

**FEDERAL AID
FINAL PERFORMANCE REPORT**

ALASKA DEPARTMENT OF FISH AND GAME
DIVISION OF WILDLIFE CONSERVATION
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**Alaska Department of Fish and Game
State Wildlife Grant**

Grant Number: T-9-1 **Segment Number:** 1
Project Number: 3.0
Project Title: Evaluation of survey methods to assess Aleutian Tern population status
Project Duration: 1 July 2008 – 30 June 2013
Report Period: 1 July 2012 – 30 June 2013
Report Due to HQ: September 1, 2013
Location: Southeastern Alaska: Black Sand Spit and Icy Bay in the Yakutat area; Copper River Delta in the Cordova area

I. PROBLEM OR NEED THAT PROMPTED THIS RESEARCH

The Aleutian Tern (*Onychoprion aleutica*) is a colonial nesting seabird of coastal Alaska that is very poorly understood. The global population of approximately 32,000 individuals is believed to breed exclusively in Alaska and eastern Siberia. The Alaska population has been estimated at 9,500 or 1/3rd of the global population estimate (North 1997). Although colonies of a few to many hundred individuals appear to be broadly distributed along the coasts of the Chukchi Sea, Seward Peninsula, the Yukon-Kuskokwim River delta, the Alaska Peninsula, the Aleutian Islands, Kodiak Archipelago, and Kenai Peninsula (USFWS 2006b), most individuals can be found in just a few large colonies of several thousand individuals, namely on the Copper River Delta and in the Yakutat area of northern Southeast Alaska. Concern about the conservation status of this species exists for at least 3 reasons. First, within Alaska, colony distribution makes the species potentially vulnerable: in particular, perhaps the largest and most accessible breeding colony of Aleutian Terns in the world nests on the Black Sand Spit area, where colony size historically has been approximated as high as 3000 individuals (Oehlers 2007), representing 10 and 30 % of global and Alaskan populations (North 1997). Second, although there are no long term data sets of accurate population sizes, anecdotal evidence is consistent with the possibility that colony sizes have undergone slight to severe declines in Southcentral and Southeast Alaska (Table 1). And third, in comparison to many migratory seabirds breeding in Alaska, essentially nothing is known about overwintering distribution of Aleutian terns, except anecdotal evidence that the species has been observed only in Southeast Asia during the overwintering phase (Figure 1). The prevalence of the Avian Influenza A (H5N1) in Southeast Asia, coupled with potential impact of practices in near-shore waters and coastal areas in this region, are potential risks to Aleutian Terns.

Table 1.

Colony location	Historical Observation	Recent Observations	Sources
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SE Kodiak Island	1559 (1979)	2 (2002)	FWS, Alaska Seabird Information Series (FWS 2006c)
Prince William Sound	Declines of a min. of 50%	(1972-2007)	Agler et al. 1999; D.Irons, <i>pers. comm.</i>
Black Sand Spit	3000 (1980)	513-2700 (2001-2007)	IBA
Riou Spit, Icy Bay	515 (1995)	0-40 (2004-2007)	FWS, unpublished data

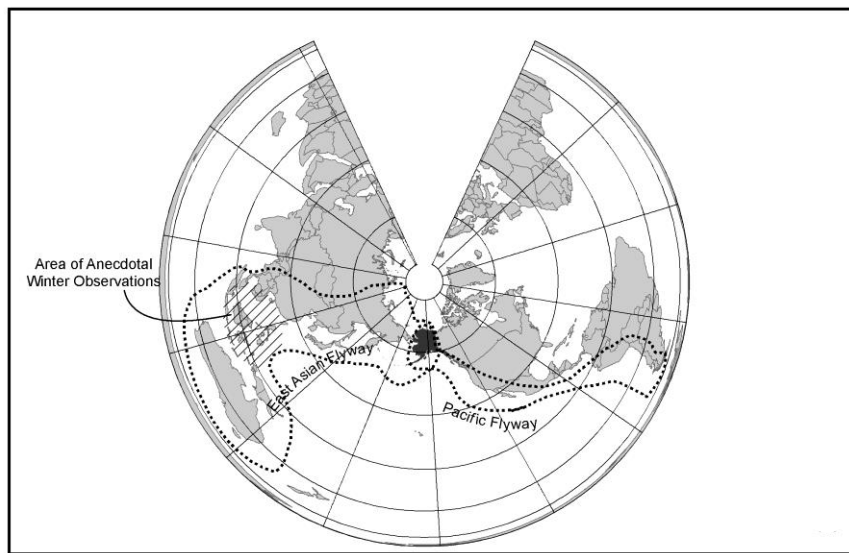


Fig 1. Potential migratory routes of Aleutian Terns from breeding sites in Alaska

