



Monitoring Bald Eagles in Southwest Alaska Network Parks

Standard Operating Procedures Version 1.0

Natural Resource Report NPS/SWAN/NRR—2017/1384



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

This document contains the Standard Operating Procedures, version 1.0, for the Southwest Alaska Network (SWAN) protocol for monitoring bald eagles in Southwest Alaska Network parks. The procedures provide detailed methods for collecting, managing and reporting monitoring data for bald eagles, 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).

SOP 1 describes how to prepare for the field season. SOP 2 describes methods for conducting field surveys and recording data. SOP 3 details data management and archiving procedures. SOP 4 contains the reporting schedule for the bald eagle vital sign. SOP 5 describes how to update the standard operating procedures. SOP 6 contains information about important field and aviation safety protocols. The appendices contain examples of important forms, and a description of an optional nest tracking procedure.

SOP 1: Preparing For Bald Eagle Field Sampling

Version 1.0. February 2017

Change History

Version #	Date of Revision	Revised By	Changes	Justification
1.0	2/3/2017	—	—	Original Version

Suggested Reading

Buehler, D.A. 2000. Bald Eagle (*Haliaeetus leucocephalus*). In Birds of North America, No. 506.

The Academy of Natural Sciences, Philadelphia, and the American Ornithologists' Union, Washington, D.C.

Thompson, W.L., S. Hall, and C.R. Lindsay. 2009. Evaluation of a survey method for estimating number and monitoring occupancy of bald eagle nests in Kenai Fjords National Park. Natural Resource Technical Report NPS/SWAN/NRTR—2009/271. National Park Service, Fort Collins, Colorado.

Thompson, W.L. and L.M. Phillips. 2011. Evaluation of a dual-frame design to estimate occupancy and productivity of bald eagle nests in Kenai Fjords National Park. Natural Resource Technical Report NPS/SWAN/NRTR—2011/413. National Park Service, Fort Collins, Colorado.

Wilson, T. L., J. H. Schmidt, W. L. Thompson, and L. M. Phillips. 2014. Using Double-Observer Aerial Surveys to Monitor Nesting Bald Eagles in Alaska: Are all Nests Available for Detection? Journal of Wildlife Management, Wildlife Society.

Introduction

This SOP describes how to prepare for and execute the two early nest initiation surveys (ENIS), performed in May, and the late productivity survey (LPS) performed in late July or early August. Pre-season field and survey tasks include: a) scheduling personnel and contract pilots; b) taking National Park Service (NPS) standard aviation safety courses (if necessary); c) preparing or updating the project aviation safety plan (PASP); d) reviewing observation techniques; e) preparing maps, photos and data; f) preparing gear and equipment; and g) communicating with dispatch and pilot.

Personnel

The project leader will choose 1-2 observers, acquire an aircraft and pilot, produce communications and safety plans, oversee field operations, and ensure that data are managed properly during and after survey flights. The project leader and crew members should have aviation training sufficient to manage and conduct the field project, as required by DOI Interagency Aviation Training (IAT) guidelines (<https://www.iat.gov>). For the project manager, the minimum required training is DOI Aviation Management Training for Supervisors (M3) if the project leader is supervising staff conducting surveys. Fixed-wing flight manager-special use or helicopter manager certifications are also recommended, depending on the aircraft used. All crew members must have the minimum training requirement of Department of Interior (DOI) Aviation 100 (A-100; see training requirements in *Training Observers in Aviation Safety* section below). If contract aircraft are used, an on-site, DOI-certified helicopter manager or fixed wing manager is required to manage the flight. The helicopter/fixed wing manager may also participate as an observer in the survey.

Aircraft

Survey aircraft sufficient to conduct a low elevation special use survey is required for both the ENIS, and LPS surveys, and may include: a tandem fixed-wing aircraft (e.g. Piper PA-18, Husky, or Maule), or a helicopter (e.g. Robinson R44-II). Aircraft must be equipped with an: FM radio, GPS, automated flight following equipment (AFF or Spidertracks). Pilots and aircraft must be carded to fly the special use, low altitude aerial surveys, and contract pilots and aircraft must be additionally approved by the Office of Aviation Services (OAS) to fly the mission. Use of fuel caches for helicopter operations in KEFJ requires that pilots carry a fuel pump with filters. Extended over-water flights (such as those conducted in KEFJ) require the aircraft to be equipped with fixed (fixed-wing or helicopter) or pop-out (helicopter) floats. Use of NPS fixed-wing aircraft is preferred as the most cost-effective means to conduct surveys in LACL and KATM. In KEFJ, surveys have been conducted by helicopter since their inception. Other types of small aircraft may be used if the preferred aircraft are not available, recognizing that increased flight velocities may reduce the observers' ability to find existing nests, resulting in missing values, which if severe can reduce estimator precision. Missing a handful of active nests should not affect estimator performance if sample sizes are large.

Contract Aircraft Procurement

A limited number of R44-II and tandem fixed-wing aircraft with floats are available from vendors in southcentral AK, so procurement should be completed well before the survey date. Generally, for May nest initiation surveys, procurement paperwork is initiated in early March. OAS aircraft

procurement procedures change frequently; therefore, the project lead should work with the park Aviation Manager to review current policy and to complete and submit procurement paperwork. Once the task order has been issued to the aircraft vendor, the project lead should work directly with the vendor to schedule exact dates of the survey. Flight windows should be scheduled to correspond to peak bald eagle nest initiation (ENIS) and pre-fledging (LPS).

Preparing Equipment

A checklist of survey and safety equipment follows this paragraph. Each observer should have a GPS unit uploaded with nest waypoints and transect start and end points. These data should also be uploaded to the pilot's GPS, therefore coordinates of known nest waypoints and transect start and end points (if applicable) should be sent to the pilot prior to the survey flight(s).

Equipment Checklist

- GPS unit with current known nest locations
- GPS antenna
- Clipboard
- Data sheets for appropriate survey (ENIS or LPS) or other data entry device
- Pencils (with extra lead)
- Binoculars (stabilized binoculars are preferred)
- Extra batteries for all electronics
- Satellite phone
- Aviation PPE (flight helmet, vest, gloves, flight suit)
- Survival equipment (3 ways to start a fire: matches, lighter, flint; space blanket; knife; sleeping bag; extra food; water purification tablets; signaling device)
- First aid kit
- Park radio with helmet adapter (required in KEFJ)
- Marine radio (KEFJ)
- Personal locator beacon (KEFJ)
- Project Aviation Safety Plan (PASP; see SOP 6)

Optional Equipment

- Maps and other aids for finding nests (e.g., nest book; Appendix D)

Early Nest Initiation Survey (ENIS)

The ENIS surveys (2) should take place during peak nest initiation when most eagles are attending nests. The peak initiation period is difficult to pinpoint, but conducting 2 ENIS surveys allows analyses that correct metrics for bias associated with missing the peak. Both ENIS surveys typically take place in May. Nesting phenology of some species is slowly advancing, so biologists should monitor chick ages to adjust the sampling window if needed.

A master database is currently saved on the SWAN team drive. A query from this database containing the coordinates of known nest locations, previous nest initiation status, and tree species will be generated prior to the first nest initiation survey each year. The project manager is responsible for sending the coordinates of known nest locations, along with transect start and end points (if appropriate) to the pilot in a format they request (e.g., latitude/longitude in degrees decimal minutes). These coordinates should be uploaded on the pilot's GPS so that s/he can use them to navigate to survey sites. The project manager shall also ensure that the coordinates of all known nest waypoints are uploaded onto a hand held GPS unit (see below for instructions for use of Garmin GPS) for use by observers during the survey flight. Observers shall review the relevant survey data sheets (ENIS or LPS) before each survey begins (SOP 2, Figures SOP 2-1, 2-2). For each survey, the project manager and observers should ensure that there are enough data sheets, and enough spaces on the data sheets, to account for all existing nests, plus up to 20 spaces for nests that may be discovered during the flight. Digital data collection is permitted if the data are formatted as shown in SOP 3.

Nests can be difficult to find, and it may help new reviewers to have visual aids. If desired, prepare maps that will help the observers find the known nests (e.g., detailed maps of each survey area, or an overview of all survey areas; Figure SOP 1-1). Maps should include all known nests coded by tree species or previous activity level, and transect lines (if available). Printed maps may be made available for observers to have on hand during the flight. If requested, email maps to the pilot, as well. KEFJ uses a nest book with photos of all known nests to assist new observers with finding nests (Appendix D).



Figure SOP 1-1. Example of map used for a bald eagle survey in KEFJ. The points depict the location of the known nests. If desired the shape, or color of the symbols can include additional information such as the tree species, whether the nest tree was alive or dead, or whether or not the nest was found during a previous survey.

Late Productivity Survey (LPS)

Bald eagles eggs incubate for 35 days, and the nesting period can last 56-98 days (Buehler 2000). LPS surveys are typically conducted between 63 and 84 days from 15 May (July 17 – August 8). There is risk that if surveys are conducted too late, then many successful nests will have fledged before the survey. Chick ages should be monitored carefully by biologists so that hatch dates can be estimated. If necessary the survey timing should be adjusted to account for changes in nesting phenology.

Preparation for the LPS is similar to the ENIS. All initiated nests (defined in SOP 3) will be revisited for the LPS survey. Thus, it is helpful to illustrate the ENIS status of all nests using maps with nest locations coded by ENIS status or by carrying copies of the ENIS data sheets during the LPS. Prior to the LPS, the project manager shall load the locations of the nests to be revisited for LPS surveys onto handheld GPS units as described below.

