U.S. Fish and Wildlife Service

Draft

Environmental Assessment

2022 Eagle Take Permit Rulemaking

Prepared by

U.S. Fish and Wildlife Service
Migratory Birds and Habitat Program

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Contents

FIGURES

TABLES

ABBREVIATIONS

2009 Eagle Rule	Eagle Permits; Take Necessary To Protect Interests in Particular Localities; Final Rules. (74 FR 46836, September 11, 2009)
2016 Eagle Rule	Eagle Permits; Revisions to Regulations for Eagle Incidental Take and Take of Eagle Nests (81 FR 91494, December 16, 2016)
A&M	Avoidance and Minimization
ANPR	Advanced Notice of Public Rulemaking
APHIS	Animal and Plant Health Inspection Service
APLIC	Avian Power Line Interaction Committee
BAEA	Bald Eagle
BCC	Bird of Conservation Concern
CET	Cumulative Effects Tool
CFR	Code of Federal Regulations
DOI	Department of Interior
EA	Environmental Assessment
Eagle Act	Bald and Golden Eagle Protection Act
ECP	Eagle Conservation Plan
EMU	Eagle Management Unit
EPOP	Eagle Protection and Offset Program
ERA	Eagle Relative Abundance
ESA	Endangered Species Act
FR	Federal Register
GOEA	Golden Eagle
GPP	General permit Program
GPS	Global Positioning System
GSM	Global System for Mobile communications
HPAI	Highly Pathogenic Avian Influenza
HV	Hazardous Volume
ILF	In-Lieu Fee
IMR	Injury and Mortality Reporting
IPaC	Information for Planning and Conservation

IPM	Integrated Population Model
LAP	Local Area Population
MBTA	Migratory Bird Treaty Act
NEPA	National Environmental Policy Act
PEIS	Programmatic Environmental Impact Statement for the Eagle Rule Revision (USFWS 2016b)
NER	National Eagle Repository
NHPA	National Historic Preservation Act
NOI	Notice of Intent
REA	Resource Equivalency Analysis
ROD	Record of Decision
Service	U.S. Fish and Wildlife Service
UAV	Unmanned Aerial Vehicle
USFWS	U.S. Fish and Wildlife Service

Chapter 1.0 Introduction

Environmental Assessment Overview

We, the U.S. Fish and Wildlife Service (Service), are proposing to revise the eagle permit regulations that authorize the incidental take of bald and golden eagles and take of eagle nests pursuant to the Bald and Golden Eagle Protection Act (Eagle Act; 16 United States Code [U.S.C.] §§ 668–668d). The Service's proposal to revise these regulations is a discretionary Federal action that is subject to the National Environmental Policy Act (NEPA) (42 U.S.C. § 4321 et seq.). This Environmental Assessment (EA) is tiered to the Final Programmatic Environmental Impact Statement for the 2016 Eagle Rule Revision (PEIS; USFWS 2016b; https://www.fws.gov/media/final-programmatic-environmental-impact-statement-eagle-rule-revision).

Our proposed action and preferred alternative is to revise our eagle permit regulations to include a general permit option for land-based wind energy facilities, power line entities, activities with the potential to disturb eagles, and nest removal activities. This is Alternative 4 below. Eligibility for general permits would be different for each activity type. Specific permits would be required for any applicant whose project or activity does not qualify for a general permit, and an option for any applicant that does not wish to apply for a general permit. Three alternatives to the proposed action analyzed in this EA are to leave existing regulations "as is," also called the No Action Alternative (Alternative 1), to revise regulations to include a general permit available for land-based wind energy facilities only, with eligibility based on distance from eagle nests and a flat, per-project fee for mitigation (Alternative 2), or to revise regulations to include a general permit available for land-based wind energy facilities only, with eligibility based on eagle relative abundance and distance from nests and mitigation fees based on the hazardous area of the project (Alternative 3). None of these alternatives propose to alter the management framework for eagle permits set forth in the 2016 PEIS to ensure authorized take is compatible with the preservation of bald and golden eagles as required by the Eagle Act and defined at 50 CFR 22.6.

Background

The Eagle Act prohibits take of bald eagles and golden eagles except pursuant to federal regulations. The Eagle Act allows the Secretary of the Interior to issue regulations to authorize the "taking" of eagles for various purposes, including the protection of "other interests in any particular locality." The PEIS (USFWS 2016b) described the specific laws affecting eagles and other environmental resources in Section 1.6, which we incorporate here by reference.

The Service promulgated regulations establishing two new permit types for take of eagles and eagle nests in 2009 (74 FR 46836, September 11, 2009, "2009 Eagle Rule"), then revised those regulations in 2016 (81 FR 91494, December 16, 2016, "2016 Eagle Rule" (USFWS 2016a)). The purpose of the incidental take permit regulations established under the 2016 Eagle Rule was to authorize take of bald eagles and golden eagles that met the following criteria: compatible with the preservation of the bald eagle and the golden eagle; necessary to protect an interest in a particular locality; associated with, but not the purpose of, the activity; and cannot practicably be avoided. A full background of eagle incidental take regulations prior to the 2016 Eagle Rule can be found in the PEIS, Section 1.2 (USFWS 2016b).

The Record of Decision (ROD) for the 2016 Eagle Rule (USFWS 2016d) described the Service's decision to revise aspects of our eagle-management program, as described in Alternative 5 of the PEIS. The 2016 Eagle Rule and PEIS established the following:

> Eagle management units (EMUs) for bald eagles were aligned with the Atlantic, Mississippi, Central, and Pacific flyways used by the Service and its partner agencies to manage other species of birds, with the Pacific Flyway divided into three EMUs: southwest, mid-latitude, and Alaska. EMUs for golden eagles also follow the flyways, with the Mississippi and Atlantic flyways combined into one EMU.
>
> Unmitigated take limits set at 0% for golden eagles and 6% of populations for bald eagles in most EMUs, with lower rates in the Southwest (3.8%).
>
> Incidental take permits can be issued for up to 30 years, with permit reviews every five years.
>
> Compensatory mitigation is required for take authorization that exceeds EMU take limits and may be required for some permits authorizing take that exceeds local area population (LAP) take limits. Compensatory mitigation is also required if necessary for the permit to be compatible with the preservation of eagles.
>
> Compensatory mitigation will be required to offset take at a minimum ratio of 1:1 for bald eagles and 1.2:1 for golden eagles for take that exceeds EMU take limits.
>
> The definition of "compatible with the preservation of eagles" was modified to incorporate greater protection at more local scales.
>
> The LAP cumulative effects analysis was incorporated into the regulations.
>
> The permit administration fee to support the Service's ability to conduct the five-year evaluations for longer-term permits is assessed at $8,000 every five years (changed from $15,000 in the May 6, 2016 proposed rule).

Evaluation of eagle incidental take permit applications under the current regulations requires project-specific review. Additional review is required for permits with a duration longer than five years (long-term permits), typically including review of an applicant-written Eagle Conservation Plan (as described in the Eagle Conservation Plan Guidance for land-based wind energy facilities (USFWS 2013)). This plan aids applicants in conserving Bald and Golden Eagles during the siting, construction, and operation of wind energy facilities. Our current assessment of collision risk for eagles at wind energy facilities includes the use of a Bayesian collision risk model (New et al. 2021). This model estimates the annual number of eagle fatalities based on eagle use of the project area, the collision probability, the amount of hazardous space created by turbines, turbine operational time, and estimated fatalities, while accounting for uncertainty.

During our review of permit applications under the current regulations, the Service sets project-specific conditions, which typically fall into five different categories: limits to take authorizations, avoidance and minimization of take, compensatory mitigation, fatality monitoring, and adaptive management. For all permits with a duration longer than five years, qualified, independent third parties approved by the Service must monitor to assess project impacts to eagles and the effectiveness of avoidance and minimization measures. Applications for eagle incidental take permits for wind facilities must also include pre-construction eagle survey information collected according to standards set in the regulations, subject to waiver by the Service under exceptional circumstances.

For projects that exceed EMU take limits, compensatory mitigation is required for the permit to be compatible with the preservation of eagles. Examples of compensatory mitigation activities could include retrofitting power poles to reduce eagle electrocution rates, removing road-killed animals along roads where vehicles hit and kill scavenging eagles, or reducing lead levels in carrion or offal. To date, the Service has only approved one compensatory mitigation activity – power pole retrofits, but we are assessing others and expects to approve other methods in the future based on what we learn from case-by-case approvals. The Service, in partnership with the Department of Interior (DOI) Office of Policy Analysis, developed a Resource Equivalency Analysis (REA) tool for calculating the compensatory mitigation needed to offset permitted take (via direct mortality, disturbance, or territory loss) using power pole retrofits. The REA outputs estimate the number of high-risk poles that would need to be retrofitted for a given number of eagles taken under a permit (calculated as a debit in Present Value Bird-Years). Currently, two programs, the Eagle Protection and Offset Program (EPOP) and the Bald Eagle and Golden Eagle Electrocution Prevention In-lieu Fee Program (Eagle ILF Program) are approved by the Service to sell compensatory mitigation credits for bald and golden eagle take.

Permitting projects for long-term incidental eagle take requires the Service to make a set of recurrent decisions while factoring in uncertainty about siting, design, operation, and compensatory mitigation. The Service attempts to account for uncertainty in those decisions through a process of adaptive management (1.6.11 Department of Interior Departmental Manual 522 DM 1 Adaptive Management Implementation Policy). The purpose of adaptive management is to improve long-term management outcomes, by recognizing where key uncertainties impede decision making, seeking to reduce those uncertainties over time, and applying that learning to subsequent decisions (Walters 1986). For long-term eagle incidental take permits, administrative check-ins between the Service and permit-holders are currently required at least every five years to determine whether changes are warranted to permit conditions, such as revision of the estimated fatality rate, adjustments to monitoring or compensatory mitigation, and implementation of additional conservation measures.

To date, the Service has issued 29 long-term permits for incidental take (killing/injury) of eagles, including two permits issued under Section 10 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. §§ 1531-1543). Nine of these permits were issued under the initial 2009 Eagle Rule – eight to wind facilities and one to a military installation. Twenty of these permits were issued under the 2016 Eagle Rule to 18 wind energy facilities, one solar energy facility, and one mine. Our processing of applications for these permits has accelerated in recent years, with 24 of the 29 permits being issued since the beginning of 2019.

Preservation Standard

The Eagle Act allows the Secretary of the Interior to issue permits for the taking of bald and golden eagles, but it requires that "the take is compatible with the preservation of the bald eagle and the golden eagle" (16 U.S.C. 668a). This statutory requirement ensures the continued protection of the species while allowing for some impacts to individual eagles. To aid in evaluating whether authorized take at an individual project meets this criteria, the 2009 Eagle Rule established a regulatory "preservation standard," stating that "compatible with the preservation of the bald eagle or the golden eagle" means "consistent with the goal of stable or increasing breeding populations." The 2016 Eagle Rule updated that definition, defining the preservation standard to mean "consistent with the goals of maintaining stable or increasing breeding populations in all eagle management units and the persistence of local populations throughout the geographic range of each species." The revised preservation standard sought to ensure the persistence of bald and golden eagle populations over the long term with sufficient distribution to be resilient and adaptable to environmental conditions, stressors, and likely future altered environments, and to better align with State and tribal interests in local eagle population management.

When analyzing the impacts of a project for a potential eagle incidental take permit, the Service analyzes the project's expected impact to eagles within the EMU and within the LAP. These scales of analysis were established in the PEIS (USFWS 2016b). If permitting a project would result in the total amount of authorized take exceeding 9% and 7% of the estimated total LAP size for bald and golden eagles respectively (or 5% of the estimated total LAP size for bald eagles in the southwest EMU), the Service would not authorize that take unless additional analysis demonstrates that permitting take over those percentages is compatible with the preservation standard. In some cases, compensatory mitigation could be required for bald eagles or additional, targeted mitigation within the LAP could be required for golden eagles to meet the preservation standard. *Note: At the time of publication of the PEIS, LAP thresholds were 6% and 5% for bald and golden eagles, respectively, and were 5% for bald eagles in the southwest EMU (USFWS 2016c). These values were recently updated to 9% in all of the United States except for the Southwest bald eagle EMU and 7%, respectively, based on updated population assessments (USFWS 2021a and USFWS 2022a, respectively)*. Updated bald eagle populations estimates did not include data from the southwestern United States, thus, LAP thresholds there remain at 5% for bald eagles.

Baseline Population Size and Baseline Take

The baseline population size for both species, which is our threshold for determining if the preservation standard is met, is estimated eagle populations in 2009. In other words, we use our 2009 population estimates for both species to determine if authorized take is (or will be) consistent with stable or increasing breeding populations. Take authorizations that may cause eagle population declines of either species relative to 2009 population estimates would not be consistent with our preservation standard and would require compensatory mitigation before the Service could authorize take. The Service has set take thresholds for each EMU that represent take levels that, if exceeded, would be inconsistent with our preservation standard (Section 1.5). Because 2009 population estimates for both species serve as our baseline, any infrastructure that was on the landscape prior to September 11, 2009 (the date the first incidental eagle take regulation was published) and is still operating with the same risk to eagles since that date is considered "baseline infrastructure." Any eagle take occurring at baseline infrastructure is considered "baseline take." Baseline take, like any take of eagles, remains unlawful and still must be permitted. However, baseline take that is authorized by the Service does not need to be deducted from EMU thresholds and, thus, authorizations for baseline take do not require compensatory mitigation to be consistent with our preservation standard.

EMU Thresholds

The 2016 Rule Revision, and associated PEIS, established species-specific thresholds for each EMU (USFWS 2016b, 2016c). These thresholds represent unmitigated take limits for each species and were set at 0% for golden eagles and 6% of populations for bald eagles in most EMUs, with lower rates in the Southwest (3.8%). Recently, the Service formally updated its population-size (USFWS 2021a) and allowable-take estimates (USFWS 2022a) for bald eagles in four of six bald eagle EMUs. The methods and approaches for these updates are presented in Zimmerman et al. (2022). Population sizes, status, and EMU thresholds (also called take limits) are discussed in greater details in Chapter 4 of this document.

Chapter 2.0 Purpose and Need

Purposes and Need for Federal Action

The Service is proposing rulemaking with the purpose of improving the system of regulations for authorizing eagle incidental take and eagle nest take. The Service needs to improve the current regulatory system because, despite previous efforts to improve our permitting program in 2013 and 2016, participation by some industries remains low. Projects that take eagles or have a significant risk of taking eagles are continuing to be built and operated without a permit. This has resulted in an increase in the number of projects that take eagles across the landscape without implementation of the avoidance and minimization, mitigation, and monitoring activities that would be required under an incidental-take permit. As with our rule-revision efforts in 2013 and 2016, the Service's purpose here is to increase the conservation benefits provided to both eagle species by encouraging increased participation in eagle incidental-take permitting and improving our efficiency in reviewing permit applications and administering permits.

To achieve this purpose, the Service has developed three reasonable alternatives (Action Alternatives) that meet the following criteria:

> Amend aspects of the existing permitting process that were viewed as barriers to participation by members of the regulated community or that created unnecessary work for the Service, thus improving conservation for both eagle species throughout their ranges by increasing the number of current and future projects and actions on the landscape that are operating under a permit.
>
> Prioritize our resources on processing permit applications for projects that have the highest or most uncertain risks to eagles, thus focusing eagle conservation efforts where it will be most beneficial to eagles.
>
> Reduce Service resources spent processing permit applications for projects where risk to eagles is likely to be low and more predictable, and where permit application review and conditions can be standardized.
>
> Allow for consistent and efficient administration of the eagle incidental take permitting program by Service staff, and increased predictability and certainty for applicants.

Encourage siting of wind energy facilities to avoid areas of the country where eagle risk and potential impacts to eagle populations are high.

Ensure implementation is consistent with the Service's preservation standard, defined at 50 CFR 22.6.

Use the best available science and data.

Tiered EA

This EA tiers to the Service's 2016 PEIS (USFWS 2016b). The selected alternative in the 2016 PEIS ensured that permit decisions are consistent with the preservation standard by conservatively assessing the risk posed by uncertainty. This ensured that the effects of eagle take permitting are more likely to be beneficial than harmful to eagles. Any rulemaking action undertaken by the Service must be consistent with the selected Alternative, Alternative 5, described in that PEIS and in the corresponding Record of Decision (ROD), which was signed by the Service Director in December 2016.

We analyze three Action Alternatives in this EA that will achieve the Service's purpose and need. To ensure that the action alternatives are consistent with the 2016 PEIS and ROD (i.e., are consistent with our established preservation standard), each alternative must meet the following criteria:

Implement a permitting framework that will not authorize eagle take in excess of applicable EMU take limits (i.e., will not have a significant impact on bald and golden eagle populations).

Allow the Service to assess the amount of authorized take at the LAP scale, such that authorized take in excess of 9% or 7% of the LAP, for bald eagles and golden eagles respectively, is flagged and receives additional analysis by the Service. Compensatory mitigation targeted to a particular LAP may be necessary for authorized take in excess of those thresholds to remain compatible with the preservation standard. *Note: At the time of publication of the PEIS, LAP thresholds were 6% and 5% for bald and golden eagles, respectively (USFWS 2016c). These values were recently updated to 9% and 7% based on updated population assessments (USFWS 2021a and USFWS 2022a, respectively)*.

Require that each permittee avoid and minimize the permitted activity's impacts on bald and golden eagles to the extent practicable.

Require compensatory mitigation for golden eagles at a minimum ratio of 1.2:1.

Require implementation of compensatory mitigation using methods that will offset all projected take and for which necessary metrics to calculate the achievement of that offset have been analyzed and established.

Based upon this analysis and application of the criteria provided in the PEIS, we have determined that tiering to the PEIS is appropriate and that an environmental assessment is the correct level of NEPA review. We do not expect any of the action alternatives to result in significant impacts to the human environment. This EA incorporates the PEIS by reference.

Authorities and Statutory and Regulatory Framework

The Service has jurisdiction over a broad range of fish and wildlife resources. Service authorities are codified under multiple statutes that address management and conservation of natural resources from many perspectives including, but not limited to, the effects of land, water, and energy development on fish, wildlife, plants, and their habitats. One of those statutes administered by the Service is the Eagle Act (16 U.S.C. §§ 668–668d). In addition, the PEIS has a list of authorities that may apply to this action (PEIS Section 1.6, pages 7–12), which are incorporated by reference here.

Scope of Analysis

This EA considers and analyzes the effects of four alternatives on the natural and human environment. The primary focus of the analysis is on the effects of our rulemaking action on bald and golden eagles and the Service's continued ability to ensure eagle incidental take permitting is consistent with our eagle preservation standard.

Geographic Extent

The effects associated with each alternative are discussed in the context of two geographic scales – both briefly described below and discussed and described in detail in the PEIS. The Service evaluates potential impacts on eagle populations at both scales to determine consistency with our preservation standard.

Eagle management unit (EMU) – An EMU is defined as "a geographically bounded region within which permitted take is regulated to meet the management goal of maintaining stable or increasing breeding populations of bald or golden eagles." The EMU is the largest geographic scale over which permitted take is regulated to meet our management objective (USFWS 2016b). As described in the PEIS, EMUs for both species are defined, with some modifications, by the four administrative flyways used by State and Federal agencies to administer migratory bird resources: the Atlantic, Mississippi, Central, and Pacific flyways. For Bald Eagles, the Pacific Flyway is divided into three EMUs: southwest (south of 40 degrees N latitude), mid-latitude (north of 40 degrees to the Canadian border), and Alaska. For Golden Eagles, the Mississippi and Atlantic flyways are combined as one EMU (USFWS 2016b).

Local-area population (LAP) – The LAP is the population of eagles within a set distance from the project footprint. This distance is different for each species and is based on each species' natal-dispersal distance. Details on the selection of these distances can be found in USFWS (2016b). The distances assigned for each species are 138 km (86 miles) for Bald Eagles and 175 km (109 miles) for Golden Eagles.

The geographic scope of the analysis of effects on other resources addressed in this EA (see Chapter 4) is based on what is biologically meaningful for each resource in the context of the potential effects of the proposed rulemaking.

PRIMARY RESOURCES AFFECTED

Eagle incidental take permits issued by the Service are not a prerequisite to construction and operation of a project or activity but are required to ensure legal compliance with the Eagle Act if eagle take occurs. Take of eagles without a permit may result in an enforcement action and potential prosecution. Consequently, this proposed rulemaking, regardless of the alternative selected, is not anticipated to affect the number of wind energy facilities, power line projects, or other projects/activities that will be proposed, constructed, and operated on the landscape. Indeed, after over a decade of experience issuing eagle incidental take permits, the Service has infrequently, if ever, observed that project or activity proponents decide not to construct projects or undertake activities because they did not possess an eagle take permit. In our experience, particularly in the case of wind energy facilities, project proponents often elect to construct their projects first, and then apply for a permit (if they apply at all). Although it is not anticipated to alter the amount of wind energy facilities on the landscape, our goal with this rulemaking is to encourage the siting of wind projects in localities where eagle abundance is relatively low. As discussed in Chapter 5, we anticipate this will have a positive impact on eagle populations across the landscape.

We anticipate that our decision and selected alternative will have environmental impacts primarily on two wildlife resources – eagles and migratory birds. These effects are analyzed and discussed below. Additionally, we discuss the potential effects of our decision on species listed as threatened or endangered, or proposed to be listed as threatened or endangered, under the ESA (hereafter listed species), tribal and cultural resources, and socioeconomics. We do not anticipate that implementation of the action alternatives will have any other effects on the human environment.

Tribal Trust Coordination

Many federally recognized tribes have interests that could be affected by this rulemaking. Our regional tribal liaisons sent notifications to all federally recognized tribes in their regions in September 2021 informing them of the Advanced Notice of Proposed Rulemaking (ANPR) for this rulemaking, offering government-to-government consultation if requested, and encouraging tribes to review and comment on our proposal.

On October 14 and 21, 2021, the Service held webinars that were restricted in attendance to only federally recognized tribal members, with the purpose of informing tribes of the proposed action and soliciting input and feedback. In these webinars, tribal representatives were invited to ask questions and seek clarifications on our proposal. In addition, we sent letters through our regional offices inviting tribes to engage in this proposed action via the government-to-government consultation process. We intend to conduct additional Tribal-only webinars as part of the proposed rule scoping process. During the comment period on the ANPR, we received comments from seven Tribes or Tribal groups. These letters were reviewed, and comments incorporated into the proposed rule and this EA as appropriate.

Public Participation

On September 14, 2021, the Service published an ANPR to inform the public of changes the Service is considering for expediting and simplifying the permit process authorizing incidental take of eagles. This ANPR also served as the Notice of Intent (NOI) for the Service to prepare a draft environmental review document pursuant to NEPA. The Service used this NOI to notify federal and State agencies, tribes, and the public of our intentions to evaluate the potential environmental impacts of the proposed action.

In the ANPR/NOI, we invited input from other federal agencies, State agencies, Tribes, and nongovernmental organizations for any pertinent issues we should address, including alternatives to our proposed approach for authorizing eagle incidental take. The public comment period for both documents was open until October 29, 2021.

During the public comment period, we received 1,899 distinct comments on the ANPR and NOI. Many comments included additional attachments (e.g., scanned letters and supporting documents). These comments represented the views of multiple Federal and State agencies, private industries, non-governmental organizations, and private citizens. In addition to the individual comments received, multiple organizations submitted attachments representing individuals' comments, form letters, and signatories to petition-like letters representing almost 1,804 signers.

Chapter 3.0 Alternatives

Introduction

This chapter describes alternatives to our proposed action and alternatives that were considered but eliminated from detailed analysis. We evaluate each alternative to determine whether it meets our eagle preservation standard and to analyze the impacts to the human environment, including eagles, impacts to socioeconomics, and other relevant impacts.

Proposed Changes Across All Alternatives

BASELINE GOLDEN EAGLE TAKE IN THE EASTERN UNITED STATES

Associated with this rulemaking, the Service is clarifying that the concept of baseline take applies to golden eagle take that was occurring East of the 100th Meridian prior to September 11, 2009 (i.e., finalization of the Service's 2009 Eagle Rule). In other words, take authorized in the Eastern golden eagle EMU that is (or would be) considered part of baseline (see section 1.4) will not be deducted from EMU take limits and, thus, will not be subject to an offsetting mitigation requirement as long as take authorizations within the LAP are consistent with our preservation standard.

In the 2016 PEIS, the Service assumed a policy that baseline take would not apply to this population. This position represented a cautious approach to expanding the availability of golden eagle take authorization to the Eastern EMU. In the intervening years, the Service has not issued any permits for incidental take of golden eagles in this management unit. Biological evidence also indicates that the Eastern golden eagle population has remained relatively stable through recent decades (Dennhardt et al 2015, Farmer et al 2008). The Service currently applies a baseline standard to pre-September 11, 2009 golden eagle take in the Western U.S., as well as bald eagle take anywhere in the U.S. that was occurring prior to this date. By broadening the baseline standard to apply to Eastern golden eagles, we intend to establish a nationally consistent policy based squarely in biology. Because no nest or incidental take permits have been issued to date for golden eagles in the Eastern EMU, this clarification will have no environmental impacts compared to the no-action alternative other than to encourage compliance from existing and future projects.

OBSERVED NEST DISTURBANCE RATE

Although not a change to the regulation, the Service will change our policy on the number of eagles debited from EMU limits and LAP thresholds for bald eagle nest disturbance permits, based on updated best available information. Presently, the Service conservatively assumes that bald eagle nest disturbance authorized under permits results in an annual loss of breeding productivity equivalent to 1.33 bald eagles (estimated annual productivity at the 80th quantile) per territory in all of the lower 48 United States, except the southwest. In the southwest, we assume a value of 0.95 bald eagles (estimated annual productivity at the 80th quantile). However, a recent Service analysis of annual reports submitted under past nest disturbance permits indicates that disturbance, as defined in the regulations, is not observed at a relatively high percentage of authorized nests. Specifically, the Service conservatively estimates (at the 80th quantile) that 19.5% of used nests authorized for disturbance nationwide are unproductive (see Appendix A). This analysis offers a glimpse into the actual loss to bald eagle populations associated with nest disturbance permits. Thus, this information can be used to update the observed nationwide bald eagle take rate under nest disturbance permits from an assumed 1.33 bald eagles per year, to 0.26 (1.33 * 0.195) bald eagles per year. Using this observed rate of take allows us to reflect the impacts of our bald eagle nest disturbance permits (general or specific) more realistically on the respective EMU limits and LAP thresholds for bald eagles. Note that this policy change only applies to bald eagle nest disturbance permits at this time and excludes permits issued in the southwest EMU, where we did not have large sample sizes for this analysis and thus will conservatively keep the take debit equal to 0.95. The Service does not have adequate information to assess this observed rate of take for golden eagle nest disturbance permits or any nest removal permits.

UNPERMITTED TAKE THRESHOLD

Also associated with this rulemaking, we propose to remove the ten-percent unauthorized mortality LAP threshold that we introduced with the 2016 Eagle Rule. Our intent in creating this threshold was to further assure the sustainability of authorized take by factoring in the cumulative impacts of unauthorized take within the local area population. However, the reality we have encountered since promulgation of the 2016 Eagle Rule is that georeferenced data on unauthorized eagle mortality are sparse and heavily biased. Thus, we cannot meaningfully assess unauthorized take as a percent of local area populations based on available information. Consequently, this provision has failed to meet our intent. We intend that unauthorized take will remain a consideration in our permitting decisions. We will also continue to monitor the health of local area populations and the impacts of unauthorized take through review of data from state, Tribal, NGO, law enforcement, pathology, and wildlife rehabilitation community sources. Further, we will continue monitoring efforts through aerial surveys, GPS telemetry monitoring, and leveraging of community science.

Key Elements of Alternatives

We analyze three Action Alternatives in this EA. The primary elements of each alternative are: a) eligibility for general permits, b) eligibility for specific Permits, c) required pre-application monitoring, d) avoidance and minimization, e) compensatory mitigation, f) adaptive management, g) fatality monitoring, h) reporting, and i) permit tenure. A summary of these elements for each alternative is provided in Table 3-1, below. Detailed descriptions of the alternatives are provided in Section 3.4.

Table 3-1. Summary of the key elements of the Alternatives

	Alternative 1 – No Action	**Alternative 2** – General permit for Wind; Eligibility Based on Distance From Nests; Flat Fee for Mitigation	**Alternative 3** – General permit for Wind; Eligibility Based on Eagle Relative Abundance and Distance From Nests; Mitigation Based on Hazardous Area	**Alternative 4** – Implement Alternative 3 for Wind; Create General permits for Power Line Entities, Activities That May Disturb Eagles, and Nest Removal Activities
General permit Eligibility	N/A	For wind only: projects where all existing or proposed turbines are or will be located > 1 mile from bald eagle nests and > 2 miles from golden eagle nests. For all others: No general permit available.	For wind only: projects in areas characterized by eagle relative abundance values less than or equal to the values in Table 3-2 AND where all existing or proposed turbines are or will be located > 660 feet and > 2 miles from a known bald and golden eagle nest, respectively OR For existing projects only, if you have applied for a specific permit but have received a letter of authorization from the Service notifying you that your project is eligible for a general permit. For all others: No general permit available.	For wind only: General permit eligibility for wind energy facilities same as Alt 3. For all others: Eligibility will be activity-specific. See Section 3.4.5.
Specific Permit Eligibility	All permits issued will be specific permits	For wind only: available to anyone who does not wish to receive a general permit and will be the only option for: a) anyone who does not meet general permit eligibility requirements, or b) existing wind energy facilities that find the remains of ≥4 individual bald eagles or ≥4 individual golden eagles during any 5-year permit term. For all others: No general permit available. All other applicants are eligible for a specific permit.	Same as Alternative 2	For wind only: same as Alternative 2 For all others: available to anyone who does not wish to receive a general permit and will be the only option for anyone who does not meet general permit eligibility requirements.

	Alternative 1 – No Action	**Alternative 2** – General permit for Wind; Eligibility Based on Distance From Nests; Flat Fee for Mitigation	**Alternative 3** – General permit for Wind; Eligibility Based on Eagle Relative Abundance and Distance From Nests; Mitigation Based on Hazardous Area	**Alternative 4** – Implement Alternative 3 for Wind; Create General permits for Power Line Entities, Activities That May Disturb Eagles, and Nest Removal Activities
Pre-Application Information Collection	Eagle-use monitoring required for wind (if not waived by the Service). May be required based on application-specific guidance for other types of activities	General Permits: Eagle-use monitoring not required. Specific Permits: Same as Alternative 1.	Same as Alternative 2	Same as Alternative 2
Avoidance and Minimization Measures	Project-specific Avoidance and Minimization Measures, negotiated for each permit application	General permits: Standardized Avoidance and Minimization Measures for wind energy facilities. Specific Permits: Same as Alternative 1	Same as Alternative 2	General permits: Standardized Avoidance and Minimization Measures for wind energy facilities and separate standardized measures for other types of activities. Specific Permits: Same as Alternative 1
Compensatory Mitigation	As needed to ensure consistency with eagle preservation standard; mitigation at a 1:1 ratio for bald eagles, mitigation at a 1.2:1 ratio for golden eagles. Under long-term permits, mitigation rates would be adjusted, if warranted, at required administrative check-ins, to happen at least every 5 years.	General permits: Each permittee would be required to provide compensatory mitigation to offset the take of 2 golden eagles over a 5-year permit term for all projects with infrastructure that is not part of baseline. Additionally, they would be required to provide LAP mitigation of 0.2 eagles over a 5-year permit term regardless of operation date. Specific Permits: same as Alternative 1, except there will be no requirement for administrative check-ins.	General permits: Each permittee would be required to provide compensatory mitigation to offset the take of golden eagles per unit volume (km^3) of hazardous area that is not a part of baseline. Mitigation rates vary by EMU and are listed in Table 3-3. Additionally, they would be required to provide LAP mitigation at a rate 2.18 eagles per unit volume (km^3) of hazardous area regardless of operation date. These requirements would repeat with every new registration. Specific Permits: Same as Alternative 2.	General permits: Same as Alternative 3 for wind. For other activities, activity-specific requirements will be in place. Specific Permits: Same as Alternative 2.

	Alternative 1 – No Action	**Alternative 2** – General permit for Wind; Eligibility Based on Distance From Nests; Flat Fee for Mitigation	**Alternative 3** – General permit for Wind; Eligibility Based on Eagle Relative Abundance and Distance From Nests; Mitigation Based on Hazardous Area	**Alternative 4** – Implement Alternative 3 for Wind; Create General permits for Power Line Entities, Activities That May Disturb Eagles, and Nest Removal Activities
Project-level Adaptive Management	Required for all permits for wind. Conditions geared towards ensuring that authorized take is not exceeded. Adaptive Management not typically required for other activities, but will be considered on a permit-by-permit basis.	General permits: None required, except if 3 eagles of a single species are found during a 5-year permit term, then the applicant will be required to implement an adaptive management plan of their own design. If 4 eagles of a single species are found during a 5-year permit term, then that permitted project will no longer be eligible for a general permit upon future applications/registrations. Specific Permits: Same as Alternative 1.	General permits: same as Alternative 2. Specific Permits: Same as Alternative 1.	General permits: Same as Alternative 2 for wind. For other activities, no adaptive management will typically be required. Specific Permits: Same as Alternative 1 for wind. For other activities, no adaptive management will typically be required, but may be on a permit-by-permit basis.
Fatality Monitoring	Project-level monitoring of eagle fatalities is required of all permits issued for wind and evaluated project-by-project with a goal of achieving a site-wide probability of detecting eagle remains (if take has occurred) of 35% (i.e. a probability of detection of 0.35) averaged over each 5-year period of the permit tenure. For nest disturbance and nest take permits, monitoring nest sites to determine occupancy or success is typically required.	General permits: No formal project-level fatality monitoring required by the permittee outside of the training and utilization of project staff to document eagle remains. Instead, the permittee will pay a fee at a rate of $2625 per turbine to the Service to monitor eagle fatalities at a program level to ensure general permitting is consistent with our preservation standard. Specific Permits: Same as Alternative 1.	General permits: Same as Alternative 2 Specific Permits: Same as Alternative 1.	General permits: Same as Alternative 2 for wind. For power line entities, comparable training and utilization of project staff to document eagle remains will be required, but no monitoring fee will be assessed. Specific Permits: Same as Alternative 1
Reporting	Required for all permits. Permittee must report evidence of incidental take to the Service and submit an annual report for each year their permit is valid.	General permits: Permittee must report eagle remains found within two weeks of the date of discovery. Annual reports will be required as in Alternative 1, Specific Permits: Same as Alternative 1.	Same as Alternative 2	Same as Alternative 2, although general permits for some activity types (such as nest removal activities) may not require annual reporting.

	Alternative 1 – No Action	**Alternative 2** – General permit for Wind; Eligibility Based on Distance From Nests; Flat Fee for Mitigation	**Alternative 3** – General permit for Wind; Eligibility Based on Eagle Relative Abundance and Distance From Nests; Mitigation Based on Hazardous Area	**Alternative 4** – Implement Alternative 3 for Wind; Create General permits for Power Line Entities, Activities That May Disturb Eagles, and Nest Removal Activities
Permit Tenure	For long-term permits, applicant can choose a permit tenure between 5 years and 30 years. For short-term permits, applicants can choose a permit tenure of any duration less than 5 years.	General permits: Maximum permit tenure of 5 years. For coverage beyond 5 years, permittees will need to re-register every 5 years. Specific Permits: Same as Alternative 1	Same as Alternative 2	Same as Alternative 2, although general permits for nest take will be limited to one year.

[1]General permits will require that project staff include searches for eagle remains into their day-to-day activities (e.g. staff will be required to look for eagle remains following a standardized protocol during turbine visits).

Alternatives Analyzed in Detail in this EA

ALTERNATIVE 1: NO RULEMAKING TO AMEND EAGLE REGULATIONS (NO ACTION)

Eligibility For General Permits

Under this Alternative, the Service would not develop a general permit framework.

Pre-Application Information Collection

Under this Alternative, the Service would continue current practices of pre-application information collection. For nest disturbance and nest take permits, pre-application information would remain relatively minimal. The major components would include a description of the activity with details on timing and intensity, the location of the nest and other nearby locations (if known), and the status of the nest.

For long-term permits for land-based wind energy facilities, the applicant would be required by regulation to collect at least two years of pre-construction eagle-use monitoring with the following additional requirements:

> Surveys must be point-based recordings of bald and golden eagle flight activity (minutes of flight) within a 3-dimensional cylindrical plot (the sample plot). The radius of the sample plot is required to be 2,625 feet (800 meters) and the height above ground level must be either 656 feet (200 meters) or 82 feet (25 meters) above the maximum blade reach, whichever is greater.
>
> The duration of the surveys for each visit to each sample plot must be at least one hour.
>
> Sampling must include at least 12 hours per sample plot per year for two or more years. Each sample plot must be sampled at least once per month, and the survey start time for sampling period must be selected randomly from daylight hours.
>
> Sampling design must be spatially representative of the project footprint, and spatial coverage of sample plots must include at least 30 percent of the project footprint. Sample plot locations must be determined randomly.
>
> The permit application package must contain the following:
>
> Coordinate of each sample point in decimal degrees.
>
> The radius and height of each sample plot.
>
> The proportion of each three-dimensional sample plot that was observable from the sample point for each survey.
>
> Dates, times, and weather conditions for each survey, to include the time surveys at each sample point began and ended.
>
> Information for each survey on the number of eagles by species observed (both in flight and perched), and the amount of flight time (minutes) that each was in the sample plot area.

The number of proposed turbines and their specifications, including brand/model, rotor diameter, hub height, and maximum blade reach (height), or the range of possible options.

Coordinates of the proposed turbine locations in decimal degrees (specify projection/datum), including any alternate nest sites.

These specific requirements for pre-application monitoring can be waived if the Service determines it has data of sufficient quality to estimate the likely risk to eagles, that expediting the permit process will benefit eagles, or that the risk to eagles from the activity is low enough relative to the status of the eagle population.

Avoidance and Minimization Measures

Under this Alternative, avoidance and minimization measures would continue to be required for every incidental take permit issued. Applicants must agree to avoid and minimize their impacts to eagles to the extent practicable. Additionally, nest removal can only be authorized if there is no practical alternative to the removal. Presently, the Service does not have standard avoidance and minimization measures for permit types, and avoidance and minimization conditions are negotiated on a permit-specific basis. However, after over a decade of negotiating with applicants during permit review and issuing permits, some conditions are relatively standardized, as they appear on many if not all permits for certain types of activities.

Compensatory Mitigation

Under this Alternative, the Service must require compensatory mitigation as a condition of eagle take permit issuance if cumulative authorized take exceeds the applicable EMU take limit, or if the issuance of the permit in question will cause cumulative authorized take to exceed the applicable EMU take limit. Because the Service is concerned that any increase in anthropogenic take of golden eagles will cause population declines that are not consistent with stable or increasing breeding populations of golden eagles, authorized take of golden eagles will always come with a requirement to provide compensatory mitigation at a ratio of 1.2:1. The Service will also require compensatory mitigation, should any bald eagle take authorization exceed EMU take limits, or should mitigation be required for the authorization of nest removal under a nest removal permit. In the case of mitigation for nest removal, compensatory mitigation needs to provide a net benefit to eagles (i.e., needs to more than offset the estimated loss).

If long-term eagle take permits are issued, and if compensatory mitigation is required, it is typically required for the first five years of the permit tenure, although an applicant could elect to offset all authorized take right away. All long-term permits are issued with requirements for an administrative check-in, not to occur any less frequently than every five years. At or around the time of these administrative check-ins, the Service reviews fatality monitoring data (and other data if applicable) collected at the project-site since the permit was issued. This data is used to update the fatality estimate at a permitted project and, if warranted, to update the take authorization and mitigation requirements associated with a permit.

Adaptive Management

Under this Alternative, permit-specific adaptive management is required under all long-term eagle take permits. The goal of this adaptive management is to set thresholds (often referred to as 'triggers') that the Service has pre-identified as being indicative of take rates that might be greater than authorized. Take rates that are higher than authorized are a concern for the Service because it would mean that, at the permit scale, authorized take is not being properly offset with compensatory mitigation. Adaptive management conditions are not typically required for short-term or nest removal permits; although the Service could elect to require them if the situation warranted it.

Fatality Monitoring

Under this Alternative, all long-term permits issued come with fatality-monitoring requirements, that must be conducted by third parties. Objectives of this fatality monitoring are:

Verify that the Service is not authorizing take at rates that exceeds our established management objectives for both eagle species.

Determine if evidence exists to support that take authorization at an individual project may be exceeded.

Produce fatality estimates for individual projects that will serve, if needed, to:

Determine if a project has over- or under-mitigated for take and adjust compensatory mitigation requirements as requested by the permittee, or as deemed necessary by the Service.

Increase certainty if deriving future project-specific fatality estimates for a future permit amendment or new application

Understand the effectiveness of any project modifications that may be implemented, voluntarily or required through adaptive management, to reduce fatality rates

Improve fatality estimates at other proposed or existing wind energy facilities by improving our understanding of exposure and collision in relation to factors across sites.

The Service requires eagle fatality monitoring methods for each permit that will meet these objectives. Since there are many site-specific variables that have a strong influence of the effectiveness of fatality monitoring, specific methods have looked different across long-term permits issued by the Service. We are currently working on fatality monitoring standards for wind facilities that would outline requirements and best management practices to achieve the monitoring objectives listed above. We anticipate that those standards will lead to better and more consistent fatality monitoring requirements under eagle take permits.

Permits issued to activities not likely to result in the injury or death of eagles, such as activities that may cause nest disturbance or nest removal activities, will not come with a requirement for fatality monitoring. Such permits do typically require monitoring of things like eagle nest occupancy, eagle behavior, and/or eagle nest success during and for a short time after completion of the activity in question.

Reporting

Under this Alternative, permittees conducting fatality monitoring are typically required to report documented eagle fatalities to the Service within 48 hours of discovery. Information submitted with this report includes date discovered, location (GPS coordinate), the suspected cause of death, and the unique tracking number assigned to the eagle. Within 7 days of discovery, the permittee must submit a full record of the observation in the Service's Injury and Mortality Reporting (IMR) system. Finally, an annual report must be submitted to the Service for each year that the permit is valid. Reports must include all fatality monitoring methods and data from each survey and observation of eagle remains. Data must be submitted in the Service's data reporting template, following the instructions for entry of data. Data in this template are easy for the Service to use to update fatality estimates at a permitted wind project.

Reporting is also required for short-term eagle take permits; however, typically these reports are only due annually. These reports must include any information on nest occupancy, success, and productivity observed incidentally or while monitoring as a requirement of the permit.

PERMITTING FRAMEWORK DETAILS COMMON TO ALL ACTION ALTERNATIVES

This section describes a new permitting framework proposed under this rulemaking that will be consistent across all three Action Alternatives, below. Alternatives to this new framework were considered, but subsequently eliminated from consideration. These are discussed in more detail in Section 3.4.6 of this EA.

General Permits

All Action Alternatives, below, incorporate the concept of general permits. General permits, in the context of eagle take permits, are automated permits that the Service will process and issue electronically and with no site- or project-specific review. These permits will only be available when we have determined that site- or project-specific analysis is not necessary to comply with the Eagle Act's preservation standard. General Permit Programs (GPPs), under which general permit eligibility will be defined and under which general permits can be issued, may be developed for different activity types. While we will issue general permits to individual organizations and/or persons, each general permit authorized will provide standard authorizations and requirements to each permittee under the applicable GPP.

The Service's purpose for introducing a permitting framework that includes general permits is three-fold:

> To streamline permit issuance for projects that the Service can pre-determine are not likely to have relatively high or uncertain impacts to eagles. This will allow the Service to focus limited staff and resources on activities or projects that may have high or uncertain risks to eagles; thus, will increase the number of projects on the landscape that obtain permits.
>
> To provide predictability and certainty to applicants.
>
> To foster consistency in eagle-take permitting across Service regions, offices, and permits.

Because general permits do not require site- or project-specific review, application-review times for projects or activities that qualify for a general permit will be substantially reduced. Additionally, issuing general permits for a subset of situations is expected to free up time and resources for Service staff to work on fewer specific permits, which is likely to result in much faster application review times for specific permit applications. We anticipate both of these general permit benefits will increase the number of applications we receive and the number of permits we issue and, thus, the amount of conservation (through implementation of avoidance, minimization, and mitigation measures) we achieve for eagles.