Collectively, these 3 observations – the significant contribution of large, potentially vulnerable Alaska colonies to the global population, the possibility of declines colonies, and the nearly complete lack of information outside of the 6-8 week breeding period in Alaska – underscore the need to derive accurate population estimate for Alaska populations as well as collect information about migration and overwintering areas. The requisite first step in evaluating population trends is developing a robust method to survey Aleutian Terns, something that has not yet been adequately explored. For Aleutian Terns, however, significant challenges must be overcome before an accurate population estimate can be derived. These challenges include: (1) Detection error. In Alaska, Aleutian terns frequently associate with morphologically similar Arctic Terns (North 1997). Distinguishing respective colony nesting locations and composition in mixed species aggregations will be important preliminary steps to assessing population size. (2) Observer Bias. The tolerance of Aleutian terns to human observers at colonies is unknown but several sources report that Aleutian terns can be moderately sensitive to disturbance (Buckley and Buckley 1979; North 1997). Therefore, development of survey methods and parameters that are minimally invasive will be important. (3) Counting Bias. Terns are also highly dispersive at

the nest site, so designing effective ground-based counting procedures will be important. Nonetheless, the facts that the species occupies large, ground nesting colonies in relatively accessible and highly visible coastal terrain of Alaska, and appears to have a reasonable level of colony fidelity, lend themselves to deriving a minimally-invasive, cost-effective, and repeatable survey method that can be deployed across Alaska.

How project relates to Alaska's Comprehensive Wildlife Conservation Strategy:

The U.S. Fish & Wildlife Service designated the Aleutian Tern as a Bird of Conservation Concern in 2002 and listed it as a Focal Species in 2006. The U.S. Forest Service may list Aleutian Terns as a Sensitive Species in the National Forests of Alaska. Monitoring of the Black Sand Spit Tern colony has been identified as a priority in the U.S. Forest Service Yakutat Ranger District Access and Travel Management Plan and in the West Forelands Landscape Assessment (Oehlers 2007, Moran 2005). This project has received priority support through the Forest Service Key Coastal Wetlands 5-year Plan. An interagency Aleutian Tern Working Group met in October 2007 and identified the development of a robust methodology to census Aleutian Terns as the highest priority need for the species.

Among conservation organizations, the Audubon Society has included the Aleutian Tern on its Watch List species (Stenhouse and Senner 2005), and has identified the monitoring of remote and scattered Tern populations as the greatest conservation concern for the species. The Audubon Society recognizes our proposed study areas (Black Sand Spit and Copper River Delta) as Important Bird Areas. The North American Waterbird Conservation Plan identified Aleutian Terns as a species of high conservation concern (Kushlan et al. 2002).

State and Federal agencies, as well as local and international conservation organizations have identified 3 Aleutian Tern conservation priorities in Alaska: an effective monitoring protocol; an accurate population estimate; and a conservation assessment. Although a species of high concern in the State of Alaska Comprehensive Wildlife Conservation Strategy (ADFG 2006), global and state populations of Aleutian Terns are not actively monitored and are thought to be declining (ADFG 2006; Appendix 4, Page 202). The lack of population monitoring has been identified as a key element in building a conservation strategy for this species (ADFG 2006; Appendix 4, page 202). This project will be consistent with the Conservation Strategy in that we will develop of a cost effective, consistent survey methodology, implement surveys across broad areas, and build a foundation for a statewide monitoring program (ADFG 2006; Appendix 4, page 203).

II. REVIEW OF PRIOR RESEARCH AND STUDIES IN PROGRESS ON THE PROBLEM OR NEED

Please see above.

III. APPROACHES USED AND FINDINGS RELATED TO THE OBJECTIVES AND TO PROBLEM OR NEED

Objective 1: Design and implement a series of sampling methods near Yakutat.

Job/Activity 1a: Survey each colony using strip, line, and variable area transects.

Job/Activity 1b: Complete colony-wide aerial photography.

Job/Activity 1c: Use counts of birds from aerial photographs to derive a “quasitrue” population estimate.

Job/Activity 1d: Develop an aerial-ground sampling ratio for future assessments.

Objective 2: Conduct a comparative population assessment.

Job/Activity 2a: Predict sizes of Aleutian Tern colonies using data from the sampling methods.