Uploading and Retrieving Waypoints

Setup

- Begin by opening or downloading current version of DNRGPS from:
<http://www.dnr.state.mn.us/mis/gis/DNRGPS/DNRGPS.html>.
- Clear old nest waypoints from the Garmin GPS unit (e.g., Garmin Map76S).
- Install And Configure DNRGPS - Unzip and install DNRGPS, and Garmin USB drivers as per their installation documentation. Connect a Garmin GPS receiver to the PC using a serial or USB cable, and turn the receiver on.
- It is important to make sure the **Projection** listed in the status bar matches that of the intended source or target GIS layer. Always check by selecting File / Set Projection:
NAD_1983_Alaska_Albers POSC code 201280708743.
- Complete following steps:
 - Select **North_America_Datum_1983** in the **Datum** list.
 - Set **201280708743** for **POSC CODE**.
 - Right click on the **NAD_1983_Alaska_Albers** and set to Favorites.
 - Press OK.
- Other trouble-shooting steps:
 - You must have administrative privileges on your computer to install this program. Contact your system administrator if installation was stalled because of installation rights.
 - If you have an earlier version of the DNR Garmin program on your machine you may need to uninstall before installing the new version. Uninstall previous versions by using the Start | Control Panel | Add/Remove Programs tool.
 - If GPS data does not align with NPS base data, then you may be projecting incorrectly. For NPS users in Alaska using ArcGIS 9.1 ensure the projection in DNRGPS is set to ESRI format 102006. Check by opening DNRGPS, selecting File | Get Projection. You should see the Projection: Alaska_Albers_Equal_Area_Conic_NAD83 is set.
 - For other installation errors please refer to Minnesota DNR Help page at:
<http://thoreau.dnr.state.mn.us/mis/gis/tools/arcview/Training/WebHelp/Training.htm#DNRExt/DNRGPS4/GPSIntro.htm>.

Uploading waypoints

- Select: File – Load from – file, and choose the current known nests file by navigating to it using the windows tool. SWAN maintains the list of known nests, and this file will be delivered to you each year either as a comma delimited file (.csv) or shapefile (.shp).
- Select upload all from the GPS menu.
- Check to make sure the waypoints show up in the correct location. If they don't check the projections settings on both the GPS unit and DNRGPS on your computer.

Retrieving waypoints

- Select download all from the GPS menu.
- Select the Waypoints tab and highlight waypoints representing the new nests. The ident field contains the waypoint number as saved using the GPS unit. Make sure these match the number recorded on the data sheets.
- To convert these waypoint positions to an ESRI shapefile, click File – Save To – ArcMap – Shapefile Layer. Make sure the saved file type is a projected shapefile, and that DNRGPS's projection matches the target GIS. Name the shapefile: YYYY_PPPP_SSSS_NewNests, where YYYY is the year, PPPP is the four letter park code, and SSSS is the survey (ENIS1 or ENIS2).
- Track vertices may be saved locally, but are not archived using this protocol. Track files may be helpful for correcting errors during the data quality control phase.
- Switch to the data view in ArcMap to inspect the new shape file. Ensure that the points are located on the map correctly. Projection and waypoint naming errors can be found this way.

SOP 2: Conducting Bald Eagle Aerial Surveys

Version 1.0. February 2017

Change History

Version #	Date of Revision	Revised By	Changes	Justification
1.0	2/3/2017	—	—	Original Version

Suggested Reading

Buehler, D.A. 2000. Bald Eagle (*Haliaeetus leucocephalus*). In Birds of North America, No. 506. The Academy of Natural Sciences, Philadelphia, and the American Ornithologists' Union, Washington, D.C.

Carpenter, G.P., 1990. An Illustrated Guide for Identifying Developmental Stages of Bald Eagle Nestlings in the Field. San Francisco Zoological Society. San Francisco, CA. 31 pp.

Thompson, W.L., S. Hall, and C.R. Lindsay. 2009. Evaluation of a survey method for estimating number and monitoring occupancy of bald eagle nests in Kenai Fjords National Park. Natural Resource Technical Report NPS/SWAN/NRTR—2009/271. National Park Service, Fort Collins, Colorado.

Thompson, W.L. and L.M. Phillips. 2011. Evaluation of a dual-frame design to estimate occupancy and productivity of bald eagle nests in Kenai Fjords National Park. Natural Resource Technical Report NPS/SWAN/NRTR—2011/413. National Park Service, Fort Collins, Colorado.

Wilson, T. L., J. H. Schmidt, W. L. Thompson, and L. M. Phillips. 2014. Using Double-Observer Aerial Surveys to Monitor Nesting Bald Eagles in Alaska: Are all Nests Available for Detection? Journal of Wildlife Management, Wildlife Society.

Wilson, T.L., L.M. Phillips, and B. Mangipane. 2017. Improving bald eagle nest monitoring with a second spring survey. The Journal of Wildlife Management: In press.

Survey Conditions and Hazards

Bald eagle surveys will be flown according to visual flight rules (VFR; see SOP 6). Surveys will not be flown in inclement weather. The survey will be conducted between 300-500 ft. AGL at a speed appropriate for the aircraft (helicopter = 21-40 knots; fixed wing > stall speed [i.e. 38 knots in a PA-18]). Fuel can be obtained at airports in Seward (ground only; no float plane access), Homer, King Salmon, and Port Alsworth. Flight routes will be adjusted to avoid hazards including power lines, other aircraft, and birds. Adult bald eagles may become aggressive if the aircraft comes too close to a nest. In such cases, aggressive behavior will be mitigated by approaching the nest at a different altitude, and more than 30ft away.

Communications

Prior to flying each day, each pilot/observer team will file a flight plan (Appendix A) in accordance with Alaska Interagency Communication Center (AICC) guidelines. At a minimum the flight plan will identify the aircraft and tail number, crew members, amount of fuel on board, estimated time of arrival back to the base station, and a map of the survey area and a list of flight transects. A flight plan should be opened with ARCC when the aircraft departs. For example, the pilot will call from the airport before take-off and after landing, whether or not NPS staff members are on board.

Current policy requires check-ins with ARCC 1) prior to and immediately after take-off; 2) prior to and immediately after landing; and 3) every 60 minutes during flight operations. Check-ins will be made via VHF, cell phone or satellite phone. Automated Flight Following (AFF) will be monitored every 15 minutes by ARCC. ARCC will confirm that AFF is functioning during each check in. To view AFF, register at <https://www.aff.gov/>.

Training Observers in Field Methods

Personnel will be familiar with this bald eagle SOP and the survey PASP. Biological technicians hired to assist with the surveys will have a background in wildlife biology and preferably previous aerial survey experience. All observers will complete required aviation safety training and be briefed on data collection and aerial observing. Each new observer should spend at least one flight day with an experienced observer (e.g., in the case of a helicopter survey), and/or an experienced pilot observer who has flown aerial surveys for bald eagles in Alaska (e.g., fixed-wing or helicopter survey). Given that each individual survey (1st nest initiation survey; 2nd nest initiation survey; productivity survey) is generally completed within 1-2 days, the time spent with an experienced observer amounts to a minimum of 50% of the flight time for a single survey. During the training day, new observers will familiarize themselves with the search image by first finding known nests from the list of known nests. They will then do 2 practice transects on areas that are not part of the normal survey. During the training period, new observers are expected to remain alert, search for new nests while on transect, and record data as if they were conducting a real survey. New observers will become familiar with bald eagle nest habitat and nest search image. At end of the flight training day, the experienced observer will review the new observer's data sheet for completeness, legibility, and errors to determine whether the new observer is ready to conduct an independent survey. If not, the experienced observer and/or pilot observer will continue to oversee the performance of a new observer until satisfied that the new observer is ready to work independently.

Briefing the Pilot About the Survey

The pilot is a critical member of the survey team, and should be thoroughly briefed about the survey protocol prior to the flight. This is especially critical for fixed-wing surveys where the pilot is considered to be a primary observer. It is therefore critical that fixed-wing surveys be flown by experienced pilots. The briefing should include the following information:

- A review of the survey area using maps printed to a known scale so that the pilot can plan for travel times and fuel range.
- Check to make sure that the known nests and transect start/end points (if used) are properly loaded on the pilot's GPS.
- Discuss the expected elevation and speed of survey.
- If the pilot is also an observer, discuss the double-observer protocol.
 - Neither observer is to indicate that they saw a nest until it is out of view of both observers.
- Discuss the protocol for recording known nests.
 - The pilot should limit nest searches to 10 minutes.
 - If the nest is difficult to find, the pilot should approach the coordinates from multiple angles and/or elevations to aid in finding the nest.
 - The pilot should allow sufficient time for the observer(s) to record data before resuming the survey.
- Discuss the protocol for recording new nests.
 - Data recording for new nests requires at least three passes of the nest: 1 to record the data; 2 to take the photo; and 3 to record the waypoint.
 - The pilot should allow sufficient time off transect for the observer(s) to accomplish all three tasks.
 - The pilot can help ensure that the photos are as good as possible by helping the observer relocate the nest after circling, and making sure the observer has a clear view of the nest. The observer(s) may need to communicate with the pilot to make sure that the aircraft is positioned favorably for their view.
 - The pilot can help ensure that the GPS positions of the nests are as accurate as possible by telling the observer when to mark the waypoint.

Early Nest Initiation Survey (ENIS) Technique

Two nest initiation surveys will be performed during the peak eagle nesting period in May using the double-observer survey technique. The double-observer nest initiation survey requires an observer-pilot team (fixed-wing), or 2 observers (helicopter). Observers will be stationed on the left side of the aircraft for the entire survey when using a helicopter or non-tandem aircraft. Survey routes should be planned based on weather, fuel and time of day. The pilot will navigate to the starting point of each transect or survey area and then fly at the appropriate speed and altitude for best detection of nests, given the current weather conditions. While traveling along transects, observers will continuously search for new bald eagle nests. Observations should be made independently by the front- and rear-

seat observers. To maintain independence, observers will refrain from mentioning a new nest observation until the nest is out of view of both observers. At that point, the pilot will return to the nest so that the observers may make additional observations. Observers shall record nest data as described below for ENIS surveys.