The lack of site- or project-specific review also means that the Service will not be able to estimate the specific impacts of any one activity authorized under a general permit on the applicable EMU and LAP prior to permit issuance. Because we will no longer have this information prior to permit issuance, we will build into general permit conditions measures designed to ensure each GPP can be implemented consistent with our preservation standard and eagle population management objectives set forth in the PEIS. These measures are described below and, in most cases (when referenced), are based on analysis described in Appendix A. Additionally, we will require each general permittee for wind energy facilities to pay a monitoring fee to fund the Service's monitoring of the actual impact of the GPPs for wind. If analysis of monitoring data suggests a GPP is authorizing take inconsistent with our preservation standard, we will suspend the GPP temporarily or indefinitely. This suspension may apply over all or part of the program area. Such a suspension could also occur if the Service finds that bald or golden eagle populations are trending in a direction that would cause concern for our preservation standard. Should the Service take such action, permits issued under the GPP would remain valid until their expiration; however no new permits could be issued under the GPP in the geographic area where suspended.

Because site- or project-specific review of general permit requests will not occur, all general permits will come with a standard condition that no activity shall occur that is likely to directly or indirectly adversely affect a listed species, or the critical habitat of such species. Projects that take listed species or the critical habitat of such species can still meet this condition if they provide documentation that the permittee is authorized to take listed species by a permit under the ESA, limited to the listed species covered by the ESA permit.

Specific Permits

All Action Alternatives, below, also include specific permit authorizations. Specific permits, in the context of eagle take permits, are permits issued to projects that do not qualify for a general permit or do not wish to receive a general permit and require a site- or project-specific analysis. To date, all eagle-take permit applications submitted to the Service have been reviewed (and any permits subsequently issued) with a site- or project-specific analysis. "Specific permits" is thus a new name for the existing system the Service uses to review and issue eagle take permits since promulgation of the incidental take permit regulations in 2009. Under the permitting framework proposed here, however, we only expect to issue specific permits to projects that do not qualify for, or do not wish to accept the conditions of, general permits.

As discussed above, we propose adding the ability to issue general permits to our eagle permitting framework to increase the efficiency of permit processing and issuance for the subset of permittees that qualify, with the goal of increasing participation in the eagle-permit program.

For projects that do not qualify for, or do not wish to accept conditions of, a general permit, we are also proposing some changes to improve program efficiency under specific permits.

First, under all alternatives below, we propose to remove third-party monitoring requirements, which are currently required for issuance of long-term permits. We included this requirement in the 2016 Eagle Rule because of concerns from the public that dishonest reporting could occur. For example, a company may underreport the number of eagle fatalities at a permitted project. However, over the last several years (and in comments submitted for the ANPR) wind companies, utility companies, and defense sectors have each communicated to the Service that the third-party monitoring requirement in the existing regulation has discouraged participation in the permitting process or influenced the permit tenure requested by applicants. These companies have indicated that cost, safety, or legal restrictions on property access can all contribute to making third-party monitoring difficult or impossible to implement. Moreover, we expect that the criminal penalties at 18 U.S.C. 1001 for making false statements when interacting with the federal government to receive a benefit or legal authorization to conduct an activity will serve as an adequate deterrent for dishonest reporting by permittees. Thus, we have decided that the benefits of greater participation in eagle take permitting outweigh the risk and cost of dishonest reporting and that existing criminal penalties for making false statements reduce any need to require third-party monitoring.

Second, under all alternatives below, we propose to eliminate administrative check-in requirements that are currently required under long-term permits. When the Service increased the maximum permit tenure to 30 years in the 2016 Eagle Rule, we introduced administrative check-ins between the Service and the permittee at a frequency not to exceed five years. The purpose of these check-ins was for the Service to review all existing data related to a permitted project and re-calculate fatality estimates, authorization levels, and mitigation requirements, as well as require new permit conditions if deemed necessary and if practicable for and agreed to by the permittee. Over the last several years, the Service has heard complaints from some wind companies that these administrative reviews introduced uncertainty into the permitting process. Long-term applicants and permittees have complained that, under the current permit regulation, they don't know what their permit is going to look like after five years or how much additional cost they may incur if their permit conditions change. According to these complaints, this requirement has discouraged participation in the permitting process or influenced the permit tenure requested by applicants (applicants simply request 5-year permits for long-term projects instead of long-term, 30-year permits with 5-year check-ins). These complaints were reiterated in comments submitted for the ANPR. In the interest of improving certainty for applicants and permittees, the Service proposes to remove the requirement for administrative check-ins under specific permits. We instead propose to hold the amount of take authorized under the permit constant, where take authorizations are listed on the face of the permit, unless the permittee requests an amendment, or unless the Service determines that an amendment is necessary and required under 50 CFR 22.200(e). Such a change would replace scheduled check-ins and amendment of permit conditions, with unscheduled check-ins and amendments that the applicant or the Service could initiate at any time when situations arise that warrant one. We propose to retain the requirement for permit-specific adaptive management plans for long-term specific permits, for certain permit types. The Service and permittee will use these adaptive management plans, when required, to account for unforeseen or unlikely circumstances, such as a new nest in the vicinity of a permitted activity or when take levels are greater than predicted. The measures in these plans will become permit conditions and will offer permittees certainty for the duration of their permit. If the Service estimates that authorized take has been exceeded at any time during the permit tenure, the permittee will need to apply for and receive an amendment to their existing permit, which would require (if necessary) additional compensatory mitigation to offset higher-than-expected amounts of take.

As with general permits, the Service would have the right to temporarily or indefinitely suspend incidental take permitting across all or parts of the country if we have reason to believe that continuing to permit eagle take would not be consistent with the preservation standard.

Definition Changes

Proposed alongside all Action Alternatives below are updates to definitions at 50 CFR 1012, 50 CFR 22.12, and 50 CFR 22.6:

For clarity, we propose adding a definition of general permit to 50 CFR 10.12 to distinguish general permits from the current definition of permit.

We propose adding to Illegal Activities (50 CFR 22.12) the requirement that obtaining a permit does not in and of itself resolve past take. This provision is currently in section 22.80(e)(8) but applies to all of Part 22 and is therefore better located in 22.12.

The current definition of eagle nest includes assemblages of materials used by eagles for breeding purposes, regardless of regardless of current situation and availability to future use by eagles. Under all action alternatives, we propose to expand this definition to clarify that materials with no conceivable future use to breeding eagles do not qualify as eagle nests. We intend this provision to avoid unnecessary protection of former nest structures when they are no longer of biological value to eagles. For example, with this definition update, a bald eagle nest that fell with a tree into a parking lot would no longer retain the regulatory designation of an eagle nest and could be destroyed without permit.

The current definition of an in-use eagle nest includes a nest containing eagle eggs. This definition does not acknowledge the common reality that nonviable eggs with no value to bald eagle reproduction may be present in nests and even incorporated into nest structures. Under all Action Alternatives, we propose to update the definition of in-use nest to specify that eggs must be viable for a nest to be considered in-use. We intend this update to better match our original regularly intent of protecting nests from removal in all circumstances except emergencies if they contained live eggs or chicks.

Nest Take Amendments

We propose to amend the existing Nest Take permitting regulations under all Action Alternatives. The purposes of these proposed changes are as follows:

Clarify that temporary obstruction of nest, causing temporary nest abandonment, constitutes nest take and requires a nest take permit.

Authorize a general permit for the take of bald eagles nests under certain circumstances and impose a one-year maximum tenure on those permits.

Add an additional justification authorizing the take of eagle nests to protect species federally protected under the Endangered Species Act (ESA) (see List of Threatened and Endangered Species (50 CFR 17.11)).

Extend the ability of the Service to authorize nest take for an in-use nest prior to egg laying, including situations where safety of humans or listed species is at risk.

Under all Action Alternatives below, the situations under which the Service can authorize nest removal would now be (including the four 4 existing situations):

(Currently in Regulation) For an Emergency: When an in-use or alternate eagle nest must be taken to alleviate an existing safety emergency, or to prevent a rapidly developing safety emergency that is otherwise likely to result in bodily harm to humans or eagles while the nest is still in use by eagles for breeding purposes.

(Currently in Regulation) For Health and Safety: When an in-use eagle nest prior to egg-laying or an alternate eagle nest must be taken to ensure public health and safety.

(Currently in Regulation) For Regaining Use of a Human-Engineered Structure: When an in-use eagle nest prior to egg-laying or an alternate eagle nest, that is built on a human-engineered structure, must be removed in order eliminate a functional hazard, or the development of a functional hazard, that renders or would render the human-engineered structure inoperable for its intended use.

(NEW) For Endangered or Threatened Species Protection: When an in-use eagle nest prior to egg-laying or an alternate eagle nest must be removed to protect species federally protected on the List of Endangered and Threatened Wildlife (50 CFR 17.11).

(Currently in Regulation) For a Net Benefit to Eagles: When the activity necessitating the removal of an alternate nest, or the mitigation for that nest removal, will provide, with reasonable certainty, a net benefit to eagles.

Alternative 2: General Permits Available for Wind Energy Facilities; Eligibility Based on Distance from Nests; Flat Fee for Mitigation

If we select Alternative 2, the Service would create a GPP for land-based wind energy facilities only. Only a subset of wind energy facilities would qualify for these general permits. Specific permits would be available to projects that do not qualify for general permits, or that do not wish to accept the conditions necessary to receive a general permit. This GPP would specify that every general permittee would pay a flat compensatory mitigation fee and a per turbine monitoring fee that would be identical for each general permit issued, regardless of project size or risk to eagles.

We include this alternative in our analysis because it represents a detailed alternative that was presented during the public comment period for the ANPR and represents a potentially viable concept and thus a reasonable alternative. However, we note (as described in more detail below) that it is difficult to analyze this Alternative's consistency with the Eagle Act's preservation standard without assessing additional criteria and conditions that would more clearly ensure consistency with that standard.

Eligibility For General Permits

Under this Alternative, wind energy facilities would qualify for a general permit if every project turbine that exists or is proposed will not be within one mile of a known bald eagle nest, or within two miles of a known golden eagle nest. No other activity types would qualify for a general permit.

All potential applicants that are not eligible for or not seeking general permit authorization to take eagles incidentally during operation of a wind energy facility would need to apply for a specific permit. Also, any wind energy facilities that do not qualify for a general permit, or that qualify but do not wish to accept conditions necessary to receive a general permit or do not otherwise want to pursue one would need to apply for a specific permit.

Pre-Application Information Collection

To determine if their project is eligible for a general permit, applicants seeking eagle incidental take authorization under a general permit would need to certify that they have searched all possible nest substrate within two miles of all turbine locations (existing or potential) for eagle nests belonging to both eagle species. For projects east of the 100th meridian, a one-mile search radius would be appropriate because golden eagles are not known to nest there. Applicants must also certify that they have searched all known databases and otherwise attempted to obtain any known records of existing/historic eagle nest locations within two miles of all existing or potential turbine locations. No pre-construction eagle-use surveys will be required for issuance of a general permit for a wind energy facility.

Applicants seeking specific permits will be required to conduct pre-construction monitoring unless this requirement is waived by the Service. Regulations will stipulate that the Service's pre-construction monitoring standards (to be approved after being made available for public comment) must be followed to the maximum extent practicable. Applicants for specific permits for wind energy facilities will be required to submit all their pre-construction monitoring data and methods to the Service. The Service will decide if submitted information is appropriate for use in our fatality estimation process for the associated permit application and will use the best available information when making such estimates.

This Alternative would retain, under all specific permits for wind energy facilities, the criteria in the current regulation for waiving pre-construction monitoring requirements for wind projects. This language states that the above data standards may not be needed if:

The Service has data of sufficient quality to estimate the likely risk to eagles.

Expediting the permit process will benefit eagles, or

The Service determines the risk to eagles from the activity is low enough relative to the status of the eagle population based on:

Physiographic and biological factors of the project site, or

The project design (i.e., use of proved technology, micrositing, etc.)

Nest surveys would be strongly recommended but not a requirement of specific permit issuance.

Applicants seeking specific permits for activities such as those that are likely to disturb or remove an eagle nest would have limited pre-application information collection requirements outside of the basic information necessary for application processing, such as nest location and status.

Avoidance and Minimization Measures

Under this Alternative, the Service would develop standard avoidance and minimization measures (A&M measures) under the wind energy GPP that all general permit applicants would have to accept in order to receive a general permit. These measures would become conditions of any general permit. To the extent practicable, we will structure avoidance and minimization requirements to encourage the use and evaluation of experimental mitigative technologies. These standard measures are likely to change over time as new information and technology becomes available. Examples of such measures are listed below. This list is not intended to be a complete list, and measures may be added or removed over time at the Service's discretion. When the Service changes these approved measures, all new general permit applicants will be held to those updated measures. If measures are updated by the Service, existing general permittees will not be required to adopt any new A&M measures until their permit term expires and (if) they re-register for another 5-year general permit. Applicants who do not wish to or cannot agree to the standard A&M measures would have the option to apply for a specific permit.

Examples of A&M measures that may be standard under the GPP for wind energy.

> Project personnel are required to drive 25mph or less on non-public Project roads, be alert for wildlife, and use additional caution in low-visibility conditions when driving any vehicle.
>
> Any garbage/waste observed will be collected and disposed of in an appropriate trash receptacle securely protected from wildlife.
>
> Any new transmission infrastructure associated with the wind energy project will be constructed and maintained to meet the most recent APLIC suggested practices (currently 2006) for reducing electrocution risk to birds.
>
> If applicable, permit holders will install underground collection lines when practicable to minimize eagle collision and electrocution risk associated with aboveground lines. Any aboveground lines will be constructed in compliance with APLIC (2006) standards.

All applicants for specific permits will be required to implement any practicable avoidance and minimization measures to obtain a permit. Measures will be negotiated at the project-level and may vary across specific permits issued.

Compensatory Mitigation

Under this Alternative, each general permittee would be required to provide compensatory mitigation adequate to offset two golden eagles, at a ratio of 1.2:1, for every five-year permit term. Compensatory mitigation would only be required for projects that contained one or more turbines that are not considered to be a part of baseline (*i.e.*, turbines that began commercial operation on or after September 11, 2009). In other words, compensatory mitigation for golden eagles under this Alternative at projects that contain infrastructure that is not a part of baseline will need to save or provide at least 2.4 golden eagles every 5 years. Compensatory mitigation for bald eagles is not typically needed to ensure authorized take is consistent with our preservation standard because most bald-eagle EMU take limits are relatively high commensurate with that species' increasing population. However, the Service does expect that general permits will occasionally be issued in areas in which compensatory mitigation for bald eagles could be necessary to meet our preservation standard. The risk of general permit issuance for bald eagles being inconsistent with our preservation standard is highest in the southwestern U.S., an area characterized by relatively low bald eagle EMU take limits and relatively small bald eagle LAPs. To reduce the risk of general permit issuance being inconsistent with bald eagle management objectives, the Service will require a small compensatory mitigation requirement for bald eagles under each general permit we issue. Under this Alternative, each general permittee would be required to provide compensatory mitigation adequate to offset 0.2 bald eagles at a ratio of 1:1 for every five-year permit term. The mitigation credits purchased with this requirement (hereafter general-permit LAP mitigation requirement) could be used to offset bald or golden eagle take should the Service determine that authorized bald or golden eagle take in a locality is inconsistent with our preservation standard.

Under a general permit, compensatory mitigation would only be implemented by using a Service-approved in-lieu fee (ILF) program. Agreements with ILF programs would be crafted to require the ILF program to track mitigation funds received from eagle take permittees and EMUs within which those funds must be spent. All mitigation credits purchased by permittees must be directed to the species-specific EMU where the take was authorized. Agreements with ILF programs will also require annual meetings with the Service. In the months between these annual meetings the Service will track the locations and estimated amounts of authorized take for each species under the GPP, noting areas with relatively high densities of general permits or high amounts of authorized take in each EMU. At each annual meeting, the Service will instruct the ILF programs where to direct mitigation efforts. Typically, the Service will direct ILF's to implement compensatory mitigation in areas in each EMU where cumulative authorized take seems to be the highest, and most likely to be impacting the LAP threshold; however, the Service may direct the funds based on other factors if deemed necessary for meeting our preservation standard.

All applicants for specific permits would be required to offset any take that exceeds established EMU take limits. For golden eagles, EMU take limits are set at zero throughout the United States; thus, compensatory mitigation would be provided for all authorized take of golden eagles that is not considered to be a part of baseline. Golden Eagle take not a part of baseline would be offset at a ratio of 1.2:1. For bald eagles, compensatory mitigation will not typically be required unless we estimate EMU take limits will be exceeded from the issuance of a specific permit. Bald Eagle take that is not considered to be a part of baseline would be offset at a ratio of 1:1. All compensatory mitigation requirements must be applied in the EMU where the authorized take above the EMU take limits is occurring. If the Service estimates that authorized take under a specific permit may be inconsistent with our preservation standard at the LAP scale, the Service may elect to require compensatory mitigation within the project-specific LAP. Under specific permits, permittees would be encouraged to use Service-approved in-lieu fee programs; however, the use of such programs would not be required. Applicants for specific permits could submit their own mitigation plan for Service approval.

Adaptive Management

General permits under this Alternative would not require the creation of a specific adaptive management plan. However, the Service will require that any wind energy facility covered by a general permit that finds three bald eagles or three golden eagles over the five-year permit tenure will be required to design and implement their own measures to reduce eagle take. Such measures need not be approved by the Service. However, it will be in the best interest of the general permittee to implement measures likely to reduce take at the project because if four bald eagles or four golden eagles are found over the five-year general permit tenure, the covered facility would be ineligible to receive another general permit upon expiration of their current permit. By requiring this adaptive management measure, the Service expects to minimize the number of wind energy facilities with unexpectedly high impacts to eagles that can receive take authorization under general permits. This will reduce the risk that the GPP is authorizing take that is inconsistent with our preservation standard. Projects that exhibit relatively high and unexpected impacts to eagles are more appropriately permitted under specific permits.

Specific permits issued to wind energy facilities will require project-specific adaptive management measures be implemented to reduce the risk that actual realized eagle take at a project exceeds the amount authorized on the specific permit. Such adaptive management conditions will typically involve a "trigger" (*e.g.*, 9 eagles found in the first 5 years of the permit tenure, or the presence of a new nest within 1 mile of a project turbine) and an associated measure that is geared towards either better understanding the eagle risk at the facility or reducing take rates. Typically, required measures would increase in intensity as concern for exceeding authorized take grew.

With the Service's proposal to remove the requirement for administrative check-ins, conditional periodic re-assessment of impacts and amendment of permit terms, such as take authorization levels, compensatory mitigation, etc., will no longer be scheduled. However, either the permittee or the Service can request an amendment to permit conditions at any time as outlined in 50 CFR 13.23. Should the permittee wish to amend permit conditions, such as mitigation requirements, the permittee can request a permit amendment by submitting a full written justification and supporting information. Conversely, the Service can determine that an amendment is necessary and require such an amendment under 50 CFR 22.200(e). The Service could require amendments to permits under this authority if information suggests we have overestimated eagle take rates at the permitted project and that over-authorization is hindering our ability to issue other permits within an EMU or LAP (but amendments could also occur if we underestimate eagle-take rates). Because of the conservative nature of estimating take rates, we would overestimate predicted take rates more frequently than we underestimate them.

When issuing shorter-term specific permits for other activities, such as activities that may cause nest disturbance or nest removal activities, adaptive management conditions would not typically be included. However, specific permits for some longer-term activities, especially where the Service has a high level of uncertainty surrounding the amount of authorized take, may include project-specific adaptive management requirements. Such adaptive management conditions would typically have the same goal as those under specific permits for wind energy development – to reduce the risk of exceeding authorized take.

Fatality Monitoring

General permits under this Alternative would require that permittees train relevant employees to recognize and report eagle take as part of their regular duties. This monitoring requirement would include visually scanning for injured eagles and eagle remains during inspections, maintenance, repair, and vegetation management at and around project turbines. Scans would occur a minimum of once every three months corresponding to the highest eagle-use, seasonal periods to the maximum extent practicable. Additionally, general permittees would pay $2,625 per turbine over a 5-year permit to fund fatality monitoring efforts. The Service would collect this fee as part of the general-permit application fee. The Service would then, in turn, take responsibility for fatality monitoring across all general permits, using the money received to implement a program-wide fatality monitoring effort. Since the Service expects project-specific eagle impacts to be relatively low at facilities receiving a general permit, we do not feel it is necessary to monitor eagle take rates at all permitted projects. Rather, fatality monitoring implemented by the Service with funds from general permit fees is expected to only be necessary at a subset of facilities with a general permit. This monitoring effort will be designed and implemented with the following primary and secondary objectives:

> <u>Primary Objective:</u> To estimate authorized eagle take (of both species) under the Wind GPP and to ensure that eagle take under the GPP, along with other authorized take from specific permits, is consistent with our preservation standard. To determine this, all authorized take should be within EMU take limits and should not significantly exceed the LAP take threshold in any LAP (additional analysis and/or compensatory mitigation might be required if it does).
>
> <u>Secondary Objective:</u> To collect data that can be used to update the collision probability prior in the future.

Specific permits issued to wind energy facilities will not require a monitoring fee, but instead will require that permittees be directly responsible for required fatality monitoring at their permitted infrastructure. The Service expects higher and more uncertain fatality rates associated with specific permits given they will generally be issued for projects in higher risk areas, so fatality monitoring under specific permits will have the same objectives as under Alternative 1, which are slightly different than under general permits in this Alternative. We intend to present fatality monitoring standards for notice and public comment that will describe requirements, and best practices for achieving the Service's fatality monitoring objectives. As more is learned about fatality monitoring techniques and technologies, the Service will update these standards in the same manner – likely through a public notice and comment process.

Reporting

Under this Alternative, permittees would need to submit reports of documented eagle fatalities to the Service within 2 weeks of discovery. Like under Alternative 1, general permittees under this Alternative would be required to submit annual reports summarizing findings for the previous year.

Reporting for all specific permits under this Alternative would not change and thus will be the same as under Alternative 1.

Alternative 3: General Permit Available for Wind energy facilities; Eligibility Based on Relative Abundance and Distance from Nests; Mitigation Fee Based on Hazardous Area

Under Alternative 3, the Service would create a GPP for land-based wind energy facilities only, just as we proposed under Alternative 2. However, eligibility for general permits would be based on the relative abundance of eagles where turbines exist or are proposed. Correspondingly, we would reduce the minimum distance eligibility requirement for bald eagle nests to 660 feet. Specific permits would still be available to projects that do not qualify for general permits, or that do not wish to accept the conditions necessary to receive a general permit.

Alternative 3 further deviates from Alternative 2 in how the Service would determine compensatory mitigation and monitoring requirements. Under Alternative 3, the GPP would specify that every general permittee would be required to pay a compensatory mitigation and monitoring fee that would be commensurate with the project's existing or proposed hazardous area (*i.e.*, rotor-swept area). This is different from Alternative 2, where mitigation and monitoring fees are the same for all general permits. The Service calculated compensatory mitigation amounts that are specific to general permits for wind-energy projects under this Alternative. This was accomplished utilizing data from pre-construction eagle-use surveys and post-construction fatality monitoring required of existing projects permitted under the current regulations that would be eligible for general permits under this alternative. We based the compensatory mitigation values described in this Alternative on our fatality predictions across all general permits (see Appendix A).

For this general-permit framework to be successful, participation in the program must be relatively high. Low participation could mean that we fail to collect sufficient funds to conduct meaningful fatality monitoring, making it more difficult to document whether general permits are consistent with our eagle preservation standard. If participation in general permits remains low, the Service would likely have to either increase the fees associated with general permits or suspend the general permit program in part or in whole and convert existing general permits to specific permits. Conversely, the more permittees that are eligible for and receive general permits, the lower the required monitoring costs may be in the future.

Eligibility for General Permits

Under this alternative, the Service proposes to use eagle abundance to determine general permit eligibility. Using eagle abundance, based on specific thresholds, allows the Service and the regulated community to identify localities where eagle use is low enough that we are confident (without site-specific survey data) that cumulative eagle fatalities at wind energy facilities will remain within EMU take limits or can be demonstrably offset with standardized contributions to implement compensatory mitigation. A detailed discussion on the benefits of utilizing eagle relative abundance to set general permit issuance criteria is included in Appendix A.

In order to use eagle abundance as eligibility criteria, the Service requires standardized information on the relative abundance of each eagle species at a fine scale in each season throughout the coterminous U.S. We evaluated the utility of the following available information sources: North American Breeding Bird Surveys, Christmas Bird Counts, the Midwinter Bald Eagle Survey, the bald eagle communal roost database, various eagle telemetry datasets, databases of nest locations, and eBird status and trends products. The only one of these datasets that meets our requirement of providing annually comprehensive spatial and temporal relative abundance estimates throughout the coterminous U.S. for either eagle species is the eBird status and trends products. We have previously evaluated the ability of the eBird relative abundance products to identify high eagle use areas delineated in the other data sets and determined that eBird successfully identified > 90% of such areas (U.S. Fish and Wildlife Service 2018, Ruiz-Gutierrez et al. 2021). Given this; and accounting for the comprehensive spatio-temporal coverage of eBird, it's availability to the public from the Cornell Lab of Ornithology, which receives federal and nonfederal support, and the fact that eBird products are regularly updated, the Service determined that eBird status and trend relative abundance estimates for eagles represents the best available information for our purposes here. eBird relative abundance values represent the average number of eagles of each species expected to be seen by an expert eBirder who observes for 1 hour at the optimal time of day for detecting the species, and who travels no more than 1 kilometer during the observation session (see eBird FAQs at https://ebird.org/spain/science/status-and-trends/faq#mean-relative-abundance). eBird relative abundance estimates for eagles are hereafter referred to as "ERA".

We used processed eBird relative abundance data from May, 2018 provided by the Cornell University Lab of Ornithology to develop maps of ERA for each species across the lower 48 United States. Before receipt of data by the Service, the hundreds of millions of bird observations reported by eBird observers are passed through a series of validation filters to ensure only accurate observations are considered. The filtered data are then combined and passed through analytical models that account for variation in detection and effort, and which incorporate environmental information, to estimate species relative abundance seasonally at the scale of 8 km^2 (Sullivan et al. 2009, Kelling et al. 2015).

Based on our analysis of these eBird ERA maps, outlined in Appendix A, we have determined that wind energy facilities could qualify for a general permit if every turbine that exists or is proposed will be located in an area characterized by expected seasonal ERA values for bald and golden eagles that are less than or equal to the values in Table 3-2 for each species in each season. ERA data from eBird is available at https://ebird.org/science/status-and-trends/data-access. As a convenience to the regulated community, a map of areas in the coterminous U.S. that have been pre-determined to meet these criteria based on the Service's analysis of eBird data is shown in Figure 3-1 and will be available in higher resolution on the Service's website (https://www.fws.gov/library/collections/eagle-incidental-take-permitting). The Service intends to update the ERA thresholds in Table 3-2 and our map periodically as updated eBird data and products become available. At present, we plan to issue these updates approximately every five years, depending on need and program demand. For example, changes in population related to external factors such as anthropogenic mortality could alter update frequency.

Table 3-2. Maximum seasonal ERA values for each eagle species and season necessary to qualify for general permits for wind energy development. For bald eagles, the seasons are defined as: Spring = February 22 to April 13; Summer = April 12 to September 6; Fall = September 7 to December 13, Winter = December 14 to February 21, and

Migration = the average of fall and spring relative abundance. For golden eagles, the seasons are defined as: Spring = February 15 to May 16; Summer = May 17 to September 27, Fall = 28 September December 13, Winter = December 14 to February 14, Migration = the average of fall and spring relative abundance.

Season	**Bald Eagle ERA**	**Golden Eagle ERA**
Spring	1.272	0.206
Summer	0.812	0.118
Fall	0.973	0.168
Winter	1.151	0.229
Migration (spring and fall pooled)	1.018	0.145

In addition to eligibility based on ERA, wind energy facilities would only be eligible for a general permit if no existing or proposed turbines are or will be located within 660 feet of a known bald eagle nest, or within two miles of a known golden eagle nest. The minimum distance for bald eagles is reduced from what would be required under Alternative 2 because the Service does not believe specific permits are necessary for that species at that distance, given recent bald eagle population trends and our EMU take limits for the species. We anticipate that the highest density bald eagle nesting areas will be captured by our selected ERA threshold and that the environments with the lower ERA for bald eagles can sustain occasional take from general permits based on the overall trajectory of bald eagle populations and the increasing number of floaters (adult eagles that have not settled on a breeding territory) ready to adopt vacant territories. However, to further ensure that wind energy facilities receiving general permits are doing what they can to minimize bald eagle impacts when they are sited in the vicinity of nests, the Service will be requiring, as a condition of all general permits under this Alternative, that permittees site turbines beyond one-half mile from the nearest known nest to the extent practical (see Avoidance and Minimization Section).

The Service recognizes that this distance (660 feet) is meant to address nest disturbance and is likely insufficient to substantially reduce fatality rates of bald eagles at wind facilities when an in-use nest is nearby. However, authorizing general permits for wind energy facilities with turbines sited so close to bald eagle nests that they may cause nest disturbance would either be inconsistent with our other eagle permit regulations or require an additional permit, which would defeat the purpose of offering a general permit option. This General permit authority would cover incidental take of eagles that causes death or injury, whereas construction or operation of facilities within 660 feet of a bald eagle nest may require a permit for disturbance take. This would undermine the primary purpose of a general permit, which is to reduce and streamline permitting requirements for the applicant and reduce Service workload when appropriate to do so.

Existing wind energy facilities that do not meet the general-permit eligibility criteria defined above may still become eligible for general permits. The facility operator would have to initially apply for a specific permit but could demonstrate during the application process that annual eagle fatality estimates at the project in question are comparable to those estimated at wind energy facilities that meet ERA eligibility requirements, as determined by the Service from project-specific fatality monitoring data. These fatality estimates must be derived from eagle fatality monitoring that complies with the Service's fatality monitoring requirements for specific permits (Section 3.4.3.6). If the Service determines, when reviewing the specific-permit application, that a general permit is appropriate, the applicant will receive a letter of authorization from the Service notifying them that they are eligible for a general permit.

All potential applicants that are not eligible for a general permit would have to apply for a specific permit. Additionally, any wind energy generation projects that qualify for but do not wish to accept conditions necessary to receive a general permit may apply for a specific permit.

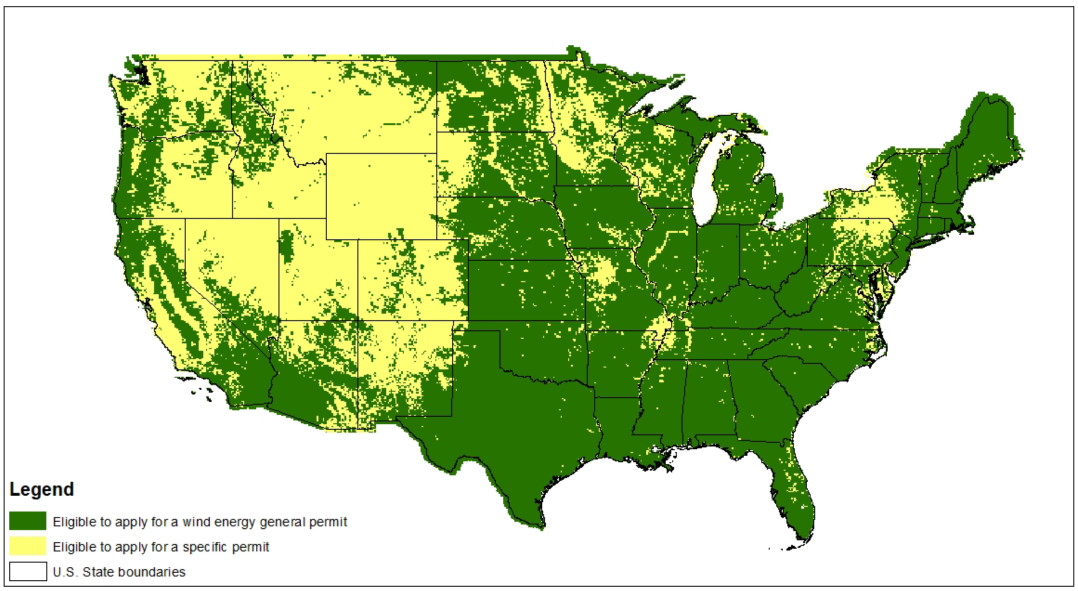

Figure 3-1. Map of the coterminous U.S. showing current localities that meet the ERA criteria in Table 3-2. Green color depicts localities where ERA values are less than or equal to the criteria and, thus, wind energy facilities are eligible to apply for a general permit, provided that minimum nest distances of 660 feet (for bald eagles) and 2 miles (for golden eagles) are also met. Yellow depicts localities where ERA values are greater than the criteria and facilities are eligible to apply for specific permits.

Since general permits will be issued in an automated way, with limited or no review by the Service at the application stage, we realize that applicants will have an opportunity to falsely certify that they meet eligibility criteria. The Service recognizes this risk and may revoke general permits if it is found that applicants have falsely certified they met eligibility criteria when applying for a general permit. Also, falsifying documents provided to or required by the federal government is a crime under 18 USC 1001. As added protection against false certifications, the Service intends to randomly audit self-certifications periodically to ensure that applications are appropriately certifying during application. The Service expects to randomly audit up to 1% of general permits on an annual basis to ensure compliance with conditions of the general permit. Audits could consist of both desktop exercise (i.e., document, report review) or in-field audits.

The audit program will be established through fees collected as part of the application fee for each permit.

Pre-Application Information Collection

Requirements for pre-application information collection under general permits will be the same as under Alternative 2, with one exception. Applicants for general permits under Alternative 3 will need to assess ERA at their project turbines and be prepared to certify that they meet general permit eligibility standards related to ERA. To make eligibility criteria clear, and to make such a certification easy for applicants, we have produced and will keep up to date a map of areas of the coterminous U.S. that have been pre-determined to meet ERA criteria. The current map is shown in Figure 3-1 and will be available online.

Requirements for pre-application information collection under specific permits will be the same as under Alternative 2.

Avoidance and Minimization Measures

Requirements for avoidance and minimization measures under general and specific permits will be the same as under Alternative 2, with one exception. Applicants for general permits under Alternative 3 will be required to site project turbines, if not already operational, at least 660 feet from known bald eagle nests if it is practicable to do so. If it is not practicable to site turbines beyond 660 feet from known bald eagle nests, the applicant may apply for a specific permit.

Compensatory Mitigation

Under this Alternative, each general permittee will be required to provide compensatory mitigation for golden eagles at a rate commensurate with the hazardous volume (HV) at each permitted project that is not considered to be a part of baseline (i.e., any hazardous volume that began commercial operation on or after Sept 11, 2009). For the purposes of calculating this requirement, hazardous volume for a group of turbines is defined as:

$$HV = n \cdot h \cdot \pi \cdot (d \div 2)^2$$

where n = the number of turbines in the project of a given rotor diameter, h = 0.200 km, and d = the rotor diameter of a single turbine in kilometers. If a project contains turbines of varying rotor diameters, the hazardous volume for the project is the sum of the hazardous volume calculated for each turbine size. This definition of hazardous volume is consistent with the equation used to estimate fatality in Appendix A, thus, it must also be used to calculate project-specific hazardous volume. If calculating hazardous volume at a wind project that has modified or added turbines after September 11, 2009, the hazardous volume requiring compensatory mitigation can be calculated as the hazardous volume that became operational after September 11, 2009, minus the hazardous volume that went operational before September 11, 2009.

$$HV = HV_{after} - HV_{before}$$

The Service will require that general permittees provide offsetting compensatory mitigation, at a ratio of 1.2:1 for golden eagles based on an EMU-specific rate of eagles per kilometer cubed (km^3) of hazardous volume. The rates for each EMU are listed in Table 3-3 and represent the number of fatalities we estimate will occur in each EMU per hazardous volume (km^3). Details on how these values were calculated are included in Appendix A.

Under this Alternative, the Service would continue to require mitigation at a 1.2:1 ratio for golden eagles, consistent with our 2016 Eagle Rule and as analyzed in the PEIS. Similar to Alternative 2, a small amount of compensatory mitigation (general-permit LAP mitigation requirement) will be required in order to ensure authorized take in LAPs remains consistent with our preservation standard. Unlike under Alternative 2, this amount will be based on a rate of eagles per kilometer cubed (km^3) of hazardous area that exists or is proposed at a wind energy facility regardless of whether is part of baseline or not. To keep these mitigation calculations simple and straightforward, we will require bald eagle mitigation based on the estimated nationwide take rate for bald eagles. The bald eagle mitigation rate was calculated at 25% of the nationwide rates per unit hazardous area volume for bald eagles and are listed in Table 3-3. Details on how take estimates were calculated are included in Appendix A. The mitigation credits purchased with this requirement could be used to offset bald or golden eagle take should the Service determine that authorized bald or golden eagle take in a locality is in danger of being inconsistent with our preservation standard.

Table 3-3. Five-year compensatory mitigation rates under Alternative 3, by EMU. Compensatory must be provided to ILF programs that will offset the number of golden eagles (**GOEA Mitigation Rate**) and apply LAP mitigation credits (**LAP Mitigation Rate**) as directed by the Service.

EMU	**Annual GOEA Fatality Rate** (# of golden eagles per km^3)	**Annual BAEA Fatality Rate** (# of bald eagles per km^3)	**Five-Year GOEA Mitigation Rate**[1] (# of golden eagles per km^3)	**Five-Year LAP Mitigation Rate**[2] (# of bald eagles per km^3)	**Total Five-year Mitigation Rate**[3] (# of eagles per km^3)

Atlantic/ Mississippi	0.73	1.74	4.38	2.18	6.56
Central	0.95	1.74	5.70	2.18	7.88
Pacific	1.55	1.74	9.30	2.18	11.48

[1] Calculated by multiplying the EMU specific Annual GOEA Fatality Rate by 1.2 (to account for the required 1.2:1 ratio), and then by five (to account for a 5-year permit term)

[2] Can be used for either eagle species as determined by the Service. Calculated as a percentage (25%) of the nationwide Annual BAEA Fatality Rate, multiplied by five (to account for a 5-year permit term).

[3] The Total Mitigation Rate is the sum of the Five-Year GOEA Mitigation Rate, and the Five-Year LAP Mitigation Rate.

Using the values in Table 3-3, a wind project in the Pacific EMU containing 100 turbines, each with a 95.7m rotor diameter (average diameter of existing turbines in the U.S. Geological Survey (USGS) U.S. Wind Turbine Database (Hoen et al. 2018)) will need to provide compensatory mitigation for 1.33 golden eagles to offset take at the EMU scale, and 0.31 bald eagles to offset take at the LAP scale for every five-year general permit received. The total mitigation requirement is calculated by the sum of the two mitigation rates; thus, the example project described would need to provide mitigation for 1.65 eagles for each 5-year general permit received.

As under Alternative 2, a general permit under Alternative 3 would require permittees to implement compensatory mitigation using a Service-approved ILF program. New agreements with ILF programs would be crafted to require the ILF program to track mitigation funds received from eagle take permittees and EMUs within which those funds must be spent. All mitigation credits purchased by permittees must be directed to the species-specific EMU where the take was authorized. Agreements with ILF programs would also require annual meetings with the Service. In the months between these annual meetings the Service will track the locations and estimated amounts of authorized take for each species under the GPP, noting areas with relatively high densities of general permits or high amounts of authorized take in each EMU. At each annual meeting, the Service will instruct the ILF programs where to direct mitigation efforts. Typically, the Service will direct ILF's to implement compensatory mitigation in areas in each EMU where cumulative authorized take seems to be the highest, and most likely to be impacting the LAP threshold; however, the Service may direct the funds based on other factors if deemed necessary for meeting our preservation standard.

Requirements for compensatory mitigation under specific permits would be the same as under Alternative 2.

Adaptive Management

Requirements for adaptive management under general and specific permits would be the same as under Alternative 2.

Fatality Monitoring

Under this Alternative, each general permittee will be required to provide a fatality monitoring fee at a rate that is commensurate with the hazardous area of each permitted project. Specifically, the Service will require that general permittees provide $2625 per turbine (calculated as described in Section 5.5.5.1). This amount would cover fatality monitoring costs for the duration of the five-year permit term. This money would be collected directly by the Service, as part of the general permit application fee, and is separate from any compensatory mitigation required. As under Alternative 2, the Service would take responsibility for fatality monitoring across all facilities with general permits. Monitoring objectives discussed under Alternative 2 would remain the same. We note that it is difficult to predict how many applications we will receive for general permits from wind energy facilities given this would be a new permit program. We have predicted participation to the best of our ability based on current information. However, if participation in general permits is lower than predicted, the Service may have insufficient funds to conduct our intended monitoring and could have to temporarily subsidize eagle monitoring efforts from our general funds. If the Service collects insufficient monitoring fees and does not have the ability to subsidize from general funds, the Service would likely have to either increase the fees associated with general permits or suspend the general permit program in part or in whole and convert existing general permits to specific permits.

Fatality monitoring for all specific permits under this Alternative would be the same as under Alternative 2.

Reporting

Reporting for all general and specific permits under this Alternative would be the same as under Alternative 2.

ALTERNATIVE 4: IMPLEMENT ALTERNATIVE 3 FOR WIND ENERGY FACILITIES; CREATE ADDITIONAL GENERAL PERMITS FOR POWER LINE ENTITIES, ACTIVITIES LIKELY TO CAUSE NEST DISTURBANCE, AND NEST REMOVAL ACTIVITIES

Under Alternative 4, the Service would implement all provisions under Alternative 3 and establish additional GPPs for the following:

Power Line Entities

Activities Likely to Cause Nest Disturbance

Nest Take and Nest Removal

Eligibility for General Permits

<u>*Wind Energy Facilities*</u>

Under this Alternative, the GPP for land-based wind energy facilities would have the same eligibility requirements as described under Alternative 3.

<u>*Power Line Entities*</u>

Under this Alternative, all power line entities would be eligible for a general permit, provided they are willing to accept and implement the conditions and certifications required by the Service (as described in the following sections).

The electric-utility industry has worked for decades alongside partners, including the Service, to find solutions that minimize raptor electrocutions and collisions that occur at some electric-utility infrastructure. This extensive work has resulted in the creation of Suggested Practice documents that describe effective methods to reduce electrocutions and collisions at infrastructure that is hazardous to raptors and eagles. The implementation of these Suggested Practice documents has reduced avian electrocutions and collisions on power line infrastructure (APLIC 2006). These proven standards for reducing avian take provide the basis for the different eligibility criteria and different GPP framework for power line entities than the framework proposed for wind energy facilities.

Activities Likely to Cause Nest Disturbance

Under this GPP, the Service would make general permits available to all activity types listed below that are likely to disturb a bald eagle nest, provided that applicants are willing to accept and implement the activity-specific conditions and certifications required by the Service.

> Building construction and maintenance within 660 feet of an in-use bald eagle nest or within 330 feet of any bald eagle nest;
>
> Linear infrastructure construction and maintenance (*e.g.*, roads, rails, trails, power lines, and other utilities) within 660 feet of an in-use bald eagle nest or within 330 feet of any bald eagle nest;
>
> Alteration of shorelines and water bodies (*e.g.*, shorelines, wetlands, docks, moorings, marinas, and water impoundment) within 660 feet of an in-use bald eagle nest or within 330 feet of any bald eagle nest;
>
> Alteration of vegetation (*e.g.*, mowing, timber operations, and forestry practices) within 660 feet of an in-use bald eagle nest or within 330 feet of any bald eagle nest;
>
> Motorized recreation (*e.g.*, snowmobiles, motorized watercraft, etc.) within 330 feet of an in-use bald eagle nest;
>
> Non-motorized recreation (*e.g.*, hiking, camping, fishing, hunting, canoeing, etc.) within 330 feet of an in-use bald eagle nest;
>
> Aircraft operation (*e.g.*, helicopters, fixed-wing aircraft, and unmanned aerial vehicles (UAV or drones)) within 1,000 feet of an in-use bald eagle nest; or
>
> Loud, intermittent noises (*e.g.*, blasting) within one-half mile of an in-use bald eagle nest, where the noise is intermittent or otherwise not present when the nest is initiated. Noise that is present prior to nest initiation and sufficiently consistent that eagles demonstrate tolerance to the activity does not require a permit.

