



## 1. PROJECT 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) (Fig. 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.

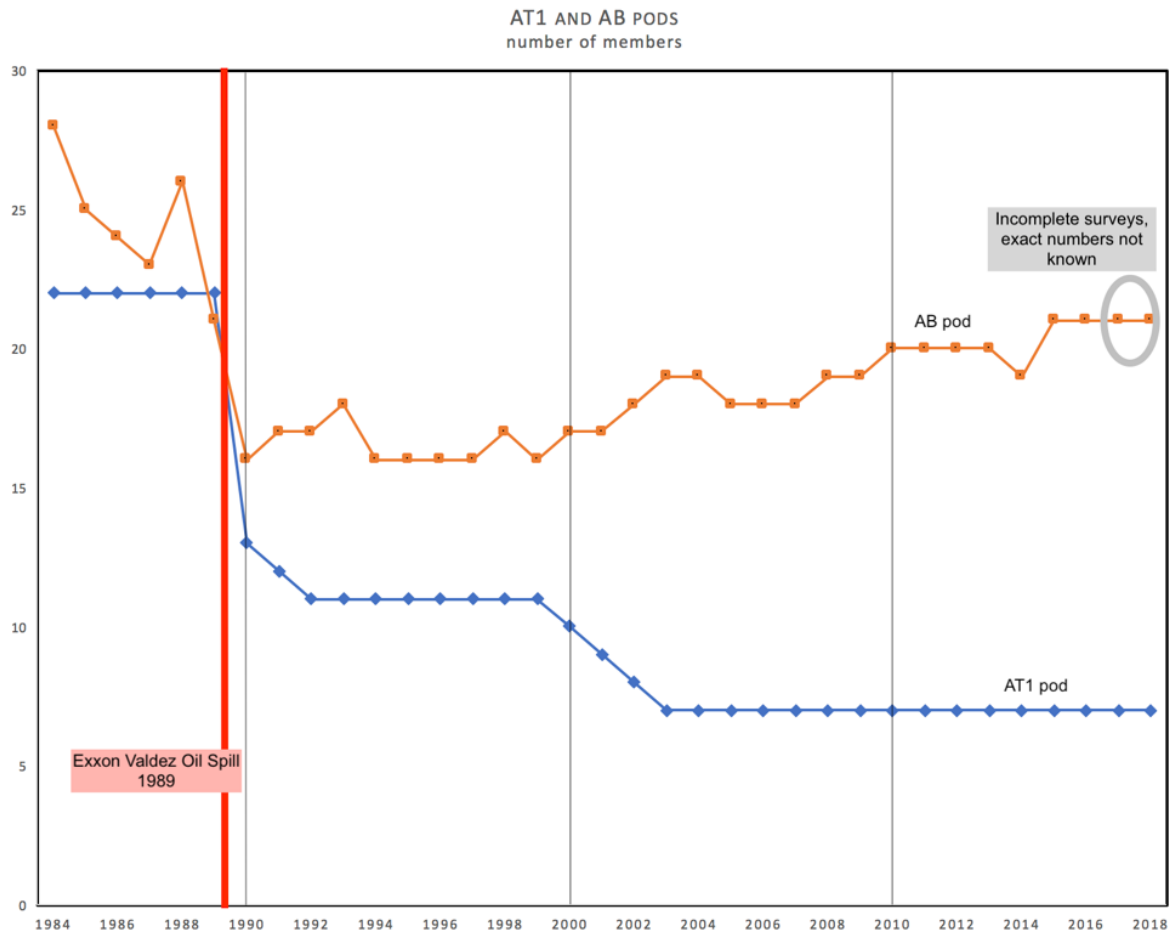


Figure 1. Number of killer whales in AB pod (1984-2016) and AT1 population (1984 to 2018). Only portions of the AB pod were seen in 2017 and 2018 (grey circle).

Unlike many cetaceans, killer whales can be closely monitored, and for resident (fish eating) killer whales detailed population dynamics can also be monitored (Matkin et al. 2014).

The AT1 transient population can be directly monitored by each individual, and the wide-ranging Gulf of Alaska transients (mammal eating) population monitored for trends (Matkin et al. 2012). We also contribute all photo identification 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 objective of this project is the monitoring of population parameters based on photo identification. Annual monitoring of contaminants, prey sampling, fecal sampling, and biopsy sampling are used to investigate feeding habits, trophic changes, and stable isotope trends. Remote acoustic stations have been placed to monitor of temporal and geographic use patterns of resident killer whales, particularly in winter, which is otherwise difficult to study. We have pioneered this type of work in Alaska in the past (Yurk et al. 2010) but will now employ more comprehensive 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 National Marine Fisheries Service (NMFS) National Oceanic and Atmospheric Administration (NOAA) killer whale stock assessments.