Known nests will be monitored whenever they are encountered during transect surveys. Observers should periodically monitor the transect route on a handheld GPS to avoid missing known nest waypoints. Occasionally nests are difficult to find. Observers should spend no more than 10 minutes searching for a known nest before returning to the survey route. Once nest data are collected for the known nest (described in the Data Recording for ENIS section below), the aircraft and observers will return to the transect to resume the search for known nests.

Data Recording for ENIS

Start by filling in the header information (date, pilot, recorder, etc.; Figure SOP 2-1 and Figure SOP 2-2) before the start of the survey on page one of the data sheets. As new sheets are added, add page numbers to the data sheets so that the sheet order can be maintained. Thus, if there is an issue with a nest ID, you should be able to figure out the correct nest ID based on the order of the nests observed.

ENIS 1 or 2 (circle one)			SWAN Bald Eagle Nest Occupancy Data Sheet										Page ____ of ____	
Date: _____			Park: _____			Recorder: _____			Pilot: _____					
Front Observer: _____ (L or R)			Rear Observer: _____ (L or R)			Aircraft: _____								
(Circle Left [L] or Right [R] position in front and rear seats.)														
S. Unit ID	Nest ID	No. Ads.	Eagle Behav.	Nest Occup.	New	Front Obs.	Rear Obs.	Nest Substr.	Tree Status	Tree Form	Nest Visibility	GPS Time	Comments	
Enter # NA	Enter #	Enter #	None N N F F P P	NA Empty Incubate	NO YES	NO YES	NO YES	Spruce Ctnwd Hemlock Ground	NA Alive Dead Both	Normal top Abnormal top Broken live top Broken dead top	1- high 2- med. 3-low	Enter time		
Enter # NA	Enter #	Enter #	None N N F F P P	NA Empty Incubate	NO YES	NO YES	NO YES	Spruce Ctnwd Hemlock Ground	NA Alive Dead Both	Normal top Abnormal top Broken live top Broken dead top	1- high 2- med. 3-low	Enter time		
Enter # NA	Enter #	Enter #	None N N F F P P	NA Empty Incubate	NO YES	NO YES	NO YES	Spruce Ctnwd Hemlock Ground	NA Alive Dead Both	Normal top Abnormal top Broken live top Broken dead top	1- high 2- med. 3-low	Enter time		
Enter # NA	Enter #	Enter #	None N N F F P P	NA Empty Incubate	NO YES	NO YES	NO YES	Spruce Ctnwd Hemlock Ground	NA Alive Dead Both	Normal top Abnormal top Broken live top Broken dead top	1- high 2- med. 3-low	Enter time		
Enter # NA	Enter #	Enter #	None N N F F P P	NA Empty Incubate	NO YES	NO YES	NO YES	Spruce Ctnwd Hemlock Ground	NA Alive Dead Both	Normal top Abnormal top Broken live top Broken dead top	1- high 2- med. 3-low	Enter time		
Enter # NA	Enter #	Enter #	None N N F F P P	NA Empty Incubate	NO YES	NO YES	NO YES	Spruce Ctnwd Hemlock Ground	NA Alive Dead Both	Normal top Abnormal top Broken live top Broken dead top	1- high 2- med. 3-low	Enter time		
Enter # NA	Enter #	Enter #	None N N F F P P	NA Empty Incubate	NO YES	NO YES	NO YES	Spruce Ctnwd Hemlock Ground	NA Alive Dead Both	Normal top Abnormal top Broken live top Broken dead top	1- high 2- med. 3-low	Enter time		
Enter # NA	Enter #	Enter #	None N N F F P P	NA Empty Incubate	NO YES	NO YES	NO YES	Spruce Ctnwd Hemlock Ground	NA Alive Dead Both	Normal top Abnormal top Broken live top Broken dead top	1- high 2- med. 3-low	Enter time		

(Version 3/2/2016)

Figure SOP 2-1. Early nest initiation survey (ENIS) data sheet

SWAN Bald Eagle Nest Productivity Data Sheet							Page ____ of ____
Date: _____		Park: _____		Recorder: _____		Pilot: _____	
Front Observer: _____		Rear Observer: _____		Aircraft: _____			

Nest ID	No. of Young	No. of Adults	Age 1	Age 2	Age 3	Comments
Enter #	Enter #	Enter #	1a 2 3a 1b 3b 3c 3d	1a 2 3a 1b 3b 3c 3d	1a 2 3a 1b 3b 3c 3d	
Enter #	Enter #	Enter #	1a 2 3a 1b 3b 3c 3d	1a 2 3a 1b 3b 3c 3d	1a 2 3a 1b 3b 3c 3d	
Enter #	Enter #	Enter #	1a 2 3a 1b 3b 3c 3d	1a 2 3a 1b 3b 3c 3d	1a 2 3a 1b 3b 3c 3d	
Enter #	Enter #	Enter #	1a 2 3a 1b 3b 3c 3d	1a 2 3a 1b 3b 3c 3d	1a 2 3a 1b 3b 3c 3d	
Enter #	Enter #	Enter #	1a 2 3a 1b 3b 3c 3d	1a 2 3a 1b 3b 3c 3d	1a 2 3a 1b 3b 3c 3d	
Enter #	Enter #	Enter #	1a 2 3a 1b 3b 3c 3d	1a 2 3a 1b 3b 3c 3d	1a 2 3a 1b 3b 3c 3d	

(Version 3/2/2016)

Figure SOP 2-2. Late productivity survey (LPS) data sheet

The header information on page two and later consecutive sheets can be filled in once the survey is finished. Any corrections made to the data sheets after the survey is completed should be made using a different colored pen so that the edits are readily differentiated from the original (raw) survey data.

Data recording for new nests

New nests are those nests, regardless of actual age, that were not previously included on the list of known nests. Please note that nests are only added to the list of known nests after both ENIS surveys are complete. If a new nest is seen during both the first and second nest initiation surveys, it is treated as a new nest both times. The following data shall be recorded for new nests:

- Name of observer(s) who saw the nest during the initial pass.
- Data pertaining to the nest tree: Species, Status, Form Visibility.
 - o Nest Substrate: Spruce (S), Hemlock (H), Cottonwood (C), Ground (G), or Not Applicable (NA).
 - o Nest Tree Status: Live (L), Dead (D), Live with Large Dead Branches (LD), or Not Applicable (NA).

- Use the GPS to create a waypoint of the nest location. Record an accurate nest position by having the pilot position the aircraft directly above the nest with enough distance between the aircraft and the nest so as to not disturb an incubating adult. This can be done while moving (fixed-wing) or stationary (helicopter). Record the waypoint number.
- Collect data and record eagle nest initiation data described below (i.e., Data to record at all nests).
- Optional data pertaining to the nest tree:
 - o Nest Tree Form: Normal Complete Top (NT), Abnormal Complete Top (AT), Broken Live Top (BL), Broken Dead Top (BD), or Not Applicable (NA).
 - o Nest Visibility: 1 (High visibility), 2 (Medium visibility), 3 (Low visibility), or Not Applicable (NA).
- Record any additional observations that will help in relocating the nest during future visits.

Data to record at all nests

- Unique identifier for the nest: In KEFJ and KATM, the unique ID will be an alpha numeric code consisting of the Sampling Unit ID, and Nest number (e.g. NO-#, AI-#, NW-#, OU-#, or NU-#). The nest numbers are sequential, and new nests will receive the next available number in the corresponding unit. In LACL a geographic code is used. A temporary identifier (e.g. NEW-001) may be used to coordinate field observations for a nest that will be officially named later.
- Number of adults: 0, 1, 2, Not Applicable (NA).
- Behavior for two Eagles: Nesting (N), Flying (F), Perching (P).
- Nest initiation: empty (E), incubating (I), or not found (NL) if nest is missing or not found. Use the code not available (NA) for nests that were missed for other reasons (e.g., weather, GPS malfunction, or observer omission).

Productivity Survey Technique

The LPS consists of a revisit of either all nests found during the ENIS (recommended), or a revisit of only the occupied nests found during the ENIS (minimum requirement). The LPS is generally performed in late July or early August and can employ a single observer, although a second observer can be useful. Aircraft can fly straight paths between each nest, point to point, without searching for additional nests. Data are recorded on the LPS data sheet (Figure SOP 2-2). Observers use a handheld GPS and photos to relocate nests and to determine chick presence or absence, and chick age, if present. Image-stabilizing binoculars may aid in locating chicks and identifying their developmental stage. Observers should check adjacent limbs and the ground around nest for nestlings that have moved out of the nest onto branches or that may have fallen out of the nest. The developmental stage, or approximate age of chicks is determined using the age classes outlined in Carpenter (1990; Figure SOP 2-3 and Figure SOP 2-4). At the time of the LPS, most chicks should be late in development, likely stage 3+ (Carpenter 1990).

Productivity surveys should not be conducted from ground- or boat-based searches. The quality of the data is not equivalent to that generated by aerial surveys, and serves as a poor substitute. For

example, it is not possible to determine the number or age of chicks present in a nest from a ground- or boat-based survey. Using ground or boat-based surveys also introduces a detection problem that is not easy to overcome without repeated observations of many nests. Although it is recommended that all nests with eagles present during either nest initiation survey are revisited, it is better to have missing data than to collect substandard data to compensate for missed nests.

