



Monitoring Bald Eagles in Southwest Alaska Network Parks

Data Quality Standards Version 1.0

Natural Resource Report NPS/SWAN/NRR—2017/1385



ON THE COVER

An adult bald eagle in Kenai Fjords National Park

Photograph courtesy of the National Park Service, Kay White

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Executive Summary

The purpose of this report is to document the standards used by the SWAN for activities related to the collection, processing, storage, analysis, and publication of bald eagle monitoring data as described in *Monitoring Bald Eagles in Southwest Alaska: Protocol and Standard Operating Procedures* (Wilson et al. 2017). The policies and procedures documented in this quality-assurance plan for activities complement the quality-assurance plans for other monitoring activities conducted by the SWAN and supplement National Inventory & Monitoring Division Quality Management Plan. The plan also serves as a guide for all SWAN personnel who are involved in protocol/program activities and as a resource for identifying memoranda, publications, and other literature that describe associated techniques and requirements in more detail.

Acknowledgments

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Introduction

The purpose of this report is to document the standards used by the Southwest Alaska Network (SWAN) for activities related to the collection, processing, storage, analysis, and publication of monitoring data as described in Monitoring Bald Eagles in Southwest Alaska: Protocol and Standard Operating Procedures (Wilson et al. 2017). The policies and procedures documented in this quality-assurance plan for activities complement the quality-assurance plans for other monitoring activities conducted by the SWAN, Lake Clark National Park and Preserve, Katmai National Park and Preserve, Kenai Fjords National Park and supplement the National Inventory & Monitoring Division Quality Management Plan. The Standard Operating Procedures provide detailed protocol/program activities associated with bald eagle monitoring. This plan serves as a guide for all personnel who are involved in protocol/program activities and as a resource for identifying memoranda, publications, and other literature that describe associated techniques and requirements in more detail.

Protocol Overview

Bald eagles play an important ecological role in freshwater and marine coastal systems throughout Alaska. Eagles are sensitive to human disturbance, contaminant exposure, and oil spills making them useful as a vital sign (Bennet et al. 2006; Thompson et al. 2009). Bald eagle populations in Alaska have been adversely affected in the past by indiscriminate harvest (DeArmond 2008) and the Exxon Valdez Oil Spill (Bowman et al. 1997), but have remained stable enough to avoid a federal listing under the Endangered Species Act. The parks in the Southwest Alaska Network (SWAN), including Lake Clark National Park and Preserve, Katmai Park and Preserve, and Kenai Fjords National Park, contain large breeding populations of bald eagles. Annual surveys are used to monitor the status of, and trends in, bald eagle nest initiation and chick productivity (Stalmaster 1987).

This documents outlines the data quality standards for the bald eagle “Vital Sign”, as part of the NPS Vital Signs Inventory and Monitoring program and as described in the SWAN Monitoring Plan (Bennet et al. 2006). The study design, data collection methods, and analytical protocols have been previously published in the *Journal of Wildlife Management* (Wilson et al. 2014) and in two National Park Service Natural Resource Technical Report (NRTR) series publications (Thompson et al. 2009, Thompson and Phillips 2011). The methods described here also closely follow those outlined in the United States Fish and Wildlife Service’s post-delisting monitoring plan (USFWS 2009).

Conceptual Framework for Monitoring

As apex predators, bald eagles are expected to be sensitive to changes in the food web that can, in turn, affect population turnover and productivity. Therefore, bald eagle reproductive performance can be an important indicator of current and long-term changes in terrestrial, freshwater and marine systems (Thompson et al. 2009). For example, bald eagle reproductive performance in interior Alaska was found to partially explain differences in nest success between sites (Steidl et al. 1997).

In addition to improving our basic understanding of bald eagle ecology, monitoring can also provide practical assistance to the parks. Bald eagle populations are under continuing threat from human disturbance that occurs within or immediately adjacent to the park boundaries. Using adaptive management and structured decision making, bald eagle monitoring can assist parks with making

management decisions about season and duration of disturbances, such as those from recreational activities permitted within park boundaries. Monitoring also plays a very important role in managing catastrophic events such as the Exxon Valdez oil spill (EVOS). Data collected before, during, and after the event (so-called before-after-control-impact [BACI] designs) are necessary for determining the overall impact and subsequent recovery from a large event (Parker and Wiens 2005). Well executed monitoring plans are a crucial step to making sure that a BACI designs can be easily applied to assess recovery after a large, catastrophic disturbance.

