

1. EXECUTIVE SUMMARY

Pelagic Component

The pelagic component research team proposed for FY17-21 to continue monitoring key pelagic species groups in Prince William Sound (PWS) using the same five projects focused on killer whales, humpback whales, forage fish, and marine birds. Thus, the two overarching questions for the pelagic component to answer during this 5-year period are:

1. What are the population trends of key upper trophic level pelagic species groups in PWS – killer whales, humpback whales, marine birds, and forage fish?
2. How do predator-prey interactions, including interannual changes in prey availability, contribute to underlying changes in the populations of pelagic predators in PWS and Middleton Island?

Killer Whale Monitoring

Both resident ecotype (AB pod) and transient ecotype (AT1 population) killer whales suffered significant mortalities following the *Exxon Valdez* oil spill in 1989. 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 (Matkin et al. 2008) (Figure 1). 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 an important role in the ecosystem; additionally, they are a primary focus of viewing by a vibrant tour boat industry in the region. Data from this project are used by tour boats to enhance viewers experience and understanding of the local environment and fauna.

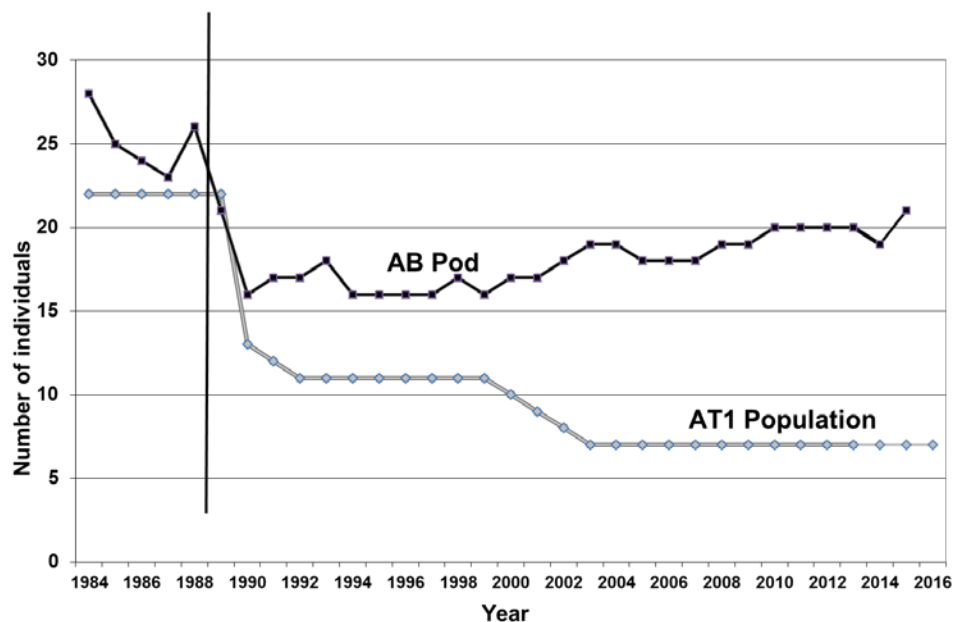


Figure 1. Number of killer whales in AB pod (1984-2015) and AT1 population (1984 to 2016).

Unlike many cetaceans, killer whales can be closely monitored and, for resident (fish eating) killer whales, detailed population dynamics monitored (Matkin et al. 2014). The AT1 transient population can be directly monitored by individual, and the wide ranging Gulf of Alaska transients (mammal eating) population monitored for trends (Matkin et al. 2012). We also contribute all photoidentification data for the offshore form of killer whale to a coast-wide database at the Pacific Biological Station (Nanaimo, BC, Canada). This project is a unique opportunity to continue a comprehensive monitoring program for a keystone marine species, with three ecotypes, that was initiated in the early 1980s. The importance of long-term killer whale monitoring has been borne out by companion studies in other regions such as Puget Sound and British Columbia.

The core of this project is the photoidentification based monitoring of population parameters, annual monitoring of contaminants, feeding, and trophic changes using fecal sampling and observation of predation and prey sampling and as possible examination of changes in stable isotopes in biopsy samples. In addition, we will develop remote acoustic techniques that will allow monitoring geographic and temporal use patterns of resident killer whales. We have pioneered this type of work in Alaska in the past (Yurk et al. 2010) but will now employ new technologies.

Analysis includes population dynamics and modeling at appropriate intervals, genetic sequencing as necessary for determination of population affiliation, and acoustic analysis of remote hydrophone data. Although we will focus on the southern Alaska resident and AT1 transient populations which were impacted by the Exxon Valdez oil spill, the study also includes the other two recognized populations in the region, the Gulf of Alaska transients and offshore killer whales and the project contributes annually to the NMFS/NOAA killer whale stock assessments.