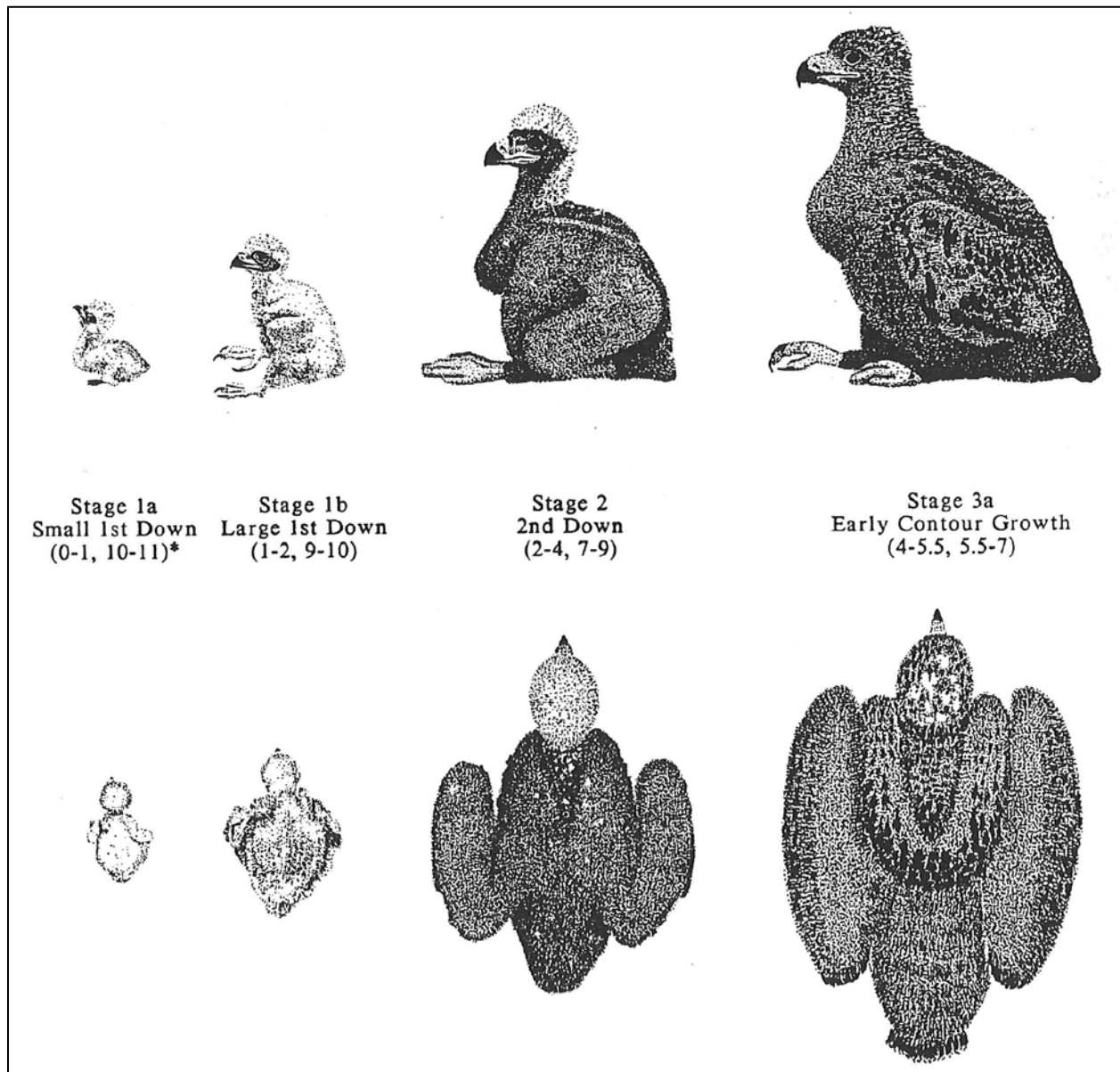


Figure SOP 2-3. Early developmental stages for bald eagle chicks. Diagram from Carpenter (1990). Image reprinted with permission of the artist.

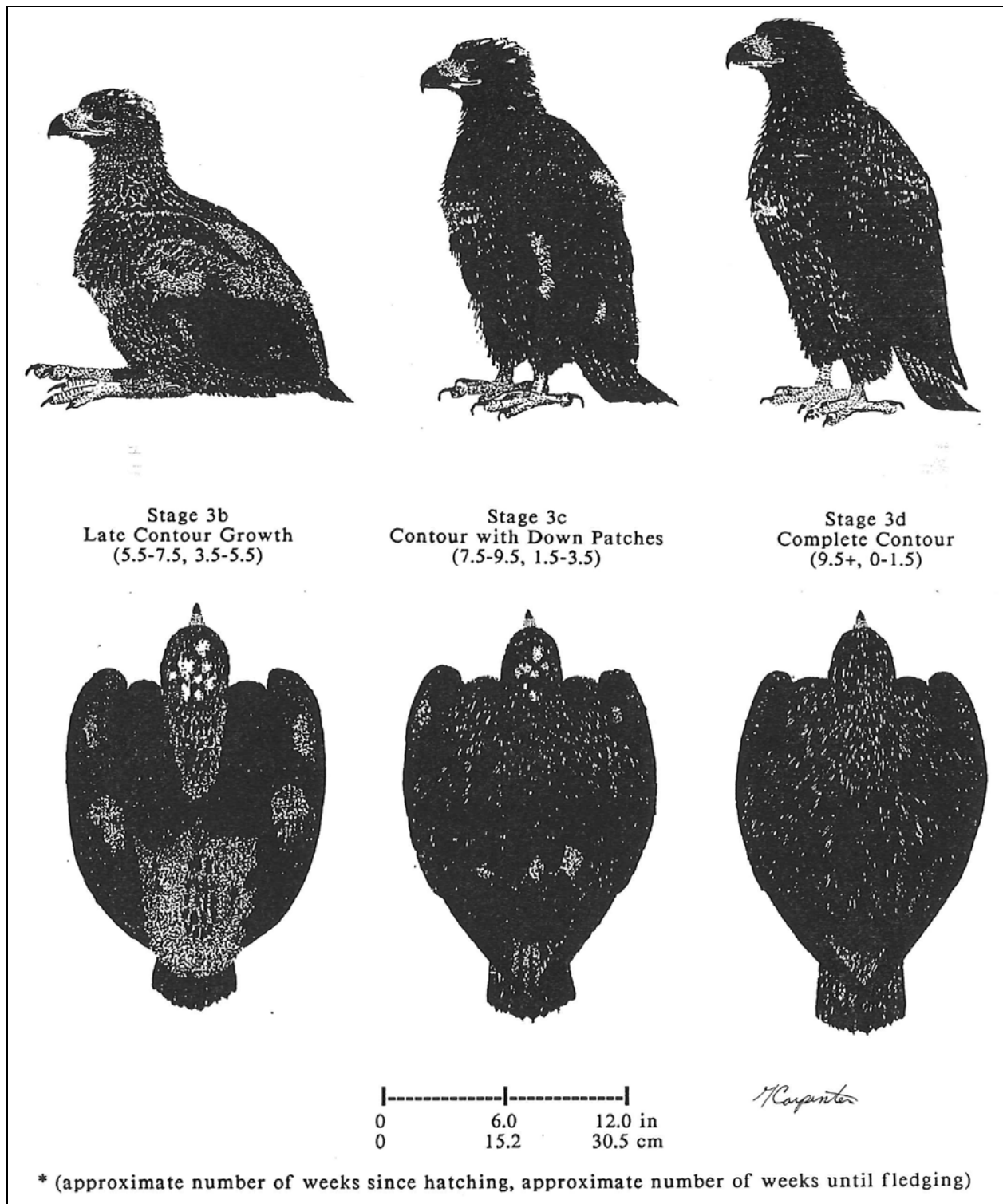


Figure SOP 2-4. Late developmental stages for bald eagle chicks. Diagram from Carpenter (1990). Image reprinted with the permission of the artist.

Data Recording for LPS

Before the start of the survey, fill in the header information (date, pilot, recorder, etc.; Figure SOP 2-2). During the survey, observers will record the number of live chicks in the nest and the number of adults present. Dead chicks are occasionally present in the nest and should not be recorded in the No. of Young column. The number of dead chicks can be noted in the comments section. Dead chicks will appear “flat,” although live chicks will also flatten out in the nest if stressed. The following data will be recorded during the LPS, generally by the backseat observer:

- Nest ID: entered as alpha numeric nest identification code (ex. NO-#, AI-#, NW-#, OU-#, or NU-#).
- Number of chicks (No. of Young): entered as an integer, likely 0, 1, 2, or 3.
- Developmental stage of chicks (Carpenter 1990): use classes shown in Figures SOP 2-3 and SOP 2-4.
 - o 1a = Small 1st down
 - o 1b = Large 1st down
 - o 2 = 2nd down
 - o 3a = Early contour growth
 - o 3b = Late contour growth
 - o 3c = Contour with down patches
 - o 3d = Complete contour stage (Figures SOP 2-3 and SOP 2-4) should be determined and the appropriate code recorded
- Number of adults: entered as an integer, likely 0, 1, or 2.

Once the survey is finished for the day, the header information should be filled out on all data sheets. Also, as with the ENIS, any corrections or edits to the original data should be made using a different color pen so that they are readily distinguished from the original (raw) data.

SOP 3: Data Management for Bald Eagle Monitoring

Version 1.0. February 2017

Change History

Version #	Date of Revision	Revised By	Changes	Justification
1.0	2/3/2017	–	–	Original Version

Suggested Reading

Kéry, M. 2010. Introduction to WinBUGS for ecologists: a Bayesian approach to regression, ANOVA, mixed models and related analyses. Academic Press, Burlington, Massachusetts, USA.

Kéry, M. and M. Schaub. 2012. Bayesian population analysis using WinBUGS: a hierarchical perspective. Academic Press, Waltham, Massachusetts, USA.