Data will be collected during a minimum 50-day field season from May through October from the R.V. *Natoa*, 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.

#### *FY18 Accomplishments and Highlights*

During the 2018 reporting period of February to July, we completed 42 field days and had 28 encounters with killer whales, 22 of which were with residents, 3 with transients, and 3 with offshores. We completely photo-identified a number of the major resident pods including AD8, AD11, AD16, AK6, AK2, and certain matrilineal pods including the AB, AE, and AX27 pods. This year, as well as last year, most of these pods are genetically southern resident haplotype, and we hope to encounter many of the pods with the northern resident haplotype (AB, AJ, AI pods) in August and September. In this and last year there has been a reduced presence of northern resident haplotype whales inshore. Between our surveys and contributed photos, we confirmed that all seven of the remaining threatened AT1 transient population have survived to 2018. We have collected 12 scale or flesh samples during predation events for our ongoing feeding habits study. We also collected 21 scat samples as part of our emphasis on feeding ecology. In other regions, killer whale scat data have supported diet findings from scale data. Remote recording hydrophones have been recovered and redeployed in Montague Strait, Hinchinbrook Entrance, and Kenai Fjords. Additional acoustic data were downloaded from a hydrophone placed on the mid-Sound mooring by Rob Campbell (environmental drivers project 19120114-G). Calls have been detected that can be identified at a pod level and a more thorough analysis will be completed in fall and winter.

We are not proposing any major changes to this project for FY19; however, some opportunistic sampling has been de-emphasized (see Section 4B for more information).

## 2. PROJECT STATUS OF SCHEDULED ACCOMPLISHMENTS

### A. Project Milestones and Tasks

Table 1. Project milestone and task progress by fiscal year and quarter, beginning February 1, 2017. Yellow highlight indicates proposed fiscal year Work Plan. Additional milestones and tasks may be added. C = completed, X = planned, but not yet completed. Fiscal Year Quarters: 1= Feb. 1-April 30; 2= May 1-July 31; 3= Aug. 1-Oct. 31; 4= Nov. 1-Jan 31.

| Milestone/Task                     | FY17 |   |   |   | FY18 |   |   |   | FY19 |   |   |   | FY20 |   |   |   | FY21 |   |   |   |
|------------------------------------|------|---|---|---|------|---|---|---|------|---|---|---|------|---|---|---|------|---|---|---|
|                                    | 1    | 2 | 3 | 4 | 1    | 2 | 3 | 4 | 1    | 2 | 3 | 4 | 1    | 2 | 3 | 4 | 1    | 2 | 3 | 4 |
| <b>Milestone 1: Collection</b>     |      |   |   |   |      |   |   |   |      |   |   |   |      |   |   |   |      |   |   |   |
| Field prep                         | C    |   |   |   | C    |   |   |   | X    |   |   |   | X    |   |   |   | X    |   |   |   |
| Field surveys                      |      | C | C |   |      | C | C |   |      | X | X |   |      | X | X |   |      | X | X |   |
| Retrieve and re-deploy hydrophones |      | C | C |   |      | C | C |   |      | X | X |   |      | X | X |   |      | X | X |   |
| <b>Milestone 2: Data</b>           |      |   |   |   |      |   |   |   |      |   |   |   |      |   |   |   |      |   |   |   |
| Data summary/analysis              |      |   |   | C | C    |   |   | X | X    |   |   | X | X    |   |   | X | X    |   |   | X |
| Review hydrophone data             |      |   |   | C | C    |   |   | X | X    |   |   | X | X    |   |   | X | X    |   |   | X |
| Photo-identification analysis      |      |   |   | C | C    |   |   | X | X    |   |   | X | X    |   |   | X | X    |   |   | X |
| Analysis of predation samples      |      |   |   | C | C    |   |   | X | X    |   |   | X | X    |   |   | X | X    |   |   | X |
| Upload previous FY data            |      |   |   |   | C    |   |   |   | X    |   |   |   | X    |   |   |   | X    |   |   |   |
| <b>Milestone 3: Reporting</b>      |      |   |   |   |      |   |   |   |      |   |   |   |      |   |   |   |      |   |   |   |
| Annual Reports                     |      |   |   |   | C    |   |   |   | X    |   |   |   | X    |   |   |   | X    |   |   |   |
| Annual PI meeting                  |      |   |   | C |      |   |   | X |      |   |   | X |      |   |   | X |      |   |   | X |
| FY Work Plan (DPD)                 |      |   | C |   |      |   | C |   |      |   | X |   |      |   | X |   |      |   |   |   |

### B. Explanation for not completing any planned milestones and tasks

All milestones and tasks have been completed as scheduled to date.