Protocol Activities and Modules

Data are collected or derived as a part of the protocol for monitoring bald eagles in Southwest Alaska in 13 activities organized into 5 modules (Table 1; Wilson et al. 2016).

Measurable Objectives

To measure changes in bald eagle breeding populations, the following three objectives will be addressed at sampling locations in the three largest park units in the SWAN: Lake Clark National Park and Preserve (LACL), Katmai National Park and Preserve (KATM), and Kenai Fjords National Park KEFJ).

- 1) Estimate long-term trends in the abundance of bald eagle nests located within the sampled areas.
- 2) Estimate long-term trends in the annual proportion of nests in which eagles attempt to reproduce (nest initiation). Nest initiation is not directly observable and will be modeled using data obtained during two nest initiation surveys conducted in May (See state variable descriptions below for a detailed definition).
- 3) Estimate long-term trends in annual nest productivity. Productivity is defined as the mean number of chicks produced per initiated nest, and is conditional on nest occupancy.

Module Descriptions

- 1) Site Reconnaissance: List frame Maintenance. Data associated with nest locations that are sampled annually. The sampling design for the list frame is census.
- 2) Site Reconnaissance: Area frame Maintenance. Data associated with the areas surveyed for abundance. These can be transects or areas according to park-specific objectives.
- 3) Field Data Collection. Measurements taken and recorded by IMD or cooperator staff. These should often be broken into activities based on implementation timing and/or scale of measurement (data collected in transects are a different activity than plot data).
- 4) Field Sample Data. Information related to observations made in the field. Covariate data (i.e. information that may help with modeling of derived quantities, described in point 5) are project-/question-/park- specific and excluded from this table.
- 5) Derived Quantities. Modeling of quantities of interest for monitoring. (diversity, environmental tolerance, environmental quality), summary statistics, multimetric indices, or other derivative measures based on data collected in one or more activities of types described in Table 1.

Table 1. Project activity matrix for bald eagle monitoring.

Activity		Description
Site Reconnaissance: List Frame Maintenance		
1	Nest characteristics	New nests only: tree info, photos, site characteristics, location (SOP 2)
Site Reconnaissance: Area Frame Maintenance		
2	Double observer	Which observer saw nests: Front only, Rear only, Both (SOP 2)
1	Nest characteristics	See above (SOP 2)
Field Observations		
3	Nest initiation data	Nest status: Incubating or Empty (SOP 2)
4	Productivity data	Number of live chicks, chick age (SOP 2; Carpenter 1990)
Derived Data		
5	Detection probability	Probability that unknown nests are seen during a flight (SOP 3)
6	Probability of initiation	Probability that a nest was initiated in any given year or proportion of all nests that were initiated (SOP 3)
7	Productivity	Mean number of chicks produced in each initiated nest (SOP 3)
8	Nest success	Probability that a nest was successful or proportion of all nests that were successful (SOP 3)
9	Number of nests	Nest abundance (SOP 3)
10	Number of initiated nests	Number of nesting attempts started in a year (SOP 3)
11	Number of successful nests	Number of nests that produced chicks in a year (SOP 3)
12	Number of chicks	Number of chicks raised to fledging age each year (SOP 3)
QA/QC Data		
13	Nest location	Check geospatial data for logical errors (e.g. nests that appear over water) (SOP 3)

Sampling Design

In general nest features can be sampled within a sampling domain by visiting all known nests in a park (list frame), or within a randomly selected areas (area frame; Bennet et al. 2006). List frame sampling yields valuable information about the sampled nests, such as nest initiation status, mean chick production, and the probability that nests will transition between initiation states between years. Without additional sampling, the list frame does not provide inference to a wider population, or give information about total number of nests, the number of initiated nests, or total number of chicks produced. Area frame samples, confer wider inference, and give information about abundance, but do not track individual nests through time. Therefore, area frame surveys give no information about dynamic properties, such as the probability that nests transition between initiation states from one year to the next. Dual frame sampling combines techniques, and retains the advantages of both maintaining a list frame, and sampling from an area frame (Haines and Pollock 1998; U.S. Fish and Wildlife Service 2009). All parks conduct list frame sampling, but the strategy for area frame sampling changes between parks. A description of the sampling domain and strategy for sampling of each park is listed in Table 2.