Sutter, D. R., S. B. Wainscott, J. R. Boetsch, C. J. Palmer, and D. J. Rugg. 2015. Practical guidance for integrating data management into long-term ecological monitoring projects. Wildlife Society Bulletin 39(3): 451-463.

Wilson, T. L., J. H. Schmidt, W. L. Thompson, and L. M. Phillips. 2014. Using Double-Observer Aerial Surveys to Monitor Nesting Bald Eagles in Alaska: Are all Nests Available for Detection? Journal of Wildlife Management, Wildlife Society.

Wilson, T.L., L.M. Phillips, and B. Mangipane. 2017. Improving bald eagle nest monitoring with a second spring survey. The Journal of Wildlife Management: In press.

Introduction

This SOP describes the steps necessary for handling the field data, completing quality assurance/quality control, data certification, and uploading the data into the bald eagle nest database.

Standardized Field Names and Definitions

Nest initiation survey data

- **Date_O:** Calendar date of survey. The field is a date with the format: day/month/year.
- **Park:** Four letter code of the park unit: KATM = Katmai National Park and Preserve, KEFJ = Kenai Fjords National Park, LACL = Lake Clark National Park and Preserve. Field is character.
- **Pilot_O:** Full name of the pilot. Field is character.
- **FrObserv_O:** Identity of the front seat observer (Last name or initials). This can be the pilot. Field is character.
- **ReObserv_O:** Identity of the rear seat observer (Last name or initials). Field is character.
- **Side_O:** Side of the aircraft from which observations are made. L = left, R = right. Not applicable for tandem aircraft (e.g. super cub).
- **Aircraft_O:** Type of aircraft used for survey. R44II = R44 helicopter, PA18A = supercub, C185 = Cessna 185. Field is character.
- **(Recorder_O:** Observer who recorded the data if different from rear seat observer (Last name or initials). Field is character.) Field is optional.

ENIS nest data

- **SUID:** Transect number derived from GPS track logs of the 2009 bald eagle survey of the entire Kenai Fjords coast. This field pertains to KEFJ data only. The field is numeric with x format. Data ranges from 1-51.
- **Nest_ID:** Unique identifier for a nest. Sequential alphanumeric code that cannot be repeated. KATM and KEFJ use a combination of region and number, LACL uses a numeric code (described here). Field is character.
- **Fobs:** Seen by front seat observer (or pilot). Pertains to the first time a nest is observed. 0 = no, 1 = yes. Field is Boolean.
- **Robs:** Seen by rear seat observer. Pertains to the first time a nest is observed. 0 = no, 1 = yes. Field is Boolean.
- **NestSub:** Nest substrate. S = spruce (e.g., P. Sitchens or P. alba), H = hemlock, C = cottonwood, G = ground. Field is character.
- **TreeStat:** Tree status. L = alive, D = dead, LD = alive with dead branches. Field is character.
- **NestVis:** Nest visibility is a subjective classification of how difficult it was to see the nest. (1 = easy, 2 = moderate, 3 = difficult. Field is numeric.) Field is optional.
- **LAT_DD:** Y coordinate (Latitude) of nest location in decimal degrees. Field is numeric.

- **LON_DD:** X coordinate (Longitude) of nest location in decimal degrees. Field in numeric.

ENIS eagle data

- **NumAds:** Number of adults seen at or near a nest, with 0 meaning no eagles were observed. The eagles do not have to be incubating to be recorded here, therefore unoccupied nests may have a non-zero number. Field is numeric with a missing data code of -999. Field is numeric.
- **AdBehav:** Behavior of adults (up to 2) at a nest. N = 1 adult nesting, P = 1 adult perched, F = 1 adult Flying, NN = 2 adults nesting (rare), PP = 2 adults perched, FF = 2 adults flying, NP = 1 adult nesting and 1 adult perched (also PN), NF = 1 adult nesting and 1 adult flying (also FN), FP = 1 adult flying and 1 adult perched (also PF). N indicated incubating behavior, and the nest must be classified as 'Incubating' in the next field. Field is character.
- **Nest_O:** Nest initiation status. I = 'incubating' (formerly Active), E = 'empty'. Prior to 2009 in KEFJ and 2011 in KATM and LACL there was a third class: 'Occupied' which had fresh signs of eagle nesting, but in which adults were not observed incubating. This class was considered too subjective and eliminated in favor of the binary 'Incubating' and 'Empty' system used today. Field is character. If the nest is not found, enter 'NL' (not located) here. Blank status records will be recorded as 'NA', implying that no effort was made to locate the nest. Field is character.
- **GPS_Time_O:** Time nest observations are made in GMT (Greenwich Mean Time) as measured by the GPS. (Field is numeric.) Data can be obtained from track logs. Field is optional.
- **Comments:** Notable comments. Field is character.

LPS Survey Data

- **Date_P:** Date of productivity survey. Field is a date with format Month/Day/Year.
- **Park:** Four letter code of the park unit: KATM = Katmai National Park and Preserve, KEFJ = Kenai Fjords National Park, LACL = Lake Clark National Park and Preserve. Field is character.
- **Recorder_P:** Observer who recorded the data (Last name or initials). Field is character.
- **Pilot_P:** Full name of the pilot. Field is character.
- **FrObserv_P:** Identity of the front seat observer (Last name or initials). This can be the pilot. Field is character.
- **ReObserv_P:** Identity of the rear seat observer (Last name or initials). Field is character.
- **Aircraft_P:** Type of aircraft used for survey. R44II = R44 helicopter, PA18A = supercub, C185 = Cessna 185. Field is character.

Nest Productivity data

- **NumYng:** Number of chicks observed, with 0 meaning no chicks were observed. Field is numeric with a missing data code of -999.
- **Chick_age [1-3]:** Chick age from chart. If there are additional chicks present, enter the data in a separate column. Field is character.

- **NumAds_P:** Number of adults observed, with 0 meaning no adults were observed. Field is numeric with a missing data code of -999.

Data Handling on Return from Field

Upon completing the survey, first review the data with the crew in order to resolve errors and answer questions. Observers should check the data sheets for the following:

- Check that observer name(s), including pilot, and date of survey have been recorded.
- Check the entered Nest IDs (each nest should only have one record for each survey).
- Ensure the page number and total page numbers are filled out (data sheets).
- Ensure the data sheet is legible to others (data sheets).
- Review the data for errors (typos with codes).
- Observers should discuss error/issues promptly before details are forgotten.
- Observers should correct errors on the data sheet without destroying the original entry. For example, if an entry is incorrect, draw a line through the entry, and use a different color of ink or lead to revise it. As soon as possible, GPS waypoints collected during the survey should be mapped and compared to the official location of nest. If the newly observed and previously recorded (official) coordinates do not align (i.e., they are not in close proximity when mapped, or as close as you can get in a moving aircraft), the observers(s) may have recorded the wrong nest ID, or the official nest location may be erroneous. Observers should review their notes and the order in which nests were observed, which should in turn help to identify the source of the error.
- Data from the data sheets (KATM and KEFJ) will be entered into an existing Microsoft Excel spreadsheet titled ‘BAEA_Year_SURVEY_PARK_raw’ located in the Resource Management archives on the SWAN team drive. If you change the datasheet for any reason, it is important to communicate with SWAN about current datasets.
- For new nests, temporarily assign the ENIS survey (1 or 2) and the waypoint number as the Nest ID.
- Replace the temporary Nest ID with the unique identifier after the nest matching process described below in the Obtaining and Recording New Nest Coordinates section.
- Send updated spreadsheet to SWAN biometrician after each survey.
- Upload new nest GPS points immediately, following directions listed in SOP 1.
- Upload any photos that were taken.

Obtaining and Recording New Nest Coordinates

- Use DRN Garmin to create a separate shapefile of new nests from the first and second ENIS.
- Use the nest tree data, photographs, and proximity of coordinates collected during the first and second ENIS to match nests that may have been encountered during both surveys.
- Assign a unique nest number to new nests by replacing the temporary nest ID in the Excel spreadsheet described above. Positively matched nests will receive the same nest number. Use

the original waypoint number and survey ID (ENIS 1 or 2) to match nests and assign nest numbers.

- Review coordinates to ensure that their locations make sense (i.e., not located in the water),
 - o If both coordinates are valid, take the midpoint of both coordinates to obtain the official nest location.
 - o If only one coordinate seems valid, use that coordinate.
 - o Record the chosen location in ink in the notes of the original datasheets. Initial all edits.
- Record the unique Nest ID in ink on the original datasheet in the Nest ID column for all new nests. Initial all edits.

Archiving data with SWAN

Data sheets should be scanned into a PDF format and archived. If corrections are made on the data sheets, they need to be made in a different color than the original (raw) survey data in order to distinguish data recorded during the survey versus data corrections made after the fact. Scanned and corrected datasheets should be sent to the SWAN data manager for archiving.

Data collected through electronic means or entered into a spreadsheet should be saved as a comma delineated file (csv). After a survey, and before review, correction, and replication of the data file, the .csv should be saved with “*_raw” added to the file name. Once data have been reviewed and errors corrected, the final data set should be saved in a .csv again with “*_YYYYMMDD” (four digit year, two digit month, and two digit day).

Once the data in the .csv have been reviewed and approved, the data will be incorporated into a relational database (under development). All of the data files (scanned data sheets and .csv files) will be copied to an archival DVD for long term storage.

Quality Assurance/ Quality Control

Everyone involved with the project has a role in ensuring that the data are of the highest quality. Those who collect data need to review and verify that the data are error free. The biometrician and data manager will be responsible for developing methods and procedure that will check for logical errors.

Data are currently recorded through multiple methods. The best way to identify and correct errors is to review the data immediately after a survey is finished for the day, while everyone involved is present and able to help resolve any issues found with the data. A nest should only be recorded once for a survey. Check that the values (behavior or chick age) are valid codes. If the data were recorded on data sheets, the hand writing should be checked for legibility and all page header information filled out.