Data will be collected during a minimum 50-day field season from May through October from the R.V. Notoa, although opportunistic photographic data is contributed from other collaborating vessels. This is the continuation of a long-term project spanning 33 years and has benefited from continued support of mariners and the coastal communities of the north Gulf coast of Alaska.

During the 2017 reporting period of February to July, we completed 39 field days and had 32 encounters with killer whales, 26 of which were with residents, 5 with transients, and 1 with offshores. We completely photo-identified a number of the major resident pods including AD5, AD8, AD11, AD16, AK6, AK2, and some matriline of a number of other major pods including the AB25, AE, and AJ8 pods. Most of these pods are genetically southern resident haplotype, and we likely will encounter many of the pods with the northern resident haplotype (AB, AJ, AI pods) in August and September. Due to the collection of contributed photos, we confirmed that 6 of the 7 (and likely all 7) of the threatened AT1 transient population have survived to 2017. The individual AT6 had not been seen or photographed in 2016. For our ongoing feeding habits study we have collected 32 scale or flesh samples from sites of killer whale predation. We also were able to collect scats to compare with the scale data, and thus far obtained 15 samples. In other regions, killer whale scat data has supported diet findings from scale data. Sound Trap remote recording hydrophones were in Montague Strait, Hinchinbrook Entrance, and Center Sound to assess winter use by killer whales in Prince William Sound. Calls have been detected that can be identified to pod.

We are not proposing any major changes to this project for FY18; however, some opportunistic sampling has been de-emphasized.

2. COORDINATION AND COLLABORATION

A. *Within an EVOSTC-funded Program*

Gulf Watch Alaska

As part of the Gulf Watch Alaska program we collaborate at annual meetings and regular teleconferences that include all members of the program. We collaborate directly with 18120114-O—Humpback Whales: Long-term monitoring of predation on Pacific herring in Prince William Sound sharing photographic and observational data. We collaborate with Rob Campbell, Prince William Sound Science Center, in placing remote hydrophones on oceanographic buoys also supported by EVOSTC under Gulf Watch Program.

Data Management

This project coordinates with the data management program by submitting data and preparing metadata for publication on the Gulf of Alaska Data Portal and DataONE within the timeframes required.

B. *With Other EVOSTC-funded Projects*

This project will coordinate with other EVOSTC-funded projects as appropriate by providing data, discussing the relevance and interpretation of data, and collaborating on reports and publications.

C. *With Trustee or Management Agencies*

Data are supplied annually and upon request to National Oceanic and Atmospheric Administration (NOAA) National Marine Mammal Laboratory in Seattle, Washington for application to marine mammal stock assessments, which are reviewed regularly. We also collaborate on papers and journal articles the NOAA Northwest regional office that conducts long-term research on the endangered Southern Resident killer whale population.

3. PROJECT DESIGN – PLAN FOR FY18

A. *Objectives for FY18*

Objective 1

Photo-identification of all major resident pods and AT1 transient groups that use Prince William Sound/Kenai Fjords. Extension of individual histories, identification catalogues of individuals and an annual update of population model are products of these data.

Objective 2

Collect fish scale samples and marine mammal tissue from kill sites to monitor potential changes in feeding habits.

Objective 3

Collect fecal samples from resident killer whales for comparison with results of fish scale/tissue collection (Objective 2).

Objective 4

Use remotely deployed submerged acoustic recorders to track killer whales year-round using calls.

Objective 5

Collect genetic tissue samples when necessary to determine population/ecotype affiliations.

B. Changes to Project Design

We are deemphasizing the collection of biopsy samples for examination of feeding habits due in part to the retirement of the chemist at NOAA Northwest Region who led the project, and are replacing it with a program of feces collection and analysis, as suggested in review of our FY12-16 final report.

The following secondary objectives (optional projects suggested in FY17-21 proposal) will not be implemented at this time:

Objective 6

Use photogrammetry to develop morphometrics for individuals and groups to assess body condition over time and develop measures to determine pregnancy rate as an additional important population parameter (secondary objective, completed as possible).

Objective 7

Use time/depth/location satellite tags coupled with prey sampling to examine feeding ecology during fall and/or spring feeding aggregations (secondary objective, completed as possible).

4. SCHEDULE

A. Project Milestones for FY18

- **Task 1**

Annually prepare for and launch field collection of core project data including: identification photos, observation of predation and sampling of prey scales/tissue and fecal material, and collect annual biopsy samples when possible and appropriate.

- **Task 2**

Prepare and deploy acoustic recorders for year-round monitoring of whale movements.

- **Task 3**

Conduct annual analysis of identification photos, prey scale samples and fecal samples, and whale skin samples.

- **Task 4**

Annually update photographic catalogue and population dynamics.