All applicants conducting activities that are likely to disturb a golden eagle nest will need to apply for a specific permit. Further, any applicant likely to take a bald eagle nest that does not fall into the above categories or that cannot, or does not wish to, implement the general permit conditions under this GPP would have to apply for a specific permit.

Nest Take Activities

As listed in Section 3.4.2.4, this action proposes five situations under which the Service can authorize nest take. Under this GPP, the Service would make general permits available to applicants nationwide that wish to remove bald eagle nests under situations 1-3 only (nest take for emergency, nest take for health and safety, and nest take on human-engineered structures; see Section 3.4.2.4 for further explanation, including situations 4 and 5). The Service has amassed substantial experience issuing permits in these situations and is comfortable automating review and issuance of these permits under a GPP. The Service would make general permits available to applicants in Alaska only for removal of bald eagle nests under situation 5 (other purposes). In Alaska, the Service has already developed and implemented standard conditions to meet these requirements that are commensurate with the robust Alaska bald eagle population.

General permits would authorize removal of a bald eagle nest and any subsequent nesting attempts on the same nesting substrate and within one-half-mile of that location for the duration of the permit if the subsequent nests recreate the emergency, safety, or functional hazard that the permittee certified applied to the original nest.

All applicants wishing to remove a golden eagle nest, or a bald eagle nest under situations 4 or 5, would require a specific permit. These situations either result in impacts that the Service wishes to analyze individually or require more in-depth analysis than would occur through issuance of a general permit. All potential applicants that cannot or do not wish to implement the general permit conditions under this GPP would have to apply for a specific permit.

Pre-Application Information Collection

Wind Energy Facilities

Under this Alternative, the GPP for wind projects would have the same pre-application information collection requirements as described under Alternative 3.

All Other Activities

Under this Alternative, we will require all power line entities, individuals conducting activities likely to disturb eagles, and individuals wishing to take eagle nests, regardless of whether they are applying for a general or specific permit, to provide basic pre-application information as part of their application. Such information requirements are outlined in 22.200(c) and 22.210(c). No eagle-specific pre-application monitoring will typically be required.

Avoidance and Minimization Measures

Wind Energy Facilities

Under this Alternative, the GPP for wind projects would have the same avoidance and minimization requirements as described under Alternative 3.

Power Line Entities

Under this alternative, all power line entities applying for a general permit would need to certify that they have complied or will comply with the standard conditions. We will design these conditions to ensure that any risk of eagle take from new infrastructure will be limited, and any risk of eagle take at existing infrastructure is reduced over time. At a minimum, standard conditions will include the following:

All new construction and reconstruction of poles must be electrocution safe, as limited by human health and safety.

Develop and implement a reactive retrofit plan to address all electrocutions of eagles.

Develop and implement a proactive retrofit plan to convert all existing infrastructure to electrocution-safe infrastructure. You must convert $1/10^{th}$ of infrastructure that is not electrocution-safe at the effective date of the permit to electrocution-safe before expiration of the permit term. You must prioritize poles that are identified as highest risk to eagles.

Develop and implement an eagle collision response plan.

New construction and reconstruction must incorporate information on eagles into siting and design considerations, including siting a safe distance from nests, foraging areas, and roosts, considering the population status of the species, and as limited by human health and safety, overly burdensome engineering, and/or significant adverse effects to biological or cultural resources.

Develop and implement an eagle shooting hotspot plan.

Comply with all MBTA Part 21 regulations and permit conditions, including any provisions specific to authorizing incidental take.

Submit required reports to the Service, and

Pay the required application fee (50 CFR 13.11(d)(4)).

We will require all applicants for specific permits to implement any practicable avoidance and minimization measures. The Service and the applicant will negotiate measures at the project-level. These measures may vary between specific permits.

Activities Likely to Cause Nest Disturbance

Under this Alternative, applicants for general permits must meet or implement standard conditions for their activity type. These measures would become conditions of any general permit. The Service will continue to develop new measures and update these standards conditions in the future as new information becomes available. Examples of such measures are listed below. This list is not intended to be a complete list, and measures may be added or removed over time at the Service's discretion. When the Service changes these measures, all new general permit applicants will be held to those updated measures. If measures are updated by the Service, existing general permittees will not be required to adopt any new A&M measures. Applicants who do not wish to or cannot agree to the standard A&M measures have the option to apply for a specific permit.

Examples (not a complete list for each activity type) of avoidance and minimization measures that may become standard under an activity-specific set of standard conditions for nest disturbance general permits:

> To the extent practicable, conduct your activity at the farthest possible distance from the nest in question.
>
> To the extent practicable, avoid conducting activity within 330 feet of the nest in question during the early parts of the breeding season, when eagles are the most susceptible to disturbance.
>
> To the extent practicable, retain visual barriers between your activity and the nest in question.
>
> To the extent practicable, phase your activity so that activity farthest from the nest in question occurs first, and activity progresses towards the nest. This should give the eagles a chance to adjust to the presence of the activity.
>
> To the extent practicable, refrain from conducting your activity in view of the eagle nest in question from sunrise until 2 hours after sunrise, and from 2 hours before sunset to sunset.

All applicants for specific permits will be required to implement any practicable avoidance and minimization measures. Measures will be negotiated at the project level and may vary between specific permits.

Nest Take Activities

Under this Alternative, we would require applicants for general permits to agree to standard conditions specific to the reason for nest removal. These measures would become conditions of any general permit. The Service will continue to develop new measures and update these standards conditions in the future as new information becomes available. Examples of such measures are listed below. This list is not intended to be a complete list, and measures may be added or removed over time at the Service's discretion. When the Service changes these measures, all new general permit applicants will be held to those updated measures. If measures are updated by the Service, existing general permittees will not be required to adopt any new A&M measures. Applicants who do not wish to or cannot agree to the standard A&M measures have the option to apply for a specific permit.

Examples (not a complete list) of avoidance and minimization measures that may be standard under nest take general permits:

> To the extent practicable, when removing a nest from a communications tower to maintain or install equipment, you must bundle wiring to reduce risk of eagle entanglement.
>
> If installing exclusionary or deterrent devices, you must ensure the installations are designed to reduce risk of lacerations, punctures, entanglement, or other direct physical harm to eagles.
>
> You must make practicable efforts to reduce risk of the justifying emergency, safety concern, or functional hazard that justified your initial nest removal from recurring and necessitating further nest removals.
>
> To the maximum extent practicable, you must limit nest removal periods when the nest is not in-use.

We would require all applicants for specific permits to implement any practicable avoidance and minimization measures. Measures will be negotiated at the project-level and may vary between specific permits.

Compensatory Mitigation

Wind Energy Facilities

Under this Alternative, the GPP for wind projects would have the same compensatory mitigation requirements as described under Alternative 3

Power Line Entities

Under this alternative, we would not require power line entities to provide compensatory mitigation for permitted eagle take under general permits. Considering the standard avoidance and minimization measures that will be required with every general permit, which includes requirements to retrofit existing infrastructure and ensure new infrastructure is electrocution-safe, we anticipate participation in this general permit will effectively reduce the annual rate of electrocutions for both eagle species over time. Considering further that we expect the majority of eagle take under these general permits to be on infrastructure that is a part of the environmental baseline for permits set when we established the incidental-take permit framework in 2009, we anticipate that any general permit issued will be compatible with golden eagle preservation in the long-term, without compensatory mitigation. Furthermore, we expect that utilities assistance in reducing illegal shooting of golden eagles, which kills approximately 500 golden eagles per year (see Table 2 of Appendix A), will also advance eagle conservation, though we cannot quantify the exact benefit at this time.

Because we would negotiate avoidance and minimization measures for all specific permits at the project level and on a case-by-case basis, compensatory mitigation requirements for specific permits must be negotiated in a similar manner. We would typically not require compensatory mitigation if the project-specific avoidance and minimization measures are determined by the Service to meet or exceed the goals/outcomes of the standard conditions for general permits.

Activities Likely to Cause Nest Disturbance

Since general permits under this GPP will only be available for bald eagles, no compensatory mitigation will be required under nest disturbance general permits so long as authorized take remains below EMU thresholds.

All applicants for specific permits will be required to offset any take that the Service estimates would exceed established EMU take limits. For golden eagles, EMU take limits are set at zero throughout the United States; thus, compensatory mitigation would be required for all authorized take of golden eagles. Golden eagle take would be offset at a ratio of 1.2:1. For bald eagles, compensatory mitigation will not typically be required unless we estimate EMU take limits will be exceeded. Bald eagle take would be offset at a ratio of 1:1. All compensatory mitigation requirements must be applied in the EMU where the authorized take is occurring. If the Service estimates that authorized take under a specific permit may be inconsistent with our preservation standard at the LAP scale, the Service may elect to require compensatory mitigation within the project-specific LAP. Under specific permits, permittees would be encouraged to use Service-approved in-lieu fee programs; however, the use of such programs would not be required. Applicants for specific permits could submit their own mitigation plan for Service approval.

Nest Take Activities

Since general permits under this GPP will only be available for bald eagles, no compensatory mitigation will be required under nest disturbance general permits.

All applicants for specific permits will be required to offset any take that the Service estimates would exceed established EMU take limits. Requirements are identical to those described above for Activities Likely to Cause Nest Disturbance, except that if compensatory mitigation is required under a nest take permit to provide a net benefit to eagles, mitigation amounts must more than offset the estimated loss to eagle population.

Adaptive Management

Wind Energy Facilities

Under this Alternative, the GPP for wind projects would have the same adaptive management requirements as described under Alternative 3.

Power Line Entities

Under this Alternative, there will typically be no adaptive management requirements for power line entities under general or specific permits.

Activities Likely to Cause Nest Disturbance

When issuing general permits for nest disturbance, there will be no adaptive management requirements.

When issuing specific permits for nest disturbance, adaptive management would not typically be included as a permit condition. However, specific permits for some longer-term activities, especially where the Service has a high level of uncertainty surrounding the amount of authorized take, may come with project-specific adaptive management requirements. Such adaptive management conditions would typically have the same goal as under specific permits for wind energy development – to reduce the risk of exceeding authorized take.

Nest Take Activities

When issuing general permits for nest take, there will be no adaptive management requirements. General permits would provide some flexibility in that they would authorize continual removal of eagle nests on the same substate in the same year if eagles renest in the same place, or continual removal of eagle nests on other substrate within one-half mile of the original nest for the duration of the permit.

When issuing specific permits for nest take, the Service would generally not require adaptive management as described above for general permits; however, we would retain the ability to require project-specific adaptive management plans, if appropriate.

Fatality Monitoring

Wind Energy Facilities

Under this Alternative, the GPP for wind projects would have the same fatality-monitoring requirements as described under Alternative 3.

Power Line Entities

Under this Alternative, we would require that all power line entities receiving general permits train relevant employees to recognize and report eagle take. These employees would visually scan for injured eagles and eagle remains during inspections, maintenance, repair, and vegetation management on and around power poles, substations, or other project infrastructure. Staff must be trained upon employment and re-trained at least once every five years through the permit tenure. Additionally, each power line entity receiving a general permit would pay a fee of $5,000 for each state they wish to have seek authorization for. This fee will be combined with funds provided under general permits for wind energy facilities to monitor whether GPPs for wind energy facilities and power line entities adequately reduce golden eagle mortality across the landscape, including mortality rates from other sources. We note that it is difficult to predict how many general-permit applications we will receive from power line entities given this would be a new permit program. Our predictions for the number of general-permit applications we will receive from wind energy facilities are similarly limited. We have predicted participation to the best of our ability based on current information. However, if participation in the two GPPs is lower than predicted, the Service may have insufficient funds to conduct our intended monitoring and could have to temporarily subsidize eagle monitoring efforts from our general funds. If the Service is short on monitoring fees and does not have the ability to subsidize from general funds, the Service would likely have to either increase the fees associated with general permits or suspend the general permit program in part or in whole and convert existing general permits to specific permits.

Specific permits issued to power line entities would require eagle fatality monitoring at least at the level required under general permits. Depending on the situation, the Service could require additional fatality monitoring. Monitoring requirements are likely to vary depending on concerns or questions the Service might have, along with the level of fatality monitoring already implemented by the applicant on and around project infrastructure.

Activities Likely to Cause Nest Disturbance

Because nest disturbance permits are not likely to result in death or injury of eagles, we would require no fatality monitoring for general or specific permits for nest disturbance. However, under both general and specific permits, we would typically require monitoring for nest occupancy, success, and productivity. Monitoring requirements under general permits would be standardized and designed not to be overly burdensome to any applicant. Under specific permits, we would determine monitoring requirements on a permit-specific basis and may include additional measures unique to permit-specific questions or concerns.

Nest Take Activities

Similar to nest disturbance permits, nest take permits are not likely to result in death or injury of eagles, thus we would require no fatality monitoring under general or specific permits. Monitoring requirements under general and specific permits for nest take should instead determine if nests are rebuilt at the location of the nest take or in the vicinity. For both general and specific nest removal permits where the nest substrate is removed, we may not require monitoring.

Reporting

Wind Energy Facilities

Under this Alternative, the GPP for wind projects would have the same reporting requirements as described under Alternative 2.

Power Line Entities

Under this Alternative, we would require all power line entities to report all eagles discovered injured or dead on or near utility infrastructure, regardless of suspected cause. The utility will also be required to report, at minimum, the location, date of discovery, distance to the nearest infrastructure, and design and retrofit status of adjacent infrastructure.

Activities Likely to Cause Nest Disturbance

General and specific nest disturbance permits may require annual reporting of nest occupancy, success, and productivity monitoring results.

Nest Take Activities

General and specific nest take permits may require annual reporting of nest site monitoring results.

ALTERNATIVE CONSIDERED BUT ELIMINATED

The following Alternatives were considered but eliminated from detailed analysis in this EA.

Amend Existing Regulations (50 CFR 22.80 and 22.85) to Encourage Increased Participation and Increased Permitting Efficiency

Under this Alternative the Service would not change the permitting framework by adding the concept of general permits. Rather, we would propose amendments to existing regulations that make eagle take permitting more efficient and increase participation. We eliminated this alternative from consideration because it still would have required project-specific analysis for all eagle-take permits. Our strong preference is to be able to focus our limited time and resources on eagle take permits that are likely to have the highest risk to eagles and/or the highest uncertainty surrounding that risk. In addition, the 2016 rulemaking effort was designed to achieve the same goal with limited success. Thus, any Alternative that simply amends the current permitting framework may not meet the purpose and need for this action.

Different Relative Abundance Eligibility Criteria for General permits for Wind

Under this Alternative, the Service would alter the eagle permitting framework to include the concept of general permits, as proposed in Action Alternatives 2, 3, and 4. However, we would have selected different ERA thresholds than described and selected in Alternative 3 and 4, which placed 95% and 50% of the overall bald and golden eagle abundance distributions, respectively, in the general permit zone (See Appendix X), provide all existing or proposed turbines in a project are beyond 660 feet and two miles from bald and golden eagle nests, respectively. Alternatives considered included scenarios with 92.5% and 97.5% of the overall bald eagle abundance distribution included in the general permit zone, and 30% and 70% of the overall golden eagle abundance distribution included in the general permit zone. The lower percentage scenarios for bald and golden eagles were slightly more protective of eagles because they decreased general permit eligibility. The higher percentage scenarios for bald and golden eagles were slightly less protective of eagles because they increased general permit eligibility. After consideration of these alternate scenarios, the higher percentage scenarios were eliminated because they contained projects with too broad a range of risk for the Service to conclude that authorizing all eligible projects under general permits would be consistent with the preservation standard. The lower percentage scenarios were more protective of eagles but were eliminated to ensure that a higher percentage of wind projects would be eligible for general permits and thus apply conservation and mitigation measures to reduce impacts to eagles. In effect, setting lower thresholds and reducing the area where projects are eligible to apply for general permits is a tradeoff between potentially increasing the overall risk to eagles from the GPP while also increasing the number of projects that apply for an eagle permit and thereby implement measures designed to protect eagles that may not be implemented otherwise. To further ensure that the selected moderate percentages in Alternatives 3 and 4 were sufficiently protective of eagles, ERA thresholds were paired with minimum distances from nest locations when setting eligibility criteria. Thus, even projects that are eligible for general permits based on ERA may still need to obtain a specific permit based on proximity to a nest location.

New Regulations Promulgating General Permits for All Activities Likely to Take Eagles; No Specific Permits

Under this Alternative, the Service would have retained very little of the current eagle take permitting framework, eliminating specific permits in lieu of general permits for all applications. Although this Alternative may make the permit process more efficient and increase participation, the Service could not see how to accomplish such a drastic change while still being able to determine that our permit program is consistent with the preservation standard. This Alternative would also eliminate a large amount of Service oversight on our eagle take permitting program and was not sufficiently protective of eagles, thus we eliminated it from further review.

Chapter 4.0 Affected Environment

Introduction

This chapter describes the affected environment associated with the current status quo, as described in the No Action Alternative, and acts as a baseline for considering the environmental impacts of adopting the actions considered as part of the three Action Alternatives. The proposed action will affect relatively few specific resources aside from both eagle species and other wildlife species that might also incidentally benefit from any permit conditions or compensatory mitigation, particularly other raptor species. This chapter therefore is limited to a description of the general populations and status of bald and golden eagles, and other wildlife that may be impacted by this rulemaking. This section also describes tribal interests and cultural resource considerations where relevant.

This EA tiers to the 2016 PEIS (USFWS 2016b), which, along with an accompanying status report (USFWS 2016c), provides population size estimates, allowable take rates, and allowable take limits for bald and golden eagles. The PEIS also established that the Service will use the 20th quantile of the probability distribution for population size as the basis for setting the take limits. In other words, the PEIS set up the sideboards within which the Service's eagle incidental permit program could operate and be compatible with the preservation of both eagle species as required in the Eagle Act. We do not expect any of the Action Alternatives to affect or alter the eagle-management framework described in the PEIS in any way that could result in significant environmental impacts. The PEIS also committed the Service to conducting population and other monitoring necessary to update the population size estimates and demographic information used to set the take limits. The PEIS required that the population size estimates be reassessed at least once every six years. We anticipated in the PEIS that these updates would not require additional NEPA analysis, including supplementation, but that we would notify the public of any updated information and any adjustments to the allowable take limits.

For bald and golden eagles, we incorporate the Affected Environment sections from the PEIS by reference here (Sections 3.2.1 for bald eagles, and 3.3.1 for golden eagles). However, new research and information related to eagle populations is available, including recent updates to the population estimate and take limits for bald eagles. This new information, and any updated EMU take limits for bald eagles, are described below.

Bald Eagles

Population Size and Take Limits

The Service has implemented monitoring programs that provide data suitable for updating population size and allowable take estimates for each eagle species' range in the United States. Based on that monitoring, the Service has formally updated population size (USFWS 2021a) and allowable take rates and take limits (USFWS 2022) for bald eagles in four of six bald eagle EMUs (87 FR 5493, February 1, 2022) since publication of the 2016 PEIS. The methods and approach for these updates are presented in Zimmerman et al. (2022).

The updated population estimate covers four EMUs (Atlantic, Mississippi, Central, and northern Pacific) excluding the Pacific Flyway South and Alaska EMUs (USFWS 2021a). The Service estimated 316,708 bald eagles were present in the four EMUs in the 2019 breeding season, 4.4 times more eagles than in 2009. The Service uses the 20th quantile of the probability distribution for the population estimate as the relevant value for management purposes, which is 273,327 bald eagles. The new population estimate was obtained via three main components:

aerial surveys in 2018 and 2019 of 364 plots (100 km^2) to estimate the number of occupied bald eagle nesting territories in 16 high-density breeding survey strata (USFWS 2021a);

a model relating eBird bald eagle relative-abundance estimates to the survey-based, occupied-nesting-territory estimates at the plot level, and then using the eBird model and eBird data to estimate the number of occupied, bald eagle, nesting territories for four of the six EMUs; and

an integrated population model (IPM) to obtain updated estimates of bald eagle vital rates. These estimates were used to extrapolate the estimated number of occupied bald eagle nesting territories to determine total population size. Using the IPM allowed better incorporation of floaters, juveniles, and subadults into estimates of overall population size. These age groups, particularly adult floaters, could not be included effectively with the previous population estimation efforts. This contributed to the increased population estimate but most of the is likely due to population growth, estimated to be around 10-percent per year.

The Service did not implement surveys in Alaska due to limited financial and logistical resources. In the Pacific Flyway South EMU, bald eagles are relatively scarce and patchily distributed, making aerial surveys impractical. Take limits for these two EMUs will remain as reported in the 2016 PEIS until the Service is able to acquire and conduct separate analyses of new information from these populations.

As part of the Service's bald eagle population update (USFWS 2021a), we used a prescribed take level model, with input from the IPM, to update the bald eagle allowable take rate (Zimmerman et al. 2022) consistent with our goal of maintaining stable bald eagle numbers measured against the baseline of population size in 2009 (USFWS 2016b). The updated allowable take rate distribution multiplied by the updated population size estimate distribution produces the updated bald eagle EMU take limits; the Service uses the 20^{th} quantile of that joint distribution as the take limit.

Under the 2016 Eagle Rule, the Service set take limits (for take that is not required to be offset) at 6% of populations for bald eagles in most EMUs, including the Alaska portion of the Pacific Flyway, with a lower rate (3.8%) in the Pacific Flyway South EMU. After updating the bald eagle population estimate and allowable take rate (USFWS 2021a), the Service updated the EMU take limits for bald eagles (Table 4-1; USFWS 2022a). Take limits for the Pacific Flyway South and Alaska Flyway EMUs were not changed because the Service's population estimate for those EMUs has not been updated.

Table 4-1: Current bald eagle EMU-specific population size and take limits. Population size for management purposes, reported here, is the 20^{th} quantile of the probability distribution for the total population size USFWS 2016b). Estimates for the Pacific Flyway South and Alaska are described in the PEIS (USFWS 2016b); estimates for all other flyways are described in USFWS 2021a, Zimmerman et al. (2022), and Appendix A. This table updates information in Table 3 in USFWS (2016c) and Table 3-2 in the PEIS (USFWS 2016b).

Eagle Management Unit	Year Updated	Current Allowable Take Rate	Current Population	Current Take Limit

			Size Estimate (20th Quantile)	(20th Quantile)
Atlantic Flyway	2021/2022	0.090	72,990	4,223
Mississippi Flyway	2021/2022	0.090	137,917	7,986
Central Flyway	2021/2022	0.090	26,253	1,521
Pacific Flyway North	2021/2022	0.090	36,302	2,102
Pacific Flyway South	2016	0.038	391	15
Alaska	2016	0.060	62,935	3,776

CAUSES OF MORTALITY

Causes of bald eagle mortality are reviewed in Section 3.2.1.2 of the PEIS (USFWS 2016). Since we issued that document, additional information has been published relevant to bald eagle populations and management. Two recent studies in particular have highlighted the negative effect of lead contamination on bald eagle population growth.

Hanley et al. (2022) used a population matrix model to compare bald eagle population dynamics under current condition to hypothetical reduced-lead and lead-free scenarios. They used annual counts, banding records, and necropsy records gathered between 1990 and 2018 in seven northeastern U.S. states to inform their model. They determined that mortality events of wild eagles that arose from the ingestion of lead affected population dynamics and depressed the long-term growth rate of the population by 4.2% in female eagles and 6.3% in male eagles. They concluded that, although current lead contamination levels have not caused a region-wide decline of eagles, these conditions have stressed the resilience of the population.

Slabe et al. (2022) quantified the lead exposure of 1210 North American bald and golden eagles across the annual cycle from 2010-2018. Study findings for golden eagles are summarized in Section 4.3. They used the blood of live bald eagles (n = 237) and from bone, liver, and feathers of dead bald eagles (n = 343) to test hypotheses about (i) the spatial, temporal, and demographic extent of lead exposure across the continent, and (ii) the degree to which lead exposure influences the trajectory of populations of these two species in North America. They found 47% of bald eagles had bone lead concentrations above thresholds for chronic poisoning. Frequency of chronic poisoning was greater in adults than subadults and greater for bald eagles in the Central Flyway than in the Atlantic and Pacific Flyways. Using matrix population models and assuming that severe clinical poisoning always results in death, they estimated that lead poisoning suppresses the bald eagle population growth rate by 3.8% (95% confidence interval: 2.5% - 5.4%).

In 2022, an emerging strain of highly pathogenic avian influenza (HPAI) has been documented in the U.S., with preliminary reports showing bald eagles are susceptible (APHIS 2022). HPAI viruses can severely affect human, domestic animal, and wildlife health (USFWS 2022c). It is unclear how vulnerable bald eagles are to HPAI or if HPAI could have population level impacts. The Service will continue to monitor HPAI along with partner government agencies including the National Wildlife Health Center (U.S. Geological Survey; National Wildlife Health Center

2022) and the Animal and Plant Health Inspection Service (U.S. Department of Agriculture; APHIS 2022).

Golden Eagles

Population Size and Take Limits

The Service has collected and analyzed updated demographic and population monitoring information for golden eagles in one and parts of a second golden eagle EMU, which collectively cover about 85% of the species U.S. population. The results of those analyses have recently been peer-reviewed and published (Millsap et al. 2022).

The golden eagle population size update (Table 4-2; USFWS 2022) used the Service's golden eagle westwide survey data through 2016 along with Breeding Bird Survey data from 1997 – 2016 from the coterminous U. S. portions of the Central and Pacific flyways. These count data were combined with demographic data from 1997 – 2016 in an IPM, and the vital rate estimates from that model were used to update our estimate of the allowable take rate for these parts of the two golden eagle EMUs. For golden eagles, much of the survival information in the IPM came from 512 individuals tagged with GSM-GPS transmitters (see Section 4.3.2). Within the golden eagle IPM, we implemented a cause-of death model to estimate the frequency of each primary cause of mortality. As with bald eagles, golden eagle population size and allowable take rates in the EMUs where updates have not occurred remain as in 2016. Golden eagle populations in the western U.S. appeared stable through 2016, but there is increasingly strong evidence that anthropogenic mortality exceeds the allowable take rate (Millsap et al. 2022), potentially leading to future population declines.

Table 4-2: Current golden eagle EMU-specific population size and take limits. Population size for management purposes, reported here, is the 20th quantile of the probability distribution for the total population size (USFWS 2016b). Estimates for the Central and Pacific Flyways are described in Millsap et al. (2022) and are combined because we did not estimate population size separately for each EMU. Estimates for the Atlantic-Mississippi Flyways and Alaska are from USFWS (2016b). This table updates information in Table 10 in USFWS (2016c) and Table 3-7 in the PEIS (USFWS 2016b). See also Appendix A.

Eagle Management Unit	Year Updated	Current Allowable Take Rate	Current Population Size Estimate (20th Quantile)	Current Take Limit (20th Quantile)
Atlantic-Mississippi Flyways	2016	0.050	3,180	0
Central & Pacific Flyways	2022	0.070	30,958	0
Alaska	2016	0.050	4,002	0

CAUSES OF MORTALITY

Section 3.3.1.2 of the PEIS (USFWS 2016b) describes known causes of mortality for golden eagles. We update that information here with more recent studies. Millsap et al. (2022) investigated causes of mortality for transmittered golden eagles (n=512) with broad coverage of the western United States. Transmittered birds provide less biased information on causes of mortality compared to band recoveries and incidental finds of dead individuals because both of the latter are dominated by birds that die in places where they are more likely to be discovered (Schaub and Pradel 2004). Millsap et al. (2022) determined cause-of-death for 126 transmittered golden eagles for which the cause-of-death could be confidently determined (Table 4-3). Based the proportions of known cause of death and population estimates for the species, Millsap et al. (2022) estimated that anthropogenic factors (collision, electrocution, shooting, poisoning, and trapping) accounted for nearly 60% of all golden eagle mortality in the coterminous western United States (Table 4-3).

Table 4-3: Estimated number of golden eagles that die annually from nine major causes of death in the interior western coterminous U. S., 1997 - 2016, reprinted from Table 2 in Millsap et al. (2022). This updates Table 8 in U. S. Fish and Wildlife Service (2016c).

Eagle age and Cause of Mortality	**Median**	**Lower 95% credible interval**	**Upper 95% credible interval**
First year			
Deaths per year			
Collision	51	11	143
Electrocution	69	20	174
Shot	69	20	174
Poisoned	32	4	109
Caught in trap	88	30	203

Fight	32	4	109
Disease	88	30	204
Accident	182	86	346
Starvation	656	416	1001
After First Year			
Collision	560	322	877
Electrocution	437	231	731
Shot	601	354	926
Poisoned	395	201	675
Caught in trap	191	67	409
Fight	191	68	408
Disease	150	45	351
Accident	274	118	523
Starvation	150	45	348

Slabe et al. (2022) quantified the lead exposure of 1210 North American bald and golden eagles across the annual cycle from 2010-2018. Study findings for bald eagles are summarized in Section 4.2. Slabe et al. (2022) used the blood of live golden eagles (n = 383) and bone, liver, and feathers of dead eagles (n = 270) to test hypotheses about (i) the spatial, temporal, and demographic extent of lead exposure across the continent, and (ii) the degree to which lead exposure influences the trajectory of populations of these two species in North America. They found that 46% of golden eagles had bone lead concentrations above thresholds for chronic poisoning. Using matrix population models and assuming that severe clinical poisoning always results in death, they estimated that lead poisoning suppresses the golden eagle population growth rate by 0.8% (95% confidence interval: 0.7%- 0.9%).

Mojica et al. (2018) reviewed known scientific literature on golden eagle electrocutions from 1940 to 2016. They concluded that golden eagle electrocution on power poles is a global conservation problem and a leading anthropogenic cause of death for golden eagles, with an estimated 504 golden eagles (95% credible interval: 124–1,494) electrocuted annually in North America (USFWS 2016c). The identified eight electrocution risk factors: pole design, eagle age, morphology, land cover and topography, prey availability, season, weather, and behavior. Pole configuration was the most frequently identified electrocution risk factor and electrocution incidents were most often associated with distribution level (<69 kV) equipment poles. Age was the second most frequently identified risk factor, with juvenile eagles electrocuted at approximately twice the rate of subadults or adults. Risk was also associated with large body size, high-quality habitat, high prey density, winter dispersal, inclement weather, and intraspecific interactions. To reduce electrocutions and mortalities, Mojica et al. (2018)

recommend updating utility construction standards to require avian-friendly construction for new facilities in eagle habitat, reactive retrofitting programs for utilities where utility staff are trained to recognize and report electrocution events and immediately retrofit the pole and nearby high-risk poles to prevent repeat events, and risk assessments for utilities to proactively target areas with high-risk poles in eagle habitat and schedule annual retrofitting activities to systematically fix poles on their system. They also recommend that compensatory mitigation should incorporate risk assessments at the regional scale to efficiently target the highest risk poles first for a greater reduction of electrocution risk at the EMU scale.

Two recent studies have also examined how mortalities may affect population dynamics for golden eagles across the continent. Katzner et al. (2016) performed a suite of genetic and stable isotope analyses on samples from 67 Golden Eagles killed at the Altamont Pass Wind Resource Area in California from 2012 to 2014. They determined that 26% (17 of 66) of the Golden Eagles killed at the study site immigrated to the area within about 12 months and concluded that the apparent stability of the local golden eagle population was maintained by continental-scale immigration. Due to the interconnectedness of the golden eagle population, Katzner et al. (2016) concluded that mitigation of turbine-associated mortality occurring in other parts of the western United States could have local benefits, which is consistent with the Service's strategy to use compensatory mitigation to offset eagle mortalities at specific permitted projects.

Tack et al. (2017) used life-stage simulation analysis to identify golden eagle life-history characteristics that most affect population growth and are amenable to management actions. They found that breeding adult survival had the greatest relative effect on population growth, although productivity explained the most variation in growth, and found that even minor reductions in breeding adult survival (<4.5%) caused otherwise stable populations to decline. Tack et al. (2017) determined that their results supported the Service's compensatory mitigation strategy for permitting at wind energy facilities under the 2009 Eagle Rule, suggested that reducing anthropogenic sources of mortality should be a top management objective, and recommended reducing golden eagle mortalities due to electrocutions and lead poisoning as two practicable mitigation targets.

In 2022, an emerging strain of highly pathogenic avian influenza (HPAI) has been documented in the U.S., with preliminary reports showing bald eagles are susceptible (APHIS 2022). No golden eagle mortalities have been reported to date, but current spread is in the eastern U.S. (APHIS 2022) where golden eagle density is low. HPAI viruses can severely affect human, domestic animal, and wildlife health (USFWS 2022c). It is unclear how vulnerable golden eagles are to HPAI or if HPAI could have population level impacts. The Service will continue to monitor HPAI along with partner government agencies including the National Wildlife Health Center (U.S. Geological Survey; National Wildlife Health Center 2022) and the Animal and Plant Health Inspection Service (U.S. Department of Agriculture; APHIS 2022).

Migratory Birds

The PEIS (USFWS 2016b) described the affected environment for migratory birds in Section 3.5.1. We incorporate that information by reference here and update it with new information.

On January 7, 2021, the Service published a final rule defining the scope of the Migratory Bird Treaty Act (MBTA), as amended (16 USC 703–712) as it applies to conduct resulting in the injury or death of migratory birds protected by MBTA (86 FR 1134). The Service determined that the MBTA's prohibitions on pursuing, hunting, taking, capturing, killing, or attempting to do the same, applied only to actions directed at migratory birds, their nests, or their eggs.

On October 4, 2021, the Service published a final rule revoking the January 7, 2021, regulation that limited the scope of the MBTA (86 FR 54642), effective December 3, 2021. The Service did not propose replacement language, instead simply removing the previous language. A Director's Order clarifying the Service's current enforcement position that the MBTA prohibits incidental take was issued at the time of this final rule's publication, coming into effect on the effective date of the final rule (USFWS 2021b).

In addition, the Service simultaneously published an Advanced Notice of Proposed Rulemaking (ANPR) announcing the intent to solicit public comments and information as we consider developing proposed regulations to authorize the incidental take of migratory birds (86 FR 54667, October 4, 2021). The ANPR describes the Service's intent to address human-caused migratory bird mortality by codifying the interpretation that the Migratory Bird Treaty Act (MBTA) prohibits incidental take of migratory birds and developing regulations that authorize incidental take under prescribed conditions, in order to further the Service's objectives to better protect migratory bird populations and provide more certainty for the regulated public. The Service intends to gather information necessary to develop a proposed rule to authorize the incidental taking or killing of migratory birds, including determining when, to what extent, and by what means it is consistent with the MBTA and compatible with the terms of the four migratory bird conventions. This information will be used to develop proposed regulations to authorize the incidental take of migratory birds under prescribed conditions and prepare a draft environmental review pursuant to the National Environmental Policy Act of 1969, as amended. Comments on the ANPR were accepted from the public until December 3, 2021. New regulations resulting from the ANPR have not yet been promulgated.

The Service announced revisions to the list of migratory birds protected by the MBTA by both adding and removing species, effective May 18, 2020 (85 FR 21282, April 20, 2020). Reasons for the changes to the list include adding species based on new taxonomy and new evidence of natural occurrence in the United States or U.S. territories, removing species no longer known to occur within the United States or U.S. territories, and changing names to conform to accepted use. The net increase of 67 species (75 added and 8 removed) brought the total number of species protected by the MBTA to 1,093.

On June 16, 2021, the Service announced the availability of Birds of Conservation Concern (BCC) 2021 (86 FR 32056, USFWS 2021c). This publication identifies species, subspecies, and populations of migratory birds in need of additional conservation actions and updates the previous list from 2008. The purpose and goal of this publication is to stimulate and guide coordinated, collaborative, and proactive conservation actions for these taxa among Federal, State, Tribal, and private partners. The 2021 BCC list does not include bald eagles or golden eagles. Bald eagles were previously listed as a BCC because of their recent Endangered-Species-Act-delisted status (USFWS 2008).

With ranges spanning the North American continent and beyond, migratory birds are bound to occur in the vicinity of permitted projects or future permitted projects, and potentially impacted by the eagle-permit conditions required of a permitted project or activity or a future permitted project or activity. Under current regulations, the Service considers impacts to migratory birds on a permit-by-permit basis prior to issuance.

Federally Threatened and Endangered Species

With ranges spanning the North American continent, bald and golden eagles often occur near listed species. Although the regulations we propose will not apply to any listed species, such species could be present at projects applying for eagle incidental take permits or in areas where compensatory mitigation is being implemented. Since the proposed regulations will apply nationwide and we expect permits to be issued in all part of the country, any listed species could be present and potentially impacted by the eagle-permit conditions required of a permitted project or activity, or by a future project or activity. Information about listed species in a given location can be obtained from the Service's Information for Planning and Conservation (IPaC) tool at https://ipac.ecosphere.fws.gov. Under current regulations, the Service considers impacts to listed species on a permit-by-permit basis prior to issuance.

Tribal Traditional Uses/Native American Religious Concerns and Cultural Resources

In Section 3.7.1 of the PEIS (USFWS 2016b), the Service describes cultural and religious issues related to the 2016 Eagle Rule, including the affected environment, the spiritual significance and use of eagles and eagle parts by Native Americans, the symbolism of eagles in U.S. history, and relevant federal and tribal statutes. We incorporate that information here by reference. The federal government has a unique responsibility and obligation to consider and consult with Native American Tribes on potential effects to resources that may have religious and cultural importance to Tribes. Eagles, eagle feathers, and eagle nests in particular may all be of interest and importance to area tribes; and eagles and their feathers are considered sacred in many Native American traditions. Under the Eagle Act and our implementing regulations, we may issue permits authorizing the taking, possession, and transportation of eagles, eagle parts, or eagle nests for Indian religious use, see 50 CFR Parts 21 and 22.

Under the 2016 Eagle Rule, eagle incidental take permits at wind energy facilities with a duration of greater than 5 years must include third-party fatality monitoring (USFWS 2016a). Dead eagles found as a result are sent to the Service's National Eagle Repository. If in good condition, the remains are distributed to permitted members of federally recognized tribes. See also the discussion of this topic in the PEIS (Section 3.7.1.4, USFWS 2016b).

In addition, issuance of an eagle take permit is an undertaking under the National Historic Preservation Act (NHPA), which may require consideration of the effects of the permit issuance on historic and cultural resources as those are defined under the NHPA and implementing regulations at 36 CFR Part 800.

Socioeconomics

The analysis of socioeconomic resources identifies those aspects of the social and economic environment that may be affected by the proposed revisions to the 2016 Eagle Rule (USFWS 2016b). The industries most likely to be directly affected include long-term infrastructure and public service projects, such as real estate development and transportation, and public utility, resource development, and energy projects. Economic considerations for developers include project finance, contracts or agreements, and weighing the cost of obtaining and complying with conditions of an eagle incidental take permit against the risks, financial and nonfinancial, of operating without one. The societal impacts analysis focuses on how recreational opportunities, aesthetic, and other societal values might be affected by the proposed revisions.

Financial Impacts

Permitting and Mitigation Costs

Costs to an applicant associated with eagle incidental take permits include the permit application fee associated with the permit itself. This fee currently differs depending on the type of permit issued, and whether the permit is a general or specific permit, and/or specific to a given industry or associated with nest disturbance or nest take. The fee is used by the Service to account for the time and resources needed to issue the permits.

For certain permits, such as those issued for wind energy projects, compensatory mitigation may be required to be implemented as a requirement of the permit. Compensatory mitigation requirements are based on the expected amount of eagle take from the project. The cost to purchase an "eagle credit" of compensatory mitigation is based on market transactions conducted with the entity that will be conducting the restoration or enhancement. The Service has approved and will continue to approve in-lieu fee programs or compensatory mitigation banks that allows the entity seeking mitigation credits to negotiate a price with a different entity that can use the funds to conduct an activity that will reduce the take of eagles. At present, the only mitigation activity that has been approved under in-lieu fee programs is retrofitting of utility poles. The costs of compensatory mitigation can be substantially greater than the permit application fee. Although the cost of an eagle credit can vary, such a credit can cost around $82,500 in the marketplace. This calculation is based on the retrofit cost of a power pole. The Service's 2013 Eagle Conservation Plan Guidance document assumes that $7,500 represents a reasonable estimate, at market price, for the current cost to retrofit power poles in the United States (USFWS 2013). We are carrying this value forward in our analysis here without increasing it to account for inflation because we do not expect the per pole cost to have permanently increased. Instead, the price may fluctuate both higher and lower than $7,500 because it is based on the programmatic market rate, which may fluctuate higher or lower based on market demand. The Service estimates that retrofitting 11 power poles is required to offset one eagle. Thus, we use this $82,500 value (11 poles at $7,500 apiece) when discussing compensatory mitigation in this analysis.

Other permitting costs include the costs incurred by the applicant to implement the permit conditions, which may include pre-construction monitoring, project specific background data, fatality monitoring, and/or reporting. These costs are detailed in Section 5.2.5.1.

Project Financing Costs

Companies often utilize project financing when an infrastructure investment needs long-term financing from sources outside the parent company. Project financing uses cash flow generated by the project to repay investors with the project's assets and rights as collateral. This type of financing is typically used by real estate development, transportation, public utility, dam, and renewable energy projects. In general, investors base their investment decision on the projected profits and associated risks of the potential project. Typical risks associated with project financing include construction, operational, supply, offtake, repayment, political, and currency (Fletcher and Pendleton, 2014). As noted by Comer (1996), "because many risks are present in such transactions, often the crucial element required to make the project go forward is the proper allocation of risk". Operational risk may be impacted if the infrastructure's location coincides with bald or golden eagle habitat, which could potentially lead to eagle take without prior authorization. As such, there would be potential that a project would no longer continue to generate the forecasted revenue to repay investors. One approach to manage operational risk would be to obtain an eagle incidental take permit or insurance that may increase the cost of the project but would also reduce the potential risk of consequences from eagle take.

Enforcement Costs

The Service uses enforcement as a last resort, preferring to first work collaboratively with companies to minimize risk to eagles and ensure the long-term health of eagle populations through the issuance of take permits. However, the Service may undertake enforcement action against companies that fail to minimize risk or obtain an incidental take permit (USFWS, 2000; USFWS, 2014). Entities operating without an eagle take permit risk federal penalties, including criminal prosecution, under both the MBTA and the Eagle Rule for any unauthorized take of eagles. The Eagle Rule prohibits anyone from, amongst other things, taking an eagle or eagle nest without prior authorization. This includes in-use and alternate nests. The first criminal offense is a misdemeanor with maximum penalty of one year in prison and $100,000 fine for an individual ($200,000 for an "organization" such as a business). The second offense becomes a felony with maximum penalty of two years in prison and $250,000 fine for the offending individual ($500,000 for an organization). Service regulations currently provides for maximum civil penalties of $14,536 for each violation of the Eagle Act (see 50 CFR 11.33). Under the MBTA, which prohibits take of listed birds including eagles, any non-commercial violation is a strict-liability misdemeanor with maximum penalty of six months in prison and $15,000 fine, and commercialization (sale of live or dead eagles or parts of eagles) is a felony violation with a maximum penalty of two years imprisonment and $250,000 fine ($500,000 for an organization) (USFWS, 2012).

Societal Impacts

Eagles provide recreational opportunities such as birding, aesthetics, and providing benefits associated with public lands. According to the 2016 National Survey of Fishing, Hunting and Wildlife-Associated Recreation published by the Service, about 45 million Americans over the age of 16 observed birds (USFWS, 2016b). In 2011, the 11.9 million visits to National Wildlife Refuges primarily for birding generated over $257 million in economic activity, $73.9 million in job income, and 3,269 jobs (USFWS, 2013). It is not possible to attribute an exact share of this effect to eagles. Eagles have educational value in part due to the public attention that bald and golden eagles attract. Birdwatching can be used to foster ecotourism as a source of income. Many nature centers and nonprofit environmental organizations create revenue through birdwatching tours. These kinds of activities can also be used to introduce students and children to the outdoors to foster an appreciation for nature.

Eagles can provide spiritual enrichment and an appreciation of nature; sighting a bald or golden eagle can fulfill an aesthetic value. Resource values such as clean air and water quality, scenery and natural landscape, open space, and the number of recreation opportunities (including wildlife watching and birding) can be economic assets for local economies (Boley and Green, 2016).