Waypoints collected during the survey should be mapped and compared to the official nest locations. Discrepancies need to be examined and corrected. Confirm the correct number value of a new nest is being used in the Nest ID.

Currently, a relational database to store the data is being developed in MS Access that will allow all of the data to reside in one location and in a standard format. For data collected electronically (or the data sheets transcribed into a formatted Excel file), importing methods will be developed that perform logical checks on the data (to be developed in consultation with the ecologists and statistician). If errors are found, the user will be notified of errors that need to be fixed before the data are imported. Data entry forms will be developed if data are transcribed directly from the data sheets; these will perform the same data checks as the importing methods so that errors are not incorporated into the final version of the data.

Data Certification

Data certification indicates that the data are in their final state or as clean as possible. Reviewing the data and verifying the transcribed data sheet is the first part of the process. The second step of the process is incorporating the data into a relational database and performing logical checks on the data (e.g. a nest has only one record for a survey; codes used for behaviors and chick age do not have typos; number of individuals are in an appropriate range).

After project managers have marked data as certified, any errors found and altered need to be well documented in the database. Include information regarding the error (reason for changing the data), the old and new value, name of person making the change, and the date the change was made.

Data Analysis

Annotated Winbugs code used to analyze bald eagle data is presented below. The first model analyzes annual survey data to generate the proportion of nests initiated in a given year (formerly occupancy) and the mean number of chicks produced for each nest initiated (productivity). The second model presents the dual frame and double observer analyses necessary to estimate the number of nests within the sampled population.

```
#####  
#####  
#####  
#####  
#####
```

```
##### Note this code uses the term occupancy to refer both to the nest initiation  
status and for the  
##### modeling technique used. Users must please read this code carefully.
```

```
#### Hierarchical model using double occupancy data to determine true p, psi, and  
productivity (lambda)  
#### Model created by T.L. Wilson 9 December 2015  
#### Data analyses based on this model were published in: Wilson et al. (in press)
```

```
### Bugs Model  
sink("nest.occ.prod.RE.txt")  
cat("  
  model {  
    # Single season occupancy model for determining bald eagle occupancy and  
productivity  
    # This version of the model originally made for the KEFJ SOTP is a random effects  
model  
    # accounting for state heterogeneity in the transects (groups).
```

```

# Priors
## loop over the number of transects (groups) to generate a priors for psi
(occupancy) and lambda (productivity)
p~dunif(0,1)
for (i in 1:n.groups) {
  alpha.psi[i]~dnorm(mu.psi,tau.psi)
  alpha.lam[i]~dnorm(mu.lam,tau.lam)
}
mu.psi~dnorm(0,0.01) #hyperparameters for random psi
tau.psi<-1/(sigma.psi*sigma.psi)
sigma.psi~dunif(0,5)
mu.lam~dnorm(0,0.01) #hyperparameters for random slopes
tau.lam<-1/(sigma.lam*sigma.lam)
sigma.lam~dunif(0,5)

# Likelihood

# Model for partially observed true nest Occupancy and nest productivity that
uses a 2-visit occupancy design
# to obtain: probability of occupancy for observed nests (psi) and the latent
true occupancy state of all nests (z)
# Treat the true occupancy state as a filter for obtaining lambda from the data,
generating counts for occupied nests
# and using the latent counts to estimate productivity for all occupied nests

for (i in 1:R){ # Start initial loop over
R sites
  prod[i]~dpois(lambda[i]) # getting lambda from data
  log(lambda[i])<-alpha.lam[tx[i]]
  z[i]~dbern(psi[i]) # latent state true occupancy
  logit(psi[i])<-alpha.psi[tx[i]]
  prod.eff[i]~dpois(lambda.eff[i]) #latent count, true productivity
  lambda.eff[i]<-z[i]*lambda[i] #applies lambda to true occupancy

  # Observation model
  for(j in 1:t){ # Start of second loop over t replicates
    # Observation model for the actual observations
    y[i,j]~dbin(p,z[i])
  }
}

# Derived Quantities
lambda.bt<-exp(mu.lam) # Backtransformed
lambda
occupancy.bt<-exp(mu.psi)/(1+exp(mu.psi)) # Backtransformed occupancy
chicks<-sum(prod.eff[]) # Expected number
of chicks produced
occ.nest<-(occupancy.bt)*R # Expected number of
occupied nests
productivity<-chicks/occ.nest # Chicks per occupied
nest

}
",fill=TRUE)
sink ()

```

```
#####
#####
#####
#####
#####

##### Note this code uses the term occupancy to refer both to the nest initiation
status and for the
##### modeling technique used. Users must please read this code carefully.

# This code fits a "double-observer" model with individual
# covariates thought to influence detection probability. The data are the
# active bald eagle nests detected during helicopter surveys of
# the KEFJ coastline during 13-19 May 2009. The two observers were on the
# left sides of the front and back seats of the R44 Clipper II helicopter.
#
# WinBugs code is repurposed multistate code from Kery and Schaub (2012).
# Set up as a data-augmented multistate model where state 1 is the augmented sample, 2
# is an empty nest,
# and 3 is a nest with breeding activity (occupied)
# This required some convoluted coding using the 'max' function to condition on prior
# detection.
# This way only nests detected for the first time contribute to the estimates of
# detection
# All nests contribute to the estimate of the number in each state.
# Code written by J.H. Schmidt and published in Wilson et al. (2014).

sink("multistate_BAEA.txt")
cat("
model {

# Priors
for(w in 1:numyrs){
  int1[w]~dnorm(0,0.01)I(-5,5)
  int2[w]~dnorm(0,0.01)I(-5,5)  }

tau<-1/(sigma*sigma)
sigma~dunif(0.01,10)           # sigmas limited to keep away from 0 boundary
tau2<-1/(sigma2*sigma2)
sigma2~dunif(0.01,10)

for(j in 1:T){
  p2[j]~dunif(0,1)
  p3[j]~dunif(0,1)
}

for(i in 1:51){
  e.trans[i]~dnorm(0,tau)I(-5,5)           #transect level RE for empty nest
  e.trans2[i]~dnorm(0,tau2)I(-5,5)        #transect level RE for occupied nest
}

# Define state vector
for (s in 1:R){
  for(w in 1:numyrs){

    phi[s,w,1]<-1-(max(max(phi.1[s,w,1],prev.det[s,w]),pilot[s,w]))
    # Prob. nest does not exist. If prev.det=1, this state cannot occur.
    phi[s,w,2]<-(max(max(phi.1[s,w,1],prev.det[s,w]),pilot[s,w])) *(1-
(max(phi.2[s,w,2],pilot.occ[s,w])))


```

```

# Prob. of an empty nest. If prev.det=1, nest is always detected, only the
occupancy state is questionable.
phi[s,w,3]<-(max(max(phi.1[s,w,1],prev.det[s,w]),pilot[s,w]))
*(max(phi.2[s,w,2],pilot.occ[s,w]))
# Prob. of an occupied nest

# model statements for phi.1 and phi.2
lPhi[s,w,1] <-int1[w]+e.trans[trans[s]] #change 'w' to 1 to switch to
'incomplete availability' version of the model
Phi[s,w,1]<-1/(1+exp(-lPhi[s,w,1]))
logit(Phi[s,w,2]) <- int2[w]+e.trans2[trans[s]]
phi.1[s,w,1]<-max(0.00001,min(0.99999, Phi[s,w,1]))
phi.2[s,w,2]<-max(0.00001,min(0.99999, Phi[s,w,2]))
}
}

# Define observation matrix
# Order of indices: true state, nestID, time, observed state

for(s in 1:R){
  for (t in 1:T){
    for(w in 1:numyrs){
      p[1,s,t,w,1] <- 1 #if nest does not
      exist, detect that state with p=1
      p[1,s,t,w,2] <- 0
      p[1,s,t,w,3] <- 0
      p[2,s,t,w,1] <- 1-(max(p2[t],prev.det[s,w])) #Prob of not detecting an empty
      nest
      p[2,s,t,w,2] <- (max(p2[t],prev.det[s,w])) #Prob of detecting an empty nest
      p[2,s,t,w,3] <- 0 #No classification
      error
      p[3,s,t,w,1] <- 1-(max(p2[t],prev.det[s,w])) #Prob of not detecting and
      occupied nest
      p[3,s,t,w,2] <- 0 #No classification
      error
      p[3,s,t,w,3] <- (max(p2[t],prev.det[s,w])) #Prob of detecting an occupied
      nest
    }
  }
}

# State-space likelihood
# State equation: model of true states (z)

for(s in 1:R){
  for (w in 1:numyrs){
    z[s,w]~ dcat(phi[s,w,])
    #z[s,w]<-max((z1[s,w]*prev.det.1[s,w]),obs.z[s,w]) }}

# Observation equation
for (s in 1:R){
  for(t in 1:T){
    for (w in 1:numyrs){
      state[s,t,w] ~ dcat(p[z[s,w],s,t,w,])
    }
  }
}
for(w in 1:numyrs){
  mean.1[w]<-mean(phi[,1,w])
  mean.2[w]<-mean(phi[,2,w])
}