Job/Activity 2b: Evaluate the methods for statistical rigor, cost effectiveness, and disturbance impact.

Job/Activity 2c: Produce a robust survey protocol for statewide application.

Objective 3: Apply the survey protocol to other regions.

Job/Activity 3a: Coordinate with other agencies.

Job/Activity 3b: Survey Aleutian Tern colonies in Yakutat, Icy Bay, and Cordova.

Job/Activity 3c: Derive accurate population estimates.

Job/Activity 3d: Refine the protocol as needed.

Objective 4: Coordinate a statewide survey effort using the protocol

Job/Activity 4a: Review historical colony data and prioritize survey locations

Job/Activity 4b: Coordinate with other agencies to delineate sites

Job/Activity 4c: Survey Aleutian Tern colonies statewide

Job/Activity 4d: Conduct analyses to derive colony size estimates

Job/Activity 4e: Conduct geospatial & climate analysis to investigate site-related correlates of colony trends

Objective 5: Determine inter-seasonal movements and wintering areas.

Job/Activity 5a: Coordinate with other agencies (USFWS)

Job/Activity 5b: Deploy geolocators

Job/Activity 5c: Recapture birds in nesting areas and recover geolocators

Job/Activity 5d: Analyze and map migratory patterns and overwintering areas

IV. MANAGEMENT IMPLICATIONS

Management implications are provided below in recommendations section and in the associated final scientific report.

V. SUMMARY OF WORK COMPLETED ON JOBS

OBJECTIVE 1 AND 2:

JOB/ACTIVITY 1A – 2B: We evaluated three different transect-based survey techniques and one remote sensing technique to census Aleutian Terns (*Onychoprion aleutica*) at a breeding colony on Black Sand Spit near Yakutat, Alaska. We took vertical low altitude aerial photos of the colony. Terns were counted from aerial images manually and using automated software. Two observer-teams walked a transect through the colony.

Observers recorded perpendicular distance from the transect to each chick, nest scrape, egg shell, and occupied nest (nest with eggs) detected. Population estimates were generated from the transect post hoc using the strip transect method, the variable-area transect method (VAT) and distance sampling (program DISTANCE). Aerial photo interpretation was unsatisfactory because, although terns were clearly detectable, many features could not be positively accepted as terns. Automated interpretation of imagery yielded too many false positives resembling terns in size and spectral characteristics to be of further utility. The 3 ground survey techniques yielded breeding-population estimates between 2100 -2700 individuals in Yakutat, with distance sampling yielding the most robust population estimate (coefficient of variation of 12.9) and VAT and strip transects yielded highly variable estimates (coefficients of variation were 5 x higher). All 3 techniques were comparable from the standpoint of cost-effectiveness and disturbance. However, in mixed colonies where species composition ratios are also known, distance sampling for occupied nests can be applied as an inexpensive, statistically valid, and repeatable method to monitor tern populations at colony sites. See interim scientific report for additional details.

JOB/ACTIVITY 2C: We produced a survey protocol that can be implemented at other large breeding colonies. The protocol consists of conducting non-invasive surveys of nest sites using distance sampling and four fine scale measurements taken at each nest. The transect generates a density estimate for breeding terns and the nest measurements allow for differentiation between Aleutian and Arctic Terns. See interim scientific report (provided in FY10) for additional details.

OBJECTIVE 3:

JOB/ACTIVITY 3A: We coordinated efforts with several other partners including USFWS (Juneau and Anchorage), USFS Cordova Ranger District, University of Hawaii, University of Alaska Fairbanks, Yakutat Tribe, National Park Service, and Alaska Department of Fish and Game Nongame program biologists.

JOB/ACTIVITY 3B: We visited the following sites in the region: (1) Icy Bay in cooperation with the USFWS in the 2008 breeding season where we identified two Aleutian Tern colonies; (2) in 2009 we again coordinated with USFWS to identify one ALTE colony at Orange Glacier in Russel Fiord and another ALTE colony near Esker Creek on the west side of Yakutat Bay; (3) in 2009 we coordinated with ADFG and NPS to locate another

large colony on gravel islands of the Alsek River area; (4) in 2009 we visited 10-12 historic colony locations identified by Holtan (1979) in the Copper River Delta in coordination with the Cordova Ranger District and found that fewer breeding-colony locations were occupied by ALTE then recorded during the 1970's on the East Copper River Delta.