The recreational value of natural resources can attract new or retain existing residents to an area. Proximity to nature, in particular to public lands, can influence where people choose to live and how much they are willing to pay for housing (i.e., property values). Homes with proximity and access to public lands receive a price premium. Research by Ham et al. (2012; 2014) and Mueller et al. (2021) indicate that people make regional housing and labor market decisions based in part on the availability of and proximity to public lands, such as forests, lakes, mountains, etc. Living proximate to public lands provides amenities such as convenient access to recreation and wildlife viewing, and sometimes disamenities such as crowds, litter, and noise. That is, population movement and migration into environmentally desirable areas can be explained by the presence of and density of natural resources and associated environmental amenities.

The value held by natural resources for purposes other than direct use is called “non-use value” or “existence value” and has been well-documented in the literature (Brookshire et al., 1983; Stevens et al. 1991; Freeman et al. 2014; Phaneuf and Requate, 2017). Individuals may receive value from the survival of eagles even if they do not expect to see one. The existence value of an eagle reflects this benefit. Eagles have served as powerful symbols in numerous cultures throughout history. In the U.S., Congress chose the bald eagle to be depicted on the official seal. In its capacity as the nation’s symbol, the bald eagle generally represents Americans’ sense of autonomy, courage, and power. Today, bald eagle imagery is ubiquitous in American culture, attesting to the widespread symbolic importance of bald eagles in U.S. society (USFWS, 2007). As the nation’s symbol, the bald eagle has a high existence value compared to other species (Ninan, 2009). The bald eagle is also widely portrayed as a symbol of environmental progress, concern, and/or general awareness. The remarkable decline and recovery of bald eagles coincides with the emergence of the ecological movement in the U.S. in the late 1960s. Bald eagles nearly became extinct due to expansive use of chemical pesticides during the booming post-World War II years, but then recovered dramatically when growing ecological awareness led to increased regulation of pesticides and the passage of numerous laws protecting wildlife and the environment. To many Americans, the bald eagle has come to exemplify ecological consciousness and the health of the environment (USFWS, 2007).

The concept of valuing species such as bald or golden eagles is controversial, as many oppose the notion of assigning dollar values to nature. However, disasters such as the Exxon Valdez and BP oil spills have created the need and opportunity to estimate non-use values of species and environmental resources. In general, it is not possible to use market prices or other revealed preference methods that use consumer behavior to estimate the existence value of the bald or golden eagle. “Stated preference” survey methods such as the contingent valuation method involve directly asking people, based on a specific hypothetical scenario and description of the environmental good or service, how much they would be willing to pay (WTP) for a change in that environmental good or service. Three example studies in the U.S. valuing bald eagle conservation from the 1980s and 1990s were found through a literature search (Boyle and Bishop, 1987, Stevens et al., 1991, Swanson, 1993). These studies report annual WTP of $30-64 per household per year in 2020 dollars. These values provide quantitative examples of WTP; however, they are not applied in the rest of the report as these studies were conducted when bald eagles were still classified as "endangered" and may not represent current values.

Chapter 5.0 Environmental Consequences

Introduction

This chapter describes the potential environmental effects associated with the No-Action alternative and the Action Alternatives. We present the Service's analysis of the direct and indirect effects to the environment that may occur as a result of implementing the alternatives.

The Council on Environmental Quality recently modified the uniform federal regulations implementing NEPA (85 FR 43304, July 16, 2020), including modifications to the definition of "effects" to be considered and the express repeal of the definition of "cumulative" impacts, see 40 CFR 1508.1(g)(3). Nonetheless, to determine our action's consistency with the Eagle Act's preservation standard, which is described in detail in the PEIS (USFWS 2016b), we must determine whether the direct and indirect effects of the take and required mitigation, together with the cumulative effects of other permitted take and additional factors, affected the eagle populations within the EMU and the LAP and if they are compatible with the preservation of bald and golden eagles. Additionally, the Council on Environmental Quality has proposed to modify certain aspects of its regulations for implementing the procedural provisions of NEPA, including restoring some regulatory provisions modified in 2020 (86 FR 55757, October 10, 2021). Thus, we analyze and discuss cumulative effects under each Alternative below where they are relevant and pursuant to our obligations under the preservation standard of the Eagle Act.

Alternative 1 – No Action

BALD AND GOLDEN EAGLES

Under the No Action Alternative, the current environmental impacts on bald and golden eagles described for the PEIS's Alternative 5 (Sections 3.2.2.7 and 3.3.2.7, USFWS 2016b) will continue.

The PEIS determined that impacts of Alternative 5 (and therefore, the impacts of the current regulations and the No Action Alternative of this EA) for eagle incidental take permits are likely to be moderately beneficial to bald eagles and minorly to moderately beneficial to golden eagles. Bald eagle populations in all of the EMUs and the nation as a whole are expected to continue increasing toward their theoretical carrying capacity, though once stabilized, would likely fall short of the levels that would be attained in the absence of human-caused impacts. For golden eagles, compensatory mitigation not only offsets authorized take but, because it is required at a ratio ≥1.2:1, also further reduces the impact of other factors that are currently limiting golden eagle population size. Thus, under the No Action Alternative, golden eagle populations may stabilize or increase in contrast to the stable or declining population projection anticipated prior to the 2016 Eagle Rule (see Figure 3-14, USFWS 2016b).

Increases in golden eagle populations as a result of mitigation are proportional to the amount of mitigation and therefore the number of permits issued and the amount of permitted take. Because the number of permits issued under the No Action Alternative is anticipated to be less than if one of the Action Alternatives is selected, mitigation and any resultant population increase under the No Action Alternative will be less than if an Action Alternative is selected. Although individual companies will ultimately determine project and turbine siting, we anticipate that the Action Alternatives below will encourage siting of future wind infrastructure in areas such that overall impacts to eagles will be lower than under the No Action Alternative.

MIGRATORY BIRDS

Under the No Action Alternative, the environmental consequences for migratory birds described for the PEIS's Alternative 5 (Sections 3.5.2.6, USFWS 2016b) will continue. As described in Section 5.3.1, the Service expects that the No Action Alternative will result in fewer permit applications and permits issued compared to the Action Alternatives due to the lack of GPP(s). Thus, the Service expects less compensatory mitigation for eagle take at wind energy facilities under the No Action Alternatives compared to the Action Alternatives.

Under the No Action Alternative, the Service would develop avoidance and minimization measures on a project-specific basis. There is a range of possible avoidance and minimization measures, and their effect on migratory birds could be beneficial (e.g., removing carcasses from a wind farm could reduce corvid moralities from turbine collisions), neutral (e.g., retrofitting power poles would have no effect on birds too small to risk electrocution) or detrimental (e.g., removing vegetation to discourage bird activity near a hazard would reduce overall habitat available for some species). Because the Service will select avoidance and minimization measures with the goal of minimizing detrimental effects, we expect that avoidance and minimization measures for GPPs will have a neutral or slightly positive impact overall on migratory birds. Because we expect the No Action Alternatives would result in the least implementation of avoidance and minimization measures compared to the Action Alternatives due to the lack of GPPs, we also expect that the positive impact on migratory birds would be less under the No Action Alternative compared to the Action Alternatives.

Compensatory mitigation for eagle incidental take permits under the 2016 Eagle Rule is likely to provide additional benefits to migratory birds. Compensatory mitigation in the form of power pole retrofits could benefit certain migratory-bird species by preventing electrocution mortalities of large-bodied birds that use power poles as nesting sites, roosts, or perches (likely raptors, vultures, and corvids). Compensatory mitigation that replaces lead ammunition with non-lead ammunition could prevent lead poisoning mortalities of birds that consume gut piles of harvested game (likely raptors, vultures, and corvids). The positive benefits to migratory birds will be proportional to the amount of mitigation and the number of permits issued. The number of permits issued under the No Action Alternative is anticipated to be less than if one of the Action Alternatives is selected, so mitigation and positive benefits to migratory birds will be less than if an Action Alternative is selected. Some potential forms of mitigation focused on eagles (such as habitat modification) could have adverse impacts to some migratory birds and migratory bird habitats, but the effects are more likely to be moderately beneficial overall. We therefore expect that compensatory mitigation for eagle take would result in a moderate reduction of migratory bird take. Because we expect the No Action Alternative would result in the least amount of compensatory mitigation, it would also have the smallest reduction of migratory bird take compared to all other Alternatives.

FEDERALLY ENDANGERED AND THREATENED SPECIES

Under the No Action Alternative, the eagle incidental take permitting program will continue as described in the PEIS (USFWS 2016b; Section 2.7). Any consequences to species listed as threatened or endangered under the ESA would be the result of implementing avoidance and minimization measures, compensatory mitigation, or required monitoring at projects permitted under the 2016 Eagle Rule. Project-specific impacts to listed species under those permits are analyzed on a case-by-case basis for each project applicant.

Fatality monitoring at permitted projects (including but not limited to wind energy facilities) could potentially detect carcasses of listed species, but such detections are unlikely to provide more than incidental information about mortality of those species. Monitoring at these facilities will be focused on detecting eagles, which are large-bodied and easier to detect than bats, songbirds, shorebirds, etc. While fatalities of listed species may occasionally be detected and recorded, it is unlikely that the Service will obtain enough information to scientifically assess risk to these species or meaningfully add to our understanding of their population status. Permittees are required to report to the Service any injuries or mortalities of listed species discovered at permitted projects. Such findings may result in an application for a Section 10 permit under ESA, which would likely result in positive impacts to affected species caused by implementation of Section 10 permit conditions, including potential mitigation of impacts.

TRIBAL TRADITIONAL USES / NATIVE AMERICAN RELIGIOUS CONCERNS AND CULTURAL RESOURCES

Under the No Action Alternative, the consequences for cultural and religious resources and effects to Native American tribes or individuals described for the PEIS's Alternative 5 (Sections 3.7.2.2 and 3.7.2.6, USFWS 2016b) will continue. This alternative is not expected to substantially interfere with cultural practices and ceremonies related to eagles, or to substantially affect the ability of tribes to use eagle feathers or parts consistent with Federal law. Because eagle remains that are found at permitted activities/projects must be sent to the Service's National Eagle Repository and, if in good condition, are distributed to permitted members of federally recognized tribes, eagle remains will be made available for cultural practices and ceremonies under this Alternative.

For reasons described in Section 5.3.1, the Service anticipates that the No Action Alternative will result in fewer permit applications and issued permits compared to the Action Alternatives. Because each permit issued under the GPP(s) will include avoidance and minimization measures that would not have been required outside of the permit process, the Service expects that a lower number of permits issued under the No Action Alternative will result in a higher amount of eagle take at wind energy facilities compared to the Action Alternatives. The Service also anticipates that, due to the overall lower number of permit applications expected for the No Action

Alternative, the amount of compensatory mitigation for eagle take will be lower and therefore eagle take will be higher compared to the Action Alternatives. We therefore expect overall eagle take to be higher under the No Action Alternative than under the Action Alternatives due to increased take at wind facilities and an increase in take rates from other sources, due to less required compensatory mitigation.

As a result of increased eagle take, under the No Action Alternative, the Service anticipates a greater magnitude of detrimental impacts on Native American tribes or individuals for whom eagles are central to cultural or spiritual values compared to the Action Alternatives. Similarly, increased eagle take under the No Action Alternative will increase the adverse effects on those who perceive the concept of authorizing eagle take as offensive and inconsistent with values they hold related to cultural beliefs, patriotism, or conservation compared to the Action Alternatives.

The No Action Alternative does not include a GPP covering wind energy facilities, but all long-term permits issued for eagle take at wind energy facilities require eagle fatality monitoring. The Service anticipates that, due to the overall lower number of permit applications and issued permits expected, eagle fatality monitoring at wind energy facilities will be substantially less under the No Action Alternative as compared to the Action Alternatives. Eagle remains found at monitored facilities must be sent to the Service's National Eagle Repository (NER) and, if in good condition, are distributed to permitted members of federally recognized tribes and made available for cultural practices and ceremonies. Under the No Action Alternative, the Service expects that fewer eagle remains will be found during monitoring and sent to the NER as compared to the Action Alternatives, resulting in longer wait times (compared to the Action Alternatives) for tribal members to receive eagle parts and feathers for religious and cultural use.

Under the No Action Alternative, the Service does not anticipate any change in how current permits affect historic properties, as defined under NHPA. In general, permitted actions under the No Action Alternative are unlikely to affect historic properties because eagle permits authorize eagle take, not ground-disturbing activities that are likely to have impacts, such as the construction of a project. An eagle permit is not a prerequisite for the construction of a project, rather it provides legal coverage for the take of eagles for project activities likely to result in injury or mortality. Additionally, in the case of wind turbines, eagle take generally occurs above ground, away from potential historic properties.

Currently, compensatory mitigation requirements requiring power-pole retrofits are the only permit conditions with any potential to impact historic properties if chosen as the method to compensate for eagle take. While most retrofits occur above ground where they would not affect historic properties, occasionally individual power-pole retrofits require replacement or relocation of that pole, where ground disturbance could potentially affect historic properties. To safeguard against this infrequent potential impact under the No Action Alternative or any of the Action Alternatives, the Service will build language into agreements with in-lieu fee programs that prevent or mitigate impacts to historic properties.

Under the No Action Alternative, any individual permit conditions that could potentially affect historic properties will continue to be analyzed on a site-specific basis. If the Service has previously concluded that permit conditions do not negatively impact historic properties, or that safeguards are in place to prevent such impacts, individual-permit analysis of NHPA-related impacts will either be unnecessary or greatly simplified.

SOCIOECONOMICS

Under the 2016 Eagle Rule, specific eagle permits are the current approach to permitting eagle take. Since the issuance of the 2016 Eagle Rule, approximately 707 permits have been issued under the current permitting framework. Of those permits, 29 were permits authorizing incidental eagle take of eagles at wind energy projects (26), solar projects (1), mines (1), and military installations (1). The remaining 677 permits that have been issued since the 2016 Eagle Rule were short-term permits granted to businesses, government agencies, and individuals for nest disturbance (479 permits) and nest take (198 permits). For the purposes of socioeconomic analysis in this EA, we assume the Service will continue to issue approximately 30 long-term permits every 5 years. Currently, the Service estimates that there are 1,970 wind generation facilities either operating or under construction (USDOE, 2021). USGS data shows a total of 70,808 turbines in the same general area as those facilities (Hoen et al. 2018). Therefore, for purposes of this analysis, we assume that the average wind project contains 36 turbines (70,808 turbines / 1,970 projects = 35.9 turbines per project). The approximately 30 issued wind energy programmatic permits represent approximately 1.5% of the total number of generation facilities.

Financial Impacts to Permittees – Applicant Permitting and Mitigation Costs

Under the current permit structure, the standardized incidental take permit fee for a wind energy project is $36,000 for the initial application submittal, with an additional $8,000 administrative fee every five years for permit review. In addition to this fee, wind energy permit applicants must compensate for the anticipated take of golden eagles and bald eagles when EMU take limits will be exceeded. Since EMU take limits for bald eagles are relatively high across the board, permits authorizing take of bald eagles rarely require compensatory mitigation. However, since golden eagle take limits are set at zero across the country, all permits authorizing take of golden eagles require compensatory mitigation. For purposes of this analysis, the average cost of this compensatory mitigation for a 36-turbine project is set at $115,533 annually per project. This number was derived from golden eagle fatality estimates at a hypothetical 100 turbine project where all turbines are 95.7 meters in diameter (Table 5 of Appendix A). Estimated take at such a 36-turbine project is 7 golden eagles over the life of a 5-year permit. At an estimated replacement cost of $82,500 per eagle (see Section **Error! Reference source not found.**), this equates to a total compensatory mitigation requirement of $577,500 over 5 years for an average wind project. Wind energy applicants must also provide pre-construction survey data, detailed location and operational data on the project, mitigation and adaptive management proposals, and any other requested information all consistent with 50 CFR 22.80. The cost data for these efforts are captured in the administration fee in the table below. The dollar values are based on estimates provided by the Energy and Wildlife Action Coalition (EWAC) as part of the scoping public comment period for this rulemaking. These costs are estimates and actual costs can range widely depending on the project.

Nest disturbance and nest take permits have a smaller fee than do programmatic wind energy permits, and do not typically have associated mitigation requirements. The lower value in the range of values outlined in the table below represents the non-commercial cost while the higher value represents the commercial cost for a permit.

Under the current framework, permits are not issued to power line entities. As such, there is no administration fee nor a mitigation requirement listed; however, many power line entities mitigate for eagle impacts voluntarily.

The estimated cost range for these additional costs to permittees is outlined in Table 5-1.

Table 5-1. No Action Alternative – Current Fee and Mitigation Costs to Industry for Eagle Incidental Take Permits

Type of Permit	**Type of Cost**	**Requirements**	**Permittee Cost (over 5 years)**
Wind Energy Project	Permit Application Fee	Cost to apply for a permit, and fee for permit review	$36k for the initial application submittal, $8k every 5 years for permit review.
	Compensatory Mitigation Requirements	Mitigation required as needed to ensure consistency with preservation standard; 1:1 ratio for bald eagles, 1.2:1 ratio for golden eagles	$578k
	Administration Fee	Project-level monitoring is required of all permittees. Typically, a permittee is asked to	$2.1M

		achieve, at every permitted project, a site-wide probability of detecting eagle remains (if take has occurred) of 35% averaged over each 5-year period of the permit tenure	
	Total Cost Range Over 5 Years		**$2.7M**
Nest Disturbance	Permit Application Fee	Cost to apply for a permit	$500 - $2,500
	Mitigation Requirements	No additional costs or fees required	$0
	Total Cost Range Over 5 Years		**$500 - $2,500**
Nest Take	Permit Application Fee	Cost to apply for a permit	$500 - $2,500
	Mitigation Requirements	No additional costs or fees required	$0
	Total Cost Range Over 5 Years		**$500 - $2,500**

The estimated costs of permitting, assuming that permit application counts are similar to those issued since the 2016 Eagle Rule was implemented, are outlined in Table 5-2.

Table 5-2. No Action Alternative – Estimated Permit Fee and Mitigation Costs to Permittees Over a Five-Year Permit Period

Type of Permit	Permit Count	Fee Per Permit (range)	Admin Cost Per Permit	Compensatory Mitigation Cost	Total Cost of Permits (range)
Wind Energy Project	30	$36,000	$2.1M	$578,000	$81M
Nest Disturbance	479	$500 – $2,500	$0	$0	$240k – $1.2M
Nest Take	198	$500 – $2,500	$0	$0	$99k – $495k
Total	**707**				**$81.8 – 83.1M**

Financial Impacts to Permittees – Project Financing Costs

In addition to the direct costs associated with the permit fee and mitigation, the current eagle incidental take application review process can be long and the costs (particularly after the first 5 years of the permit tenure) can be uncertain. Projects that are not able to adequately predict and account for their expected mitigation costs may face some financial challenges managing the costs and risks associated with operations over the project life cycle.

Financial Impacts to Permittees – Enforcement Costs

The facilities that have not received a permit are potentially operating under increased operational risk due to the unmitigated risk of incidental take occurring. As described in Section 2.4.2, we believe it is likely that many facilities at risk of incidental take would continue to operate without a permit under the No Action Alternative. As such, the number of permits issued is likely to be significantly lower than the number of facilities eligible for such a permit – leaving many projects without permits and at risk for enforcement actions if take occurs. Enforcement costs are described in detail in Section 4.7.1.3.

FINANCIAL IMPACTS TO THE SERVICE

The $36,000 eagle incidental take standardized permitting fee was developed to reflect the Service's estimate of the administrative costs of processing a long-term permit application. However, since the Service implemented the 2016 Eagle Rule, the eagle incidental take permit processing time and burden has routinely exceeded this estimate for long-term permits. Thus, the resources required to process permits has created an administrative burden in the form of time and costs on the Service. However, time and cost associated with long-term permit issuance has come down in recent months as the regulated community has become more familiar with the application process and as the Service has standardized application processing methods.

The Service also provides technical assistance and consultation services as part of the eagle incidental take permit program. This technical assistance is meant to help potential applicants weigh their risk to eagles, determine for themselves whether a permit is necessary, and if so what potential fees may be required. The funding for this technical assistance was meant to come from excess funds associated with the administration of permits; however, because the Service has not issued as many permits as expected and because the administration costs associated with the permits are higher than the Service expected, the funding for technical assistance has been less than originally anticipated.

Under the present regulation, the Service's costs associated with administering specific permits exceeded the revenue associated with the permit fees. Thus, the Service is likely to continue to subsidize the permit review process using general funds under the No Action Alternative.

SOCIETAL IMPACTS

As described in previous sections, the benefits of permit issuance from permit conditions that require avoidance and minimization, compensatory mitigation, and fatality monitoring would not be realized to the extent that they would be under the Action Alternatives. Thus, benefits to eagle populations under this Alternative are limited by comparison. Correspondingly, societal benefits of eagles described in Section 4.7 would be reduced compared to the Action Alternatives. Specifically, this Alternative would result in slightly reduced recreational opportunities and a reduced aesthetic and cultural benefit from sighting and viewing fewer eagles as compared to the Action Alternatives.

Permitting Framework Common to All Action Alternatives

Bald and Golden Eagles

All Action Alternatives include general permits for incidental take of eagles. The GPP(s) described under the Action Alternatives authorize take of eagles in a more automated way than specific permits and include standard provisions requiring conservation measures for eagles, including offsetting compensatory mitigation when necessary to remain consistent with the eagle preservation standard.

General permits are structured to require less administrative work and Service staff review and are expected to have lower mitigation and monitoring fees than specific permits, resulting in reduced costs and much faster processing for applicants than for specific permits (see *Monitoring Considerations* and Table 9 in Appendix A). For these reasons, the Service anticipates that creating GPP(s) will result in an increase in projects that obtain permits to authorize incidental take of eagles, potentially a significant increase. Because each permit issued under GPP(s) will include conservation measures and compensatory mitigation (when necessary for maintaining our preservation standard) for eagles that would not have been required outside of the permit process, the Service concludes that the expected increase in permit applications will reduce eagle take at many more wind energy facilities than currently occurs, and also reduce take from other sources. We expect this positive impact on eagles from reduced incidental take to outweigh any negative impact from potentially reducing mitigation requirements for projects operating under general permits instead of specific permits. Within the Action Alternatives, differing standards for eligibility for general permits, monitoring and mitigation fee structure, and number of activities covered under GPPs influence the type and extent of predicted effects, as described below in subsequent sections.

While all Action Alternatives include a GPP for wind energy facilities, only Alternative 4 includes GPPs for other activities – analyzed in Section 5.6. The general permit framework is intended to increase efficiency in permitting and significantly increase the proportion of wind energy projects that are permitted, but it is not expected to affect the number of new wind energy facilities built on the landscape. The Service does not have regulatory authority over the siting or construction of wind energy facilities. Instead, eagle permits authorize eagle take that may occur at facilities, primarily take caused by operation of the facility once constructed, but potentially also disturbance that may occur during construction. See also Section 2.4.2. Applying for an eagle incidental take permit is not a prerequisite to site and construct a project, but an eagle permit is required to operate a project legally if eagle take occurs. However, many wind energy facilities currently operate without an eagle incidental take permit and the Service anticipates some will continue to do so even if general permits are available. The purpose of developing a general permit framework is to substantially reduce the number of projects at risk of taking eagles that operate without a permit.

For GPPs covering wind energy facilities, eagle fatality monitoring is required. Monitoring will not occur at all permitted facilities but rather a subset of facilities, which will result in a lower proportion of facilities monitored when compared with specific permits. The Service anticipates that, due to the overall expected increase in permit applications, eagle fatality monitoring at wind energy facilities will increase substantially overall under all Action Alternatives. Under general permits, monitoring will be performed by the Service. Under specific permits, permittees will continue to be responsible for monitoring at the covered project. Due to the standardization of data collection and the ability to institute a systematic survey design across both permit types, the Service expects that current uncertainty about eagle mortalities at wind energy facilities will decrease over time, leading to improved accuracy of predicted take assessments and consequently management of the species in general.

For GPPs covering wind energy facilities, compensatory mitigation for eagle take is required. The Service anticipates that, due to the overall increase in permit applications expected, compensatory mitigation for eagle take at wind energy facilities will increase substantially compared to the No Action Alternative. Take that is currently unpermitted and unmitigated will be converted to permitted and mitigated take, and actual take would decrease due to the implementation of additional conservation measures for eagles at permitted facilities. Mitigation funds would be administered by Service-approved ILF programs. Although all possible ILF programs cannot be anticipated, two currently available ILF programs mitigate eagle take through retrofitting power poles to prevent electrocutions. Increasing the overall mitigation required at projects across the landscape through permit authorizations that likely would not occur under the No Action Alternative will result in more power poles being retrofitted and a reduction of mortalities for eagles. We also anticipate that one or more future ILFs could mitigate eagle take through programs to reduce lead ammunition used for hunting. Poisoning due to ingesting lead from spent ammunition in gut piles is a leading source of illness and mortality in eagles nationwide (Millsap et al. 2022, Slabe et al. 2022). Creating one or more ILFs to reduce lead in gut piles would result in a reduction of mortalities for eagles. We also expect to develop other mitigation measures suitable for Service approval in the future.

All Action Alternatives include restrictions on general permit eligibility for wind projects to ensure that wind projects expected to have higher risk to eagles will be ineligible. Ineligible facilities would have to apply for a specific permit that requires a project-specific risk analysis along with additional requirements that are similar to those required under the current permit scheme represented by the No Action Alternative. However, under all Action Alternatives, the Service proposes several minor changes that are intended to increase interest and participation in specific permits compared to the interest and participation in long-term permits under the current regulations (see Section 3.4.2.2). Specifically, we are proposing to remove the existing requirement that permittees hire an independent third-party to conduct fatality monitoring and remove the requirement for a mandatory administrative check-in every five years (see section 3.4.2.2). The Service anticipates that these two changes will increase application rates for specific permits. Any increase in the number of permit applications received will result in implementation of more conservation measures for eagles and will further convert unpermitted and unmitigated take to permitted and mitigated take, which will benefit eagles.

The Action Alternatives include different eligibility restrictions (Table 3-1) for GPPs, so we analyze the specific impacts of those restrictions for each Alternative (see Sections 5.4.1 and 5.5.1). Overall, introducing general permits, which will not require pre-construction eagle use data collection or any project-specific analysis, may increase the difficulty in estimating and understanding project-specific impacts to eagles compared to the No Action Alternative. Although permittees will be required to look for and report any dead or injured eagles, many injuries/mortalities will likely be missed because facilities' effective search effort and search area will be relatively low compared to that required under specific permits. However, any increased difficulty in assessing project-specific impacts under a GPP assumes all or most eligible projects under the No Action Alternative would apply for a permit to authorize take of eagles, which has not been the case under the current permit framework.

Under the wind-energy GPPs proposed in the Action Alternatives, the Service would conduct eagle fatality monitoring at a subset of permitted facilities and permittees would be responsible for monitoring at projects under specific permits. The Service will use that data to estimate take within the EMUs and ensure that estimated take is below take limits, consistent with the preservation standard. Tables 4-1 and 4-2 provide updated bald and golden eagle take limits for each EMU. The Service's recent increase in take limits for bald eagles (USFWS 2022a) is related to strong population growth in 4 of the 6 bald-eagle EMUs. Higher take limits also indicate a reduced likelihood that the take limits will be exceeded.

The general-permit LAP mitigation requirement, collected under general permits for wind facilities under all Action Alternatives, would be used to offset bald or golden eagle take should the Service determine that authorized bald or golden eagle take in a locality is in danger of being inconsistent with our preservation standard (see Sections 3.4.3.4 and 3.4.4.4). To accomplish this, the Service would direct ILFs to implement compensatory mitigation in areas in each EMU where cumulative authorized take is higher and most likely to impact the LAP threshold; however, the Service may direct the funds based on other factors if deemed necessary for meeting our preservation standard. This mitigation would offset the LAP take, providing a check on the impacts of authorized take and ensuring that the preservation standard is not violated. We note that estimated take in the Pacific - South EMU is closest to the take threshold for bald eagles (Table 5-7). The Service will observe this threshold closely and apply general-permit LAP mitigation funds in that EMU if there is any concern that implementation of the general permit program is approaching EMU limits or LAP thresholds. Under specific permits, the Service can analyze take at the EMU and LAP scale and make decisions before permit issuance that are consistent with our preservation standard for bald eagles. The Action Alternatives include different mitigation requirements (Table 3-1) and the overall amount and distribution of mitigation may differ among Alternatives. We analyze the specific impacts of mitigation for each Alternative (Sections 5.4.1 and 5.5.1).

The Service acknowledges that, in rare instances, relatively high levels of take may occur at projects that qualify for general permits under all Action Alternatives. Two measures limit general permit availability to high-risk wind energy facilities: wind energy facilities covered by general permits are required to design and implement measures to reduce eagle take if they find three dead or injured bald eagles or three dead or injured golden eagles at permitted infrastructure, and facilities that find four dead or injured bald eagles or four dead or injured golden eagles are ineligible to receive another general permit upon expiration of their current permit. Such facilities would have to apply for a specific permit, requiring a project-specific risk analysis. These requirements would reduce the number of wind energy facilities with unexpectedly high impacts to eagles that qualify for general permits and reduce the risk that the GPP is authorizing take that is inconsistent with our preservation standard.

MIGRATORY BIRDS

As described in Section 5.3.1, the Service expects that the Action Alternatives will result in an overall increase in permit applications and permits issued that provide conservation benefits as compared to the No Action Alternative. Each permit includes a fee for monitoring and mitigation. Under this Alternative, the Service anticipates due to the overall increase in permit applications expected, compensatory mitigation for eagle take at wind energy facilities will be greater (perhaps significantly greater) for the Action Alternatives compared to the No Action Alternative.

Under the Action Alternatives, the Service would develop standard avoidance and minimization measures required for permitted activities under each GPP. There is a range of possible avoidance and minimization measures, and their effect on migratory birds could be beneficial (e.g., removing carcasses from a wind farm could reduce crow moralities from turbine collisions), neutral (e.g., retrofitting power poles would have no effect on birds too small to risk electrocution) or detrimental (e.g., removing vegetation to discourage bird activity near a hazard would reduce overall habitat available). Because the Service will select avoidance and minimization measures with a goal of minimizing detrimental effects to eagles, we expect that avoidance and minimization measures for GPPs will have a neutral or slightly positive impact on migratory birds overall. This is because we expect the positive impacts of these measures on migratory birds will outweigh any potential negative impacts of these measures on migratory birds, particularly raptors with similar characteristics to eagles. Because we expect all Action Alternatives would result in the implementation of avoidance and minimization measures for more activities than would the No Action Alternative, we also expect that the positive impact on migratory birds is greater under the Action Alternatives compared to the No Action Alternative. Relative benefits among Action Alternatives are discussed under the specific Alternatives below.

For GPPs covering wind energy facilities, compensatory mitigation for eagle take is required. The Service anticipates that permit applications will increase, perhaps significantly, under a GPP, which will result in a substantial increase in applied compensatory mitigation for eagle take at wind energy facilities. Mitigation funds would be administered by Service-approved ILFs. Although we cannot anticipate how many ILF programs will ultimately be developed, two currently available ILFs mitigate eagle take through retrofitting power poles to prevent electrocutions. Increasing the number of permitted projects will increase the mitigation funds available to these ILFs, which will result in more power poles being retrofitted and a reduction of mortalities of eagles and other large-bodied birds that use power poles as nesting sites, roosts, or perches (likely raptors, vultures, and corvids). We also anticipate that one or more future ILFs may mitigate eagle take through programs to reduce lead ammunition used for hunting. Creating one or more ILFs to reduce lead in gut piles would result in a reduction of mortalities other animals that scavenge gut piles (likely vultures, raptors, corvids, and mammals including rodents and canids). Some potential forms of mitigation focused on eagles (such as habitat modification) could have adverse impacts to some migratory birds and migratory bird habitats, but the effects are more likely to be moderately beneficial overall. We therefore expect that compensatory mitigation for eagle take under the Action Alternatives would result in a moderate reduction of migratory bird take and potentially a large reduction for some species, such as raptors, vultures, and corvids. Relative benefits among Action Alternatives are discussed under the specific Alternatives below.

Federally Endangered and Threatened Species

Under all Action Alternatives, any consequences to species listed as threatened or endangered under the ESA would be the result of avoidance and minimizations measures, compensatory mitigation, or required monitoring at permitted projects. The Service does not anticipate impacts to listed species resulting from general-permit issuance. General permits would be issued contingent on certification by the permittee that they will accept the standard permit condition that no activity shall occur that is likely to directly or indirectly adversely affect a listed species or a species proposed for such designation, or the critical habitat of such species. Documentation that the permittee is authorized to take listed species by a permit under the ESA can replace or supplement such certification only for the listed species covered by the ESA permit. If the applicant cannot make such a certification, they may apply for a specific permit instead, which would include analysis of project-specific impacts to listed species and intra-Service consultation under Section 7 if the project may affect listed species. Fatality monitoring for general permits will be carried out by the Service, and mitigation will be carried out by Service-approved ILF programs, who will be required by agreement to avoid conducting activities that are likely to directly or indirectly adversely affect a listed species or species proposed for such designation, or the critical habitat of such species.

Monitoring at permitted projects (including but not limited to wind energy facilities) could potentially detect carcasses of listed species, but such detections are unlikely to provide more than incidental information about mortality of those species. Monitoring at permitted projects would be focused on detecting eagles, which are large-bodied and easier to detect than bats, songbirds, shorebirds, etc. Although listed species may occasionally be detected and recorded, it is unlikely that the Service will obtain enough information to scientifically assess risk to these species or meaningfully add to our understanding of their population status. Permittees are required to report to the Service any injuries or mortalities of listed species discovered at permitted projects. Such findings may result in an application for a Section 10 permit under ESA, which would potentially result in positive impacts to affected species as compared to no permit and no application of conservation measures.

Under all Action Alternatives, an amendment to the Nest Take permitting framework for nest take permits will add an additional justification authorizing the take of eagle nests when necessary to protect listed species. Although the Service expects such nest take permits to be rare, nest removal could potentially result in significant positive impacts on the immediate population of the species affected by the nesting eagle pair and a moderately positive impact on the listed species overall. However, because the intent of this provision is to address very specific, uncommon situations where a nesting eagle pair is affecting individuals or a local population of a listed species, we do not expect authorizing eagle-nest take when necessary to protect listed species to have a significant impact overall on listed species.

Tribal Traditional Uses / Native American Religious Concerns and Cultural Resources / General Public Concerns

The PEIS describes in detail the expected effects of a permitting program for incidental take of eagles on cultural and religious resources and effects to Native American tribes and individuals (Sections 3.7.2.2 and 3.7.2.6, USFWS 2016b). We do not expect that selection of an Action

Alternative would substantially interfere with cultural practices and ceremonies related to eagles, or to affect the ability of tribes to use eagle feathers or parts consistent with Federal law.

As described in Section 5.3.1, all Action Alternatives include a class of general permits available for incidental take of eagles. The Service anticipates that creating the GPP(s) will result in an increase in permit applications and issued permits. As described in Section 3.7 of the PEIS (USFWS 2016b), effects to Native American tribes or individuals could be detrimental emotionally or spiritually if the permit issuance is perceived as desecration of something sacred. Some tribes could experience adverse effects because any permitting of existing and future incidental take of wild eagles is contrary to cultural and spiritual values. Such effects would be greater under the Action Alternatives as compared to the No Action Alternative due to the increase expected in permit applications and issued permits. As described in Section 3.7 of the PEIS (USFWS 2016b), as the nation's symbol, the bald eagle has a special significance to many Americans, and it is also a treasured species among wildlife enthusiasts. Some Americans may experience adverse effects if they perceive the concept of authorizing eagle take as offensive and inconsistent with values they hold related to cultural beliefs, patriotism, or conservation. Such effects would be greater under the Action Alternatives as compared to the No Action Alternative due to the increase expected in permit applications and issued permits.

For reasons described in Section 5.3.1, the Service anticipates that creating the GPP(s) under the Action Alternatives will result in an increase in permit applications and issued permits compared to the No Action Alternative. Because each permit issued under the GPP(s) will include avoidance and minimization measures for eagles that would not have been required outside of the permit process, the Service expects that an increase in the number of permits issued under the Action Alternatives would result in a reduction of eagle take at wind energy facilities compared to the No Action Alternative. The Service also anticipates that the overall increase in permit applications expected for the Action Alternatives will increase the amount of compensatory mitigation for eagle take and, therefore, eagle take will decrease under any Action Alternative compared to the No Action Alternative. We therefore expect overall eagle take to be reduced under the Action Alternatives compared to the No Action Alternative due to a reduction of take at wind facilities and a reduction in take rates from other sources, via required compensatory mitigation. We anticipate that a reduction in eagle take under the Action Alternatives would also decrease the magnitude of detrimental impacts, compared to the No Action Alternative, on Native American tribes or individuals for whom eagles are central to cultural or spiritual values. Similarly, reduced eagle take under the Action Alternatives may reduce the adverse effects on those who perceive the concept of authorizing eagle take as offensive e and inconsistent with values they hold related to cultural beliefs, patriotism, or conservation compared to the No Action Alternative.

All Action Alternatives include a GPP covering wind energy facilities, with required eagle fatality monitoring. Monitoring may not occur at all facilities but rather a subset of facilities. The Service anticipates that, due to the overall increase in permit applications expected, eagle fatality monitoring at wind energy facilities will increase substantially under the Action Alternatives as compared to the No Action Alternative. Eagle remains found at facilities permitted under GPPs must be sent to the Service's National Eagle Repository (NER) and, if in good condition, are distributed to permitted members of federally recognized tribes and made available for cultural practices and ceremonies. Under the Action Alternatives, the Service expects that more eagle remains will be found during monitoring and sent to the NER as compared to the No Action Alternative, resulting in an average decrease in the wait times for tribal members to receive eagle parts and feathers for religious and cultural use. Again, it is important to note that any increase in eagles supplied to the repository would not be the result of an increase in eagle take from implementing the Action Alternatives, but instead the result of an increase in mortality monitoring at more projects operating under permits.

The Service determines that this proposal is not likely to affect historic properties, as defined under the NHPA. The proposed federal undertaking under Alternatives 2, 3, and 4 is to amend and update the regulations governing issuance of permits authorizing eagle take. Any impacts to historic properties from specific permits are addressed consistent with current policy as described under the No Action Alternative (section 5.2.4). Thus, any conditions of specific permits that may affect historic properties would continue to be analyzed on a permit-specific basis. If the Service concludes that permit conditions do not negatively impact historic properties, or that safeguards are in place to prevent such impacts, individual-permit analysis of NHPA-related impacts will either be unnecessary or greatly simplified.

We do not expect general-permit authorizations under any of the Action Alternatives to affect historic properties for several reasons. First, issuance of an eagle permit is not a prerequisite for the construction of a project or for other ground-disturbing activities that may affect historic properties. Under all Action Alternatives, general-permit conditions set forth broad requirements designed to reduce the take of eagles at a project or activity. For wind-energy general permits, eligibility and general conditions encourage siting of facilities in areas of lower risk to eagles and include requirements to site turbines and project boundaries away from eagle nests that are designed to reduce the likelihood of incidental take at the project. While our goal is for these conditions to guide the siting of projects, they do not dictate any individual turbine siting or placement decision by the applicant. General requirements of this nature do not prescribe where specific ground-disturbing activities will take place and thus do not directly affect historic properties. General permit conditions for eagle disturbance are similarly conditioned on avoiding impacts to eagle nests. Disturbance general permits are not a prerequisite to building a project and do not control placement of ground-disturbing activities other than providing general guidance on where to avoid engaging in those activities. For power line general permits, power pole retrofit plans under all Action Alternatives would specifically govern mitigation measures that occur above-ground and do not involve ground-disturbing activities in most cases. If a permittee wishes to conduct ground-disturbing activities as a part of these plans, for example, when burying lines or moving or replacing power poles, we will require that each applicant for a general permit certify that their activity either does not affect a property that is listed, or is eligible for listing, in the National Register of Historic Places as maintained by the Secretary of the Interior; or that the applicant has obtained, and is in compliance with, a written agreement with the relevant State Historic Preservation Officer (SHPO) or Tribal Historic Preservation Officer (THPO) that outlines all measures the applicant will undertake to mitigate or prevent adverse effects to historic properties.

While negotiated mitigation measures under specific permits have a limited potential to affect historic properties, we do not anticipate that universal conditions under general permits will. Under general permits, the Service will ensure that any final permit conditions will contain safeguards that avoid any impacts to historic properties if we receive information indicating that any proposed general-permit conditions have the potential to cause effects. Conditions with the most potential to affect historic properties involve power pole retrofit and compensatory mitigation requirements. Specifically, if power pole retrofits are required as standard conditions under general permits for power line entities, or if retrofits are required under general permits for other activity types (e.g. wind energy), ground disturbance from any pole replacements could potentially affect historic properties. To safeguard against this possible impact, the Service will build language into agreements with in-lieu fee programs that prevents impacts to historical properties.

Alternative 2 – General Permits Available for Wind Energy Facilities; Eligibility Based on Distance from Nests; Flat Fee for Mitigation

Bald and Golden Eagles

General permits are structured to require less administrative work and Service staff review and are expected to have lower mitigation and monitoring fees than specific permits, resulting in reduced costs and much faster processing for applicants than for specific permits (see *Monitoring Considerations* and Table 9 in Appendix A). For these reasons, the Service anticipates that Alternative 2 will result in an increase in permit applications compared to the No Action Alternative. The breadth of activities covered under general permits in Alternative 2 (wind energy facilities only) is the same as Alternative 3 but narrower than Alternative 4 (wind energy facilities, power line entities, activities likely to cause nest disturbance, and nest take or nest removal activities). Alternative 2's flat fee for mitigation and monitoring, may disincentivize smaller projects with tens of turbines from applying for take permits compared to larger projects with hundreds of turbines. Lower-risk project proponents may decide the cost of paying the flat fee exceeds the cost of potential enforcement based on perceived liability risk. For all these reasons, the Service expects Alternative 2 to result in more permit applications than the No Action Alternative, but a reduced number of permit applications compared to Alternatives 3 and 4.

Each permit includes additional conservation measures designed to reduce project impacts on eagles, therefore the Service expects any increase in permit applications to result in reduced eagle take. The Service therefore expects Alternative 2 to result in less actual eagle take than the No Action Alternative but a greater amount of actual eagle take than Alternatives 3 and 4. Each permit would also include a fee for monitoring and mitigation. The Service anticipates that, due to the overall increase in permit applications expected, compensatory mitigation for eagle take at wind energy facilities would be greater under Alternative 2 than the No Action alternative and less than compensatory mitigation under Alternatives 3 and 4.

Monitoring would occur at a subset of wind energy facilities under general permits. Under Alternative 2, monitoring will not occur at all wind energy facilities under general permits, so some high-risk facilities with general permits could have high levels of undetected take. Such take would be more likely detected if the facility were covered by a specific permit (as under the No Action alternative or Alternatives 3 or 4) which would require project-specific fatality monitoring. Therefore, based on our current understandings and assumptions, we conclude that the possibility of violating the preservation standard is greater for Alternative 2 compared to all other Alternatives.

Under Alternative 2, general permits are available to projects if all existing or proposed turbines are or will be located over one mile from bald eagle nests and over two miles from golden eagle nests. These restrictions make some projects that are expected to have higher risk to eagles due to nest proximity ineligible for general permits, but eligibility is not restricted by eBird eagle relative abundance (ERA) as it is under Alternatives 3 and 4. We expect that some projects with high ERA but not within the specified distances to eagle nests will pose a high risk to eagles. Therefore, some higher-risk projects would still qualify for general permits. Additionally, because eligibility is based on nest locations and the Service does not know where all eagle nests are or will be on the landscape, we are unable to perform as rigorous an analysis of the Alternative's impacts as we did for Alternatives 3 and 4 (Section 5.5.1, Appendix A). We therefore conclude that Alternative 2 has the highest uncertainty about impacts to eagles of any Alternative, at the project, LAP, and EMU scales.

We expect more projects overall will be eligible for general permits under Alternative 2 than under Alternatives 3 and 4 because there is no added eligibility restriction based on ERA under Alternative 2, like there is under Alternatives 3 and 4. The bald eagle nest distance restriction is greater under Alternative 2 than under Alternatives 3 and 4, but the additional land area from this restriction is very likely to be less than the additional land area from the ERA restrictions under Alternative 3 and 4. Therefore we expect a larger area to be eligible for general permits under Alternative 2 than Alternatives 3 and 4. The Service was not able to quantify eligibility areas under this Alternative because we do not know where all, or even most, of the bald or golden eagle nest locations are throughout the country.