```

```

    mean.3[w]<-mean(phi[,3,w])
  }

# Derived quantities
for(s in 1:R){
  for(w in 1:numyrs){
    occ1[s,w] <- equals(z[s,w], 1)
    occ2[s,w] <- equals(z[s,w], 2)
    occ3[s,w] <- equals(z[s,w], 3)

  }
}
for(w in 1:numyrs){
  n.occ[1,w] <- sum(occ1[,w]) # Sites in state 1
  n.occ[2,w] <- sum(occ2[,w]) # Sites in state 2
  n.occ[3,w] <- sum(occ3[,w]) # Sites in state 3
  n.nests[w]<-sum(occ2[,w])+sum(occ3[,w])
  prop.nest[w]<-n.occ[2,w]/n.nests[w]
  prop.occ[w]<-n.occ[3,w]/n.nests[w]
  AI[w]<-sum(test1[w,6:18])
  NO[w]<-sum(test1[w,1:5])
  NU[w]<-sum(test1[w,34:51])
  NW[w]<-sum(test1[w,19:25])
  OU[w]<-sum(test1[w,26:33])
  for(s in 1:R){
    for(k in 1:51){
      test[s,w,k]<-(equals(z[s,w],3))*(equals(trans[s],k))
    }
    for (k in 1:51){
      test1[w,k]<-sum(test[,w,k]) }
    }
  D1.2<-(sum(occ2[,2])+sum(occ3[,2]))-(sum(occ2[,1])+sum(occ3[,1]))
  D2.3<-(sum(occ2[,3])+sum(occ3[,3]))-(sum(occ2[,2])+sum(occ3[,2]))
  D1.4<-(sum(occ2[,4])+sum(occ3[,4]))-(sum(occ2[,1])+sum(occ3[,1]))
  D2.4<-(sum(occ2[,4])+sum(occ3[,4]))-(sum(occ2[,2])+sum(occ3[,2]))
  D3.4<-(sum(occ2[,4])+sum(occ3[,4]))-(sum(occ2[,3])+sum(occ3[,3]))

  R1.2<-(sum(occ2[,2])+sum(occ3[,2]))-
  (sum(occ2[,1])+sum(occ3[,1]))/(sum(occ2[,1])+sum(occ3[,1]))
  R2.3<-(sum(occ2[,3])+sum(occ3[,3]))-
  (sum(occ2[,2])+sum(occ3[,2]))/(sum(occ2[,2])+sum(occ3[,2]))
  R1.4<-(sum(occ2[,4])+sum(occ3[,4]))-
  (sum(occ2[,1])+sum(occ3[,1]))/(sum(occ2[,1])+sum(occ3[,1]))
  R2.4<-(sum(occ2[,4])+sum(occ3[,4]))-
  (sum(occ2[,2])+sum(occ3[,2]))/(sum(occ2[,2])+sum(occ3[,2]))
  R3.4<-(sum(occ2[,4])+sum(occ3[,4]))-
  (sum(occ2[,3])+sum(occ3[,3]))/(sum(occ2[,3])+sum(occ3[,3]))

}
",fill=TRUE)
sink()

```

SOP 4: Reporting Bald Eagle Monitoring Data

Version 1.0. February 2017

Change History

Version #	Date of Revision	Revised By	Changes	Justification
1.0	2/3/2017	–	–	Original Version

Annual Reporting

Resource briefs

Resource briefs will be produced biennially. These briefs will be produced for a non-technical audience, and produced with professional-quality graphics. They present the previous two years of data collected from each park, notable findings from summary/trend reports, and other news items that may be relevant and/or interesting (e.g., unusual observations, relevant policy decisions, recent publications). Examples of resource briefs can be found on the SWAN website:

<http://science.nature.nps.gov/im/units/swan/publications.cfm>.

Multi-year Reports

Every 3-5 years a report summarizing multiple years of data collection will be produced. The report can include: methodological or analytical advancements, trend (time series analysis), or eagle nesting ecology (e.g. nest site selection, fecundity, or survival). This document will be of the quality and caliber to be published in a professionally respected peer-reviewed journal. Publishing in an international journal with >1.5 impact factor is preferred, but respected regional or avian journals can be considered, as well.

SOP 5: Revising the Bald Eagle Monitoring Protocol or SOP

Version 1.0. February 2017

Change History

Version #	Date of Revision	Revised By	Changes	Justification
1.0	2/3/2017	–	–	Original Version

All edits and amendments made to the SOPs should be recorded in the revision history log table at the beginning of this document. Users of this protocol should promptly notify the project leader of the wildlife monitoring program (currently the biometrician) of recommended edits or changes. The project leader will review and incorporate suggested changes as necessary, record these changes in the revision history log, and modify the date and version number on the title page of this document to reflect these changes. It is anticipated that following at least five years of annual data collection it will be important to evaluate, in terms of power and sensitivity, the ability of the sampling design to detect change in the data derived from bald eagle data collection protocols. Following such analyses it may be appropriate to consider revising sampling design or data collection protocols.

SOP 6: Safety Considerations for Bald Eagle Monitoring

Version 1.0. February 2017

Change History

Version #	Date of Revision	Revised By	Changes	Justification
1.0	2/3/2017	–	–	Original Version

Suggested Reading

Department of Interior 2014. Field reference guide for aviation users.

https://www.iat.gov/docs/FRGAU_2014.pdf

Introduction

This SOP describes the safety paperwork, training and communication protocol necessary for conducting fieldwork. A Project Aviation Safety Plan (PASP) must be filed by the project manager. The PASP should be reviewed by all project participants, and a copy should remain in a data clipboard during the survey. This document outlines the specifics of safety and communication during the survey flights which will be detailed in the *Conducting Aerial Surveys* section below.

Use of Aircraft

From a risk assessment perspective, wildlife aerial surveys have a high level of risk. With this in mind, survey operations will be conducted with safety as the priority in personnel decision making processes. The use of aircraft within the NPS is managed by the Department of Interior, National Business Center (NBC), Aviation Management Directorate (AMD). See the DOI Office of Aviation Services (OAS) website: <http://www.doi.gov/aviation>.

The bald eagle survey is considered to be a low level resource reconnaissance flight, and is classified as a special use activity. Flights must be conducted under visual flight rules (VFR), with the following minimum ceiling and wind restrictions: The minimum conditions necessary for the flight are regulated by Federal Aviation Administration. Flights will be conducted in weather conditions with a cloud ceiling above ground level (AGL) of no less than 370 m (fixed-wing) or 152 m (helicopter) and wind speeds no greater than 25 km/hr. These minimum standards are more restrictive than FAA guidelines. All persons who fly in aircraft are required to wear PPE, consisting of a nomex flight suit, aviation helmet with integrated communication hardware, nomex gloves, high-top leather boots, and an inflatable floatation aid containing survival gear in the pockets.

Aviation Safety Training

Required Safety Training for Observers as outlined by AMD/IAT (2016)

Training requirements change frequently. Project leaders, helicopter managers, and fixed-wing special use flight managers should stay abreast of training required to maintain current certification by consulting the Interagency Aviation Training Center (IAT) website, <https://www.iat.gov>. Many aviation courses may be completed online at <http://www.iat.gov>.

- Aviation 100 Basic Airplane and Helicopter Safety (A-100: 8 hours, formerly B-3)
- The initial course is required to be taken in person and an A-100 Refresher is required every 3 years.
- 5 modules are required for the A-100 online refresher course:
 - o A101 Aviation Safety
 - o A105 Aviation Life Support Equipment
 - o A106 Aviation Mishap Reporting
 - o A108 Preflight Checklist & Briefing/Debriefing
 - o A113 Crash Survival
 - o S-271 Helicopter Air Crew Member

Additional Recommended Safety Training for Observers

- Operational Leadership
- A-312 DOI Underwater Egress (Dunker) Training
- CPR/1st Aid/Wilderness Safety

Safety Training Requirements for Other Project Participants

- M3 DOI Aviation Management Training for Supervisors (for project lead or supervisors of field staff)
- S-372 Interagency Helicopter manager

If a helicopter is used, the helicopter flight manager should have completed the required training (S-372 Interagency Helicopter manager) and possess a secure understanding of aviation management including the use of PPE, aircraft contracting, pilot flight time and duty time limitations. Fixed-wing flight managers should obtain all training related to managing special use flights.

Pre-flight safety briefing

The team will complete a go-no go checklist (Aviation handbook pp. 47; Appendix C). Pilots will be required to possess a current AMD certification for low level surveys. If contract aircraft are used, the helicopter or fixed-wing manager will check the pilot and aircraft cards to ensure that the pilot and aircraft are currently certified to fly low level surveys, inspect the condition of the aircraft, and review pilot flight time and duty days. If helicopters are used, the helicopter manager will complete a load calculation. The pre-survey safety briefings should include a review of the field plan and local hazards so the pilot has a firm understanding of the mission and potential hazards (seabird colonies, glaciers, etc.). The pilot will conduct a briefing describing the safety features and protocols of the aircraft. The flight manager (helicopter) or pilot (fixed-wing) will then check in with ARCC to ensure the AFF is working, and open the flight plan. Once these safety items are completed the survey crew will brief the pilot on observation and survey protocols (see SOP 2).

Project Aviation Safety Plan

Each survey requires a project aviation safety plan (PASP) that details all important information about the flight. This document should be available to all participants and supervisors involved in the project. Include critical elements such as:

- Project description, objective, justification and dates.
- Base of operation.
- Description of aircraft, fuel, and communication equipment.
- Detailed communication plan: Emergency Locator Transmitter and Automated Flight Following and schedule of these safety precautions detailing check-ins with ARCC.
- Aerial Hazard Analysis: should detail the physical hazards near base operations and survey sites (e.g. powerlines, towers, large seabird colonies).

- Pre-Accident Plan: a Missing/Overdue Aircraft procedure that is initiated in case of failure to meet a scheduled check-in requirement. The aircraft is considered “overdue” one-half hour after missing a check-in and Aviation Mishap Response Plan will be initiated. Notify necessary personnel via phone (e.g. Chief Ranger, any Park Ranger or Park Superintendent and then the Regional Aviation Manager).
- Risk assessment: Aviation Risk Assessment /Aerial Hazard Analysis (see Risk Management Worksheet in Appendix B).
- Mission briefing, orientation, pre-flight safety briefing, necessary PPE, personal duties and responsibility.
- Air space coordination (potential complications), unimproved landing sites description and necessity.
- Reference to this SOP and the Interagency Helicopter Operations Guide (IHOG) (<http://gacc.nifc.gov/sacc/logistics/aircraft/IHOG.pdf>).
- Signature approval of project leader, supervisors, and park superintendent.