Surveys of wildlife are often prone to imperfect detection of the object of state of interest (Nichols et al. 2009). Counts of nest structures (U.S. Fish and Wildlife Service 2009), and determining whether or not eagles have attempted to reproduce at observed nests (Booms et al. 2010) are both affected. In both cases, estimators that do not correct for imperfect detection will be biased, and inference about status and trends will be incorrect. Replicate sampling can be used to formally account for imperfect detection, thereby eliminating bias from estimators (Nichols et al. 2009). Our protocol uses two types of replicate sampling: 1) double observer (Nichols et al. 2000) to correct counts from nests that are missed during the surveys and 2) modified occupancy sampling (Wilson et al. in review) to correct initiation metrics for missing peak nesting by eagles. Bayesian hierarchical models are then used to produce robust estimates of the monitoring quantities listed in the objectives.

Table 2. Activity-level sample design matrix for bald eagle monitoring in the SWAN.

Activity		Sampling Design	Revisit Design
Site Recon, Establishment, and Maintenance			
1	List frame	KATM (Probability and Census): Dual frame design on all shorelines and rivers adjoining major lakes within Naknek drainage KEFJ (Probability and Census): Dual frame design on 23 random coastal transects LACL (Census) List frame only	All known nests revisited three times annually
2	Area frame		All area frame transects revisited twice annually
Field Observations			
3	Nest initiation data	KATM (Probability and Census): Dual frame design on all shorelines and rivers adjoining major lakes within Naknek drainage KEFJ (Probability and Census): Dual frame design on 23 random coastal transects LACL (Census) List frame only	Revisit annually; two surveys in May
4	Productivity data		Revisit annually; one survey in July/August

Data Quality Objectives

Table 3. Data Quality Values (DQVs) to be considered in development of quality assurance plans for bald eagle monitoring in the SWAN.

Data Quality Value	Definition	Protocol Considerations
Intrinsic Data Quality		
Accuracy	Measurements reflect the true value of the parameter being observed. This applies to measures (length, width, position) or classes (species, types, or categories). Includes components of precision and bias. [Measurements reflect what observers saw in the field]	The quantities of interest cannot be observed directly in the field. Quantities of ecological interest are obtained from unbiased estimators that use the field data. Bias and precision are properties of the estimators. The recorded data are assumed to be accurate representations of what the observer(s) saw in the field. We do not place standards on the magnitude of the bias, only that the revisit design allows estimators that can account for it.
Representativeness	Measurements represent conditions at the time of sampling. Combined with accuracy, leads to repeatable data collection. [Statistical Inference]	Inference of dual frame samples pertains to the study area. List frame samples pertain to the nests sampled. Observations represent conditions at the time of sampling.
Contextual Data Quality		
Comparability	The degree to which data can be compared among sample locations, data sources, or periods of time.	Metrics pertaining to the list frame are comparable across parks and through time. Abundance metrics derived from the area frame are comparable within areas of inference through time.
Completeness	All data/measures required to evaluate accuracy representativeness are present; incomplete data sets (either at a location, across sampling locations, or over time) lose utility or relevance. Data records contain values as planned across the period of record.	Every effort will be made to complete the two ENIS and LPS surveys. All data/ measures required to evaluate accuracy representativeness are as complete as possible. Field conditions are difficult, and incomplete datasets are often recorded. Incomplete data sets are still valuable and are analyzed using model-based inference that accommodates missing records. Data records contain values that are complete as possible across the period of record.
Representational Data Quality		
Consistent representation	Use of standard definitions when describing data quality or resource quality based on data	Standard field definitions are described in the data management SOP3
Data Accessibility		
Secure	Access to data, products, and systems limited to appropriate audiences.	No protected data are being collected as part of this protocol.