Despite more projects likely being eligible for general permits under Alternative 2, we anticipate the fee structures for mitigation and monitoring would likely reduce general permit participation under Alternative 2. But, more importantly, we conclude that not including ERA-based eligibility criteria under Alternative 2 will likely result in some projects with relatively high ERA and high corresponding eagle risk (under the assumption that eagle risk is proportional to eagle use) meeting eligibility criteria for general permits, resulting in higher overall risk to eagles and higher levels of unmitigated take than Alternatives 3 and 4.

MIGRATORY BIRDS

As described in Section 5.4.1, the Service expects Alternative 2 to result in more permit applications than the No Action Alternative, and a reduced number of permit applications compared to Alternatives 3 and 4.

Under Alternative 2, the Service would develop standard avoidance and minimization measures required for permitted activities under the GPP. There is a range of possible avoidance and minimization measures, and their effect on migratory birds could be beneficial (e.g., removing carcasses from a wind farm could reduce corvid moralities from turbine collisions), neutral (e.g., retrofitting power poles would have no effect on birds too small to risk electrocution) or detrimental (e.g., removing vegetation to discourage bird activity near a hazard would reduce overall habitat available). Because the Service will select avoidance and minimization measures with a goal of minimizing detrimental effects to eagles, we expect that avoidance and minimization measures for GPPs will have a neutral or slightly positive impact on migratory birds overall. This is because we expect these measures will have a net positive impact on migratory birds, particularly raptors with similar characteristics to eagles. Because we expect

Alternative 2 would result in the implementation of avoidance and minimization measures for more activities than would the No Action Alternative, we expect it to produce greater positive impacts on migratory birds than the No Action Alternative, but less than Alternatives 3 and 4, which should result in implementation of avoidance and minimization measures at more projects.

Each permit includes a fee for monitoring and mitigation. The Service anticipates that, due to the overall increase in permit applications expected, compensatory mitigation for eagle take at wind energy facilities would be greater under Alternative 2 than the No Action alternative but less than under Alternatives 3 and 4. Mitigation funds would be administered by Service-approved ILFs. Although we cannot anticipate how many ILF programs will ultimately be developed, two currently available ILFs mitigate eagle take through retrofitting power poles to prevent electrocutions. Increasing the number of permitted projects will increase the mitigation funds available to these ILFs, which will result in more power poles being retrofitted and a reduction of mortalities of eagles and other large-bodied birds that use power poles as nesting sites, roosts, or perches (likely raptors, vultures, and corvids). We also anticipate that one or more future ILFs may mitigate eagle take through programs to reduce lead ammunition used for hunting. Creating one or more ILFs to reduce lead in gut piles would result in a reduction of mortalities other animals that scavenge gut piles (likely vultures, raptors, corvids, and mammals including rodents and canids). Some potential forms of mitigation focused on eagles (such as habitat modification) could have adverse impacts to some migratory birds and migratory bird habitats, but the effects are more likely to be moderately beneficial overall. We therefore expect that compensatory mitigation for eagle take under Alternative 2 would result in a moderate reduction of migratory bird take, and potentially a significant reduction for some species, such as raptors, vultures, and corvids, compared to the No Action Alternative. We expect that this reduction of migratory bird take would be less under Alternative 2 than it would be under Alternatives 3 and 4, where more implementation of compensatory mitigation is expected to result in a greater reduction in migratory bird take.

Federally Endangered and Threatened Species

See description of environmental consequences in Section 5.3.3.

Tribal Traditional Uses / Native American Religious Concerns and Cultural Resources

See description of environmental consequences in Section 5.3.4.

For reasons described in Section 5.4.1, the Service expects Alternative 2 to result in more permit applications and issued permits than the No Action Alternative, but a reduced number of permit applications and issued permits compared to Alternatives 3 and 4. Because each permit issued under the GPP will include avoidance and minimization measures for eagles that would not have been required outside of the permit process, the Service expects that an increase in the number of permits issued under Alternative 2 would result in a reduction of eagle take at wind energy facilities compared to the No Action Alternative, although Alternatives 3 and 4 would have a greater reduction. The Service also anticipates that, the overall increase in permit applications expected for Alternative 2 will increase the amount of compensatory mitigation for eagle take and, therefore, eagle take will decrease compared to the No Action Alternative, although

Alternatives 3 and 4 would have a greater increase in compensatory mitigation and greater decrease in eagle take. We therefore expect overall eagle take to be reduced under the Alternative 2 compared to the No Action Alternative, due to a reduction of take at wind facilities and a reduction in take rates from other sources, via required compensatory mitigation, although Alternatives 3 and 4 would have a greater reduction in overall eagle take. We anticipate that a reduction in eagle take would also decrease the magnitude of detrimental impacts on Native American tribes or individuals for whom eagles are central to cultural or spiritual values. Similarly, reduced eagle take may reduce adverse effects on those who perceive the concept of authorizing eagle take as offensive and inconsistent with values they hold related to cultural beliefs, patriotism, and/or conservation.

The Service anticipates that, due to the overall increase in permit applications expected, eagle fatality monitoring at wind energy facilities will increase substantially under Alternative 2 compared to the No Action Alternative, although Alternatives 3 and 4 would have a greater increase. Eagle remains found at facilities permitted under GPPs must be sent to the Service's National Eagle Repository (NER) and, if in good condition, are distributed to permitted members of federally recognized tribes and made available for cultural practices and ceremonies. Under the Alternative 2, the Service expects that more eagle remains will be found during monitoring and sent to the NER as compared to the No Action Alternative (although less than under Alternatives 3 and 4), resulting in an average decrease in the wait times for tribal members to receive eagle parts and feathers for religious and cultural use. Again, it is important to note that any increase in eagles supplied to the repository would not be the result of an increase in eagle take from implementing the Action Alternatives, but instead the result of an increase in mortality monitoring at more projects operating under permits.

The Service does not anticipate that any of the Action Alternatives discussed in this EA will impact historic resources as defined under the NHPA, as described in detail in Section 5.3.4.

SOCIOECONOMICS

Under Alternative 2, the anticipated number of permits that may be issued and estimated costs of permitting are represented in Table 5-3. Currently, the Service estimates that there are 1,970 wind generation facilities either operating or under construction (USDOE, 2021). USGS data shows a total of 70,808 turbines across the same area (Hoen et al. 2018). Therefore, for purposes of this analysis, we assume that the average wind project contains 36 turbines (70,808 turbines / 1,970 projects = 35.9 turbines per project). We further assume that approximately 85-90% of all wind energy projects would meet the criteria for a general permit under this Alternative. Without knowledge of all nest locations on the landscape, it is difficult to determine this percentage with high confidence. However, we anticipate that eligibility under this Alternative will be higher than under Alternatives 3 and 4 . For this analysis, we assumed eligibility at the highest end of the estimated range – 90%. The remaining 10% of projects that are not eligible for general permits would need to apply for specific permits. Of the 90% of projects that are eligible to apply for general permits, we conservatively estimate that 15% of eligible projects will apply. We expect a lag time between the permitting program being put in place and industry engaging with the program. Some firms may decide to act once the permitting program has been in place for several years and the impacts from entities getting a permit can be better understood. Some firms may also choose not to seek a permit and continue operating at the risk of enforcement discretion. Although we are proposing regulatory changes to specific permit requirements that are intended to increase the proportion of qualifying projects that apply for specific permits, the proposed general permit option will also be available to a large percentage of existing and future projects. Thus, many eligible wind projects that would have otherwise needed a specific permit are now likely to seek a general permit. Considering the likely effect of these changes to our permit regulations (one that may increase participation in specific permits and one that may decrease it), the Service expects to issue a similar number of specific permits would be issued as have been issued under the existing permit framework.

Table 5-3. Alternative 2 – Anticipated Numbers of Permits Issued Over a Five-Year Permit Period

Type of Permit	**Alternative 1: No Action (Existing)**	**Alternative 2: (New)**	**Change (increase in permits compared to Alt 1)**
Wind Energy Project (General)	—	266	266
Wind Energy Project (Specific)	30	30	0
Nest Disturbance	479	479	0
Nest Take	198	198	0
Total Permits (Over 5 years)	**707**	**973**	**266**
Average Annual Permits	**141**	**195**	**53**

Financial Impacts to Permittees

Under Alternative 2, the GPP is expected to save significant time and money to applicants by streamlining the permitting process. The costs of the application fee and mitigation fees associated with a general permit are represented in Table 5-4. For wind energy projects, the permit application fee would be $500. As described in Chapter 3, each permittee would be required to provide compensatory mitigation to offset the take of 2.4 golden eagles over 5 years (per project, regardless of size). However, all golden eagle take for projects under general permits that is a part of baseline (see Section 1.4) would not require payment of this fee. This requirement would repeat with every new registration, generally on a 5-year basis. Based upon the $82,500 estimate for the compensatory mitigation of an eagle (see Section **Error! Reference source not found.**), this compensatory mitigation would cost a permittee approximately $198,000 over the 5-year permit term. In addition to this mitigation, which is designed to offset take at the EMU scale, projects would also need to pay a general-permit LAP mitigation requirement of 0.04 golden eagles annually, or $3,300. This totals $16,500 over 5 years. The cost of fatality monitoring over a 5-year permit period would be a fee payable to the Service, which will take on the responsibility to monitor eagle fatalities at a program level. Permittees would no longer need to conduct pre-application monitoring and fatality monitoring. The Service estimates that the cost to administer this monitoring program would be approximately $7.2 million annually. Dividing this estimate by the total number of anticipated wind projects expected to be covered by general permits under Alternative 2 (assuming 15% participation) gives an average per project monitoring cost of $27,000 per year, or $135,000 per project for the life of a 5-year general permit.

For specific permits, the costs of the permit application fee and mitigation fees would not change and would be $36,000 for the initial application submittal, and $8,000 every 5 years for permit review. Similarly, the expectations for mitigation and monitoring would not change and would be $2.1 million per project over a five-year period. Specific permit compensatory mitigation calculations come out to 1.6 bald eagles and 1.1 golden eagles annually. This equates to an average total of $465,795 per project over a five-year period.

The permit application fee for nest disturbance and nest take would be $100 per year per nest, or $500 for five years if taking or disturbing a nest each year, a decrease from the No Action Alternative.

Table 5-4. Alternative 2 – Proposed Fee and Mitigation Costs to Permittees for Incidental Take Permits Over a Five-Year Permit Period

Type of Permit	Type of Cost	Basis and Requirements	Permittee Cost (over 5 years)
Wind Energy Project (General)	Permit Application Fee	Cost to apply for a permit	$500
	Compensatory Mitigation Costs	Cost to offset the take of golden eagles over 5 years	$214.5k
	Mitigation and Monitoring Fee	Permittee will pay a fee of $135,000 to the Service to monitor eagle fatalities at a program level to ensure general permitting is consistent with our preservation standard Other mitigation requirements, such as pre-construction monitoring, preparation of eagle conservation plans, adaptive management, and	$135k

		certain reporting requirements will no longer be required	
	Total Cost Range Over 5 Years		**$350k**
Wind Energy Project (Specific)	Permit Application Fee	Cost to apply for a permit, and fee for permit review	$36k for the initial application submittal, $8k every 5 years for permit review
	Compensatory Mitigation Costs	Mitigation required as needed to ensure consistency with preservation standard; 1:1 ratio for bald eagles, 1.2:1 ratio for golden eagles	$466k
	Mitigation and Monitoring Fee	Project-level monitoring is required of all permittees. Permittee must achieve, at every permitted project, a site-wide probability of detecting eagle remains (if take has occurred) of 35% (i.e., a probability of detection of 0.35) as averaged over each 5-year period of the permit tenure	$2.1M
	Total Cost Range Over 5 Years		**$2.6M**
Nest Disturbance	Permit Application Fee	Cost to apply for a permit	$500
	Other Mitigation Requirements	No additional costs or fees required	$0
	Total Cost Range Over 5 Years		**$500**
Nest Take	Permit Application Fee	Cost to apply for a permit	$500
	Other Mitigation Requirements	No additional costs or fees required	$0
	Total Cost Range Over 5 Years		**$500**

Total Costs Associated with Permits Under Alternative 2

The possible ranges (minimum to maximum) of total permit costs, including the variability of fees, range of values for mitigation costs, and representing the various types of permit applicants, are shown in Table 5-5.

Table 5-5. Alternative 2 – Estimated Permit Fee & Mitigation Cost Over a Five-Year Permit Period

Type of Permit	Administration Fee	Compensatory Mitigation Costs	Other Mitigation Costs	Permit Count Estimate	Total Cost of Permits	Existing Cost of Permits	Marginal Change (Increase in Permit Costs Compared to Alt 1)
Wind Energy Project (General)	$500	$214.5k	$135k	266	$93.1M	$0	$93.1M

Wind Energy Project (Specific)	$36k	$466k	$2.1M	30	$78.1M	$78.1M	$0
Nest Disturbance	$500	0	0	479	$240k	$240k - $1.2M	$0 – ($960k)
Nest Take	$500	0	0	198	$99k	$99k - $495k	$0 – ($396k)
Total[1]				**973**	**$171.5M**	**$79.8M**	**$91.7M**
[1] We assume the highest cost for the existing cost of permits whenever there is a range of costs in question.							

Alternative 2 could disproportionately impact small businesses, as the administration fee, compensatory mitigation costs, and monitoring and mitigation fee are all flat fees per project, thus would represent a larger proportion of total revenue as compared to a larger business. If small businesses chose not to apply for a permit, they would be more susceptible to future enforcement actions and associated enforcement costs.

Financial Impacts to the Service

Under Alternative 2 we expect that the Service will spend approximately the same amount of time and resources processing eagle take permits in the near term when compared to the other Alternatives. However, we expect this time to be dedicated to processing permits with higher risk to eagles or greater uncertainty surrounding that risk; thus, we expect that time to result in greater benefits to eagles across all Action Alternatives. In the long run, as many interested parties on the landscape receive permits, there could be a reduction in the amount of permit applications received and a corresponding reduction in workload and cost to the Service.

As with the other Action Alternatives, the burden of fatality monitoring for projects under a general permit would fall to the Service. The administration fee associated with the permit would cover these monitoring costs. If the rate of permit applications is as expected, the financial impacts will be minimal. However, if permit uptake is lower than expected, the Service would be required to fund necessary monitoring from other sources.

Societal Impacts

Under Alternative 2, the Service expects gains in eagle conservation from increased numbers of issued permits and corresponding increases in compensatory mitigation compared to the No Action Alternative. However, we would still expect to issue fewer permits when compared to Alternatives 3 and 4. The estimated eagle offset credits that selecting Alternative 2 would provide based on the estimates of the number of projects that may apply for a permit are shown in Table 5-6.

Table 5-6. Alternative 2 – Estimated Eagle Offset Credits Over a Five-Year Permit Period

Activity	Average estimated eagle take reduction/offset	Number of affected entities	Eagle take offset credits
Wind Energy Project eagle offset credit (General)	2.4 eagles per project	197 projects	473
Wind Energy Project eagle offset credit (Specific)	5.5 eagles per project	30 projects	165
Wind Energy Project eagle offset credit (General LAP)	0.2 eagles per project	443 projects	89
Wind Energy Project eagle offset credit (Specific LAP)	0.2 eagles per project	30 projects	6
Note: Nest disturbance and nest take will not typically require mitigation, so they are not included in this table.			

The benefits to eagles under this Alternative would be greater than under the No Action Alternative. Correspondingly, societal benefits of eagles described in Section 4.7 would be increased under this Alternative when compared to the No Action Alternative. However, societal benefits would be lower than under Alternatives 3 and 4.

Alternative 3 – General Permits Available for Wind Energy Facilities; Eligibility Based on Relative Abundance and Distance From Nests; Mitigation Fee Based on Hazardous Area

BALD AND GOLDEN EAGLES

General permits are structured to require less administrative work and Service staff review and are expected to have lower mitigation and monitoring fees than specific permits, resulting in reduced costs and much faster processing for applicants than for specific permits (see *Monitoring Considerations* and Table 9 in Appendix A). For these reasons, the Service predicts that Alternative 3 will result in an increase in permit applications and a corresponding increase in the number of projects operating in compliance with the Eagle Act compared to the No Action Alternative. The breadth of activities covered under general permits in Alternative 3 (wind energy facilities only) is the same as Alternative 2 but narrower than Alternative 4 (wind energy facilities, power line entities, activities likely to cause nest disturbance, and nest take or nest removal activities). Because fees will be scaled by hazardous area under Alternative 3, projects are expected to apply for permits independently of project size. This could disincentivize lower-risk projects from applying for a general permit if they perceive fees to not be worth paying when compared to their perceived liability risk, but that effect is expected to be lower than the potential disincentive for small projects discussed under Alternative 2. In sum, the Service expects Alternative 3 to result in more permit applications than the No Action Alternative or Alternative 2 and a reduced number of permit applications compared to Alternative 4.

Because each permit under this Alternative would include additional conservation measures for eagles at each permitted project, the Service expects the potential increase in permit applications to cause a reduction in eagle take. Thus, the Service also expects Alternative 3 would reduce actual eagle take compared to the No Action Alternative and Alternative 2 and increase actual eagle take compared to Alternative 4. Each permit would also include a fee for monitoring and mitigation. The Service anticipates that the expected increase in permit applications would result in greater implementation of compensatory mitigation for eagle take at wind energy facilities under this Alternative than under the No Action alternative or Alternative 2. However, we expect this Alternative to result in fewer applications than Alternative 4 and thus and less implementation of compensatory mitigation.

The general permit framework under Alternative 3 is intended to increase efficiency in permitting and increase participation in the program but is not expected to affect the number of new wind energy facilities on the landscape. Because general permits under Alternative 3 are available only in areas with relatively low ERA, the Service anticipates the proportion of newly constructed wind energy facilities may increase over time in those areas and the proportion of newly constructed wind energy facilities in areas with high ERA may decline. Under Alternative 3, the Service expects that eagle take at newly constructed wind farms will therefore occur at a lower rate than at existing facilities or newly constructed facilities under the No Action Alternative or Alternative 2. We predict this effect will have a minor to moderate, but not significant, effect on local and regional eagle populations beginning approximately 2 years after the regulations are implemented, due to the time needed to plan and permit a new wind energy facility.

Under Alternatives 3 and 4, general permits are only available to projects in areas characterized by eagle relative abundance values less than or equal to the values in Table 3-2 and where all existing or proposed turbines are or will be located > 660 feet and > 2 miles from a known bald and golden eagle nest, respectively. These restrictions make projects that are expected to have higher risk to eagles ineligible for general permits. We therefore expect that fewer high-risk projects will be covered by general permits and overall eagle take will be lower for Alternatives 3 and 4 than for Alternative 2. Uncertainty about eagle impacts may be greater for individual projects under general permits than under the No Action Alternative (see Section 5.3.1). Despite potential uncertainty at the project scale, the preservation standard requires maintaining stable or increasing breeding populations in all EMUs, and the persistence of LAPs throughout the geographic range of each species. We therefore analyzed impacts at the two scales identified in the preservation standard, the EMU and LAP. That analysis is detailed in Appendix A and summarized here.

We first analyzed the proposed GPP for wind energy facilities, which is a component of all Action Alternatives, at the EMU scale. The Service analyzed all existing turbines that qualify for general permits based on ERA eligibility criteria for Alternatives 3 and 4 (Appendix A). For the analyses of the effects of issuing general permits on bald and golden eagles, we developed prior distributions ("priors") for species-specific eagle exposure for the general permit zone and the inverse (specific permit zone; Figure 3-1) based on ERA for each species using all qualifying data in the Service's possession (see Appendix 1 of Appendix A). We used the Service's Collision Risk Model (CRM) to estimate the fatality probability distributions for hypothetical "average" wind energy projects in the general and specific permit zones and produced fatality probability distributions for all known turbines within the general and specific permit zones in each bald or golden eagle EMU (USFWS 2021d). Table 5-7 (bald eagles) and Table 5-8 (golden eagles) below summarize the Service's analysis and provide conservative fatality estimates (60^{th} quantile for bald eagles and 80^{th} quantile for golden eagles). It is noteworthy that our analysis produced substantially decreased fatality estimates per project in the general permit zone and increased fatality estimates per project in the specific permit zone when compared to the nationwide prior that has been used previously. This expected effect is a result of the construction of new exposure priors for each zone, which effectively split out the highest eagle abundance areas from the rest of the U.S. Data from projects in areas with lower eagle abundance were used to build a species-specific prior for the general permit zone. We expected estimates produced from that prior to be lower than in the specific permit zone. Conversely, data from projects in areas with relatively high eagle abundance were used to build the prior for the specific permit zone. We expected estimates produced from that prior to be higher than the general permit estimates. We do not know where all existing and future nest locations are or will be on the landscape, therefore there may be more turbines than anticipated that do not qualify for general permits. As such, the estimates in Appendix A and Tables 5-7 and 5-8 may overestimate take resulting from general permits in each EMU, and underestimate take resulting from specific permits in each EMU.

Table 5-7: Bald eagle take estimates (eagles per year) for all existing turbines that meet ERA eligibility criteria for general permits under Alternatives 3 and 4, and all turbines that are not eligible (specific permits).

EMU	**EMU Take Limit**	**General Permit Fatality Estimate (eagles per year)**	**Specific Permit Fatality Estimate (eagles per year)**
Atlantic	4,223	5	8
Mississippi	7,986	70	8
Central	1,521	67	21
Pacific - North	2,102	5	17
Pacific - South	15	3	4

Table 5-8: Golden eagle take estimates (eagles per year) for all turbines that meet ERA eligibility criteria for general permits under Alternatives 3 and 4, and all turbines that are not eligible (specific permits).

EMU	EMU Take Limit	General Permit Fatality Estimate (eagles per year)	Specific Permit Fatality Estimate (eagles per year)
Atlantic / Mississippi	0	21	40
Central	0	49	478
Pacific	0	9	358

For bald eagles, take estimates for general permits would not exceed EMU take limits in any EMU, under any Action Alternative. Thus, without considering future increases in the number of wind turbines on the landscape or future increases in demand for eagle take permits from other activity types, we conservatively estimate that authorized bald eagle take from all general permits will be well within our established EMU take limits in every EMU and, thus, consistent with our preservation standard. Because none of the estimated take levels even approach the EMU take limits for bald eagles, the Service anticipates that, even allowing for an increased number of wind turbines on the landscape and other permitted take from other activities, GPPs for wind energy facilities as described in Alternatives 3 and 4 can be implemented consistent with our preservation standard for bald eagles. It is noteworthy that estimated take from general permits for wind energy facilities is 20% of the EMU take limits in the Pacific - South EMU (Table 5-7). For this EMU, if general permits were issued to cover every wind turbine eligible, there would only be 12 eagles remaining under the EMU take limit.

For golden eagles, all EMU-specific take estimates exceed the EMU take limits, which are set at zero for the species (Table 5-8). However, we require all golden eagle take for projects under general permits that is not a part of the baseline (see Section 1.4) to be offset with compensatory mitigation at a minimum ratio of 1.2:1. Thus, even when assuming an increased number of wind turbines on the landscape and other permitted take from other activities (all of which will also require compensatory mitigation at a ratio of ≥1.2:1 for golden eagles), GPPs for wind energy facilities as described in Alternative 3 and 4 can be implemented consistent with our preservation standard for golden eagles. Of course, there is a danger that the Service has underestimated take that will arise from the GPP in Alternatives 3 and 4. If our estimations were underestimates, there would be a concern that we are not requiring enough compensatory mitigation for projects that qualify for general permits. We reduced the risk of our compensatory mitigation rate being too small by using the nationwide fatality estimates for general permits at the 80th quantile. By using this conservative estimate, we significantly reduce the risk of insufficient mitigation for authorized take. If, through fatality monitoring, the Service concludes that more take is occurring under general permits than has been mitigated for, we will temporarily or indefinitely suspend the GPP for wind energy facilities. Under specific permits, the Service will analyze take at the EMU and LAP scale and can make decisions pre-permit issuance that are consistent with our preservation standard for golden eagles.

At the LAP scale, we analyzed hypothetical "average" wind energy projects to evaluate theoretical limits to the number of projects that could be authorized in direct proximity to one another within the general permit zone before LAP thresholds (9% or 7% of the LAP, for bald eagles and golden eagles respectively) might be exceeded (Appendix A). The number of projects with overlapping LAPs in the general permit zone that would trigger LAP thresholds by EMU for golden and bald eagles are presented in Table 7 of Appendix A. For 4 of 6 EMUs, more than 300 “average” projects with a combined estimated take >120 bald eagles would be necessary to exceed the bald eagle LAP thresholds, indicating that many general permits could be issued in those EMUs without creating concerns for bald eagles at the LAP scale and remaining consistent with the preservation standard. Bald eagle LAP thresholds could be triggered with fewer projects and less authorized take for the Central Flyway EMU and Pacific - South EMU (Table 7 of Appendix A). Compensatory mitigation to offset LAP impacts for bald eagle take is more likely to be necessary in those EMUs for general permits to maintain consistency with our preservation standard. For golden eagles, the LAP threshold for 5 of 14 LAP density units could be exceeded by fewer than 50 projects (Table 7 of Appendix A). Overall, LAP thresholds are more likely to be exceeded for golden eagles than for bald eagles given densities. Compensatory mitigation for golden eagle take under general permits may need to be sited taking LAP scale impacts into account in order to maintain consistency with our preservation standard.

MIGRATORY BIRDS

As described in Section 5.5.1, the Service expects Alternative 3 to result in more permit applications than the No Action Alternative or Alternative 2 and a reduced number of permit applications compared to Alternative 4. Each permit includes a fee for monitoring and mitigation. The Service anticipates that, due to the overall increase in permit applications expected, compensatory mitigation for eagle take at wind energy facilities will be greater for Alternative 3 than the No Action alternative or Alternative 2 and less compensatory mitigation than for Alternative 4. By basing fees on the hazardous area of projects, mitigation funds would be less influenced by the number of permit applications received than would occur under Alternative 2.

Under Alternative 3, the Service would develop standard avoidance and minimization measures required for permitted activities under the GPP. There is a range of possible avoidance and minimization measures, and their effect on migratory birds could be beneficial (e.g., removing carcasses from a wind farm could reduce crow moralities from turbine collisions), neutral (e.g., retrofitting power poles would have no effect on birds too small to risk electrocution) or detrimental (e.g., removing vegetation to discourage bird activity near a hazard would reduce overall habitat available). Because the Service will select avoidance and minimization measures with a goal of minimizing detrimental effects to eagles, we expect that avoidance and minimization measures for GPPs will have a neutral or slightly positive impact on migratory birds overall. This is because we expect these measures will have a net positive impact on migratory birds, particularly raptors with similar characteristics to eagles. Because we expect Alternative 3 would result in the implementation of avoidance and minimization measures for more activities than would the No Action Alternative or Alternative 2, we expect it to produce greater positive impacts on migratory birds than the No Action Alternative or Alternative 2, but less than Alternatives 4, which should result in implementation of avoidance and minimization measures at more projects.

Mitigation funds would be administered by a Service-approved ILF. Although we cannot anticipate how many ILF programs will ultimately be developed, two currently available ILFs mitigate eagle take through retrofitting power poles to prevent electrocutions. Increasing the number of permitted projects will increase the mitigation funds available to these ILFs, which would result in more power poles being retrofitted and a reduction of mortalities of eagles and other large-bodied birds that use power poles as nesting sites, roosts, or perches (likely raptors, vultures, and corvids). We also anticipate that one or more future ILFs may mitigate eagle take through programs to reduce lead ammunition used for hunting. Creating one or more ILFs to reduce lead in gut piles would result in a reduction of mortalities other animals that scavenge gut piles (likely vultures, raptors, corvids, and mammals including rodents and canids). Some potential forms of mitigation focused on eagles (such as habitat modification) could have adverse impacts to some migratory birds and migratory bird habitats, but the effects are more likely to be moderately beneficial overall. We therefore expect that compensatory mitigation for eagle take under Alternative 3 would result in a moderate reduction of migratory bird take compared to Alternative 2, and potentially a significant reduction for some species, such as raptors, vultures, and corvids, compared to the No Action Alternative. We expect that this reduction of migratory bird take would be similar under Alternative 3 than it would be under Alternative 4, where a comparable amount of compensatory mitigation is expected.

FEDERALLY ENDANGERED AND THREATENED SPECIES

See description of environmental consequences in Section 5.3.3.

TRIBAL TRADITIONAL USES / NATIVE AMERICAN RELIGIOUS CONCERNS AND CULTURAL RESOURCES

See description of environmental consequences in Section 5.3.4.

For reasons described in Section 5.5.1, the Service expects Alternative 3 to result in more permit applications and issued permits than the No Action Alternative or Alternative 2 and a reduced number of permit applications and issued permits compared to Alternative 4. Because each permit issued under the GPP will include avoidance and minimization measures for eagles that would not have been required outside of the permit process, the Service expects that an increase in the number of permits issued under Alternative 3 would result in a reduction of eagle take at wind energy facilities compared to the No Action Alternative and Alternative 2, although Alternative 4 would have a greater reduction. The Service also anticipates that the overall increase in permit applications expected for Alternative 3 will increase the amount of compensatory mitigation for eagle take will increase and therefore eagle take will decrease compared to the No Action Alternative and Alternative 2. We therefore expect overall eagle take to be reduced under the Alternative 3 compared to the No Action Alternative and Alternative 2, due to a reduction of take at wind facilities and a reduction in take rates from other sources, via required compensatory mitigation, although Alternative 4 would have a greater reduction in overall eagle take. We anticipate that a reduction in eagle take would also decrease the magnitude of detrimental impacts on Native American tribes or individuals for whom eagles are central to cultural or spiritual values. Similarly, reduced eagle take may reduce adverse effects on those who perceive the concept of authorizing eagle take as offensive and inconsistent with values they hold related to cultural beliefs, patriotism, or conservation.

The Service anticipates that, due to the overall increase in permit applications expected, eagle fatality monitoring at wind energy facilities will increase under Alternative 3 as compared to the No Action Alternative or Alternative 2 but would be less than for Alternative 4. Eagle remains found at facilities permitted under GPPs must be sent to the Service's National Eagle Repository (NER) and, if in good condition, are distributed to permitted members of federally recognized tribes and made available for cultural practices and ceremonies. Under Alternative 3, the Service expects that more eagle remains will be found during monitoring and sent to the NER as compared to the No Action Alternative or Alternative 2 (although less than under Alternative 4), resulting in an average decrease in the wait times for tribal members to receive eagle parts and feathers for religious and cultural use. Again, it is important to note that any increase in eagle supplied to the repository would not be the result of an increase in eagle take from implementing the Action Alternatives, but instead the result of an increase in mortality monitoring at more projects operating under permits.

The Service does not anticipate that any of the Action Alternatives discussed in this EA will impact historic resources as defined under NHPA, as described in detail in Section 5.3.4.

SOCIOECONOMICS

Under Alternative 3, the anticipated number of permits that may be issued and the estimated costs of permitting are represented in Table 5-9. Currently, the Service estimates that there are 1,970 wind generation facilities either operating or under construction (USDOE, 2021). USGS data shows a total of 70,808 turbines in the same general area (Hoen et al. 2018). Therefore, for purposes of this analysis, we assume that the average wind project contains 36 turbines (70,808 turbines / 1,970 projects = 35.9 turbines per project). For purposes of this analysis the Service estimates that 75% of all wind energy projects may meet the criteria for a general permit. A project would be eligible for a general permit based upon meeting relative abundance thresholds. Of the 75% of wind energy projects that are eligible for general permits, we assume 25% of eligible projects apply. The remaining 25% of projects that do not meet the general permit criteria would meet the specific permit criteria. The Service expects that a similar number of specific permits would be issued as have been issued under the existing framework.

Table 5-9. Alternative 3 – Anticipated Numbers of Permits Issued Over a Five-Year Permit Period

Type of Permit	Alternative 1: No Action (Existing)	Alternative 3: (New)	Change (increase in permits compared to Alt 1)
Wind Energy (General)	—	369	369
Wind Energy (Specific)	30	30	0
Nest Disturbance	479	479	0
Nest Take	198	198	0

Total Permits (Over 5 Years)	**707**	**1,076**	**369**
Average Annual Permits	**141**	**215**	**74**

Financial Impacts to Permittees

Under Alternative 3, the GPP is expected to save significant time and money to applicants that qualify by streamlining the permitting process relative to the No Action Alternative. The costs of the permit application fee and mitigation fees associated with a general permit are represented in Table 5-10. For wind energy projects, the permit application fee would be $500. Each permittee would have to provide compensatory mitigation that would offset the take of eagles at the rates (per cubic-kilometer of hazardous volume) described in Table 3-3. Under this Alternative, we estimate an average project will need to provide compensatory mitigation for approximately 0.4 golden eagles over 5 years. We calculated this by taking the fatality estimate for a 100-turbine project in the general permit zone (Appendix A), and multiplying it by 0.36, to get the estimate for a 36-turbine project. However, all projects under general permits that consist entirely of infrastructure that falls under baseline (see Section 1.4) will not be required to pay this fee. Based upon the $82,500 estimate for the compensatory mitigation required to offset a single eagle (see Section **Error! Reference source not found.**), this compensatory mitigation would cost a permittee approximately $32,670 over the life of a 5-year permit. The general-permit LAP mitigation requirement would be approximately $9,323 per project over the life of a 5-year permit. This totals $42,000 over 5 years. These mitigation requirements would repeat with every new registration.

Under Alternative 3, the cost of fatality monitoring would be a fee of $2,625 per permitted turbine payable to the Service. USGS data shows a total of 54,876 turbines across the general permit area (Hoen et al. 2018). Assuming 25% participation amongst those turbines, we anticipate authorizing eagle take under general permits at 13,719 turbines. The Service estimates that the cost to administer this monitoring program nationally would be approximately $7.2 million annually. Dividing this estimate by the total number of turbines expected to be authorized under general permits (13,719) results in a monitoring cost estimate of $526 per turbine per year, or $2,625 per turbine over a 5-year permit tenure. Dividing this estimate by the total number of anticipated wind projects expected to be covered by general permits under Alternative 3 (assuming 25% participation) gives an average per project monitoring cost of $19,500 per year, or $97,500 per project for the life of a 5-year general permit issued to a 36-turbine (average) project. The Service will use this money to take on the responsibility to monitor eagle fatalities at the program level. Permittees would no longer need to conduct pre-application monitoring and fatality monitoring.

For specific permits, the costs of the permit application fee and mitigation fees would not change and would be $36,000 for the initial application submittal, and $8,000 every 5 years for permit review. Similarly, the expectations for mitigation and monitoring would not change and would be $2.1 million per project over a five-year period. Specific permit compensatory mitigation calculations equate to 0.58 bald eagles and 2.5 golden eagles annually. This results in an average total of $1 million per project over a five-year period for compensatory mitigation.

The permit application fee for nest disturbance and nest take would be $100 per year per nest, or $500 for five years if taking or disturbing a nest each year, a decrease from the No Action Alternative.

Table 5-10. Alternative 3 – Proposed Fee and Mitigation Costs to Permittees for Incidental Take Permits Over the Five-Year Permit Period.

Type of Permit	Type of Cost	Requirements	Permittee Cost (over 5 years)
Wind Energy Project (General)	Permit Application Fee	Cost to apply for a permit	$500
	Compensatory Mitigation Costs	Cost to offset the take bald and golden eagles at rates specified in Table 3-3 (per cubic kilometer of hazardous volume)	$42k

	Mitigation and Monitoring Fee	Permittee will pay a fee of $97,500 to the Service (for an average project) to monitor eagle fatalities at a program level to ensure general permitting is consistent with our preservation standard Other mitigation requirements, such as pre-construction monitoring, preparation of eagle conservation plans, adaptive management, and certain reporting requirements will no longer be required	$97.5k
	Total Cost Range Over 5 Years		**$140k**
Wind Energy Project (Specific)	Permit Application Fee	Cost to apply for a permit, and fee for permit review	$36k for the initial application submittal, $8k every 5 years for permit review
	Compensatory Mitigation Costs	Compensation for anticipated take of eagles	$1M
	Mitigation and Monitoring Fee	Pre–construction monitoring, project specific background data, mitigation proposal, adaptive management, fatality monitoring and reporting	$2.1M
	Total Cost Range Over 5 Years		**$3.1M**
Nest Disturbance	Permit Application Fee	$500 – Non–commercial/ $500 – Commercial	$500
	Other Mitigation Requirements	No additional costs or fees required	$0
	Total Cost Range Over 5 Years		**$500**
Nest Take	Permit Application Fee	$500 – Non–commercial	$500
	Other Mitigation Requirements	No additional costs or fees required	$0
	Total Cost Range Over 5 Years		**$500**

<u>*Total Costs Associated with Permits Under Alternative 3*</u>

The estimated total permit costs including the variability of fees, range of values for mitigation costs, and representing the various types of permit applicants, are shown in Table 5-11.

Table 5-11. Alternative 3 – Estimated Permit Fees and Mitigation Costs Over a Five-Year Permit Period

Type of Permit	**Administration Fee**	**Compensatory Mitigation Costs**	**Other Mitigation Costs**	**Permit Count Estimate**	**Total Cost of Permits**	**Existing Cost of Permits**	**Marginal Change (Increase in Permit Costs**

							Compared to Alt 1)
Wind Energy (General)	$500	$42k	$97.5k	369	$51.8M	$0	$51.8M
Wind Energy (Specific)	$36k	$1M	$2.1M	30	$94.1M	$78.1M	$16M
Nest Disturbance	$500	$0	$0	479	$240k	$240k – $1.2M	$0 - $(960k)
Nest Take	$500	$0	$0	198	$99k	$99k - $495k	$0 – ($396k)
Total[1]				**1,076**	**$146.2M**	**$79.8M**	**$66.4M**

[1] We assume the highest cost for the existing cost of permits whenever there is a range of costs in question.

Because the compensatory mitigation requirements associated with a wind energy general permit under Alternative 3 are not based upon a flat fee, but upon a calculation of the anticipated take of eagles, it is less likely that Alternative 3 would disproportionately impact small businesses. However, the relative cost of permitting would likely remain a larger proportion of total revenue as compared to a larger business. If small businesses chose not to apply for a permit, they would be more susceptible to future enforcement actions and associated enforcement costs.

Financial Impacts to the Service

Under Alternative 3 we expect that the Service will spend approximately the same amount of time and resources processing eagle take permits in the near term when compared to the other Alternatives because we expect the number of specific permit applications to remain fairly constant. However, we expect this time to be dedicated to processing permits with higher risk to eagles or greater uncertainty surrounding that risk; thus, we expect that time to result in greater benefits to eagles across all Action Alternatives. In addition, many more projects would be authorized under general permits, which require little additional processing time and resources. Thus, the additional conservation benefits accruing to eagles from many more projects being authorized under permits requiring implementation of mitigation measures would come with little additional administrative cost to the Service. In the long run, as many interested parties on the landscape receive permits, there could be a reduction in the amount of specific permit applications received and a corresponding reduction in workload and cost to the Service.

As with the other Action Alternatives, the burden of fatality monitoring for projects under a general permit would fall to the Service. The intention is for the administration fee associated with the permit to cover these monitoring costs. If permit uptake is as expected, the financial impacts will be minimal. However, if permit uptake is lower than expected, the Service will be required to fund the monitoring from other sources.

Societal Impacts

Under Alternative 3, gains in eagle conservation from increased numbers of issued permits and corresponding increases in compensatory mitigation are expected compared to the No Action Alternative and Alternative 2. However, we still expect fewer total permit issuances when compared to Alternative 4. The estimated eagle offset credits that would be provided under this Alternative based on the estimates of the number of projects that apply for a permit are shown in Table 5-12.

Table 5-12. Alternative 3 – Estimated Eagle Offset Credits Over a Five-Year Permit Period

Activity	Average estimated eagle take reduction/offset	Number of affected entities	Eagle offset credits (range)
Wind Energy Project eagle offset credit (General)	0.4 eagles per project	273 projects	109
Wind Energy Project eagle offset credit (Specific)	12 eagles per project	30 projects	360
Wind Energy Project eagle offset credit (General LAP)	0.09 eagles per project	369 projects	33
Wind Energy Project eagle offset credit (Specific LAP)	0.09 eagles per project	30 projects	3
Note: Nest disturbance and nest take will not require mitigation, so they are not included in this table.			

The benefits to eagles under this Alternative are likely to be greater, perhaps substantially, than under the No Action Alternative and Alternative 2. Correspondingly, societal benefits of eagles described in Section 4.7 would be increased under this Alternative when compared to the No Action Alternative and Alternative 2 and reduced when compared to Alternative 4.

Alternative 4 – Implement Alternative 3 For Wind Energy Facilities; Create Additional General Permits For Power Line

Entities, Activities Likely to Cause Nest Disturbance, and Nest Take Activities

BALD AND GOLDEN EAGLES

All Permits

General permits are structured to require less administrative work and Service staff review and are expected to have lower mitigation and monitoring fees than specific permits, resulting in reduced costs and much faster processing for applicants than for specific permits (see *Monitoring Considerations* and Table 9 in Appendix A). For these reasons, the Service anticipates that Alternative 4 will result in an increase in permit applications compared to the No Action Alternative. The breadth of activities that can be covered under general permits in Alternative 4 (wind energy facilities, power line entities, activities likely to cause nest disturbance, and nest take activities) is greater than for Alternatives 2, 3, and the No Action Alternative. The Service anticipates increases in permit applications received from wind energy facilities (discussed under Section 5.5.1) and power line entities under this Alternative. We anticipate small, if any, increases in permit applications for nest disturbance or nest take permits if general permits are made available for those activities under this Alternative. All general and specific permits issued under this Alternative, especially for wind energy facilities and for power line entities, would require avoidance and minimization measures that should reduce (likely substantially for power line entities) existing take on the landscape. Additionally, permits would require compensatory mitigation if necessary to ensure that take of eagles is consistent with our preservation standard. Thus, we expect a net benefit to eagles as a result of increased participation in the eagle permit program. This benefit is likely to be greater for Alternative 4 than for all other Alternatives described. Environmental consequences from unique aspects of each GPP proposed under this Alternative are discussed below.

Wind Energy Facilities GPP

The Service expects that impacts to eagles from the wind energy GPP will be similar to those described under Alternative 3 in Section 5.5.1. However, under Alternative 4, the Service anticipates an increased ability to process specific permits for wind energy facilities at a level not anticipated under Alternatives 2 or 3 or under the No Action Alternative. We anticipate that the addition of GPPs for nest disturbance and nest take will result in a significant time savings for the limited number of Service staff processing eagle take permits, leaving more time for Service staff to focus on review of permit applications for specific permits for all activities and significantly reducing permit processing time for applicants. This should result in decreased review times and increase rates of specific permit applications under this Alternative, which we anticipate will result in benefits to both eagle species that would not occur under the other Alternatives.

Power Line Entities GPP

To date, the Service is reviewing two requests for long-term eagle take authorization from power line entities (one has been requested under a Section 10 Habitat Conservation Plan (HCP)). Thus, current participation in long-term eagle take permitting by power line entities is limited. The

Service's goal in introducing a GPP for power line entities under this Alternative is to catalyze increased participation in the Service's eagle-take permitting program. Because power line entities have the knowledge and ability to substantially reduce eagle take rates observed on their infrastructure, especially in the case of electrocutions, the GPP we are proposing for power line entities differs from the GPP for wind energy facilities. Under general permits for power line entities, every permittee would be required to implement standard conditions that limit new impacts to eagles and reduce existing impacts to eagles. Recent estimates suggest that approximately 506 golden eagles die from electrocution each year. Further, estimates suggest that approximately 611 golden eagles die from collisions, and at least a subset of those collisions are with power line infrastructure (Table 4-3). If participation in the proposed GPP for power line entities is moderate to high, we anticipate that general permits will result in a substantial reduction in power line infrastructure mortality and a net benefit to eagles. Even limited participation in the GPP would provide at least a moderate net benefit to eagles over the current non-participation in our permit program as reflected in the No Action Alternative

Additionally, general permits for power line entities would come with a standard condition that requires the permittee to develop a plan and take actions to reduce mortality on their infrastructure from unlawful shooting of protected birds (including eagles). This source of mortality is one of the leading sources of anthropogenic mortality for golden eagles (Millsap et al. 2022; Table 4-3) and, to-date, has been difficult to address with our limited law enforcement resources. However, we anticipate that, with the cooperation of utilities, small to moderate gains in conservation may be achieved by reducing levels of unlawful shooting where it is a problem.