JOB/ACTIVITY 3C & 3D: All of these colonies were relatively small (<100 individuals) and thus, deploying the sampling protocol was unnecessary. Further refinement of the protocol is still ongoing and will focus on refinement of sampling parameters associated with distance sampling through post-hoc manipulation of data; and this will be completed prior to distribution of the protocol for statewide surveys planned for spring/summer of 2013.

OBJECTIVE 4:

JOB/ACTIVITY 4A: We consolidated information from a variety of sources to create a list of historical colony locations in Alaska. More recently, we combined efforts with the U.S. Fish and Wildlife Service (Homer Office), who was engaged in a parallel database effort, and integrated this information, along with survey data from summer 2013 (see below). These data are available through the USFWS North Pacific Seabird Colony Database: <http://www.fws.gov/alaska/mbsp/mbm/northpacificseabirds/colonies/>

JOB/ACTIVITY 4B: We initiated statewide outreach in 2012-2013 with the following entities: U.S. Fish and Wildlife Service, USGS Alaska Science Center Avian Research Team, Izembeck Wildlife Refuge, Chugach National Forest, Cape Krusenstern National Monument, Noatak National Preserve, Katmai National Park, Aniakchak National Par, Glacier Bay National Park, BLM Alaska, Kodiak Wildlife Refuge, Alaska Department of Fish and Game, and the Tongass National Forest, and Audubon Society.

We drafted a general outreach letter (Appendix E) which was sent out to 90 contacts in these agencies and birding groups, and followed up directly with those entities expressing interest. The primary motivation for this outreach was to stimulate a planning effort for a preliminary statewide survey of Aleutian Tern breeding colonies in 2013 (see below). We also inquired with these contacts as to any historical records they were in possession of regarding the location of Aleutian tern breeding colonies and the number of animals therein.

JOB/ACTIVITY 4C: To support a preliminary survey effort across a range of historical colonies with unknown conditions in 2013, we devised a standardized "quick count" protocol (included in Appendix E). This protocol was adapted from a repeat count methodology (Royle 2004) and represented a compromise between survey effort – e.g. untrained personnel with limited time and visual estimation of bird numbers – and sampling considerations – e.g. use of multiple visits/observers to estimate sampling errors. The protocol was distributed to potential partners through the U.S. Fish and Wildlife Service.

Then, through collaboration and leadership from the USWFS (Homer office), we facilitated and participated in a preliminary statewide survey of a subset of historical colony locations (listed below) during the 2013 summer field season, using the protocol described above..

JOB/ACTIVITY 4D: These data either are or will be incorporated into the USFWS North Pacific Seabird Colony Database. Analyses of these data are ongoing and are included in a USFWS Status Assessment that is currently in review. These data are also included in a collaborative manuscript with the USFWS on the conservation status of the species in Alaska; this manuscript is drafted but pending final review and submission.

JOB/ACTIVITY 4E: Analyses of trend data relative to stressors are ongoing and will be included in a poster presentation at the Pacific Seabird meetings in February 2014 as well as a second manuscript to be drafted in 2014.

OBJECTIVE 5: Determine inter-seasonal movements and wintering areas.

JOB/ACTIVITY 5A: We coordinate with other agencies (USFWS for band permitting, University of Hawaii for Animal Care protocols, and ADFG for capture and handling permits.) We have also coordinated with several partners such as the Wildlife Conservation Society in Asia and Southeast Asia to scope for collaborative opportunities to identify wintering grounds.

JOB/ACTIVITY 5B: We captured 113 birds using walk-in traps in 2 colonies (Black Sand Spit & Italo River mouths) in the Yakutat area during summer of 2010, with no known mortalities and injuries. We deployed a total of 113 archival light loggers (“geolocators”) from British Antarctic Survey to determine the species migration path and timing. On the right leg, the 1.5 g geolocator was attached to an orange darvic band, and on the left leg, a metal band was attached over yellow color band.



JOB/ACTIVITY 5C: In 2011, terns did not return to the same colony locations within Yakutat. Between June 14 and July 1 2011, we captured a total of 107 birds in 3 other colonies within the general vicinity of Yakutat (Ankau River, South of Italo River, and the 9-Mile Meadow area several miles inland). A single bird was a recaptured with a geolocator.

In 2012 the Italo River Mouth and Black Sand Spit colonies within the Yakutat Ranger District were surveyed intensively for six weeks in an effort to recover more geolocators. Investigators followed capture protocols outlined in previous years. Of the 41 captures, one geolocator was recovered. The other 40 birds captured were new animals and were subsequently banded, measured, and had feather samples taken for future genetic analysis.