### C. Justification for new milestones/tasks

No new milestones/tasks proposed.

## 3. PROJECT 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, by 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 the *Exxon Valdez* Oil Spill Trustee Council (EVOSTC) under the Gulf Watch Alaska program.

#### Herring Research and Monitoring

This project coordinates with the herring research and monitoring program by sharing data and discussion of relevant trends, as well as collaborating on reports and publications.

#### 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.

## **4. PROJECT DESIGN**

### **A. Overall Project Objectives**

#### *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 predation 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 and Objectives**

As stated in our FY18 Work Plan, 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)

If additional funding is obtained, and if possible without compromising the core project, we will 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. Satellite tagging will be pursued only if less invasive techniques are developed that will reduce risk of infection. Infection that resulted in a killer whale death in Puget Sound was directly linked to tag attachment and resulting infection.

## **5. PROJECT PERSONNEL – CHANGES AND UPDATES**

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

## **6. PROJECT BUDGET FOR FY19**

### **A. Budget Forms (See GWA FY19 Budget Workbook)**

Please see project budget forms compiled for the program.

### **B. Changes from Original Project Proposal**

The overall cost of this project for FY19-21 has not changed and total amounts in categories have not changed. We have reallocated funds between categories, but the overall project design and objectives have not changed. This budget transfers contractual funds for biopsy analysis to the analytic budget for acoustics and adjusts salary amounts.

### **C. Sources of Additional Project Funding**

We will continue to explore funding possibilities for 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 are currently submitting a joint National Fish and Wildlife Foundation proposal with Northwest Fisheries Science Center, Seattle WA, for analytical support in our shift from satellite tagging to collection and genetic analysis of scat samples in our examination of killer whale feeding ecology.

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. FY18 PROJECT PUBLICATIONS AND PRODUCTS

### *Publications*

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 Long-term Monitoring Program (Gulf Watch Alaska) Final Report (Exxon Valdez Oil Spill Trustee Council Project 16120114-M), Exxon Valdez Oil Spill Trustee Council, Anchorage, Alaska.

Matkin, C.O., and D. Olsen. 2018. Long term killer whale monitoring in Prince William Sound / Kenai Fjords. FY17 annual report to the *Exxon Valdez* Oil Spill Trustee Council, project 17120114-N.

### *Published datasets*

**Research Workspace:** 2017 photo-identification, behavioral observation, field acoustic recording, prey and scat sample, and biopsy sample data are uploaded to Research Workspace and undergoing QC. Data will be added to Gulf of Alaska Data Portal on schedule.

### *Presentations*

Olsen, D. 2018. Killer whales of the world. Zegrahm Expeditions, Antarctica. **Oral presentation.** January, 2018

Olsen, D. 2018. Killer whales of Prince William Sound. Prince William Sound Brown Bag presentation. **Oral presentation.** May 9, 2018

Olsen, D. 2018. Killer whales of Alaska. Kenai Fjords National Park interpretive guide training. **Oral presentation.** May 17, 2018

Olsen, D. 2018. Mother knows best: Killer whale culture in Alaska. Annual Kenai Fjord Tourboat Operators and Boaters meeting. **Oral presentation.** May 30, 2018

### *Outreach*

Pillsbury, R. 2018. A Sense of What Is, interview with Craig Matkin. *In* Guided by Whales. Duende Press.

Matkin, C. 2018. Beyond Delta-Sound Connections. Delta Sound Connections. Prince William Sound Science Center. [http://pwssc.org/wp-content/uploads/2018/05/DSC-2018-FINAL\\_WEB.pdf](http://pwssc.org/wp-content/uploads/2018/05/DSC-2018-FINAL_WEB.pdf)

North Gulf Oceanic Society. 2018. Updates to Facebook page during field season with descriptions of field activities. <https://www.facebook.com/NorthGulfOceanicSociety/>

## LITERATURE CITED

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., 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. 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.