Activities Likely to Cause Nest Disturbance GPP

The introduction of a GPP for activities that are likely to cause nest disturbance is primarily for the benefit of applicants and permittees and for the benefit of the Service. Because the Service has learned what types of conditions are typically practicable and relatively easy to implement for certain activity types, we conclude that general permits issued under this GPP would likely have similar benefits to eagle populations as the permits we would issue for the same activity types under Alternatives 2 and 3, and under the No Action Alternative. As previously mentioned, however, a more streamlined and efficient permitting process for a subset of our commonly permitted activities using a GPP would free up Service time and resources to spend on processing permit applications for specific permits that may pose a higher or more uncertain risk to eagles.

Under the proposed GPP for nest disturbance permits, we would only issue general permits for activities likely to disturb bald eagle nests. Activities likely to disturb golden eagle nests would still require a specific permit. Because EMU take limits are not typically in danger of being exceeded from nest disturbance permits, the issuance of general permits under this GPP is expected to be consistent with EMU management objectives. It is more typical, although still not common, for take authorized under nest disturbance permits to approach LAP thresholds. The Service proposes to institute several policies that will help avoid impacts to eagles at the LAP scale. Although compensatory mitigation will not be required for general permits for activities likely to cause nest disturbance, the Service may elect to require compensatory mitigation for specific permits within the project-specific LAP if necessary to remain consistent with the preservation standard.

The Service will meet with ILF programs annually to direct compensatory mitigation funds to areas where cumulative authorized take may be approaching or exceeding levels of concern. The Service also proposes to reduce the amount of take that will be debited from LAP take thresholds in most of the country (except the southwest; see Section 3.2.2). A recent analysis of monitoring reports required under past nest disturbance permits has revealed that nest disturbance only occurred at approximately 19.5% of the permits issued for bald eagle nest disturbance nationwide (see Appendix A). This data effectively updates the observed nationwide bald eagle take rate under nest disturbance permits from an assumed 1.33 bald eagles per year to 0.26 bald eagles per year. Using this observed rate of take allows us to more accurately account for the impacts of our nest disturbance permits (general or specific) on the respective EMU and LAP. This, in turn, would reduce our concern that take authorized under nest-disturbance permits could impact bald eagle populations at the LAP scale.

Nest Take Activities GPP

The introduction of a GPP for nest take activities would have similar effects on eagles to those described for nest disturbance, immediately above. However, because we do not have information to update the debit amount, the Service would not alter it as proposed for nest disturbance permits and would continue to debit take at 1.33 bald eagles per year. The Service may update this to reflect observed rates if information collected over time suggests it is appropriate to do so.

MIGRATORY BIRDS

As described in Section 5.6.1, the Service expects that Alternative 4 would result in an overall increase in permit applications and permits issued compared to the No Action Alternative, Alternative 2, or Alternative 3.

Under Alternative 4, the Service would develop standard avoidance and minimization measures required for permitted activities under the GPP. There is a range of possible avoidance and minimization measures, and their effect on migratory birds could be beneficial (e.g., removing carcasses from a wind farm could reduce crow moralities from turbine collisions), neutral (e.g., retrofitting power poles would have no effect on birds too small to risk electrocution) or detrimental (e.g., removing vegetation to discourage bird activity near a hazard would reduce overall habitat available). Because the Service will select avoidance and minimization measures with a goal of minimizing detrimental effects to eagles, we expect that avoidance and minimization measures for GPPs will have a neutral or slightly positive impact on migratory birds overall. By including GPPs for activities other than wind energy facilities, we expect Alternative 4 would result in a greater number and variety of avoidance and minimization measures required of permittees due to the greater diversity of permitted activities. Avoidance and minimization measures for power line entities will include power pole and substation retrofits, which we expect would reduce mortalities for other large-bodied birds that use power poles or substations as nesting sites, roosts, or perches (likely raptors, vultures, and corvids). We expect the increased avoidance and minimization measures under Alternative 4 would result in a reduction in migratory bird take compared to the No Action alternative or Alternatives 2 or 3.

Because none of the additional GPPs will require compensatory mitigation (any that do will require a specific permit), we expect compensatory mitigation for eagle take under Alternative 4 to be the same as analyzed under Alternative 3. We therefore expect that compensatory mitigation for eagle take under Alternative 4 would result in a similar reduction of migratory bird take compared to Alternative 3, and potentially a significant reduction for some species, such as raptors, vultures, and corvids, compared to the No Action Alternative and Alternative 2. However, because we expect Alternative 4 would result in the greatest amount of voidance and minimization, it would also have a greater reduction in migratory bird take, and benefits to migratory birds, compared to all other Alternatives.

FEDERALLY ENDANGERED AND THREATENED SPECIES

See description of environmental consequences in Section 5.3.3 for consequences related to eagle take permits for wind energy facilities

Under this Alternative, there would be added potential for impacts to listed species from the introduction of general permits for power line entities, nest disturbance, and nest take. Under general permits for power line entities, there could be impacts to listed species that result from the required standard conditions. Specifically, we anticipate that, as permittees retrofit existing infrastructure to be electrocution-safe, there could be localized impacts to listed species. These impacts could be beneficial (*e.g.*, reductions in electrocutions of other raptors that are listed species) or detrimental (*e.g.*, death of or harm to a listed species from implementation of mitigation measures required under a general permit). Impacts to listed species could also be realized under general permits for nest disturbance or nest take if the activity that would disturb the nest or the nest removal itself has the potential to impact listed species. The Service cannot anticipate and thus cannot analyze all possible impacts to all possible listed species under the general permits we issue. To ensure that impacts to listed species are avoided, the Service will require, as a standard condition of all general permits, that no activity shall occur that is likely to directly or indirectly adversely affect a listed species or a species proposed for such designation, or the critical habitat of such species. Projects that take listed species or the critical habitat of such species can still meet this condition if they provide documentation that the permittee is authorized to take listed species by a permit under the ESA, limited to the listed species covered by the ESA permit. The Service intends this condition to create a requirement that, if impacts to listed species are anticipated from a permit-related action, the permittee avoid them. If impacts to listed species cannot be avoided, applicants can apply for a specific permit instead.

TRIBAL TRADITIONAL USES / NATIVE AMERICAN RELIGIOUS CONCERNS AND CULTURAL RESOURCES

See description of environmental consequences in Section 5.3.4.

For reasons described in Section 5.6.1.1, the Service expects Alternative 4 to result in more permit applications and issued permits than under all other Alternatives described. Because each permit issued under the GPP(s) will include avoidance and minimization measures for eagles that would not have been required outside of the permit process, the Service expects an increase in the number of permits issued under Alternative 4. That increase and the corresponding increase in implementation of avoidance and minimization measures designed to positively impact eagles at all permitted projects would result in a reduction of eagle take across activity types that would be greater than for any other Alternative. A reduction in eagle take would also decrease the magnitude of detrimental impacts on Native American tribes or individuals for whom eagles are central to cultural or spiritual values. Similarly, reduced eagle take may reduce adverse effects on those who perceive the concept of authorizing eagle take as offensive and inconsistent with values they hold related to cultural beliefs, patriotism, or conservation.

Monitoring for eagle fatalities at wind facilities will be the same as under Alternative 3. Under Alternative 4 there would not be an increase in required fatality monitoring, however, monitoring will be required to some extent for the three additional GPPs. Specifically, power line entities will be required to pay a monitoring fee to document long-term trends in eagle mortality. The Service anticipates that, because of additional monitoring funds contributed through the GPP for power line entities, there will be an improvement of the Service's ability to monitor eagle mortality rates across the landscape, and a slight improvement in the rates of discovery of eagle fatalities (from many sources) compared to all other Alternatives. As with Alternative 3, eagle remains found at permitted projects (or found as a result of monitoring funded by general permittees) must be sent to the Service's National Eagle Repository (NER) and, if in good condition, are distributed to permitted members of federally recognized tribes and made available for cultural practices and ceremonies. Under Alternative 4, the Service expects that more eagle remains will be found during monitoring and sent to the NER as compared to the No Action Alternative or Alternative 2, and slightly greater numbers of eagle remains will be found compared to Alternative 3. As under Alternative 3, this would result in an average decrease in the wait times for tribal members to receive eagle parts and feathers for religious and cultural use. Again, it is important to note that any increase in eagle supplied to the repository would not be the result of an increase in eagle take from implementing the Action Alternatives, but instead the result of an increase in mortality monitoring at more projects operating under permits.

The Service does not anticipate that any of the Action Alternatives discussed in this EA will impact historic resources as defined under the NHPA, as described in detail in Section 5.3.4.

Socioeconomics

The Service expects general permit participation from wind energy facilities to be the same as under Alternative 3. Anticipated numbers of permits to be issued are depicted (again) in Table 5-13, below.

The estimated number of general permits expected for power line entities is 21. This figure is based on the number of special purpose utility permits (SPUT permits) that have reported eagle take over the past 10 years. Because this is a new general permit framework, the Service expects that adoption will be relatively slow and will replicate the number of existing permittees having reported eagle take. Under Alternative 4, although general permits for nest disturbance and nest take would be available, the permit application and mitigation costs for these permits are not expected to change from the No Action Alternative. The significant change to these permits would be the ability to obtain a general permit. This would allow for permits to be obtained faster and with less effort required. The total number of potential applicants for nest disturbance and nest take under Alternative 4 are unknown; therefore, the numbers below reflect no change from the No Action Alternative.

Table 5-13. Alternative 4 – Anticipated Numbers of Permits Issued Over a Five-Year Permit Period

Type of Permit	Alternative 1: No Action (Existing)	Alternative 4: (New)	Change (increase in permits compared to Alt 1)
Wind Energy Project (General)	—	369	369
Wind Energy Project (Specific)	30	30	0
Power Line Entities	—	21	21
Nest Disturbance	479	479	0
Nest Take	198	198	0
Total Permits (Over 5 Years)	**707**	**1,097**	**390**
Average Annual Permits	**141**	**219**	**78**

Financial Impacts to Permittees

The costs of the permit application fee and mitigation fees associated with general permits for wind energy facilities are the same as under Alternative 3, and are represented (again) in Table 5-14, below.

The proposed GPP under Alternative 4 would be expanded to include power line entities and will create new costs in the form of permit fees, administrative fees, and beneficial practice implementation costs. Beneficial practices are intended to reduce the risk and amount of active take. The primary cost driver for the beneficial practices established for power line entities will be the requirement to retrofit existing poles to ensure that they are electrocution-safe.

Estimates show that there are likely over 190 million power poles in the U.S., and of those 190 million poles, we estimate that 76% are already electrocution-safe and will not require retrofitting (Harness, 2000). This estimate is based on a single field inventory conducted in Rangely, Colorado, after an enforcement action in the year 2000. During this field inventory, over 3,000 poles were inspected for raptor fatalities (including eagles). Of those, approximately 24% required retrofitting to make them electrocution-safe, while the other 76% did not require retrofitting. Using those percentages and our power pole estimates, we estimate that 144 million poles are electrocution-safe and will only need to be maintained as such in the future. The remaining 45.6 million poles would need to be retrofitted over the next 50 years under the new permit program. We note that these estimates are based only on one field inventory in one part of the country and may not accurately represent the percentage of electrocution-safe poles across the United States. The Service would appreciate any information that would help improve this estimate and, thus, improve the economics analysis under this Alternative.

Under Alternative 4, each power line entity receiving a general permit would be required to retrofit $1/10^{th}$ of their existing non-electrocution-safe poles over the initial 5-year permit, or 2% of those poles per year on average. Based on an estimated total number of 1,244 eligible power line entities and considering the number of poles that need to be made electrocution-safe, we estimate that each eligible power line entity would need to retrofit approximately 733 poles each year. Per pole mortality estimates suggest that each power pole is responsible for the take 0.0036 eagles per year (Lehman et al. 2010). Based on that rate, each entity will retrofit enough poles to save the equivalent of 2.64 eagles per year. At an estimated cost of $82,500 per eagle, this will cost each entity approximately $218,000 per year, or approximately $1.09M over a 5-year permit tenure.

Additionally, each power line entity receiving a general permit would be required to pay a fee of $5,000 per state that a permittee operates within (up to a maximum of five states), payable to the Service, for monitoring eagle mortality rates (see Section 3.4.5.6).

In 2006, the Avian Power Line Interaction Committee (APLIC) published their "Suggested Practices for Avian Protection on Power Lines" document with support from the Edison Electric Institute and the California Energy Commission (APLIC, 2006). This document provided a list of best practices and general recommendations on reducing avian mortality associated with power line electrocutions. These recommendations included retrofitting existing poles in a manner that reduces the likelihood of incidental take. Many larger power line entities have since started implementing avian protection plans (APPs) to target prioritized replacement and retrofit of at-risk poles. Because some companies are already implementing APPs, the costs to power line entities calculated above cannot be considered "new costs" to some entities. However, there are other, typically smaller entities that are not currently retrofitting poles per an APP. For those entities, the costs calculated above may be "new costs."

According to electric power survey data from the U.S. Energy Information Administration (USEIA), there were almost 3,000 power line entities operating in the U.S. (USEIA, 2019). These utilities were classified into three ownership types: investor-owned utilities (IOUs), publicly run or managed utilities, and cooperatives. Publicly owned or managed utilities made up two thirds of the total number of utilities in the market. Many of these larger utilities have existing APPs in place and, may not need to spend $1M, if anything, to qualify for a permit. For the purposes of this analysis, we estimate that 75% of all utilities would have an existing retrofit plan in place and would therefore not incur a new cost associated proactive and reactive retrofit requirements under Alternative 4.

Additional beneficial practices associated with general permits for power line entities are the creation of plans to address eagle mortality from collision with infrastructure and at shooting hotspots (described in greater detail in Section 3.4.5.3). Both plans will likely incur some small additional cost to applicants; however, we anticipate this cost will be relatively low when compared to other costs incurred from general permit conditions; thus, we are not assuming a significant up-front cost for these actions. Furthermore, the likelihood of incurring these costs is variable across all projects because some entities have more collision risk than others, and costs may be incurred outside of the five-year permit window.

The areas where requirements have been added, reduced, or removed, and the estimated new cost of meeting the permit conditions for both the new general permits and the existing specific permits are shown in Table 5-14.

The permit application fee for nest disturbance and nest take would be $100 per year per nest, or $500 for five years if taking or disturbing a nest each year, which is a decrease from the No Action Alternative.

Table 5-14. Alternative 4 – Proposed Fee and Mitigation Costs to Applicants for Incidental Take Permits Over Five-Year Permit Period

Type of Permit	**Type of Cost**	**Requirements**	**Permittee Cost (over 5 years)**
Wind Energy Project (General)	Permit Application Fee	TBD	$500
	Compensatory Mitigation Requirements	Cost to offset the take bald and golden eagles at rates specified in Table 3-3 (per cubic kilometer of hazardous volume)	$42k
	Mitigation and Monitoring Fee	Permittee will pay a fee of $95,000 to the Service to monitor eagle fatalities at a program level to ensure general permitting is consistent with our preservation standard Other mitigation requirements, such as pre-construction monitoring, preparation of eagle conservation plans, adaptive management, and certain reporting requirements will no longer be required	$97.5k
	Total Cost Range Over 5 Years		**$140k**
Wind Energy Project (Specific)	Permit Application Fee	Cost to apply for a permit, and fee for permit review	$36k for the initial application submittal, $8k every 5 years for permit review
	Compensatory Mitigation Costs	Compensation for anticipated take of eagles	$1M
	Mitigation and Monitoring Fee	Pre–construction monitoring, project specific background data, mitigation proposal, adaptive management, fatality monitoring and reporting	$2.1M
	Total Cost Range Over 5 Years		**$3.1M**
Power Line Entity	Permit Application Fee (including monitoring requirements)	Application fee and monitoring fee (up to five states)	$5,500 - $25,500
	Mitigation Requirements	Power pole retrofitting and other requirements (assuming that 25% of entities do not have a retrofit plan and will be required to pay this cost)	$0 - $1.1M ($275,000 average)
	Total Cost Range Over 5 Years		**$5,500 - $300,500 (using average mitigation requirement)**
	Permit Application Fee	$100 annually	$500

Type of Permit	Type of Cost	Requirements	Permittee Cost (over 5 years)
Nest Disturbance	Other Mitigation Requirements	Minimal	$0
	Total Cost Range Over 5 Years		**$500**
Nest Take	Permit Application Fee	$100 annually	$500
	Other Mitigation Requirements	Minimal	$0
	Total Cost Range Over 5 Years		**$500**

Total Costs Associated with Permits Under Alternative 4

The estimated total permit costs including the variability of fees, range of values for mitigation costs, and representing the various types of permit applicants, are shown in Table 5-15.

Table 5-15. Alternative 4 - Estimated Permit Fee and Mitigation Cost Over a Five-Year Permit Period

Type of Permit	Administration Fee	Compensatory Mitigation Costs	Other Mitigation Costs (range)	Permit Count Estimate	Total Cost of Permits	Existing Cost of Permits	Marginal Change (Increase in Permit Costs Compared to Alt 1)
Wind Energy (General)	$500	$42k	$97.5k	369	$51.8M	$0	$51.8M
Wind Energy (Specific)	$36k	$1,000,000	$2.1M	30	$94.1M	$78.1M	$16M
Power Line Entities	$5,500 - $25,500	0	$0 - $275,000[1]	21	$6.3M	$0	$6.3M
Nest Disturbance	$500	0	0	479	$240k	$240k – $1.2M	$0 - $(960k)
Nest Take	$500	0	0	198	$99k	$99k - $495k	$0 – ($396k)
Total[2]				**1,097**	**$152.5M**	**$79.8M**	**$72.7M**

[1] We estimate that 1 of every 4 permittees per year (25% of power line entities) will not have an existing retrofit plan and will therefore be required to pay this cost.

[2] We assume the highest cost in the existing cost of permits whenever there is a range of costs in question.

Because the compensatory mitigation requirements associated with a wind energy general permit under Alternative 4 are not based upon a flat fee, but upon a calculation of the anticipated take of eagles, it is less likely that Alternative 4 could disproportionately impact small businesses. However, the relative cost of permitting would likely remain a larger proportion of total revenue as compared to a larger business. If small businesses chose not to apply for a permit, they would be more susceptible to future enforcement actions and associated enforcement costs.

Project Financing Costs

The operational risk and uncertainty for all industries permitted under this program revision would decrease substantially. This will ease financial uncertainties related to unpredicted post construction incidental take events by allowing a project to preemptively obtain a permit and secure liability protections against enforcement actions if they follow the permit conditions and requirements. This would reduce the cost to industry of securing financing, purchasing insurance, and thereby increase the number of projects that will be considered financially viable. Easier permitting would also provide projects with the ability to buy down risk more readily in the form of avoiding enforcement actions, with the permit acting as a form of insurance against unpredicted take.

Enforcement Impacts

For projects that would otherwise take eagles without obtaining authorization under an eagle permit, the lower barrier to obtaining a permit under Alternative 4 will provide a financial benefit by reducing potential enforcement costs.

Financial Impacts to the Service

Under Alternative 4 we expect that the Service would spend approximately the same amount of time and resources processing eagle take permits in the near term when compared to the other Alternatives. However, we expect this time to be dedicated to processing permits with higher risk to eagles or greater uncertainty surrounding that risk; thus, we expect that time to result in greater benefits to eagles across all Action Alternatives. In the long run, as many interested parties on the landscape receive permits, there could be a reduction in the amount permit applications received and a corresponding reduction in workload and cost to the Service.

As with the other Action Alternatives, the burden of fatality monitoring for projects under a general permit would fall to the Service. The intention is for the administration fee associated with the permit to cover these monitoring costs. If permit uptake is as expected, the financial impacts will be minimal. However, if permit uptake is lower than expected, the Service will be required to fund the monitoring from other sources.

Societal Impacts

Under Alternative 4, positive gains in eagle conservation from the increased number of issued permits and corresponding increases in compensatory mitigation required under those permits are expected compared to the No Action Alternative and Alternatives 2 and 3. The estimated eagle offset credits that would be provided under this Alternative based on the estimates of the number of projects that apply for a permit are shown in Table 5-16. Note that the cumulative reduction in take from all activities may be less than the sum listed in the table. Power line retrofits are currently the source used for the in-lieu mitigation program. A wind energy project that purchases one credit that is used to pay for a retrofit of a power line will offset the take of one eagle.

Table 5-16. Alternative 4 – Estimated Eagle Offset Credits Over a Five-Year Permit Period

Activity	Average estimated eagle take reduction/offset	Number of affected entities	Eagle offset credits (range)
Wind Energy Project eagle offset credit (General EMU)	0.4 eagles per project	273 projects	109
Wind Energy Project eagle offset credit (Specific EMU)	12 eagles per project	30 projects	360
Wind Energy Project eagle offset credit (General LAP)	0.09 eagles per project	369 projects	33
Wind Energy Project eagle offset credit (Specific LAP)	0.09 eagles per project	30 projects	3
Power Line Entities fatality reduction from retrofits	0.0036 deaths per pole per year	21 entities 733 poles per entity	55
Note: Nest disturbance and nest take will not require mitigation, so they are not included in the table.			

The benefits to eagles under this Alternative are likely to be greater than under the No Action Alternative and Alternatives 2 and 3. Correspondingly, societal benefits of eagles described in Section 4.7 would increase under this Alternative when compared to the other Alternatives.

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APPENDICES

Appendix A: Analysis of the Effects of Potential General permit Scenarios on Bald and Golden Eagles. Division of Migratory Bird Management, U. S. Fish and Wildlife Service, Washington D.C., USA.

ANALYSIS OF THE EFFECTS OF POTENTIAL GENERAL PERMIT SCENARIOS ON BALD AND GOLDEN EAGLES

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Table of Contents

Introduction

The U.S. Fish and Wildlife Service's (Service) National Raptor Program (NRP) was asked to evaluate the effects of a proposed general eagle incidental take permit for energy development (wind) on bald and golden eagles. The Service intends for the general permit to be consistent with the eagle management objectives established in the Service's 2016 Programmatic Environmental Impact Statement covering the eagle permit regulations (U.S. Fish and Wildlife Service 2016*a*). The objective of the general permit type for wind is to preauthorize the incidental take of eagles in areas of the United States where take at individual locations is expected to be minimal. The program will theoretically greatly reduce the workload and costs to industry and the Service in applying for and issuing permits, respectively. By facilitating participation by industries that have avoided seeking permits previously, the Service expects that a higher proportion of facilities and activities that take eagles will obtain general permits. Take of eagles that exceeds eagle management unit (EMU) take limits will be required to be offset with compensatory mitigation under the general permit, thus the general permit could result in more of the ongoing incidental take of golden eagles being offset. Although similar approaches may be useful in analyzing the effects of general permits for other activities, our assessment focuses on the delineation of a general permit zone to facilitate incidental take permitting for onshore wind energy projects.

Framework for Delineating *A Priori* Eligibility for a General Permit for Wind Energy Projects

A fundamental initial decision the Service must make before any analysis of the effects of the general permit on eagles can be conducted is how the area in which general permits for wind will be made available will be determined. The Service has previously advocated for development of a "low-risk" eagle incidental take permit for wind energy facilities based on predicted low eagle relative abundance (U. S. Fish and Wildlife Service 2018, Ruiz-Gutierrez et al. 2021). Industry groups and some conservation organizations have advocated against using eagle relative abundance as a proxy for risk, and instead proposed that the general permit be made available anywhere that an applicant can attest that their facility is of low-risk to eagles (American Clean Power 2021, Bean 2021). These groups argued that eagle abundance is a poor predictor of eagle fatalities at wind energy facilities, an assertion that has some support in the scientific literature (De Lucas et al. 2008). Designation of areas of lesser risk at the scale under consideration here, however, does depend on eagle abundance at a fundamental level – a site where few eagles are exposed to risk on an annual basis cannot result in more fatalities than the number of individuals exposed. Sites where eagle abundance is high have the potential to cause more fatalities than sites where few eagles are present. Because the Service is preauthorizing take in the absence of local information on eagle abundance or use, a strong argument can be made to use broader indices of relative abundance as the basis for designating areas of the United States where general permits are preapproved in the absence of any site-specific data.

Another advantage of using eagle relative abundance to establish an a priori general permit zone is that eagle relative abundance can be mapped. Mapping allows the Service to use data from wind projects in the mapped area to estimate the amount of eagle take that would be expected to occur under a general permit. There are many sources of data that have been used to map eagle relative abundance, including GPS tagging data (Brown et al. 2017, McCabe et al. 2021), nesting locations (Dunk et al. 2019), and data from widespread targeted surveys (Nielson et al. 2016). Although there are many advantages to these kinds of data, four major disadvantages for the Service's need to evaluate relative abundance at a continental scale are that (1) none of these analyses are geographically comprehensive; (2) some of the datasets are not seasonally comprehensive and thus do not provide information on relative abundance throughout the year; (3) in some cases they are based on inferences from a subset of the overall population that may or may not be representative of regional eagle use in general; and (4) they are not easily updatable, a requirement for use for eagle regulatory purposes given the Service's commitment to regularly updating the information sources used for eagle permitting (U.S. Fish and Wildlife Service 2016a).

An alternative is to use geographically comprehensive citizen-science data sets such as eBird (Sullivan et al. 2009) to map eagle relative abundance. eBird is coordinated by the Lab of Ornithology at Cornell University, and current methods of screening, processing, and analyzing eBird checklists have provided spatially explicit relative abundance data useful for a variety of conservation purposes (Fink et al. 2013, Kelling et al. 2015, Robinson et al. 2018, Howell et al. 2022). Ruiz-Gutierrez et al. (2018) demonstrated that predicted relative abundances derived from eBird data performed well in identifying areas of high importance to bald eagles at the continental scale, and that the inverse of such a map could be used to identify areas of relatively lower risk. Similarly, U.S. Fish and Wildlife Service (2021), in collaboration with Cornell University, found that May eBird relative abundance was strongly associated with estimates of the number of occupied bald eagle nests derived from aerial plot surveys; they used eBird relative abundance to predict bald eagle density in areas not covered by the aerial survey. A possible disadvantage of eBird expressed by some raptor biologists is that its partial reliance on birdwatcher access to lands to collect data, combined with regionally varying detectability of golden eagles, might result in a failure to identify some eagle high-use areas as such. We acknowledge this possibility, but believe the more comprehensive coverage, ability to model relative abundance consistently everywhere, and ability to continually update eBird estimates makes it the better platform for modeling eagle relative abundance on a continental scale.

Ideally, we would have preferred to have more time to evaluate the performance of eBird information relative to other data sets. The pace of this rulemaking effort precluded that. In 2018, however, we evaluated the performance of eBird relative abundance at different thresholds for capturing important bald eagle nesting and wintering areas (Ruiz-Gutierrez et al. 2021), and golden eagle nesting areas (U. S. Fish and Wildlife Service 2018). eBird relative abundance was able to correctly capture the target of > 90% of these important eagle use areas at a threshold of the 50th quantile of the relative abundance probability distribution for bald eagles and at the 30th quantile of the relative abundance distribution for golden eagles (U. S. Fish and Wildlife Service 2018, Ruiz-Gutierrez et al. 2021). In the future it might be possible to integrate both targeted survey and tagged eagle data with eBird to generate improved maps of relative abundance. The Service and Cornell University are currently engaged in an effort to develop a composite model that integrates eBird relative abundance data with golden eagle aerial transect survey data (Nielson et al. 2014), similar to what has been done for bald eagles (U.S. Fish and Wildlife Service 2021) and for golden eagles using Breeding Bird Survey data (Millsap et al. 2013). Similar efforts to integrate eBird data with data from GPS-tagged golden eagles might also improve relative abundance estimates from eBird data. For now, however, we base our assessment of the effects of the general permit for wind on bald and golden eagles on eagle relative abundance maps developed from eBird relative abundance data (Fink et al. 2020), following methods we used previously for bald eagles (Ruiz-Gutierrez et al. 2021) and described below.

Methods

Updating Population Size Estimates and Take Limits

The 2016 PEIS (U.S. Fish and Wildlife Service 2016a) and accompanying status report (U.S. Fish and Wildlife Service 2016b) provided population size estimates, allowable take rates, and allowable take limits for bald and golden eagles. The PEIS also established that the Service will use the 20th quantile of the probability distribution for population size as the basis for setting the take limits. The Service's eagle take permitting program was designed to ensure compliance with the take limits and associated conservation measures outlined in the PEIS (U.S. Fish and Wildlife Service 2016c). The PEIS also committed the Service to conducting population and other monitoring necessary to update the population size estimates and demographic information used to set the take limits. The PEIS required that the population size estimates be reassessed at least once every six years.

The Service has implemented monitoring programs that provide data for conducting such updates for at least the majority of each eagle species' range in the United States. Based on that monitoring, the Service has formally updated population size (U.S. Fish and Wildlife Service 2021) and allowable take estimates (U. S. Fish and Wildlife Service 2022) for bald eagles in four of six bald eagle EMUs since publication of the 2016 PEIS, and the methods and approach for these updates are presented in Zimmerman et al. (2022). Similarly, the Service has collected and analyzed updated demographic and population monitoring information for golden eagles in one and parts of a second golden eagle EMU, which collectively cover about 85% of the species U.S. population. The results of those analyses have recently been peer-reviewed and published (Millsap et al. 2022).

The bald eagle population size update released in 2021 used data from the Service's nest plot survey in 2018 (Atlantic, Central, and Pacific flyways) and 2019 (Mississippi Flyway) and eBird relative abundance data; the count data were combined with demographic data in an integrated population model (IPM) to obtain estimates of total population size (Table 1). This update did not include the Pacific Flyway South or Alaska bald eagle management units, so the Service continues to use the 2016 population size estimates for those EMUs. As part of this update, we used a prescribed take level model, with input from the IPM, to update the bald eagle allowable take rate (Zimmerman et al. 2022) given our management objective of maintaining stable bald eagle numbers measured against the baseline of population size in 2009 (U.S. Fish and Wildlife Service 2016a).

The golden eagle population size update published in 2022 used the Service's golden eagle westwide survey data through 2016 along with Breeding Bird Survey data from 1997 – 2016 from the coterminous U.S. portions of the Central and Pacific flyways. These count data were combined with demographic data from 1997 – 2016 in an IPM, and the vital rate estimates from that model were used to update our estimate of the allowable take rate for these parts of the two golden eagle EMUs. As with bald eagles, golden eagle population size and allowable take rates in the EMUs where updates have not occurred remain as in 2016.

For both bald and golden eagles, the prescribed take level model used by the Service to update the allowable take rate incorporated improvements over the form of the model used in the 2016 status report. For the update, we allowed for nonlinear density dependence in the model, which is more appropriate and realistic for birds with life history strategies like bald and golden eagles. Model results for both bald and golden eagles suggested the demographic effects of density dependence are greater as populations of these species approach carrying capacity. This leads to slightly higher estimates of the allowable take rate than under the assumption density dependent effects increase linearly.

For golden eagles, much of the survival information came from 512 individuals tagged with GSM-GPS transmitters. The Service and collaborators partnered in an effort to recover and obtain cause-of-death information from as many of these eagles as possible. Within the golden eagle IPM, we implemented a cause-of death model to estimate the frequency of each primary cause of mortality. Because transmitters largely avoid recovery biases inherent in band recoveries and incidentally found dead eagles, we believe the estimates from this model provide reasonable information on the frequency and population-level effects of different mortality factors (Millsap et al. 2022). This information is important when considering compensation mitigation strategies and the potential to offset anticipated levels of take that could be authorized under a general permit for wind.

In this document we consolidate and present the results of these updates, and we incorporate by reference the original reports and publications that describe the data collection, data, methods, and analytical approaches used (U.S. Fish and Wildlife Service 2021, Millsap et al. 2022, U. S. Fish and Wildlife Service 2022, Zimmerman et al. 2022).

Mapping Relative Abundance

We used processed eBird relative abundance data from May, 2018 provided by the Lab of Ornithology, Cornell University to develop bald and golden eagle relative abundance maps. We would have preferred to use more recent eBird relative abundance data, but the compressed timeline to complete this work required us to use what was in hand and available. eBird relative abundance values represent the average number of eagles of each species expected to be seen by an expert eBirder who observes for 1 hour at the optimal time of day for detecting the species, and who travels no more than 1 kilometer during the observation session (see eBird FAQs at https://ebird.org/spain/science/status-and-trends/faq#mean-relative-abundance). The dataset we used provided relative abundance estimates for bald and golden eagles throughout the coterminous United States at 8 km^2 resolution for each of five periods (breeding, fall, migration, spring, winter). Using multiple seasons of data provides better measures of relative abundance for mapping purposes (Johnston et al. 2020), and our goal was to identify locations with high relative abundance in any one season.

We were asked to develop maps depicting potential golden eagle general permit zones under three alternative scenarios: with (1) 30%, (2) 50%, and (3) 70% of the overall golden eagle abundance distribution included in the general permit zone (hereafter RA30, RA50, and RA70, respectively). For bald eagles, we were asked to prepare and evaluate general permit zones under three different alternative scenarios: with (1) 92.5%, (2) 95%, and (3) 97.5% of the overall bald eagle abundance distribution included in the general permit zone (hereafter RA92.5, RA95, and RA97.5, respectively). To accomplish this, for each species we dropped cells with relative abundance values of zero, and then processed the non-zero relative abundance data for each season using custom R scripts in Program R (R Core Team 2021). We identified all 8 km^2 cells that had relative abundance values in each season that exceeded the relevant quantile and combined these to identify all cells that exceeded the threshold in any one season. We then created maps of the general permit zone (i.e., grid cells that did not exceed the relative abundance threshold in any season) for each scenario for each species in R. Density plots of the eBird relative abundance distributions for each scenario for bald eagles are in Figure 1 and for golden eagles in Figure 2.

The Service was interested in an operational general permit zone that incorporated risk tolerance for both bald and golden eagles. For this, we were asked to map a general permit zone consisting of the golden eagle RA50 and bald eagle RA95 combined maps.

All of the analyses in this report are based on the assumption that the pre-analyzed general permit zone will be areas of the coterminous U.S. that have eBird status and trend relative abundance values ≤ the reported thresholds. Our analyses would not be applicable to other measures of eagle relative abundance.

Collision Risk Model Exposure Prior Distributions

The Service uses a collision risk model (CRM) to estimate take at wind energy projects (New et al. 2015, 2021). The model was developed with the constraint that it only requires data typically collected at wind energy facilities to meet recommendations in the Service's Land-based Wind Energy Guidelines (U. S. Fish and Wildlife Service 2012). The CRM uses species-specific pre-construction eagle use information (eagle exposure), information on the amount of hazardous airspace created by a wind project (an expansion factor), and information on collision probability for eagles that enter the hazardous airspace (collision probability) to estimate annual fatalities at individual projects, or for groups of projects. The model is implemented in a Bayesian framework, and information on prior eagle exposure and collision probability are incorporated into the modeling process. In the absence of adequate site-specific eagle exposure and eagle fatality data (necessary to estimate collision probability), the model can be run using only the prior information; "priors-only" model runs produce fatality probability distributions representative of the suite of wind projects included in the prior distribution. Species-specific priors for eagle exposure and collision probability are updated with new information periodically as part of the adaptive management process associated with the eagle incidental take permit program (U.S. Fish and Wildlife Service 2013, New et al. 2021).

For the analyses of the effects of a general permit on golden eagles, we developed prior distributions for eagle exposure for the general permit zone and the inverse (hereafter the specific permit zone) for RA30, RA50, and RA70 using all qualifying data in the Service's possession (Appendix 1). Similarly, for bald eagles we developed prior distributions for exposure for the general permit zone and the inverse for RA92.5, RA95, and RA97.5 using the same data, as applicable. We used the criteria and methods described in New et al. (2021) to filter the data and to develop the exposure prior distributions, except that we also filtered out any new projects that (1) used < 800-m radius for eagle point counts, and (2) did not conduct eagle-use surveys across the period(s) when each species of eagle was expected to be present in the area. The initial priors were developed in 2013 with a total of 11 projects (U.S. Fish and Wildlife Service 2013). Upon further review of the data, two of those were dropped in 2015, so the priors created in 2015 used

9 projects (New et al. 2015). In 2021, the Service updated the exposure priors using data from 61 sites for golden eagles and 59 sites for bald eagles (U. S. Fish and Wildlife Service 2021). For this prior update, we updated the 2015 exposure prior distributions with additional data from 67 projects for bald eagles and 60 projects for golden eagles (Attachment 1).

Estimating Eagle Take for General Permit Scenarios

We used the Service's CRM to estimate the fatality probability distributions under each scenario in two ways. First, we produced fatality probability distributions for hypothetical "average" wind energy projects of 100, 150, and 200 turbines in the general and specific permit zones. Second, we produced "nationwide" fatality probability distributions for the number of turbines within the general and specific permit zones in each bald or golden eagle EMU. For both analyses we used the exposure prior distributions described above and the 2021 nationwide prior distribution for collision probability (New et al. 2021, U. S. Fish and Wildlife Service 2021) in the CRMs.

The expansion term in the CRM takes into account the amount of hazardous volume created by turbines and the number of daylight hours that eagles are exposed to the hazardous space. For the average project CRM runs we used daylight hours for the center of the coterminous U.S. in the expansion term and assumed a 95.7 m rotor diameter for each turbine.

We used the hypothetical "average" project estimates to explore standards for existing projects outside the defined general permit zone to potentially qualify for a general permit that would be consistent with the general permit eagle risk and mitigation rates. We also used average project estimates to evaluate theoretical limits to wind projects that could be authorized in direct proximity to one another within the general permit zone before local area population (LAP) thresholds might be exceeded.

For the nationwide model runs we acquired turbine data from the U.S. Geological Survey (USGS) U.S. Wind Turbine Database (Hoen et al. 2018) on 10 February 2022. This database provides information on individual turbine locations and specifications throughout Alaska and the coterminous U.S. We used these data to estimate the hazardous volume for each turbine in the U.S.; for turbines where specifications were not provided, we assigned the mean rotor diameter from all turbines in the database. We calculated the number of daylight hours of exposure for each turbine in the U.S. based on its location. We also used the location information to adjust the number of hours of exposure to reflect the migratory behavior of each eagle species; for any months when a species of eagle is expected to be absent, daylight hours in the model were set to zero. We used eBird Status and Trend abundance maps (Fink et al. 2020), with input from the Service's Regional Eagle Permit Biologists, to determine eagle presence. We spatially stratified the CRM by EMU to calculate EMU-specific fatality estimates. Stratifying the model by EMU also allowed us to combine the estimated fatality distributions for the individual EMUs by summing the estimates to generate the overall estimated number of fatalities for bald and golden eagles across the U.S.

For the analysis of the effects of the combined bald and golden eagle general permit zone scenarios, we combined the RA95 bald eagle and RA50 golden eagle maps to delineate species-specific general and specific zones and identified areas where the bald eagle specific zone overlapped the golden eagle general zone, and conversely, where the golden eagle specific zone overlapped the bald eagle general zone. Individual turbines that fell into each of these zones were grouped to estimate take for each zone. In areas where the bald eagle specific zone overlapped the golden eagle general zone, golden eagle general zone priors were used to estimate golden eagle take for this group of turbines and this take was included in the specific permit zone total for this EMU. Conversely, bald eagle general zone priors were used to estimate bald eagle take for the grouped turbines in the area where the golden eagle specific zone overlapped the bald eagle general zone, and this take was included in the specific permit zone take total. Attachment 1 provides a more detailed description of the nationwide take analyses.

Compensatory Mitigation Considerations

We were asked to calculate the number of bald and golden eagles estimated to be taken per m^3 of hazardous airspace created by wind turbines in each EMU under the combined bald eagle RA95 and golden eagle RA 50 scenario. This value can be used to calculate the compensatory mitigation fee that would have to be associated with each authorization under a general permit, provided the location, size, and number of wind turbines for each authorization are known. We had information on the size and relevant daylight hours of operation for each turbine from the nationwide take analysis described above. To calculate the expected eagle take per m^3 of hazardous airspace, we divided the estimated number of annual fatalities in the EMU by the volume of hazardous airspace (we converted to km^3 for ease of reporting).

Monitoring Considerations

The 2016 PEIS required or implied that the Service would implement monitoring to: (1) verify adherence to EMU take limits and local population take thresholds; (2) update population size estimates for bald and golden eagles; and (3) evaluate all available data that could be used to update estimates of vital rates and allowable take limits. The PEIS specified that these updates should occur not less than once every six years. The Service has invested considerable resources in collecting data to inform objectives (1) and (2) above, but less so for (3). And, for (1), the Service has only just begun to attempt to use these data to estimate overall take under permits, and we must verify that tools like the nationwide take analysis used here are providing accurate estimates of authorized take. With respect to (3), the Service has shown that past investments in opportunistic demographic monitoring for golden eagles yielded substantial improvements to estimates of golden eagle vital rates and provided data useful in estimating frequencies of causes of mortality (Millsap et al. 2022). This work suggests that demographic monitoring in the form of deploying and maintaining a targeted sample of GPS-transmitter tagged golden eagles in the population could not only allow for regular updates to critical demographic parameters (e.g., the adult survival rate), but it could also potentially detect reductions in some mortality factors due to compensatory mitigation efforts, as well as provide a source of information independent from (1) above on the frequencies of mortality at wind energy facilities. It may be that after a few years of such monitoring, we would learn that the nationwide take modeling combined with a consistent level of demographic monitoring could be sufficient to achieve the Service's primary monitoring objectives, thus more expensive fatality monitoring could be discontinued. In this section, we evaluated sample size requirements and costs associated with establishing Service-controlled operational programs for the first and third monitoring components. The Service already conducts bald and golden eagle population monitoring using existing budget resources, so we ignore the second monitoring component in this assessment.

Permit-level fatality monitoring for eagle take at wind facilities has been the responsibility of the permittee in the past, but under the general permit, enrollee-level monitoring requirements will be insufficient to ensure the Service is complying with EMU take limits. But such monitoring is a fundamental requirement of the eagle permit program, and so, as an alternative, the Service is considering requiring general permit enrollees to pay into a pooled monitoring fund as part of their general permit application fee. To determine how much monitoring would be required, and thus the cost to general permit permittees, we evaluated several fatality monitoring intensity scenarios designed primarily to meet the objective of having at least a 0.95 probability that true take under the general permit in each EMU is below permitted take (the 80th quantile of the fatality probability distribution). We conducted this analysis only for golden eagles because numbers of expected bald eagle fatalities in the general permit zone were nearly equal to or higher than the number of expected golden eagle fatalities in each EMU (or combined EMU) (i.e., if sampling is sufficient to estimate take for golden eagles, it should be sufficient to quantify the higher take expected for bald eagles). For this analysis, we used the median annual take estimates for each EMU from the nationwide take analysis as the expected number of annual eagle fatalities within an EMU, and then simulated monitoring at increasing numbers of wind turbines with probabilities of detection of eagle carcasses present of 0.35, 0.45, 0.55, and 0.65. Probability of detection is the probability that an eagle carcass is detected during a survey (searcher efficiency and proportion of the possible fall area searched) given that it was available to be detected (carcass persistence; e.g., not be removed by scavengers) over the proportion of the area searched. We used the Evidence of Absence software for this analysis, because it acknowledges that zero counts are not equivalent to zero mortalities (i.e., when detection rates are <1, carcasses may be missed by observers) (Dalthrop et al. 2014). We propose a sampling design where we randomly select a sample of wind facilities from the facilities that have received a general permit to monitor each year to estimate fatalities at those sites, and then scale estimates up to the general permit zone within an eagle management unit. For a more detailed description of these analyses see Attachment 2. We then used information available to the Service on fatality monitoring costs to calculate funding levels necessary to achieve the fatality monitoring objective under each scenario. Specifically, we explored the relative efficiency of sampling the randomly selected facilities with increasing effort (i.e., higher detection rates), vs sampling more facilities. Monitoring for specific permits would still be a condition of individual permits and was not included in our analyses.