JOB/ACTIVITY 5D: Please refer to final scientific report for details of migration patterns and mapped migration trajectories. Although a recovery of n=2 is not enough data to make recommendations for specific migration corridors, overwintering sites, or stopover colonies, this information does provide valuable information on the variability of wintering site selection. The information from the analysis of the geolocators recovered during this project revealed a winter migration that not only confirmed occurrence in parts of Southeast Asia, but extended winter range significantly in Southeast Asia and most surprisingly, to Oceania. Although there are anecdotal reports of



possible Aleutian Terns in Southeast Asia (Goldstein et al., unpublished), these reports are possible juveniles, transient birds (observed flying over open water), and are largely restricted to western-northwestern portions of (highly populated) Southeast Asia, e.g. Hong Kong, Singapore, Taiwan, and the S China Sea. This study has elucidated a large geographic region south and east --- Indonesia and Oceania --- which is serving as long-term, overwintering residence habitat for Alaskan birds. This wintering area -- from Sumatra to the Bismarck Archipelago --- represents a longitudinal span of several thousand kilometers. To our knowledge, this species has never been described in coastal Papua New Guinea and the Coral Sea Islands. Overwintering site fidelity in this species is still unknown but the flight data from one of our recaptures that lasted > 2 years did include the same overwintering sites two years.

VI. PUBLICATIONS

There are 4 associated publications in various stages of drafting and submission. These are (1) a 2013 USFWS Status Assessment that is completed and currently in review. (2) a collaborative manuscript with the USFWS that includes the statewide survey data and an assessment of the conservation status of the species in Alaska; this manuscript is drafted but pending submission. (3) Analyses of trend data relative to stressors are ongoing and will be included in a second manuscript that is in the early stages of drafting' submission is expected to occur in mid 2014. (4) a third manuscript documenting migration funding is currently being drafted and submission is expected to occur in mid 2014.

We presented posters at the Alaska Chapter of The Wildlife Society meeting and the Alaska Bird Conference in 2010 and at the national Wildlife Society meetings in Nov 2011. At the Pacific Seabird meetings in February 2014, we will make 3 presentations on subject matter relating to (2), (3), and (4) above.

VII. ADDITIONAL FEDERAL AID-FUNDED WORK NOT DESCRIBED ABOVE THAT WAS ACCOMPLISHED ON THIS PROJECT DURING THIS SEGMENT PERIOD

None.

VIII. RECOMMENDATIONS FOR THIS PROJECT

- (1) Localization of overwintering areas through reconnaissance efforts on-the-ground by PIs and through networking with international partners. Although this was an explicit objective of this project, pursuit of this objective was suspended by the ADFG Nongame Program Director in 2013. However, potential risks on wintering grounds where Terns spend 3-fold more time that they do in Alaska may be critical for understanding (largely negative) trends observed at breeding grounds in Alaska. New technology – geolocators couple with VHF transmitters, or GPS transmitters – will almost certainly become available for deployment on Terns within the next few years.
- (2) We initiated a preliminary survey effort and reconnaissance at historical breeding colonies in summer 2013, and these should be formalized into a statewide network

and multi-year survey effort in future years, beginning in 2014, using the protocols developed in this project. Re-evaluation of the species' status after ca. 3 consecutive years of survey data become available is warranted, given the year to year variability in colony occurrence and numbers that have been observed.

- (3) We recommend increasing the level of understanding of statewide population structure and inter-colony movements. Our geolocator data and observations suggest that colony selection by Aleutian Terns is more fluid than previously believed, with interannual breeding-colony shifts ranging upwards of 50km. Our very low recapture rates (1%) between consecutive years, despite ostensibly large colonies in an area, suggest breeding sites are not legacies and breeding populations are not closed.
- (4) We recommend a better understanding of the relevance of marine environments and near shore productivity/timing to Aleutian Tern breeding site-selection and productivity. In our observations, forage-fish species such as capelin and lance were routinely the focus of adult foraging activity and offspring-provisioning. Climate-induced changes in the north pacific, along with fisheries depletion, could be a vulnerability for this species.
- (5) The role of human disturbance, especially egging, which we learned apparently occurs more frequently than we originally suspected across much of Alaska, is an important potential stressor on breeding colonies. In addition to disturbance, harvesting could have important indirect effects on population demography; and with the demographic data we collected on clutch size and colony abundance, etc., these effects could be modeled and managed better.

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