Measurement Quality Objectives and Performance Standards

Table 4. Example Measurement Quality Objective table to be included in Quality Assurance Plans for protocols implemented by the NPS Inventory & Monitoring Division. Measurement Quality Objectives for chemical or lab analyses should be referenced in separate tables where MQOs can be specified by analyte. Activities (shaded cells) match those in the Protocol Activity Matrix Table (Table 1).

Measure / Quality Indicator		Quality Objective
Site Reconnaissance: List Frame, New Nests		
1	Location accuracy	+/- 300m (horizontal), no standards for vertical accuracy
1	Tree information	The substrate the nest is built on (generalized tree species or ground): spruce, hemlock, cottonwood, or ground.
1	Tree condition	The status of the tree: Live or Dead (NA if nest is built on the ground). Value may change in subsequent years.
1	Site characteristics	If collected, additional information about the nest or structure of the tree (e.g. broken top). May assist in identification of the nest in subsequent years.
1	Photos	If photos are taken, they can be used to help identify the nest during the subsequent years.
1	List frame completeness	Nests is able to be found during the survey. A max time of ten minutes searching for nest should be used. If the nest is not found, it will be recorded as Not Located. Weather conditions or time considerations may shorten the amount of time spend searching for individual nest from the ten minute max. Nests will be removed from the list frame if it is observed to be destroyed or if it has not been found in 3 consecutive years.
Site Reconnaissance: Area Frame, Nest Characteristics		
1	Location	Nest is located within the area frame.
1	Nest tree species	Not always collected: the substrate the nest is built on (generalized tree species or ground). If the substrate is different from previous years, the Nest ID needs to be confirmed; this can come from examining the timeline of nest observations.
1	Tree condition	Not always collected: the status of the tree: live or dead. The status of a tree can change from live to dead. The status of a tree should not change from dead to live.
1	False positive	All large nests are bald eagle nests
2	Double observer data	Who observed the nest (front observer, rear observer, or both). Provides data to correct estimator bias based on a capture-recapture algorithm.
1	Photos	Photos are not collected if there is already an image of the nest.

(continued on next page)

Table 4 (continued)

Measure / Quality Indicator		Quality Objective
Field Observations: Nest Initiation data		
3	Nest status	Incubation status of the nest. An incubating nest is determined from adults sitting on the nest or observation of eggs in the nest. An empty nest has no signs of adults sitting on the nest nor are eggs visible. If the nest cannot be found, the status will be Not Located.
Field Observations: Productivity data		
4	Chick count	Chick count at each nest is <4 chicks. If the nest is not located, the value will be null.
4	Chick age	Observations are recorded accurately, or with null value indicator.
Derived quantities		
5	Nest detection	Double observer design used
6	Nest initiation	2-visit spring revisit design used
7-8	Nest productivity/success	Summer productivity sampling conducted
9-12	Abundance metrics	Dual frame design used

Taxonomic Standards

Haliaeetus leucocephalus- Bald eagle (Buehler 2000)

Table 5. Example activity-level sample design matrix to be included in Quality Assurance Plans for protocols implemented by the NPS Inventory & Monitoring Division. Numbers (left column) should match those in the Protocol Activity Matrix Table (Table 1) and may be combined as appropriate.

Activity	Standard to be Used	Reference / Authority
Options		
1	– <u>Scientific Publication</u> that serves as the reference for identification or reporting Or <u>Field Subject Matter Expert</u> if/when data are collected in the field or verified in the office to one or more undetermined standards Or <u>Taxonomic Subject Matter Expert</u> if/when data are collected and verified by an individual with documented taxonomic expertise	Publication reference and year of publication (to distinguish among versions) --- Position(s) responsible for performing the identifications --- Name and organization of taxonomic subject matter expert
Field Observations		
1	Nest tree species	Scientific Publication Flora of North America (1993, 2010)

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