For demographic monitoring of golden eagles, we were interested in evaluating how many GPS tags would need to be deployed annually to regularly update estimates of several key demographic parameters with reasonable levels of precision. The most important demographic parameter relative to the population growth rate is adult survival; Millsap et al. (2022) estimated the elasticity of this parameter from the population matrix equals 0.76. Accordingly, we targeted this parameter in our sample size assessment. We were also interested in being able to use the cause-of-death submodel in the 2022 integrated population model (IPM, Millsap et al. (2022)) to detect changes in the frequency of specific causes of mortality, and so we evaluated the sensitivity of our design scenarios to that as well, using electrocution as the example mortality factor. This latter objective would also allow us to evaluate the efficacy of compensatory mitigation methods. For this assessment, we extracted the survival/cause of death submodel from the 2022 IPM, and then randomly ran subsets of the data of various sizes through the model to obtain estimates for the parameters of interest and standard errors. We evaluated sample sizes between 50 and 1,000, with a goal of assessing at what sample size the coefficient of variation

(CV) for adult survival dropped below 10%. See Attachment 2 for a complete description of our methods.

Bald Eagle Nest Disturbance Take Limit Debit

Currently, the Service debits the bald eagle EMU take limits by 1.33 (expected mean productivity per occupied nesting territory [territories where breeding is attempted]) for each occupied nesting territory for each nest disturbance permit that is issued. The Service requires monitoring to determine nest fates for each disturbance permit. We undertook a review of these monitoring reports to determine the probability that a disturbance permit for a used bald eagle nest results in actual nest failure. We conducted the analysis using a simple Bernoulli model in a Bayesian framework. In keeping with the Service's risk management policy for eagles (U.S. Fish and Wildlife Service 2016*a*), we selected the 80th quantile of the posterior distribution of the probability of nest failure as basis for adjusting the take limit debit. The proposed adjustment to the take limit debit for bald eagle nest disturbance is 1.33 * 80th quantile of probability of nest failure. For more details on the approach used for this analysis see Attachment 3.

Results

Updated Bald and Golden Eagle Population Size and Take Limits

The current bald and golden eagle population size estimates, allowable take rates, and take limits are shown in Table 1. These values are used where relevant in this report. We also provide updated estimated frequencies of golden eagle causes of death in Table 2.

Bald eagle populations have increased 4.4 times the size of the 2009 population estimate in the coterminous U.S. and appear to be growing at a rate of about 10% per year (Zimmerman et al. 2022). Golden eagle populations in the western U.S. appeared stable through 2016, but there is increasing evidence anthropogenic mortality exceeds the allowable take rate (Millsap et al. 2022), potentially leading to declines in the future.

Relative Abundance Maps

Our initial analyses focused on providing information on the effects of the three scenarios on golden eagles to inform a decision regarding which eBird relative abundance quantile to use to produce a general permit map for this species. Figure 3 shows a combined version of the RA92.5, RA95, and RA97.5 maps for bald eagles. Figure 4 shows a combined version of golden eagle maps for scenarios RA30, RA50, and RA70. Figure 5 shows the combined bald eagle RA95 and the golden eagle RA50 maps. An online version of both maps that facilitates close inspection is available at https://www.fws.gov/story/2022-03/eagle-wind-permit-eligibility.

Exposure Priors

The updated prior distributions for bald and golden eagle exposure are provided in Table 3. An anonymized list of the projects used in each prior are provided in Attachment 1.

Expected Annual Take at Typical Wind Projects

Estimates of expected annual bald and golden eagle take at hypothetical wind projects of 100, 150, and 200 turbines under each species-specific scenario are presented in Tables 4 and 5.

Take Rates for Existing Projects in the Specific Permit Zone Compatible with General Permits

The risk of eagle collision for wind projects located in the Specific Permit zone may, in some cases, be low enough to be consistent with a general Permit once site-specific data on mortalities is available. Annual take rates per km^3 of wind turbine hazard for typical projects that are consistent with the rates associated with general permit projects are presented in Table 6.

Local Area Population Considerations

The number of typical 100-turbine projects with overlapping LAPs in the general permit zone that would trigger 7% or 9% LAP thresholds by EMU for golden and bald eagles, respectively, are presented in Table 7.

Expected Annual Take by Permit Zone

Estimated annual take nationwide and by EMU under each species-specific scenario are given in Table 8 and Table 9.

Expected Annual Take by Combined Permit Zone

The estimated annual take for both eagle species under the combined bald eagle RA95 and golden eagle RA50 scenario are provided in Table 10.

Compensatory Mitigation Considerations

Estimated take of bald and golden eagles per km^3 of hazardous airspace in the combined bald eagle RA95 and golden eagle RA50 scenario is presented in Table 11. The Service requires that mitigation for eagle take above the take limits be at a 1.2:1 ratio (U. S. Fish and Wildlife Service 2016*a*), so for mitigation purposes the number of eagles estimated to be taken must be multiplied by 1.2.

Monitoring Considerations

For demographic monitoring, the CV for adult survival dropped below 10% in simulations if we maintained 150 GPS tagged eagles in the population annually (Figure 6). With this level of demographic monitoring, we would have a modest ability to detect a change in frequency in a prevalent mortality factor like electrocution (Figure 7). Expected annual costs for demographic monitoring would vary for the first five years depending on the number of transmitters being monitored, with expected costs increasing from approximately $320,000 in year one to approximately $450,000 in year 4 (Table 12). We expect annual costs would level off to approximately $450,000 from year six on.

Figure 8 shows an example of the sample size calculation plots used to determine the sampling intensity necessary to achieve the fatality monitoring objectives; see Attachment 2 for details on all scenarios explored. Estimated fatality monitoring costs for different intensity scenarios are presented in Table 13. Fatality monitoring scenarios with detection probabilities less than 0.65 at each site monitored appeared unstable given the expected small numbers of true fatalities. This, combined with the results of the scenario comparisons suggest an effective and efficient monitoring program should emphasize attaining a 0.65 probability of detection at the site-level.

The number of turbines that need to be monitored to accomplish the objective of ensuring actual take is ≤ permitted take under general permits in each EMU depends on the number of wind energy projects that enroll in the general permit program. This is because the expected number of fatalities decreases as the number of enrolled turbines decreases, and sampling intensity is linked to the expected number of fatalities. Table 14 illustrates this using varying enrollment proportions for the Central Flyway. The key message from this analysis is that the monitoring fee associated with general permits should not be based on an overestimate of enrollment, as such would result in insufficient funds to meet the monitoring objectives.

These analyses suggest that an effective fatality monitoring program that satisfies the Service's fatality monitoring objective and which provided consistent demographic data on golden eagle survival could be implemented for $125,000 - $620,000 per km^3 of enrolled hazardous volume annually, depending on enrollment (Table 14). Assuming an average turbine size of 0.0014 km^3 of hazardous volume and an average wind project size of 100 turbines, the annual monitoring contribution for a typical wind energy facility under the general permit program would be from ~$17,000–$87,000 annually. For comparison, according to comments provided by the wind energy industry on the Service's October 2021 Advanced Notice of Proposed Rulemaking, annual costs for eagle fatality monitoring under current eagle take permits range from $87,000–$130,000 per year (American Clean Power 2021).

Bald Eagle Nest Disturbance Take Limit Debit

Our analysis of nest failure data indicated that the proportion of bald eagle nesting efforts subjected to potential disturbance that failed ranged from 16%–25%, depending on which subset of permits is considered (Attachment 3). Given the Service's risk tolerance policy for eagle management, we would use the 80^{th} quantile of the probability distribution for management (U.S. Fish and Wildlife Service 2016*a*). Using the 80^{th} quantile for the nest season distribution, we would set the take debit at 1.33 * 0.195 = 0.259. If this adjustment were to be incorporated, future bald eagle nest disturbance permits would be debited from the EMU take limits as 0.26 rather than 1.33.

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Table 1. Current bald and golden eagle EMU-specific population size and take limits. Population size (N) for management purposes, which is what is reported here, is the 20th quantile of the probability distribution for N (U.S. Fish and Wildlife Service 2016*a*). This updates information in Tables 3 and 10 in U.S. Fish and Wildlife Service (2016*b*) and Tables 3-2 and 3-7 in U. S. Fish and Wildlife Service (2016*a*).

Species EMU	Year Updated	Current Allowable Take Rate	Current Population Size Estimate (Q20)	Current Take Limit (Q20)
Bald Eagle				
Atlantic Flyway[a]	2021/2022	0.090	72,990	4,223
Mississippi Flyway[a]	2021/2022	0.090	137,917	7,986
Central Flyway[a]	2021/2022	0.090	26,253	1,521
Pacific Flyway North[a]	2021/2022	0.090	36,302	2,102
Pacific Flyway South[b]	2016	0.038	391	15
Alaska[b]	2016	0.060	62,935	3,776
Golden Eagle[c]				
Atlantic-Mississippi Flyways[b]	2016	0.050	3,180	0
Central & Pacific Flyways[d]	2022	0.070	30,958	0
Alaska[b,e]	2016	0.050	4,002	0

[a]Sources for the information for these bald eagle management units are U. S. Fish and Wildlife Service (2021), U. S. Fish and Wildlife Service (2022), and Zimmerman et al. (2022).

[b]The source for the information for these bald eagle management units is U. S. Fish and Wildlife Service (2016*a*).

[c]Estimates of current anthropogenic mortality for golden eagles likely exceed the allowable take for all golden eagle management units, hence there is no remaining available take for this species (U.S. Fish and Wildlife Service 2016*a*, Millsap et al. 2022).

[d]The source of the information for these golden eagle management units is Millsap et al. (2022). The Central and Pacific flyway management units are combined because we did not estimate population size separately for each EMU in the 2022 analysis.

[e]Alaska is considered part of the Pacific Flyway golden eagle management unit, however population size estimates have not been updated for that part of the Pacific Flyway since 2016, so it is reported separately here.

Table 2. Estimated number of golden eagles that die annually from nine major causes of death in the interior western coterminous U. S., 1997– 2016, reprinted from Table 2 in Millsap et al. (2022). This updates Table 8 in U. S. Fish and Wildlife Service (2016*b*).

	Median	Lower 95% Credible Interval	Upper 95% Credible Interval
First Year			
Collision	51	11	143
Electrocution	69	20	174
Shot	69	20	174
Poisoned	32	4	109
Caught in trap	88	30	203
Fight	32	4	109
Disease	88	30	204
Accident	182	86	346
Starvation	656	416	1001
After First Year			
Collision	560	322	877
Electrocution	437	231	731
Shot	601	354	926
Poisoned	395	201	675
Caught in trap	191	67	409
Fight	191	68	408
Disease	150	45	351
Accident	274	118	523
Starvation	150	45	348

Table 3. Statistics, gamma parameters, and sample sizes for the exposure prior distributions for bald and golden eagles under each relative abundance scenario explored. Exposure prior distributions are used in the Service's collision risk model to estimate eagle take under each scenario.

Species	Distribution Characteristics				Gamma Parameters		Number of projects
Scenario	Mean	SD	Mean SD	SDEV	α	β	
Bald Eagle							
RA92.5 General	0.50	1.14	0.15	1.13	0.19	0.38	45
RA92.5 Specific	1.52	3.96	0.15	3.96	0.15	0.10	22
RA95 General	0.48	1.07	0.14	1.06	0.20	0.42	52
RA95 Specific	2.07	4.69	0.17	4.69	0.19	0.09	15
RA97.5 General	0.54	1.09	0.14	1.08	0.24	0.45	61
RA97.5 Specific	3.85	6.91	0.24	6.91	0.31	0.08	6
Nationwide	0.83	2.50	0.15	2.50	0.11	0.13	67
Golden Eagle							
RA30 General	0.05	0.09	0.03	0.09	0.26	5.57	17
RA30 Specific	1.36	2.21	0.34	2.18	0.38	0.28	43
RA50 General	0.05	0.09	0.03	0.08	0.32	6.25	20
RA50 Specific	1.46	2.26	0.35	2.23	0.42	0.29	40
RA70 General	0.07	0.11	0.04	0.10	0.43	5.88	26
RA70 Specific	1.69	2.38	0.38	2.34	0.51	0.30	34
Nationwide	0.99	1.96	0.29	1.94	0.25	0.26	60

Table 4. Estimated annual take of bald eagles in the general and specific permit zones under the three scenarios considered for this species at typical wind energy projects of 100, 150, and 200 turbines. The Service uses the 60th quantile of the fatality probability distribution (Q 60) as the take estimate for debiting the bald eagle EMU take limits. Turbines represented are average-sized (rotor diameter of 95.7 m) based on the U.S. Wind Turbine Database (Hoen et al. 2018).

Species	100 Turbines			150 Turbines			200 Turbines		
Scenario	Mean	SD	Q60	Mean	SD	Q60	Mean	SD	Q60
Bald Eagle									
RA92.5 General	2.24	6.73	0.37	3.37	10.19	0.56	4.50	13.60	0.74
RA92.5 Specific	6.82	23.19	0.62	10.26	34.83	0.93	13.65	46.62	1.24
RA95 General	2.13	6.26	0.38	3.21	9.48	0.57	4.26	12.69	0.75
RA95 Specific	9.29	27.68	1.60	13.97	41.89	2.39	18.57	55.60	3.23
RA97.5 General	2.41	6.53	0.59	3.61	9.78	0.89	4.82	13.10	1.19
RA97.5 Specific	17.32	41.75	5.87	26.04	62.66	8.78	34.52	83.09	11.61
Nationwide	3.74	14.56	0.14	5.58	21.63	0.21	7.53	29.45	0.28

Table 5. Estimated annual take of golden eagles in the general and specific permit zones under the three scenarios considered for this species at typical wind energy projects of 100, 150, and 200 turbines. The Service uses the 80th quantile of the fatality probability distribution (Q 80) as the take estimate for debiting the golden eagle EMU take limits. In the case of golden eagles, the take limits are zero, hence this column estimates the number of golden eagles for which take will have to be compensated at a ratio of 1.2:1 (U.S. Fish and Wildlife Service 2016a). Turbines represented are average-sized (rotor diameter of 95.7 m) based on the U.S. Wind Turbine Database (Hoen et al. 2018).

Species	100 Turbines			150 Turbines			200 Turbines		
Scenario	Mean	SD	Q80	Mean	SD	Q80	Mean	SD	Q80
Golden Eagle									
RA30 General	0.17	0.46	0.18	0.25	0.69	0.27	0.33	0.92	0.36
RA30 Specific	4.92	11.39	6.27	7.40	17.27	9.39	9.82	22.73	12.51
RA50 General	0.19	0.46	0.22	0.28	0.70	0.33	0.37	0.92	0.45
RA50 Specific	5.28	11.83	6.86	7.90	17.74	10.29	10.56	23.78	13.72
RA70 General	0.26	0.58	0.34	0.39	0.87	0.51	0.39	0.87	0.51
RA70 Specific	6.13	12.62	8.35	9.17	18.90	12.47	12.27	25.35	16.68
Nationwide	3.57	9.88	3.89	5.34	14.73	5.81	7.13	19.74	7.76

Table 6. Thresholds for the 60th and 80th quantiles of estimated annual bald and golden eagle take rates, respectively, projects located in the specific permit zone must meet for consistency with general permit standards for eagle risk, mitigation, and monitoring. We assumed data informing the estimates would represent a minimum of five years of mortality monitoring with an annual average overall detection probability of 35 percent or greater. Turbines represented are average-sized (rotor diameter of 95.7 m) based on the U.S. Wind Turbine Database (Hoen et al. 2018).

Species	Annual Fatality Rate			
	Per Hazardous Km^3	Per 100 Turbines	Per 150 Turbines	Per 200 Turbines
Bald Eagle	2.62	0.38	0.55	0.73
Golden Eagle	1.54	0.22	0.32	0.43

Table 7. The number of average-sized 100-turbine (rotor diameter of 95.7 m) projects with overlapping local area populations (LAP) in the general permit zone that could theoretically be authorized before triggering LAP thresholds (7% for golden eagles and 9% for bald eagles) by LAP Density Units. The annual authorized take is the total of 60th quantile (bald eagle) or 80th quantile (golden eagle) fatality estimates for projects assuming they are located fully within the general permit zone of the LAP Density Unit specified. Projects in the table represent theoretical (highly simplified) wind-only project limits, as all eagle incidental take authorizations are included in the LAP evaluation.

Species Density Unit	Eagle Density (eagles/km^2)	LAP (# eagles)	General Permit Projects (#)	Total Annual Authorized Take to Reach LAP Threshold
Bald Eagle				
Atlantic Flyway EMU	0.0594	3,576	658	250.0
Mississippi Flyway EMU	0.0663	3,989	734	278.9
Central Flyway EMU	0.0106	637	117	44.5
Pacific Flyway Alaska EMU	0.0365	2,198	404	153.5
Pacific Flyway North EMU	0.0303	1,826	336	127.7
Pacific Flyway South EMU	0.0004	22	3	1.1
Golden Eagle				
Eastern LADU	0.0010	99	31	6.9
AK LADU	0.0022	213	67	14.9
BCR 05 LADU	0.0006	62	19	4.2
BCR 09 LADU	0.0081	788	248	55.1
BCR 10 LADU	0.0094	907	285	63.3
BCR 11 LADU	0.0012	120	37	8.2
BCR 15 LADU	0.0007	69	21	4.7
BCR 16 LADU	0.0069	671	211	46.9
BCR 17 LADU	0.0220	2,127	670	148.9
BCR 18 LADU	0.0028	274	86	19.1
BCR 32 LADU	0.0033	321	101	22.4
BCR 33 LADU	0.0010	96	30	6.7
BCR 34 LADU	0.0018	178	56	12.4
BCR 35 LADU	0.0028	272	85	18.9

Table 8. Estimates of bald eagle take throughout Alaska and the coterminous U.S. (nationwide) and by EMU under each bald eagle general and specific permit scenario. The Service uses the 60th quantile (Q 60) of the fatality probability distribution as the take number debited from the EMU take limit (U. S. Fish and Wildlife Service 2021).

Scenario / EMU / Permit Zone	% Turbines[a]	Mean	SD	Q 50	Q 60
RA92.5					
Nationwide					
General	95%	1058	3193	64	175
Specific	5%	207	708	5	19
Atlantic					
General	94%	59	178	4	10
Specific	6%	15	50	0	1
Mississippi					
General	94%	403	1212	24	66
Specific	6%	76	261	2	7
Central					
General	98%	487	1461	29	80
Specific	2%	54	183	1	5
Pacific North					
General	79%	76	232	5	13
Specific	21%	59	201	1	5
Pacific South					
General	97%	35	106	2	6
Specific	3%	4	14	0	0
RA95					
Nationwide					
General	97%	1045	3108	69	183
Specific	3%	145	434	9	25
Atlantic					
General	95%	57	168	4	10
Specific	5%	19	57	1	3
Mississippi					
General	97%	397	1176	26	70
Specific	3%	45	135	3	8
Central					
General	99%	474	1405	32	84
Specific	1%	27	79	2	5
Pacific North					
General	86%	79	234	5	14
Specific	14%	50	148	3	8
Pacific South					
General	97%	34	100	2	6
Specific	3%	5	16	0	1

RA97.5					
Nationwide					
General	99%	1191	3207	130	295
Specific	1%	135	326	23	45
Atlantic					
General	95%	65	174	7	16
Specific	5%	33	79	6	11
Mississippi					
General	99%	453	1233	49	111
Specific	1%	50	121	9	17
Central					
General	100%	537	1454	58	133
Specific	0%	19	45	3	6
Pacific North					
General	95%	99	266	11	24
Specific	5%	23	56	4	8
Pacific South					
General	98%	38	102	4	9
Specific	2%	9	21	1	3

[a]Total number of turbines in Alaska and the coterminous U.S. = 70,605 (Hoen et al. 2018).

Table 9. Estimates of annual golden eagle take throughout the coterminous U.S. (nationwide) and by EMU under each golden eagle general and specific permit scenario. The Service uses the 80th quantile (Q80) of the fatality probability distribution as the take number debited from the EMU take limit (U.S. Fish and Wildlife Service 2016*a*).

Scenario / EMU / Permit Zone	% Turbines[a]	Mean	SD	Q50	Q80
RA30					
Nationwide					
General	74%	54	150	6	58
Specific	26%	793	1852	163	1005
Atlantic - Mississippi					
General	89%	15	43	2	17
Specific	11%	45	105	9	57
Central					
General	80%	35	97	4	38
Specific	20%	393	916	81	499
Pacific					
General	23%	3	9	0	4
Specific	77%	359	836	73	457
RA50					
Nationwide					
General	79%	66	165	11	79
Specific	21%	672	1509	154	874
Atlantic - Mississippi					
General	93%	18	45	3	21
Specific	7%	31	69	7	40
Central					
General	83%	41	102	7	49
Specific	17%	366	816	84	476
Pacific					
General	43%	8	19	1	9
Specific	57%	275	616	63	359
RA70					
Nationwide					
General	89%	108	240	25	142
Specific	11%	435	899	122	592
Atlantic - Mississippi					
General	99%	27	59	6	35
Specific	1%	3	6	1	4
Central					
General	90%	65	145	15	85
Specific	10%	249	514	69	338
Pacific					
General	65%	17	37	4	22
Specific	35%	183	376	52	250

[a]Total number of turbines in Alaska and the coterminous U.S. = 70,605 (Hoen et al. 2018).

Table 10. Estimates of bald and golden eagle take throughout Alaska and the coterminous U.S. (nationwide) and by EMU under the combined bald-golden eagle general and specific permit zones. SDs of the mean estimates can be found in Attachment 1, Tables 4 and 5.

Species / EMU / Permit Zone	% Turbines[a]	Mean	Q50	Q60
Bald Eagle				
Nationwide				
General	78%	855	57	151
Specific	22%	333	22	58
Atlantic				
General	49%	31	2	5
Specific	51%	45	3	8
Mississippi				
General	97%	396	26	70
Specific	3%	46	3	8
Central				
General	82%	380	26	67
Specific	18%	122	8	21
Pacific North				
General	35%	29	2	5
Specific	65%	100	7	17
Pacific South				
General	48%	18	1	3
Specific	52%	21	1	4
Golden Eagle				
Nationwide				
General	78%	65	11	78
Specific	22%	674	154	876
Atlantic - Mississippi				
General	90%	17	3	21
Specific	10%	31	7	40
Central				
General	82%	41	7	49
Specific	18%	367	84	478
Pacific				
General	42%	7	1	9
Specific	58%	275	63	358

[a]Total number of turbines in Alaska and the coterminous U.S. = 70,605 (Hoen et al. 2018).

Table 11. Estimated annual take of each eagle species per km^3 of hazardous airspace in the combined bald eagle RA95 and golden eagle RA50 general permit zone. The fatalities per km^3 of hazardous space values for golden eagles can be converted to numbers of eagles that must be replaced by multiplying by 1.2 (U. S. Fish and Wildlife Service 2016*a*).

Bald Eagle

EMU	Number of Turbines (as of 2022)	Hazardous Volume (km^3)	Estimated Annual Fatalities (Q60)	Fatalities per hazardous space (km^3)
Atlantic	1,582	2.08	5	2.40
Mississippi	17,201	26.72	70	2.62
Central	31,161	51.6	67	1.30
Pacific North	1,761	1.95	5	2.56
Pacific South	3,162	3.87	3	0.78
Total	54,876	86.22	150	1.74

Golden Eagle

EMU	Number of Turbines (as of 2022)	Hazardous Volume (km^3)	Estimated Annual Fatalities (80th Quantile)	Fatalities per km^3 of hazardous space
Atlantic - Mississippi	18,792	28.8	21	0.73
Central	31,161	51.6	49	0.95
Pacific	4,923	5.82	9	1.55
Total	54,876	86.22	79	0.92

Table 12. Yearly costs to deploy and maintain a sample of 150 GPS-tagged adult golden eagles annually. The number of tagged eagles stabilizes after 50 tags are deployed per year in years 1–3, and 15 are deployed annually each year thereafter.

Budget Item	Year					
	1	2	3	4	5	>6
Personnel	$108,050	$108,050	$108,050	$108,050	$108,050	$86,425
GPS Tags - New[a]	$175,000	$175,000	$175,000	$175,000	$175,000	$122,500
Argos Service	$36,000	$77,760	$111,600	$141,840	$169,200	237,600
Total Cost	$319,050	$360,810	$394,650	$424,890	452,250	446,525
Cost per km^3 hazardous volume[b]	$4,153	$4,696	$5,137	$5,530	$5,886	$5,812

[a]Cost based on purchasing 50 units in years 1–5, and 35 annually thereafter.

[b]Hazardous volume from Table 12.

Table 13. Estimated monitoring intensity necessary to ensure permitted take does not exceed allowable take for golden eagles by EMU (see Methods for an explanation of the approach and rationale). The cost per km^3 of hazardous volume and cost per turbine do not necessarily scale consistently because turbines vary in size. To account for this in considering cost, we assumed all turbines were an average[a] turbine size.

EMU	Turbines Sampled (#)	Sample Cost ($)	Total Turbines	Sampled (%)	Total HazKm3[a]	Cost Per $HazKm^3$	Cost Per Avg Turbine
Atlantic - Mississippi							
0.35	2,650	$5,599,450	18,792	14%	26.31	$212,836	$298
0.45	1,750	$3,697,750	18,792	9%	26.31	$140,552	$197
0.55	3,550	$12,957,500	18,792	19%	26.31	$492,516	$690
0.65	850	$3,102,500	18,792	5%	26.31	$117,926	$165
Central							
0.35	1,900	$4,014,700	31,161	6%	43.63	$92,027	$129
0.45	1,200	$2,535,600	31,161	4%	43.63	$58,122	$81
0.55	3,200	$11,680,000	31,161	10%	43.63	$267,734	$375
0.65	600	$2,190,000	31,161	2%	43.63	$50,200	$70
Pacific							
0.35	NA	NA	4,923	NA	6.89	NA	NA
0.45	NA	NA	4,923	NA	6.89	NA	NA
0.55	1,075	$3,923,750	4,923	22%	6.89	$569,303	$797
0.65	525	$1,916,250	4,923	11%	6.89	$278,032	$389

[a]Calculated using the national average for turbine size (0.0014 km^3 of hazardous volume per turbine).

Table 14. Examples of annual golden eagle fatality monitoring costs in the general permit zone of the Central Flyway EMU if 10%, 20%, 25%, 30%, or 50% of turbines are covered under a general permit. The number of turbines sampled is the minimum number necessary to ensure the 95% confidence interval for actual take is ≤ permitted take. There are 31,161 turbines in the Central Flyway EMU general permit zone based on the U.S. Wind Turbine Database.

	Enrollment				
	10%	20%	25%	30%	50%
Number of turbines enrolled (31,161 total)	3,116	6,232	7,790	9,348	15,581
Turbines sampled	625	625	625	625	625
Demographic study cost	$446,525	$446,525	$446,525	$446,525	$446,525
Fatality sampling cost[a]	$2,271,769	$2,271,769	$2,271,769	$2,271,769	$2,271,769
Total km^3 hazardous volume[b]	4.36	8.73	10.91	13.09	21.81
Total cost per hazardous km^3	$623,099	$311,549	$249,240	$207,700	$124,620
Cost per average turbine sampled	$4,349	$4,349	$4,349	$4,349	$4,349
Cost per average turbine enrolled	$872	$436	$349	$291	$174
Cost per average 100 turbine project enrolled	$87,234	$43,617	$34,894	$29,078	$17,447

[a]Assuming that sampling a turbine costs $3,634.83

[b]Calculated using the national average for turbine size (0.0014 km3 of hazardous volume per turbine).

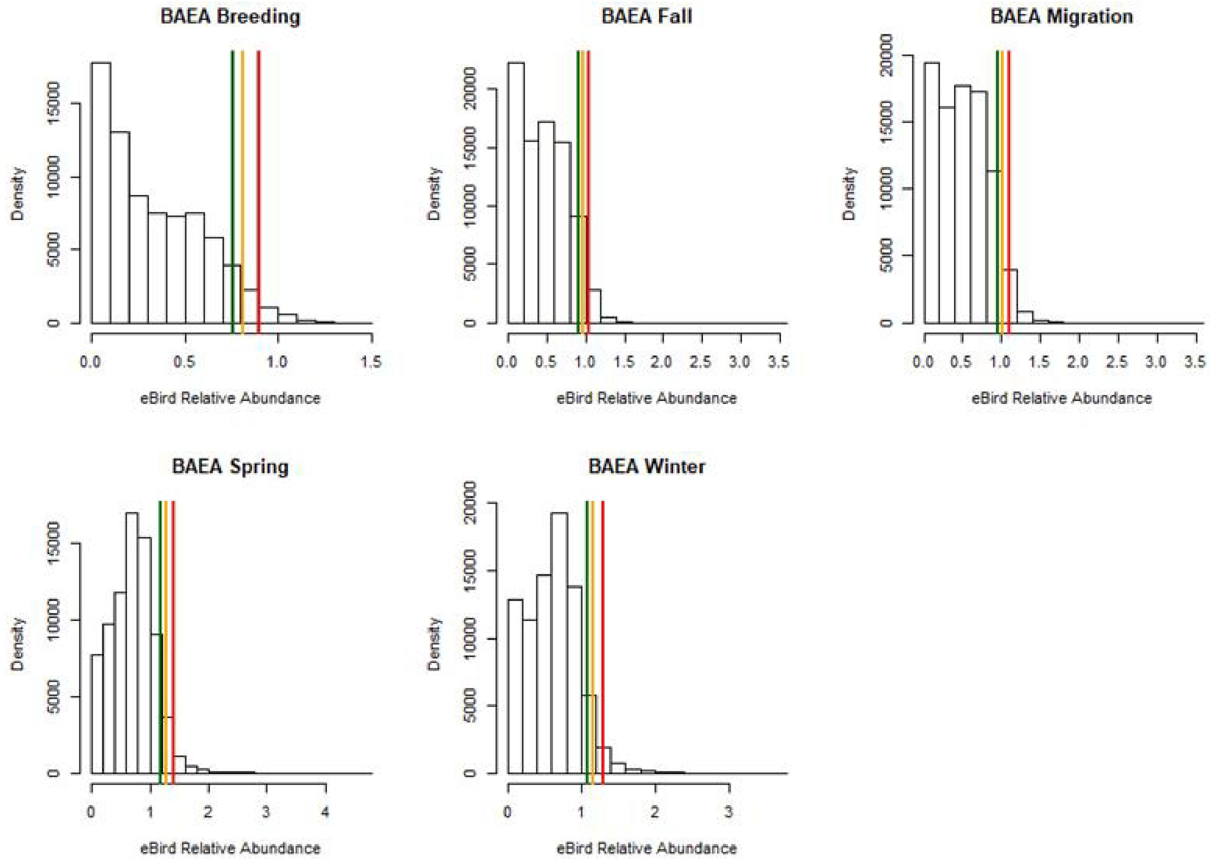

Figure 1. Seasonal density plots of bald eagle relative abundance based on eBird relative abundance model predictions. The vertical green, yellow, and red lines denote the relative abundance thresholds for RA92.5, RA95, and RA97.5, respectively.

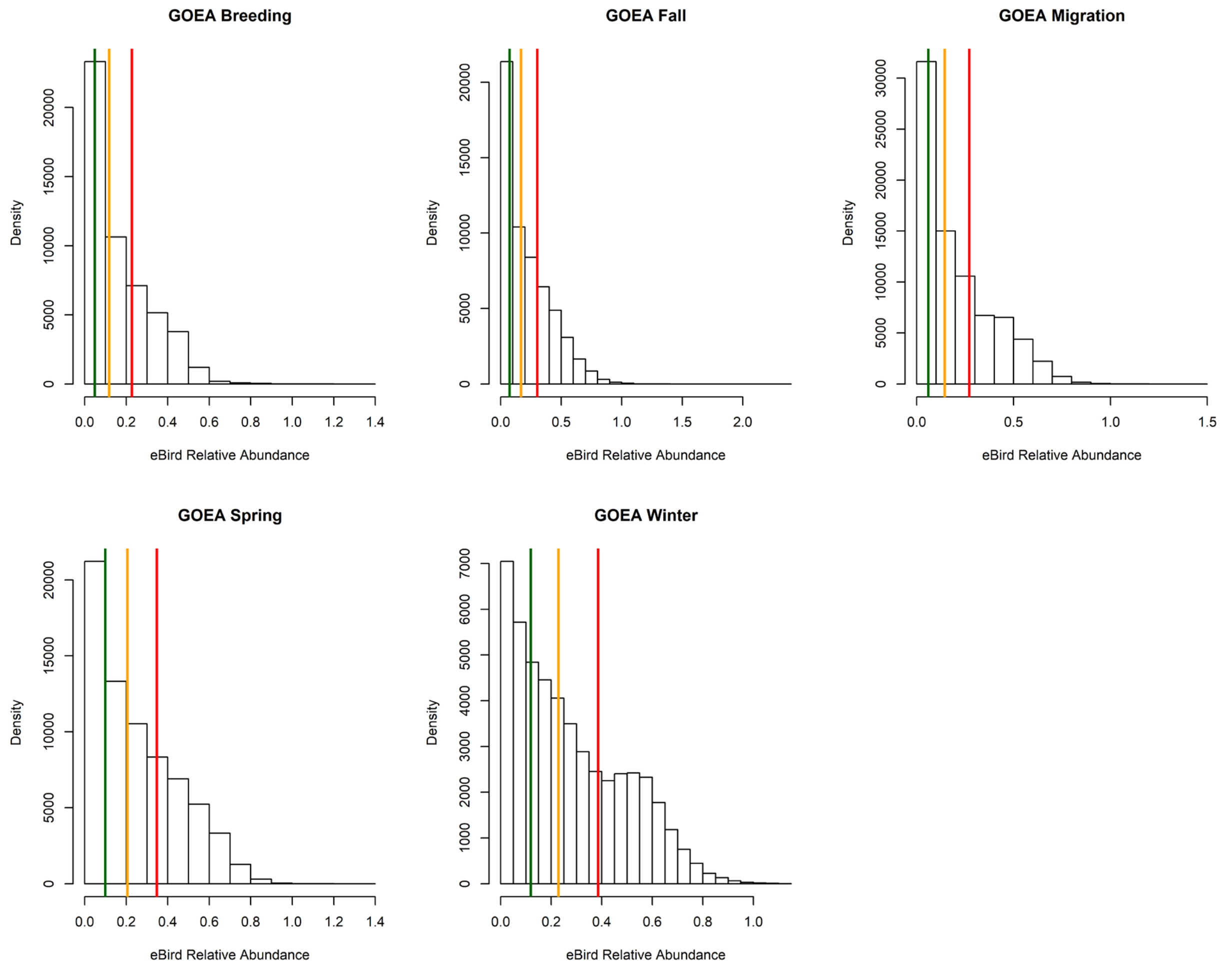

Figure 2. Seasonal density plots of golden eagle relative abundance based on eBird relative abundance model predictions. The vertical green, yellow, and red lines denote the relative abundance thresholds for RA30, RA50, and RA70, respectively.

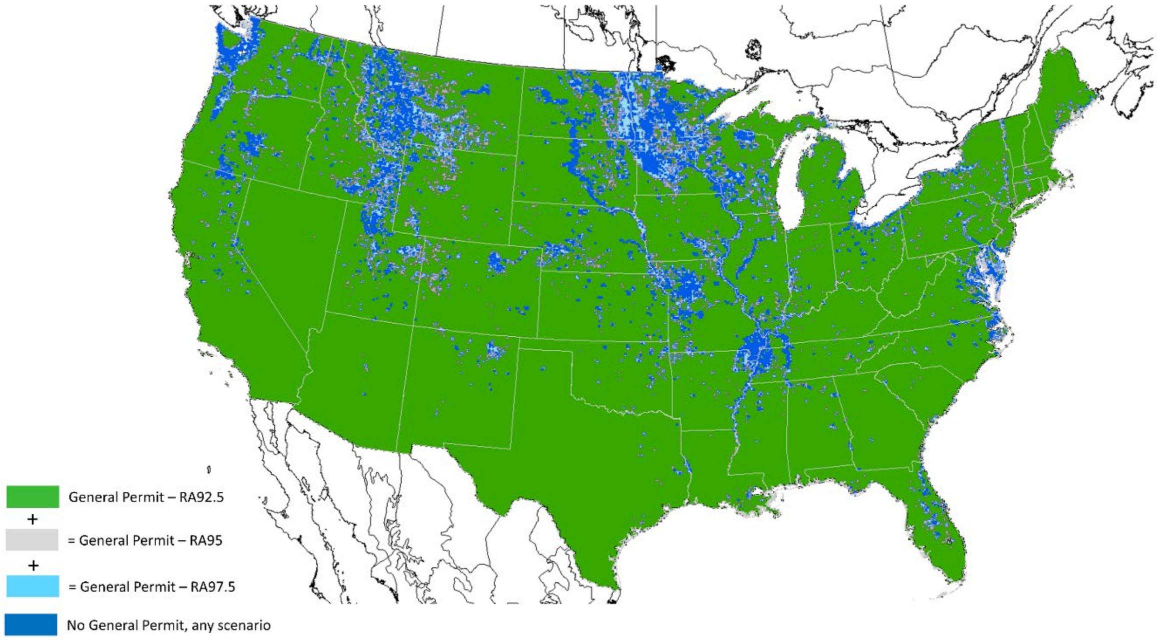

Figure 3. Map showing the general permit zone and, conversely, the specific permit zones for bald eagles under the three scenarios explored. The RA92.5 scenario places all 8 km^2 map cells that have eBird relative abundance values in the top 92.50% of the relative abundance distribution in the specific permit zone (gray plus light blue plus dark blue; the general permit zone in this scenario is the green). The RA95 scenario places all 8 km^2 map cells that have eBird relative abundance values in the top 95% of the relative abundance distribution in the specific permit zone (light blue plus dark blue; the general permit zone in this scenario is green plus gray). The RA97.5 scenario places all 8 km^2 map cells that have eBird relative abundance values in the top 97.5% of the relative abundance distribution in the specific permit zone (dark blue; the general permit zone in this scenario is green plus gray plus light blue). To view an interactive version of this map that allows for closer inspection go to https://www.fws.gov/story/2022-03/eagle-wind-permit-eligibility.

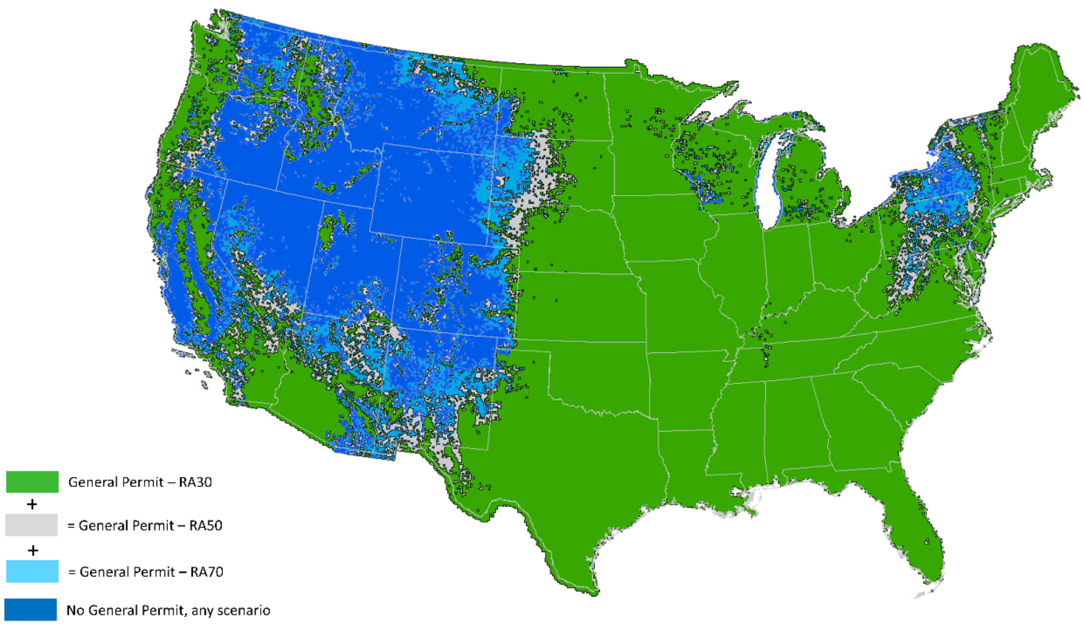

Figure 4. Map showing the general permit zone and, conversely, the specific permit zones for golden eagles under the three scenarios explored. The RA30 scenario places all 8 km^2 map cells that have eBird relative abundance values in the top 70% of the relative abundance distribution in the specific permit zone (gray plus light blue plus dark blue; the general permit zone in this scenario is the green). The RA50 scenario places all 8 km^2 map cells that have eBird relative abundance values in the top 50% of the relative abundance distribution in the specific permit zone (light blue plus dark blue; the general permit zone in this scenario is green plus gray). The RA70 scenario places all 8 km^2 map cells that have eBird relative abundance values in the top 30% of the relative abundance distribution in the specific permit zone (dark blue; the general permit zone in this scenario is green plus gray plus light blue). To view an interactive version of this map that allows for closer inspection go to https://www.fws.gov/story/2022-03/eagle-wind-permit-eligibility.

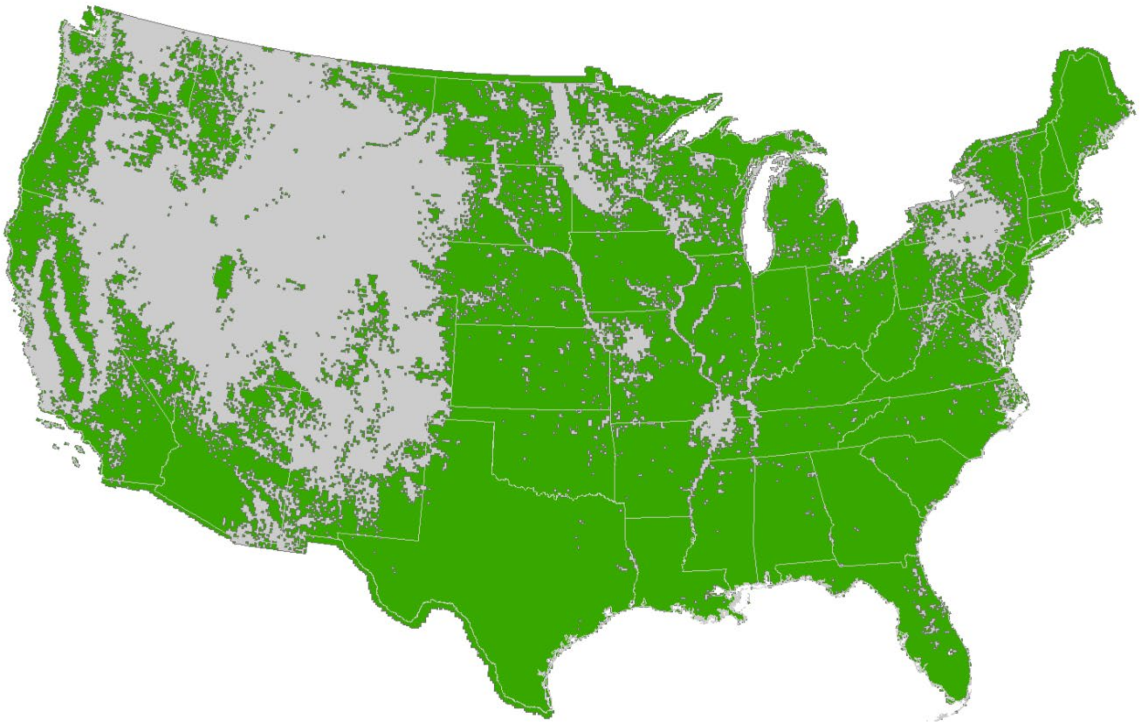

Figure 5. Map showing the general permit zone (green) and, conversely, the specific permit zone (gray) combining the bald eagle RA95 and golden eagle RA50 scenarios. This map places all 8 km^2 map cells that have eBird relative abundance values in the top 50% of the golden eagle relative abundance distribution, and all cells that have bald eagle eBird relative abundance values in the top 5% of the bald eagle relative abundance distribution, in the specific permit zone. To view an interactive version of this map that allows for closer inspection go to https://www.fws.gov/story/2022-03/eagle-wind-permit-eligibility.