B. Measurable Project Tasks for FY18

FY 2018 (Year 7)

FY18, 1st quarter (February 1, 2018 - April 30, 2018)

Complete annual report (March 1). Continue analysis, update identification catalogue and distribute. Complete annual update of databases and upload previous years data onto GWA site (Feb.). Prepare journal paper for publication. All field preparation completed and boat outfitted for season, with photo equipment, GIS systems and computers, biopsy and tagging rifle and supplies, remote and boat based hydrophones, prey/fecal sampling nets and supplies.

FY18, 2nd quarter (May 1, 2018 - July 31, 2018)

Initiate field season in early May with regular cruises until early July. Deploy hydrophones. Vessel resupplied at 10-14 day intervals. Trips led by either Craig Matkin or Dan Olsen. Weekly outreach through Facebook. In July the R/V Notoa will be on standby in Kenai Fjords to respond to unique encounters; however, no scheduled trips.

FY18, 3rd quarter (August 1, 2018 - October 31, 2018)

Submit Work Plan to EVOSTC (Aug.) Regular fieldwork begins again in late August and continues in September. Redeploy hydrophones. All field equipment will be cleaned and stored and data analysis will begin by mid-October. Samples will be sent to appropriate laboratories.

FY18, 4th quarter (November 1, 2018 - January 31, 2019)

Analysis continues along with preparation for annual GWA meeting in November and for Alaska Marine Science Symposium in January. Frame by frame photo-identification completed. Begin annual report, summarize annual results, including outreach. Work on journal papers. Make data available to the public through Research Workspace.

5. PROJECT PERSONNEL – CHANGES AND UPDATES

There have been no changes or updates in project personnel from previous fiscal year.

6. BUDGET

A. Budget Forms (See GWA FY18 Budget Workbook)

Please see project budget forms compiled for the program.

B. Changes from Original Proposal

There are no major changes in proposal, only shifting emphasis as described above.

C. Sources of Additional Funding

If additional funding is obtained, and if possible without compromising the core project, we will explore optional objective 6 - use of 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.

Analytical support is provided as needed by the Northwest Fisheries Science Center, Seattle WA (Gina Ylitalo) and equipment support is provided by the Norcross Foundation.

7. RECENT PUBLICATIONS AND PRODUCTS

Publications

Matkin, C., D. Olsen, G. Ellis, G. Ylitalo, R. Andrews. 2017. Long-term killer whale monitoring in Prince William Sound/ Kenai Fjords. Exxon Valdez Oil Spill Restoration Project Final Report (Restoration Project 16120114-M), North Gulf Oceanic Society Homer, Alaska.

Matkin, C. O. In Review. Behavioral changes during multi-pod aggregations of southern Alaska resident killer whales (*Orcinus Orca*). 2017 Society for Marine Mammalogy Biennial Conference.

Olsen, D. W., C. O. Matkin, R. D. Andrews, and S. Atkinson. In Review. Seasonal and pod-specific shift in habitat use by resident killer whales in the Northern Gulf of Alaska. Deep Sea Research Part II: Topical Studies in

Oceanography, Spatial and temporal ecological variability in the northern Gulf of Alaska: what have we learned since the *Exxon Valdez* oil spill?

Published datasets

- 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>.

Presentations

- Matkin, C. O. 2017. Killer Whales of Antarctica. Presentation. January 18, 2017.
- Matkin, C. O. 2017. Kenai Fjords National Park Interpretive guide training. Presentation. May 5, 2017.
- Matkin, C. O. 2017. Killer whales. Presentation. Seward public science night, Resurrect Art Coffee House. May 16, 2017.

Outreach

- Matkin, C. O. 2017. Tracking whales with hydrophones. Gulf Watch Alaska popular article. Delta Sound Connections, PWS Science Center. March 10, 2017.

LITERATURE CITED

- Matkin, C. O., J. W. Durban, E. L. Saulitis, R. D. Andrews, J. M. Straley, D. R. Matkin, and G. M. Ellis. 2012. Contrasting abundance and residency patterns of two sympatric populations of transient killer whales (*Orcinus orca*) in the northern Gulf of Alaska. *Fishery Bulletin* 110:143–155.
- Matkin, C. O., G. M. Ellis, E. L. Saulitis, P. Olesiuk, and S. D. Rice. 2008. Ongoing population-level impacts on killer whales *Orcinus orca* following the *Exxon Valdez* oil spill in Prince William Sound, Alaska. *Marine Ecological Progress Series* 356:269–281.
- Matkin, C. O., G. W. Testa, G. M. Ellis, and E. L. Saulitis. 2014. Life history and population dynamics of southern Alaska resident killer whales (*Orcinus orca*). *Marine Mammal Science* 30:460-479 DOI: 10.1111/mms.12049
- Yurk, H., O. Filatova, C.O. Matkin, L.G. Barrett-Lennard, M. Brittain. 2010. Sequential habitat use by two resident killer whale (*Orcinus orca*) clans in Resurrection Bay, Alaska as determined by remote acoustic monitoring. *Aquatic Mammals* 36:67-78.