total number of whales in AB pod. Although we have had two births in the past 3 years, we have no way of knowing at this time how many mortalities there have been in these matriline with older whales.

There has been an increasing tendency toward temporary (and in some cases permanent) splitting of pods in recent years. This may signify more challenging feeding opportunities (e. g. fewer numbers of fish/smaller school size) that favor hunting in smaller groups. Most of the population, other than the AB pod, has been growing steadily, although we expect this is expected to change if salmon stocks stabilize or decline. There has been a rebound in salmon stocks in the past 40 years that we suspect has fueled increases in numbers in most resident pods.

Due to the participation and cooperation of tour boat operators and their crew, both in Prince William Sound and Kenai Fjords, we were able to document all seven remaining AT1(Chugach) transient killer whales and also ascertain that there have been no recruitment of calves into this diminished population.

Acoustics and Movement

Our remote hydrophone project is proceeding forward with four Soundtrap recording devices currently deployed. One is on the mid-Sound oceanographic buoy, one in Hinchinbrook Entrance, one in Montague Strait, and one in outer Resurrection Bay. The first digital recordings were recovered from three of these sites this past fall. They contain killer whale calls and we are in the process of analyzing them. Although the Soundtrap devices have presented some technical issues (primarily software issues) and battery life is a continuing challenge, we are picking up killer whale vocalizations on the recordings and are confident that this will be an effective technique to determine year round distribution and movements of resident killer whales.

We are deferring attaching satellite tags to killer whales (optional component of work plan) in the wake of a death of an endangered southern resident killer whale. It was determined that the death of this whale was due to the introduction of pathogens at the tagging site that became systemic and resulted in the whale's death. There are issues with current attachment techniques that may create open wounds and foster movement of infections into the body and until attachment design is improved this program will remain an "option". Additionally we believe that the whales tend to pull the tags off their conspecifics making the cost/benefit ratio of attachments too high by seriously reducing attachment time and endangering health. If the tag is pulled off, the darts/barbs then they remain implanted in the whale and can cause a route for infection as well as migrate into the tissue.

We have also determined that the killer whale morphometrics project (optional part of our work plan) is not viable without additional funding and additional boat time or a cooperative

arrangement with an agency. We continue to look for opportunities to further development of this technique.

8. Coordination/Collaboration:

A. Projects Within a Trustee Council-funded program

1. Within the Program

We collect humpback whale identification photos and provide data on distribution and abundance of humpback whales as possible during our surveys. This is provided to the humpback whale project within the GWA pelagic component (Moran & Straley; project 17120114-0).

We share Prince William Sound Science Center oceanographic moorings and work cooperatively with Rob Campbell (project 17120114-G) from the GWA environmental drivers component for our killer whale acoustic monitoring efforts.

2. Across Programs

a. Herring Research and Monitoring

NA

b. Data Management

We are coordinating with the Data Management team to upload data to the Research Workspace and make it available on the Gulf of Alaska data portal and review metadata and update for accuracy.

c. Lingering Oil

NA

B. Projects not Within a Trustee Council-funded program

NA

C. With Trustee or Management Agencies

All data collected are provided to the National Marine Fisheries Service (NMFS) for use in stock assessments and other management actions. We directly exchange data with the NMFS Northwest Fisheries Science Center in a collaborative project comparing Southern Alaska resident killer whales with the endangered southern resident killer whales of Puget Sound. We contribute and collaborate on killer whale genetic and feeding habit studies and both Northwest Fisheries Science Center and Pacific Biological Station, Department of Fisheries and Oceanography, Nanaimo, British Columbia, Canada.

9. Information and Data Transfer:

A. Publications Produced During the Reporting Period

Matkin, C., D. Olsen, G. Ellis, G. Ylitalo, R. Andrews. 2018. Long-term killer whale monitoring in Prince William Sound/ Kenai Fjords. *Exxon Valdez* Oil Spill Restoration Project Final Report (Restoration Project 16120114-M). *Exxon Valdez* Oil Spill Trustee Council, Anchorage Alaska.