Appendix A: ARCC Flight Plan Form

NPS ARCC FLIP FORM V 3.3 4/4/2013

ARCC AK Region Flight Plan		Dates of Mission: _____ to _____		DOI Flight Manager: _____		☐ Fleet ☐ Vendor	
1. TYPE ☐ VFR ☐ IFR ☐ DVFR	2. AIRCRAFT IDENTIFICATION N-	3. AIRCRAFT TYPE SPECIAL EQUIPMENT	4. TRUE AIRSPEED KTS	5. DEPARTURE POINT	6. DEPARTURE TIME PROPOSED: _____ ACTUAL*: _____	7. CRUISING ALTITUDE	
8. ROUTE OF FLIGHT (USE BOX 26 FOR FLIGHT LEGS)							
3. DESTINATION Airport City		10. EST. TIME ENROUTE HOURS: _____ MINUTES: _____		11. PILOT NAME PILOT PHONE		14. NUMBER ABOARD	
				12. PROJECT MANAGER		13. PARK AVIATION MANAGER	
15. FUEL ON BOARD HOURS: _____ MINUTES: _____		16. ALTERNATE AIRPORT(S)		17. REMARKS (INCLUDE PROJECT AND AVIATION MANAGER PHONE NUMBERS IF NOT ON FILE)			
18. AIRCRAFT COLOR		19. GEAR CONFIGURATION		20. MISSION PURPOSE ☐ PT TO PT ☐ SPECIAL USE ☐ HIGH RECON ☐ OTHER:		21. CRM SCORE (OPTIONAL)	
*FOR ARCC OFFICE USE ONLY							
Additional Information		22. AIRCRAFT HOME BASE (LOCATION, COMPANY AND PHONE)		24. TYPE OF TRACKING (ARCC MUST HAVE ACCESS PRIOR TO FLIGHT) ☐ AFF ☐ Spidertracks ☐ Other:			
		23. AIRCRAFT SAT PHONE ☐ Panel Mount ☐ Handheld		25. ADDITIONAL INFORMATION			
26. FLIGHT SEGMENTS							
Leg - Start		Leg - End		Pax Information:			
1)							
2)							
3)							
4)							
5)							
6)							
7)							
8)							
9)							

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Sat Phone: 8816-3145-8390

Mobile Phone: (907) 378-5751

27. OPTIONAL MANIFEST			
	Passenger Info:	Gear Info:	Weight:
1)			
2)			
3)			
4)			
5)			
6)			
7)			
8)			
9)			
10)			
11)			
12)			
Add. Cargo:			
HAZMAT:		Total Outbound Allowable Payload:	
		Actual Outbound Payload:	
28. REMARKS			

29. OPTIONAL MANIFEST			
	Passenger Info:	Gear Info:	Weight:
1)			
2)			
3)			
4)			
5)			
6)			
7)			
8)			
9)			
10)			
11)			
12)			
Add. Cargo:			
HAZMAT:		Total Outbound Allowable Payload:	
		Actual Outbound Payload:	
30. REMARKS			

Appendix B: Example Risk Analysis Chart

RISK ANALYSIS CHART		
METHOD		
1. Is there an alternative method which would accomplish the mission more safely and/or efficiently (including accomplishment by ground methods)?		No
2. Is the method selected approved and do detailed instructions for safe accomplishment exist?	Yes	
3. Have adequate flight following and communications methods been established?	Yes	
MEDIUM		
1. Can factors of terrain, altitude, temperature, or weather, which could adversely affect the mission's success, be mitigated?	Yes	
2. Will the mission be conducted at low (below 500' AGL) or high altitudes -- can the same objective be achieved by flying at a higher altitude AGL?	Yes	No
3. If low-level flight, have all known aerial hazards been identified during the planning process and are they known to all participants?	Yes	
4. If there is a potential for an airspace conflict (military, media, or sightseeing aircraft), have mitigating measures been taken?	Yes	
5. Have adequate landing areas been identified and/or improved to minimum requirements?	Yes	
MAN (GENERIC)		
1. Is the Pilot properly carded for the mission to be conducted?	Yes	
2. Will the flight be conducted within the Pilot flight time/duty day requirements and limitations?	Yes	
3. Have the minimum number of personnel necessary to accomplish the mission safely been assigned, and do they meet personnel qualifications and experience requirements?	Yes	
4. Will adequate personnel (flight and ground crew) and Pilot briefings be conducted prior to the flight?	Yes	
5. Are users aware that the Pilot-in-command has final authority over any operations conducted involving the aircraft or its occupants?	Yes	
MACHINE		
1. Is the aircraft capable of performing the mission in the environment (altitude, temperature, terrain, and weather) where the operation will be conducted?	Yes	
2. Is the aircraft properly carded for the intended mission?	Yes	

Hazard Analysis
With
Risk Mitigation Measures

Flight Operation	HAZARD/RISK ID	Risk	Risk Mitigation/Control Measures	Residual Risk
Low Level Reconnaissance	Flight operations below 500 feet AGL.	High	Pilot and aircraft carded and approved for mountain and low-level reconnaissance. Perform high-level recon and/or a map recon and/or get local knowledge of area planned for low-level flight ops to identify potential hazards. Maintain safe speed during low-level flight operations. Pilot and passengers wearing appropriate PPE.	Low – pilot's decision
Overwater	Ditching	Medium	Aircraft equipped with fixed utility floats Passengers wearing inflatable PFDs.	Low
Low Level Reconnaissance	Aggressive behavior from Bald Eagles directed at helicopter.	Medium	Pilot and passengers will maintain situational awareness. Maintain safe distance from Bald Eagle nests. Pilot and aircraft prepared for evasive maneuver.	Low

Appendix C: KEFJ Helicopter Pre-Flight Checklist

Kenai Fjords Pre-Flight Checklist

Flight Location:		Date of flight:
Pilot:	A/C N#:	Passengers:
DESCRIPTION	Yes/No	Measures/Mitigations
Weather		
For Fixed-Wing: Is the weather reported as <500' ceiling and <2 statute miles visibility? For Helicopters: Is the weather reported as <500' ceiling and <½ statute mile visibility?		Weather must improve before takeoff
Are winds within safe operating limits for mission? <35 kts (fixed-wing) and <30 kts (rotor-wing)		Wait for winds to diminish or obtain special approval from Aviation Manager
Mission		
Has a flight plan been filed?		File with Denali Comm Center
For Special Use Flights, have you done a GAR or a project aviation safety plan?		Special Use Flights are: fixed wing - low level and undeveloped landing sites; helicopters - all flights except passenger transport.
Is flight following in place?		AFF monitored and position documented every 15 min. Check-ins within 10 min of landing/takeoff. Hourly check-ins if flight-time >1 hr in air, revert to 30 min check-ins if AFF fails
Is there HazMat to be transported?		If yes, does shipper and pilot meet the DOI training requirements to utilize the DOI HazMat exemption; current exemption, ERG, and DOI HazMat guide onboard AC. Bear Spray, gas, & propane are HazMat.
Has the pilot been briefed on the mission and all pertinent data?		Load, fuel, hazards, route of flight, intermittent stops, policy requirements.
Flight leader will ensure the pilot conducts a pax safety briefing prior to take off.		Flight does not proceed until briefing is completed.
Crew		
PPE available for all passengers?		Fixed wing special use and helicopter flights require: Flight helmet, nomex clothing, leather or nomex gloves, ankle high leather boots, and survival vests (or equivalent) required (PFD-equipped over water) unless PPE waiver in place.
Do the employees involved meet the aviation training requirements?		Any/all discrepancies must be reviewed by the Aviation Manager prior to continuation of flight.
Aircraft/Pilot		
Is the aircraft equipped with a working AFF?		Portable AFF as backup
Is the aircraft equipped with a satellite phone?		Bring satellite phone if you will be out of park radio contact for any part of your mission
Have park radio frequencies been loaded into aircraft radio and tested?		Bring hand-held park radio (with helmet adapter) as backup
Are the aircraft and pilot approved/carded for the mission?		If not, terminate the flight operations.
For helicopters: has a load calc been completed? Are you within allowable limit?		
Flight Lead Signature:		

Appendix D: KEFJ Nest Book

A nest book is optional, but can be useful to help observers locate nests that are difficult to find. Park ecologists and technicians create, store, and maintain the nest book. In KEFJ, the nest book includes labeled photos of all known bald eagle nests, including a close-up of the nest tree and a landscape perspective shot to provide context. In the example shown (Figure D-1), a red arrow indicates the nest in the photo. If a nest book is used, observers should ensure that all known nests are included prior to the survey by comparing the most recent list of known nests with the photos in the nest book.



Figure D-1. Example of distant perspective photo from the nest book for KEFJ. The nest site identifier is shown in the lower left corner. The red arrow indicates the location of the nest in a stand of Sitka spruce.

Preparing Photos for the Nest Book

Follow directions to create arrows for new nest photos to include in nest book:

- Open the photo using software that allows image manipulation.
- Choose arrow symbol.
- Choose an arrow color. Use a color that will easily stand out against the background colors of the image (e.g., red or yellow). Make sure the background is transparent.
- Drag to resize the arrow and place so that it points to the nest.
- Save the file in an updated folder for that survey year (keep originals and updated files separate).

- Perform this operation for both the close-up and distant perspective photos.

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

NPS 953/136180, February 2017

National Park Service
U.S. Department of the Interior



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