Olsen, Daniel W., et al. "Seasonal and pod-specific differences in core use areas by resident killer whales in the Northern Gulf of Alaska." *Deep Sea Research Part II: Topical Studies in Oceanography* (2017).

B. Dates and Locations of any Conference or Workshop Presentations where EVOSTC-funded Work was Presented

Matkin et al. 2018. Southern Alaska resident killer whales may be dependent on more than Alaska salmon: some initial stream of origin genetic data from prey samples. **Poster** Alaska Marine Science Symposium, Anchorage Alaska. January 2018.

Matkin, C. O. 2017. Kenai Fjords National Park Interpretive guide training. **Oral Presentation**. May 5, 2017.

Matkin, C. O. 2017. Killer whales. **Oral Presentation**. Seward public science night, Resurrect Art Coffee House. May 16, 2017.

Matkin, C. O. 2017. Tracking whales with hydrophones. **Article**. Delta Sound Connections, PWS Science Center. March 10, 2017.

Olsen et al. 2017. Behavioral Changes During Multi-pod Aggregations of Southern Alaska Resident Killer Whales (*Orcinus orca*). **Oral Presentation**. Society of Marine Mammalogy Conference, Halifax, Nova Scotia, November 2017.

C. Data and/or Information Products Developed During the Reporting Period, if Applicable

All data sets for the period since the initiation of GWA (through 2016) have been supplied to AXIOM and published to DataONE. Here are the citations for these published data sets:

Matkin, C. O. 2017. Acoustic Recordings of Killer Whales in Prince William Sound and Kenai Fjords, 2012 to 2016, Gulf Watch Alaska Pelagic Component. Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Research Workspace. <https://doi.org/10.24431/rw1k1f>.

Matkin, C. O. 2017. Acoustic Kenai Fjords and Prince William Sound Long-Term Photographic Monitoring of Killer Whales, 2012-2016, Gulf Watch Alaska Pelagic Component. Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Research Workspace. <https://doi.org/10.24431/rw1k1s>.

Matkin, C. O. 2017 Prince William Sound Killer Whale Satellite Telemetry Data, 2004 to 2016, Gulf Watch Alaska Pelagic Component. Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Research Workspace. <https://doi.org/10.24431/rw1k1g>.

Matkin, C. O. 2017. Behavior and Feeding Summaries for Killer Whales in Alaska, 2012-2016. Dataset. *Exxon Valdez* Oil Spill Trustee Council Long-Term Monitoring program, Gulf Watch Alaska. Research Workspace. <https://doi.org/10.24431/rw1k1r>.

D. Data Sets and Associated Metadata that have been Uploaded to the Program's Data Portal

All data sets are updated annually as surveys are completed in the fall. The 2016 data set was updated in FY 2017 and the 2017 data set will be updated in FY18.

10. Response to EVOSTC Review, Recommendations and Comments:

Science Panel Comments and Responses on Revised FY17-21 Proposal, September 2016

In September 2016, the Science Panel had no specific comments.

Science Panel Comments and Responses on FY18 Work Plans, September 2017

In September 2017, the Science Panel commented: The Panel applauds the work being conducted by the PI demonstrating the impact of oil on killer whales depends on whether the group of whales is transient or resident. These results help refine the restoration goal of this species, which might otherwise not capture the genetic differences between pods. These differences suggest unanswered questions about their social activities, which will be further addressed by the PI. The Panel appreciates that the PI does an excellent job regarding outreach.

PI Response: Thank you for your comments.

11. Budget:

Please see revised program workbook.

Budget is on track except for shortfall in commodities as we wait for Soundtrap recorders with improved battery performance and updated software. Monies for these purchases will be rolled over into FY18. A small amount of contract work was not completed in this (FY17) fiscal year and this amount will be used in FY18.