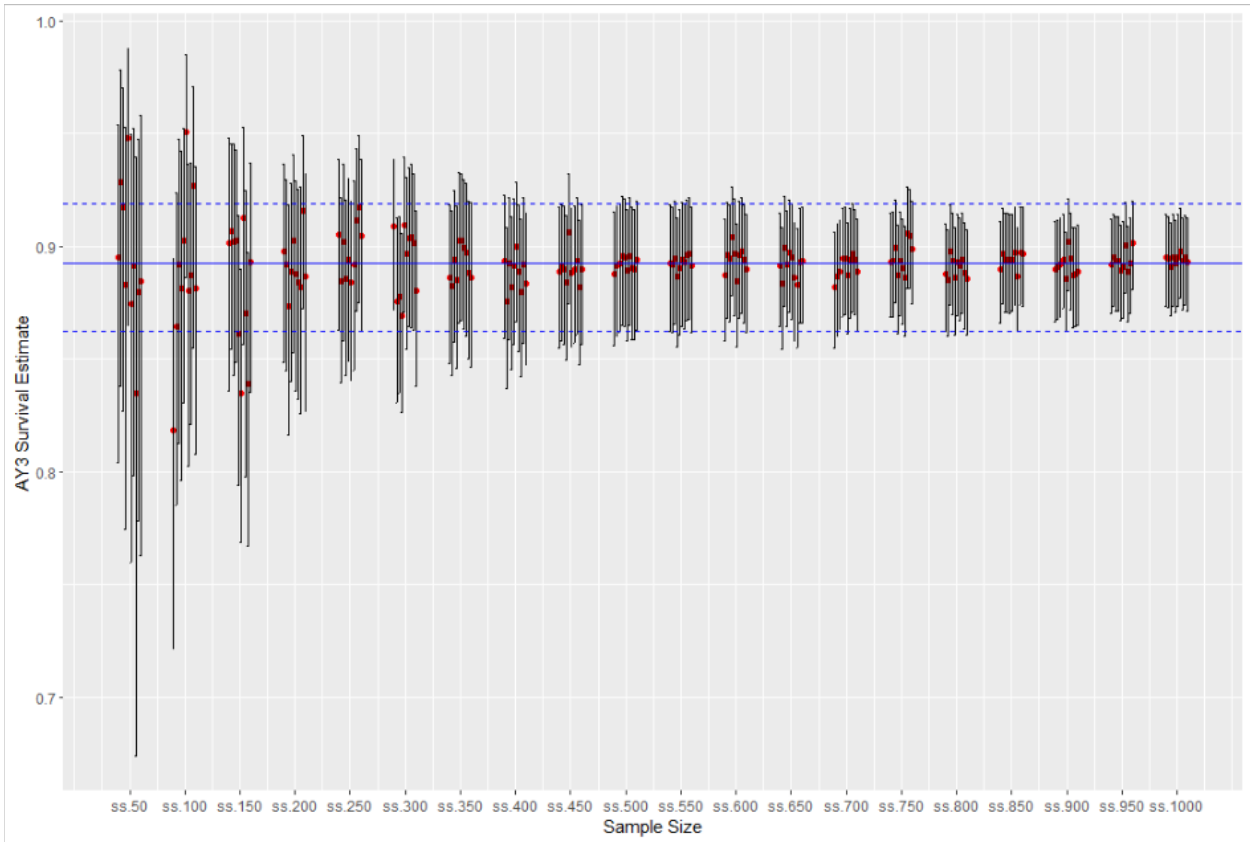

Figure 6. Plots showing median (red dot) and 95% credible intervals (CI) for each of 10 estimates of adult survival at each sample size (50 – 1000). Blue lines represent the median (solid line) and 95% CI (dotted lines) for survival using the full sample of 512 individuals.

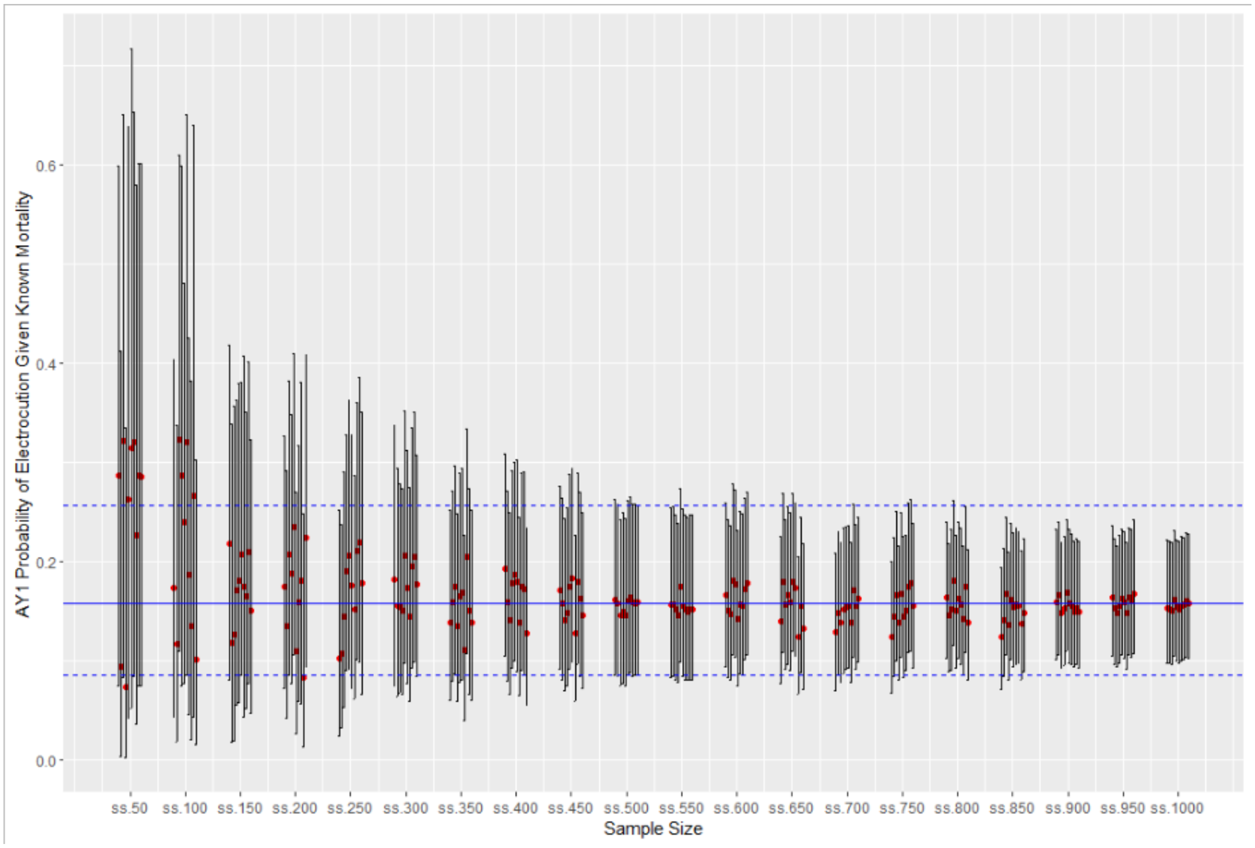

Figure 7. Plots showing median (red dot) and 95% credible interval (CI) for each of 10 estimates of adult golden eagle electrocution probability at each sample size (50 – 1,000). Blue lines represent the median (solid line) and 95% CI (dotted lines) for electrocution using the full sample of 512 individuals.

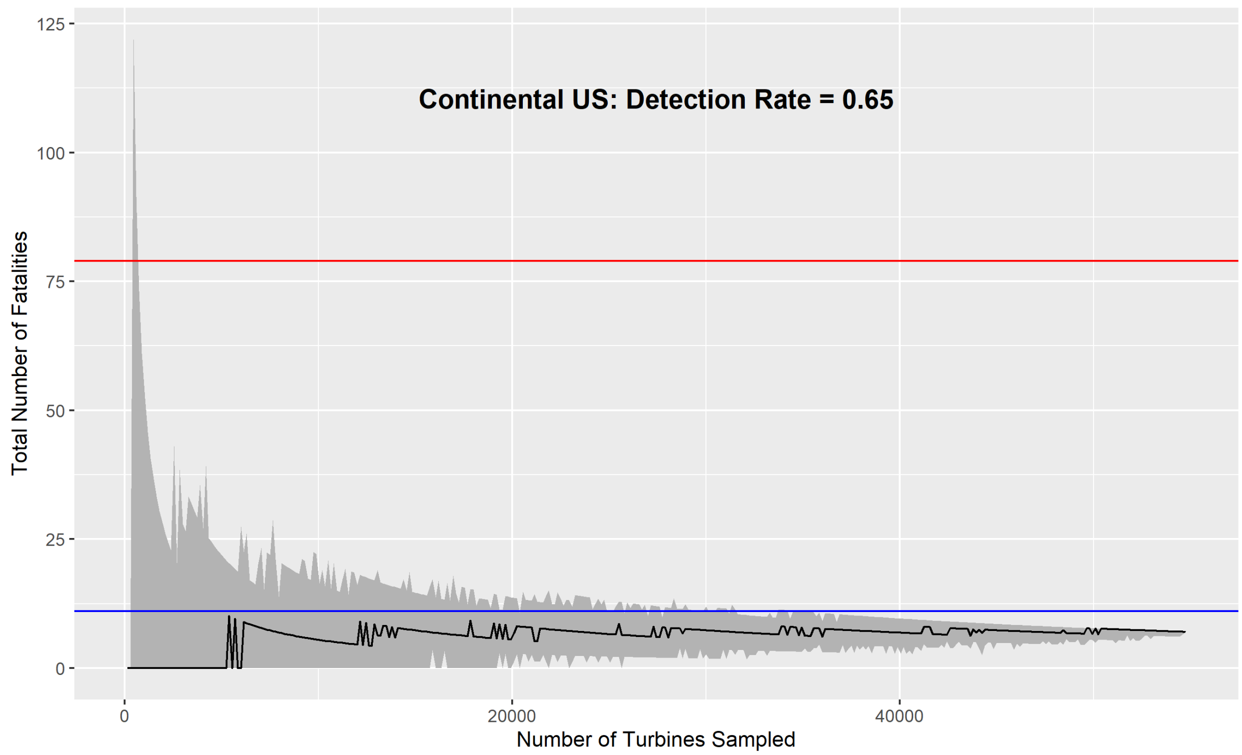

Figure 8. Fatality monitoring sample size analysis results for the entire general permit zone in the coterminous U. S., as an example. For this example, searches are conducted with sufficient intensity that the probability of detecting an eagle carcass killed at a sampled turbine is 065. The blue line represents the expected number of total fatalities across all wind energy projects, and the red line represents the 80th quantile of the probability distribution of the number of fatalities, which is used as the permitted take level for debits to the EMU take limits. The gray polygon is the 95% credible interval for the estimated number of fatalities. Our objective was to select a sample size where we would expect to have ≥ a 0.95 probability of detecting true take in excess of the permitted take limit. That condition is satisfied when the number of turbines searched exceeds the number where the 95% credible interval remains below the red line. In this case, that condition is met if 600 turbines are searched with a probability of detection of 0.65.

Appendix 1.

Table 1. Anonymized list of wind energy projects used to compute prior distributions for eagle exposure in the Service's analyses.

Bald Eagle				
Name	State	RA92.5	RA95	RA97.5
Project_1	OK	General Permit	General Permit	General Permit
Project_2	NY	Specific Permit	Specific Permit	General Permit
Project_3	MO	Specific Permit	Specific Permit	General Permit
Project_4	MN	Specific Permit	Specific Permit	Specific Permit
Project_5	WA	General Permit	General Permit	General Permit
Project_6	OR	Specific Permit	Specific Permit	General Permit
Project_7	OH	General Permit	General Permit	General Permit
Project_8	MN	Specific Permit	General Permit	General Permit
Project_9	OR	General Permit	General Permit	General Permit
Project_10	WY	General Permit	General Permit	General Permit
Project_11	WY	General Permit	General Permit	General Permit
Project_12	NY	Specific Permit	Specific Permit	General Permit
Project_13	WY	General Permit	General Permit	General Permit
Project_14	MO	Specific Permit	General Permit	General Permit
Project_15	SD	Specific Permit	General Permit	General Permit
Project_16	MI	General Permit	General Permit	General Permit
Project_17	AZ	General Permit	General Permit	General Permit
Project_18	WY	General Permit	General Permit	General Permit
Project_19	OR	General Permit	General Permit	General Permit
Project_20	OR	General Permit	General Permit	General Permit
Project_21	OH	General Permit	General Permit	General Permit
Project_22	WY	Specific Permit	Specific Permit	General Permit
Project_23	OH	General Permit	General Permit	General Permit
Project_24	OK/TX	General Permit	General Permit	General Permit
Project_25	FL	General Permit	General Permit	General Permit
Project_26	MN	General Permit	General Permit	General Permit
Project_27	MD	Specific Permit	Specific Permit	Specific Permit
Project_28	OH	General Permit	General Permit	General Permit
Project_29	OH	General Permit	General Permit	General Permit
Project_30	CA	General Permit	General Permit	General Permit
Project_31	WY	General Permit	General Permit	General Permit

Project_32	WY	General Permit	General Permit	General Permit
Project_33	WI	General Permit	General Permit	General Permit
Project_34	WA	General Permit	General Permit	General Permit
Project_35	OR	General Permit	General Permit	General Permit
Project_36	WA	General Permit	General Permit	General Permit
Project_37	MO	General Permit	General Permit	General Permit
Project_38	UT	General Permit	General Permit	General Permit
Project_39	NY	Specific Permit	Specific Permit	General Permit
Project_40	WY	General Permit	General Permit	General Permit
Project_41	WA	Specific Permit	General Permit	General Permit
Project_42	ID	Specific Permit	Specific Permit	Specific Permit
Project_43	MD	Specific Permit	Specific Permit	General Permit
Project_44	CO	General Permit	General Permit	General Permit
Project_45	CA	General Permit	General Permit	General Permit
Project_46	MO	General Permit	General Permit	General Permit
Project_47	MN	Specific Permit	Specific Permit	Specific Permit
Project_48	NC	Specific Permit	Specific Permit	Specific Permit
Project_49	MN	Specific Permit	General Permit	General Permit
Project_50	MN	General Permit	General Permit	General Permit
Project_51	OH	Specific Permit	Specific Permit	General Permit
Project_52	WI	General Permit	General Permit	General Permit
Project_53	AZ	General Permit	General Permit	General Permit
Project_54	MN	General Permit	General Permit	General Permit
Project_55	OH	Specific Permit	Specific Permit	Specific Permit
Project_56	MT	General Permit	General Permit	General Permit
Project_57	CA	General Permit	General Permit	General Permit
Project_58	OH	General Permit	General Permit	General Permit
Project_59	OH	General Permit	General Permit	General Permit
Project_60	MN	Specific Permit	Specific Permit	General Permit
Project_61	MI	Specific Permit	General Permit	General Permit
Project_62	WY	General Permit	General Permit	General Permit
Project_63	IA	General Permit	General Permit	General Permit
Project_64	CA	General Permit	General Permit	General Permit
Project_65	OR	General Permit	General Permit	General Permit
Project_66	WY	General Permit	General Permit	General Permit
Project_67	WA	Specific Permit	General Permit	General Permit

Golden Eagle				
Name	State	RA30	RA50	RA70
Project_1	CA	Specific Permit	Specific Permit	General Permit
Project_2	NM	Specific Permit	General Permit	General Permit
Project_3	OK	General Permit	General Permit	General Permit
Project_4	MO	General Permit	General Permit	General Permit
Project_5	WA	Specific Permit	Specific Permit	Specific Permit
Project_6	OR	Specific Permit	Specific Permit	General Permit
Project_7	OR	Specific Permit	Specific Permit	Specific Permit
Project_8	WY	Specific Permit	Specific Permit	Specific Permit
Project_9	WY	Specific Permit	Specific Permit	Specific Permit
Project_10	WY	Specific Permit	Specific Permit	Specific Permit
Project_11	WY	Specific Permit	Specific Permit	Specific Permit
Project_12	MO	General Permit	General Permit	General Permit
Project_13	MI	General Permit	General Permit	General Permit
Project_14	AZ	Specific Permit	Specific Permit	General Permit
Project_15	WY	Specific Permit	Specific Permit	Specific Permit
Project_16	OR	General Permit	General Permit	General Permit
Project_17	OR	Specific Permit	Specific Permit	Specific Permit
Project_18	WY	Specific Permit	Specific Permit	Specific Permit
Project_19	OK/TX	General Permit	General Permit	General Permit
Project_20	MN	General Permit	General Permit	General Permit
Project_21	MD	General Permit	General Permit	General Permit
Project_22	OH	General Permit	General Permit	General Permit
Project_23	CA	General Permit	General Permit	General Permit
Project_24	WY	Specific Permit	Specific Permit	Specific Permit
Project_25	WY	Specific Permit	Specific Permit	Specific Permit
Project_26	WA	Specific Permit	General Permit	General Permit
Project_27	OR	Specific Permit	Specific Permit	Specific Permit
Project_28	WA	Specific Permit	Specific Permit	Specific Permit
Project_29	MO	General Permit	General Permit	General Permit
Project_30	UT	Specific Permit	Specific Permit	Specific Permit
Project_31	WY	Specific Permit	Specific Permit	Specific Permit
Project_32	NY	Specific Permit	Specific Permit	Specific Permit
Project_33	WY	Specific Permit	Specific Permit	Specific Permit
Project_34	WA	Specific Permit	Specific Permit	Specific Permit

Project_35	CA	Specific Permit	Specific Permit	Specific Permit
Project_36	ID	Specific Permit	Specific Permit	Specific Permit
Project_37	MD	Specific Permit	Specific Permit	General Permit
Project_38	CO	Specific Permit	Specific Permit	Specific Permit
Project_39	CA	Specific Permit	Specific Permit	Specific Permit
Project_40	MO	General Permit	General Permit	General Permit
Project_41	CA	Specific Permit	Specific Permit	Specific Permit
Project_42	CA	General Permit	General Permit	General Permit
Project_43	AZ	Specific Permit	Specific Permit	Specific Permit
Project_44	MN	General Permit	General Permit	General Permit
Project_45	WY	Specific Permit	Specific Permit	Specific Permit
Project_46	AZ	Specific Permit	Specific Permit	Specific Permit
Project_47	MN	General Permit	General Permit	General Permit
Project_48	MT	Specific Permit	Specific Permit	Specific Permit
Project_49	CA	Specific Permit	Specific Permit	General Permit
Project_50	WY	Specific Permit	Specific Permit	Specific Permit
Project_51	OH	General Permit	General Permit	General Permit
Project_52	WY	Specific Permit	Specific Permit	Specific Permit
Project_53	CA	Specific Permit	Specific Permit	General Permit
Project_54	IA	General Permit	General Permit	General Permit
Project_55	CA	Specific Permit	Specific Permit	Specific Permit
Project_56	OR	Specific Permit	Specific Permit	Specific Permit
Project_57	WY	Specific Permit	Specific Permit	Specific Permit
Project_58	AZ	Specific Permit	General Permit	General Permit
Project_59	WY	Specific Permit	Specific Permit	Specific Permit
Project_60	WA	Specific Permit	Specific Permit	Specific Permit

Attachment 1: Estimating Bald and Golden Eagle Take from Wind Turbines in the United States

Introduction

Wind energy is a rapidly growing industry in the United States with the power capacity of wind turbines more than tripling since 2008 (U.S. Department of Energy 2021). Coincident with this marked increase in the number of turbines on the landscape is the risk of bird collisions and potential impacts on their populations. Mortality from wind turbine collisions has been estimated to exceed half a million birds annually, including more than 80,000 raptors (Smallwood 2013). Bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) are particularly vulnerable to wind-turbine mortality as a result of much of their important habitat overlapping with areas where wind resources are amenable for developing wind energy facilities (Buehler 2000; Kochert et al. 2002; National Renewable Energy Laboratory 2017). Therefore, it is important to quantify the influence of wind energy development on eagle populations when formulating management and conservation strategies.

The U.S. Fish and Wildlife Service's (Service) National Raptor Program was tasked to evaluate the effects of a proposed general eagle incidental take permit on bald and golden eagle populations. The Service intends for the general permit to be consistent with the eagle management objectives established in the 2016 Programmatic Environmental Impact Statement covering the eagle permit regulations (U.S. Fish and Wildlife Service 2016). The objective of the general permit type is to preauthorize the incidental take of eagles in areas of the U.S. where take at individual locations is expected to be minimal. A fundamental initial decision the Service must make is how the area in which general permits will be made available will be determined. Because the Service is preauthorizing take in the absence of local information on eagle abundance or use, a strong argument can be made to use broader indices of relative abundance as the basis for designating areas of the U.S. where general permits are preapproved. For this we used bald and golden eagle relative abundance maps developed from eBird relative abundance data, following methods previously used for bald eagles (Ruiz-Gutierrez et al. 2021).

Collision risk models (CRMs) are a valuable tool for assessing the potential impacts of wind turbines on birds (Masden and Cook 2016). A CRM generally requires site-specific data, including a count of the number of birds within a hazardous space (i.e., to estimate the likely number of collision events) and a calculation of the probability of a collision occurring. However, there is often a lack of site-specific data to inform a CRM, particularly at larger spatial scales. New et al. (2015, 2021) developed a CRM that is structured in a Bayesian framework, whereby site-specific data in the model can be replaced with prior-probability distributions derived from wind energy facilities throughout the U.S. This serves as an ideal modelling approach for the Service's aim of estimating take of bald and golden eagles at a nationwide scale.

Our objectives were to, (1) delineate a general permit zone that represents a lower risk (based on relative abundance) of bald and golden eagle collisions with wind turbines, and (2) use a CRM to estimate annual bald and golden eagle mortalities from wind turbines in Alaska and the coterminous U.S. based on the current level of wind energy development in the U.S.

Methods

Turbine Data

We downloaded turbine data from the U.S. Geological Survey (USGS) U.S. Wind Turbine Database (Hoen et al. 2018), which provides turbine locations and specifications. We used these data to estimate the hazardous space for each turbine when operating during daylight hours. We calculated turbine-specific number of daylight hours based on turbine locations and for turbines where specifications were not reported, we imputed the mean rotor diameter across turbines where specifications were provided.

Collision Risk Model

We used a CRM developed by New et al. (2015, 2021) for estimating avian fatalities at wind energy facilities to estimate bald and golden eagle mortalities due to wind-turbine collisions. The CRM parameters are modeled in a Bayesian framework where uncertainty surrounding eagle exposure and collision probability are defined by prior-probability distributions (priors) for each parameter, which are estimated from wind energy facilities across the U.S. (see *Estimation of Priors* section below). Site-specific pre-construction eagle use and post-construction eagle mortality monitoring data can then be used to update these priors, which decrease the uncertainty of the parameter estimates and results in more precise estimates of annual eagle fatalities at a site (New et al. 2015).

We ran the CRM in R 4.1.2 (R Core Team 2021) to estimate annual take of bald and golden eagles across all onshore wind energy facilities in Alaska and the coterminous U.S. Site-specific eagle-use data were not available for all wind energy facilities, and thus, we used priors for eagle exposure and collision probability in the CRM to estimate annual eagle fatalities. The CRM incorporates, (1) a prior for pre-construction eagle use (eagle exposure), which accounts for the time eagles spend in the turbine's hazardous space as a function of survey effort (eagle minutes $hour^{-1}$ $(km^3)^{-1}$), (2) a prior for the probability of an eagle colliding with a turbine while within the turbine's hazardous space (collision probability, eagles/minute of exposure), and (3) the hazardous space of a turbine (expansion factor, Eqn 1); the only site-specific data included in the CRM.

$$\text{Expansion factor} = th\pi r^2 \qquad (1)$$

Here, t is turbine location-specific daylight hours (i.e., both species of eagle exhibit diurnal behavior), h is turbine hazardous space height (a constant set at 200 m), and r is turbine-rotor radius (m). In our models, we treated each turbine independently and turbines were assumed to be operating during all daylight hours.

Eagle Management Units and Migratory Behavior

The CRMs were spatially stratified by the Service bald or golden eagle management unit (EMU) and/or sub-EMU based on regional species-specific migratory behavior, and EMU-specific annual take estimated. We used eBird status and trend abundance maps (Fink et al. 2020) to determine seasonal eagle presence, with input from the Service's Regional Eagle Permit Biologists. Therefore, within each EMU or sub-EMU, we adjusted daylight hours to reflect the migratory behavior of each species (i.e., for any period when a species is expected to be absent, daylight hours in the model are set to zero), and used these adjusted daylight hours to calculate the expansion factor.

Eagle Relative Abundance

The Cornell University Lab of Ornithology provided us with processed eBird relative abundance data from May 2018 to develop combined bald and golden eagle relative abundance maps. eBird relative abundance values represent the average number of eagles of each species expected to be seen by an expert eBirder who observes for 1 hour at the optimal time of day for detecting the species, and who travels no more than 1 km during the observation session (for more details on eBird data collection methods, see https://ebird.org/spain/science/status-and-trends/faq#mean-relative-abundance). The dataset we used provided relative abundance estimates for bald and golden eagles throughout the coterminous U.S. at an 8-km^2 resolution for each of five periods (breeding, fall, migration, spring, winter). Using multiple seasons of data provides better measures of relative abundance for mapping purposes; our goal was to identify locations with high relative abundance in any single season.

Our objective was to identify regions in the coterminous U.S. that represent areas of lower relative abundance for bald and golden eagles whereby existing or potential wind energy facilities can apply for a permit that preauthorizes incidental take of eagles due to take in these areas expected to be minimal (i.e., general permit zone). Wind energy facilities outside of this general permit zone (i.e., in areas of higher bald and golden eagle relative abundance) would still be required to apply for the current type of permit to authorize eagle take based on data collected at that site (i.e., specific permit zone). Based on population estimates for bald and golden eagles, and thus species-specific risk tolerance, we mapped the threshold between the general and specific permit zones at the 95th quantile for bald eagles (RA95) and the 50th quantile for golden eagles (RA50).

We started by removing cells (map pixels) with relative abundance values of zero, then processed the non-zero relative abundance data for each season in R 4.1.2 (R Core Team 2021). If we had included zero-value cells, we would have been including a large amount of area where eagles are not at risk from being struck by wind turbines, because they do not occur there. We identified all 8-km^2 cells that had relative abundance values in each season that exceeded the relevant species-specific quantile and combined these to identify all cells that exceeded the threshold in any single season. We then created maps delineating the general (i.e., grid cells that did not exceed the relative abundance threshold in any season) and specific permit zones.

We wanted to determine an operational general permit zone that incorporated risk tolerance for both bald and golden eagles, and so we created a map combining both RA95 and RA50 into a single map and identified areas where the bald eagle specific zone overlapped the golden eagle general zone, and conversely, where the golden eagle specific zone overlapped the bald eagle general zone. Individual turbines that fell into each of these zones were grouped to estimate take for each zone. All wind energy facilities located within these overlapping zones, when applying for an eagle take permit, would require a specific-zone permit.

Estimation of Priors

The exposure and collision probability priors that we used in the CRM to estimate bald and golden eagle take were derived from pre-construction and mortality monitoring data, respectively, collected at wind energy facilities across the U.S. The mean and variance of the exposure and collision probability priors were calculated from a mixture distribution based on these data, and were assumed to come from gamma and beta distributions, respectively (New et al. 2015). We used criteria described in New et al. (2021) to filter the data used to derive the exposure and collision probability priors. In addition, for the estimation of exposure priors, we excluded data from wind energy facilities where they did not conduct eagle-use surveys across all periods when each species is expected to be present in the area or the radius of survey plots was < 800 m.

We developed permit zone-specific exposure priors for both bald and golden eagles based on which zone the wind energy facilities that were used for estimating the priors were located. In areas where the bald eagle specific zone overlapped the golden eagle general zone, golden eagle general zone exposure priors were used to estimate golden eagle take for this group of turbines and this take was included in the specific permit zone total for this EMU. Conversely, bald eagle general zone priors were used to estimate bald eagle take for the grouped turbines in the area where the golden eagle specific zone overlapped the bald eagle general zone, and this take was included in the specific permit zone take total. The initial priors were developed in 2013 with data from 11 wind energy facilities (U.S. Fish and Wildlife Service 2013). Upon further review, the data from two of these facilities were removed in 2015, so the priors created in 2015 used data from 9 wind energy facilities (New et al. 2015). For this update, we updated the 2015 exposure prior distribution with additional data from 67 and 60 wind energy facilities for bald and golden eagles, respectively.

The collision probability priors used in the CRM to estimate bald and golden eagle take were taken from New et al. (2021) and were not permit zone specific (Table 1). These priors were calculated from data from 14 wind energy facilities for bald eagles and 21 facilities for golden eagles.

Results

Turbine Data

The USGS U.S. Wind Turbine Database contained 70,809 turbines as of January 2022 (Hoen et al. 2018). For our analyses, we removed turbines located in Hawaii, Puerto Rico, and Guam (n = 196), non-island-based offshore turbines (n = 5), and turbines with unspecified locations (n = 3), leaving a total of 70,605 onshore turbines covering Alaska and the coterminous U.S. (Tables 2 and 3). Data on rotor diameter were absent for 5,394 turbines (8%) to which we assigned the average rotor diameter of 95.7 m. More than half of the turbines (54%) are located in the Central Flyway and one quarter (25%) are in the Mississippi Flyway (Figs. 1 and 2; Tables 2 and 3). The proportions of turbine hazardous volume in each EMU are similar to the proportions of turbines (Tables 2 and 3), indicating that there is little variation in turbine sizes among EMUs.

Eagle Management Units and Migratory Behavior

Bald eagles are generally present year-round in the eastern U.S. (Atlantic and Mississippi Flyways) and the northern half of the western and central U.S., and Alaska (Central and Pacific North Flyways), whereas in most of the Central South and Pacific South, they are only present during winter (Fig. 1). In contrast, golden eagles can be found year-round in the western half of the coterminous U.S. and only in winter in the eastern half, and in summer in Alaska (Fig. 2). Due to differing periods of eagle presence within the Central Flyway, it was subdivided into

Central North and South for bald eagles and Central East and West for golden eagles (Figs. 1 and 2).

Eagle Relative Abundance

When the bald eagle RA95 and the golden eagle RA50 are combined in a map, 78% of the turbines are in the general permit zone and 22% are in the specific permit zone (Figs. 3 and 4; Tables 4 and 5). For bald eagles, 88% of the turbines that are in the general permit zone overlap with the golden eagle specific permit zone, and these wind energy facilities would require a specific zone permit to authorize eagle take (Fig. 1; Table 4). For golden eagles, 6% of the turbines that are in the general permit zone overlap with the bald eagle specific permit zone, and these wind energy facilities would require a specific zone permit to authorize eagle take (Fig. 2; Table 5).

Estimation of Priors

As of 2022, we had eagle-use survey data from an additional 67 wind energy facilities for bald eagles and 60 for golden eagles to update the New et al. 2015 exposure prior distributions (Figs. 3 and 4). The 2022 exposure prior used to estimate take of bald eagles in the general permit zone was Gamma(0.1978, 0.4156) with a mean ± SD of 0.48 ± 1.07 eagle minutes $hour^{-1}$ $(km^3)^{-1}$ and was estimated with data from 52 wind energy facilities (Table 1). The bald eagle exposure prior for the specific permit zone was Gamma(0.1949, 0.0941) with a mean ± SD of 2.07 ± 4.69 eagle minutes $hour^{-1}$ $(km^3)^{-1}$ and was estimated with data from 15 wind energy facilities. The exposure prior used to estimate take of golden eagles in the general permit zone was Gamma(0.3206, 6.2526) with a mean ± SD of 0.05 ± 0.09 eagle minutes $hour^{-1}$ $(km^3)^{-1}$ and was estimated with data from 20 wind energy facilities (Table 1). The golden eagle exposure prior for the specific permit zone was Gamma(0.4167, 0.2857) with a mean ± SD of 1.46 ± 2.26 eagle minutes $hour^{-1}$ $(km^3)^{-1}$ and was estimated with data from 40 wind energy facilities.

The collision probability prior used to estimate take of bald eagles was Beta(1.61, 228.2) with a mean ± SD of 0.007 ± 0.005 eagles/minute of exposure (Table 1). The collision probability prior used to estimate take of golden eagles was Beta(1.29, 227.6) with a mean ± SD of 0.006 ± 0.005 eagles/minute of exposure (Table 1).

Eagle Take

The Service uses the 60^{th} and the 80^{th} quantile of the fatality probability distribution as the take estimate for debiting bald and golden eagle EMU take limits, respectively. The total estimated bald eagle take across Alaska and the coterminous U.S. at the 60^{th} quantile was 210 individuals, ranging from 7 and 13 in Pacific South and Atlantic, respectively, to 78 and 89 in Mississippi and Central, respectively (Table 4; Fig. 5). Estimated bald eagle take in the general permit zone was 150 individuals and 60 in the specific permit zone (Table 4). The total estimated golden eagle take across Alaska and the coterminous U.S. at the 80^{th} quantile was 956 individuals, ranging from 62 in Atlantic-Mississippi to 527 in Central (Table 5; Fig. 6). Estimated golden eagle take in the general permit zone was 79 individuals and 877 in the specific permit zone (Table 5).

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Table 1. Bald and golden eagle distribution parameters by permit zone used in the collision risk model to estimate eagle take in Alaska and the coterminous U.S.

Species	Permit Zone	Eagle Exposure			Collision Probability		
		Mean ± SD	Gamma		Mean ± SD	Beta	
		eagle-mins hr-1(km3)-1	α	β	Eagle fatalities eagle-min-1	α	β
Bald Eagle	General	0.48 ± 1.07	0.1978	0.4156	0.007 ± 0.005	1.61	228.2
	Specific	2.07 ± 4.69	0.1949	0.0941			
Golden Eagle	General	0.05 ± 0.09	0.3206	6.2526	0.006 ± 0.005	1.29	227.6
	Specific	1.46 ± 2.26	0.4167	0.2857			

Table 2. Number of wind turbine generators (WTGs), hazardous volume (Hazkm^3), and daylight hours (DayLtHr, million) by bald eagle management unit (EMU) and permit zone in Alaska and the coterminous U.S. as of January 2022.

	General Permit Zone			Specific Permit Zone			Total		
EMU	WTGs	HazKm^3	DayLtHr	WTGs	HazKm^3	DayLtHr	WTGs	HazKm^3	DayLtHr
Atlantic	1,582	2.08	7.1	1,660	2.05	7.4	3,242	4.13	14.5
Mississippi	17,210	26.72	76.7	478	0.70	2.1	17,688	27.42	62.07
Central	31,161	51.60	68.5	6,828	10.47	20.4	37,989	62.07	88.9
Pacific North	1,761	1.95	7.9	3,341	4.15	14.9	5,102	6.10	22.8
Pacific South	3,162	3.87	4.5	3,422	3.53	4.8	6,584	7.40	9.3
Total	54,876	86.22	164.6	15,729	20.90	49.7	70,605	107.12	214.3

Table 3. Number of wind turbine generators (WTGs), hazardous volume (Hazkm^3), and daylight hours (DayLtHr, million) by golden eagle management unit (EMU) and permit zone in Alaska and the coterminous U.S. as of January 2022.

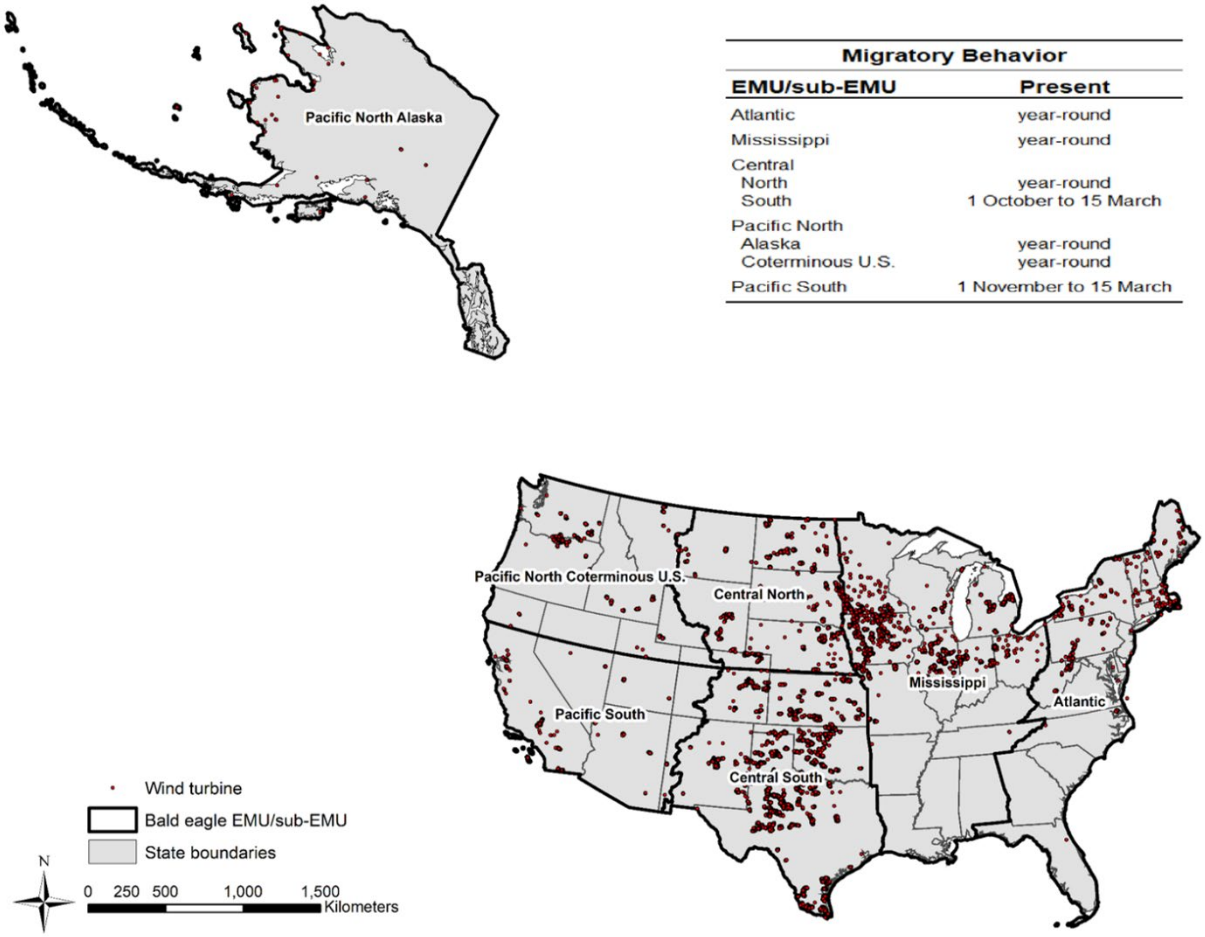
	General Permit Zone			Specific Permit Zone			Total		
EMU	WTGs	HazKm^3	DayLtHr	WTGs	HazKm^3	DayLtHr	WTGs	HazKm^3	DayLtHr
Atlantic - Mississippi	18,792	28.80	39.1	2,138	2.75	4.5	20,930	31.55	43.5
Central	31,161	51.60	88.4	6,828	10.47	29.6	37,989	62.07	118.0
Pacific	4,923	5.82	21.9	6,763	7.68	29.6	11,686	13.50	51.6
Total	54,876	86.22	149.4	15,729	20.90	63.7	70,605	107.12	213.1

Table 4. Annual bald eagle take estimates by bald eagle management unit (EMU), permit zone, and exposure prior used in the collision risk model for Alaska and the coterminous U.S.

EMU	Permit Zone	Exposure Prior	Turbines (#)	Mean	SD	Q50	Q60
Atlantic	General	General	1,582	31	92	2	5
	Specific	General	1,487	26	77	2	5
	Specific	Specific	173	19	57	1	3
Mississippi	General	General	17,210	396	1,181	26	70
	Specific	General	0	0	0	0	0
	Specific	Specific	478	46	138	3	8
Central	General	General	31,161	380	1,125	26	67
	Specific	General	6,487	95	280	6	17
	Specific	Specific	341	27	80	2	5
Pacific North	General	General	1,761	29	85	2	5
	Specific	General	2,632	50	148	3	9
	Specific	Specific	709	50	148	3	9
Pacific South	General	General	3,162	18	54	1	3
	Specific	General	3,234	15	45	1	3
	Specific	Specific	188	5	16	0	1
Total			70,605	1,187		78	210

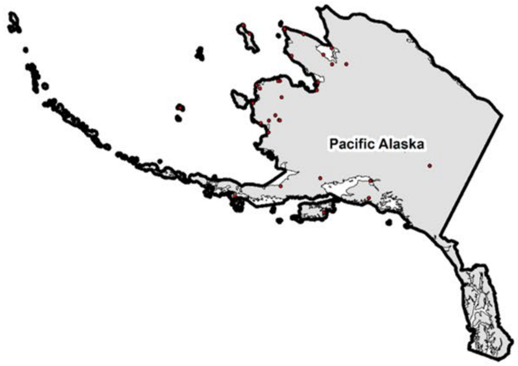
Table 5. Annual golden eagle take estimates by golden eagle management unit (EMU), permit zone, and exposure prior used in the collision risk model for Alaska and the coterminous U.S.

EMU	Permit Zone	Exposure Prior	Turbines (#)	Mean	SD	Q50	Q80
Atlantic-Mississippi	General	General	18,792	17	43	3	21
	Specific	General	626	1	1	0	1
	Specific	Specific	1,512	69	69	7	40
Central	General	General	31,161	102	102	7	49
	Specific	General	261	1	1	0	0
	Specific	Specific	6,567	367	824	84	478
Pacific	General	General	4,923	7	19	1	9
	Specific	General	105	0	0	0	0
	Specific	Specific	6,658	275	613	63	358
Total			70,605			165	956



Migratory Behavior	
EMU/sub-EMU	**Present**
Atlantic	year-round
Mississippi	year-round
Central	
North	year-round
South	1 October to 15 March
Pacific North	
Alaska	year-round
Coterminous U.S.	year-round
Pacific South	1 November to 15 March

Figure 1. Map showing the Service's bald eagle management units (EMUs) and sub-EMUs, location of wind turbines in Alaska and the coterminous U.S. as of January 2022, and bald eagle migratory behavior by EMU and sub-EMU.



Migratory Behavior	
EMU/sub-EMU	**Present**
Atlantic-Mississippi	1 October to 15 April
Central	
East	1 November to 31 March
West	year-round
Pacific	
Alaska	7 March to 7 November
Coterminous U.S.	year-round

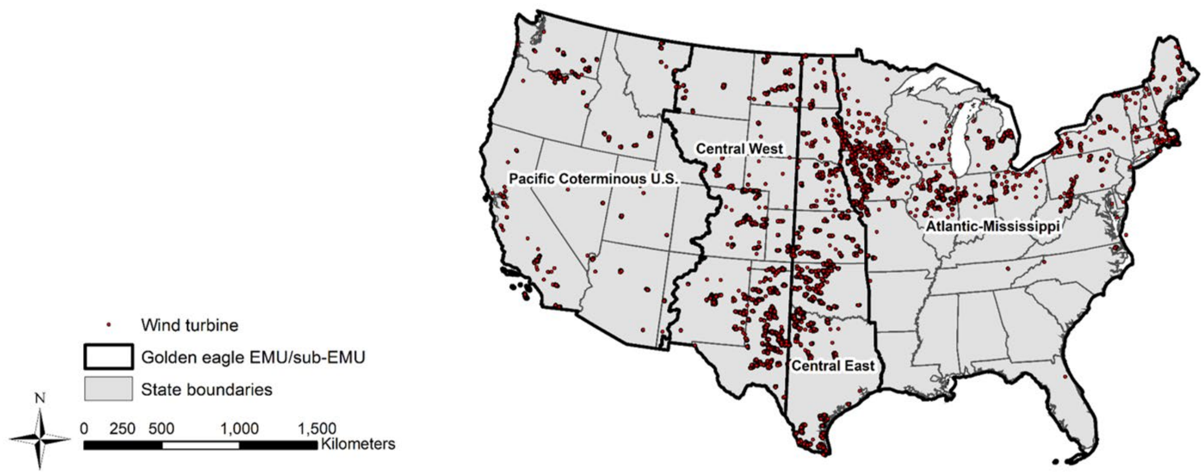


Figure 2. Map showing the Service's golden eagle management units (EMUs) and sub-EMUs, location of wind turbines in Alaska and the coterminous U.S. as of January 2022, and golden eagle migratory behavior by EMU and sub-EMU.

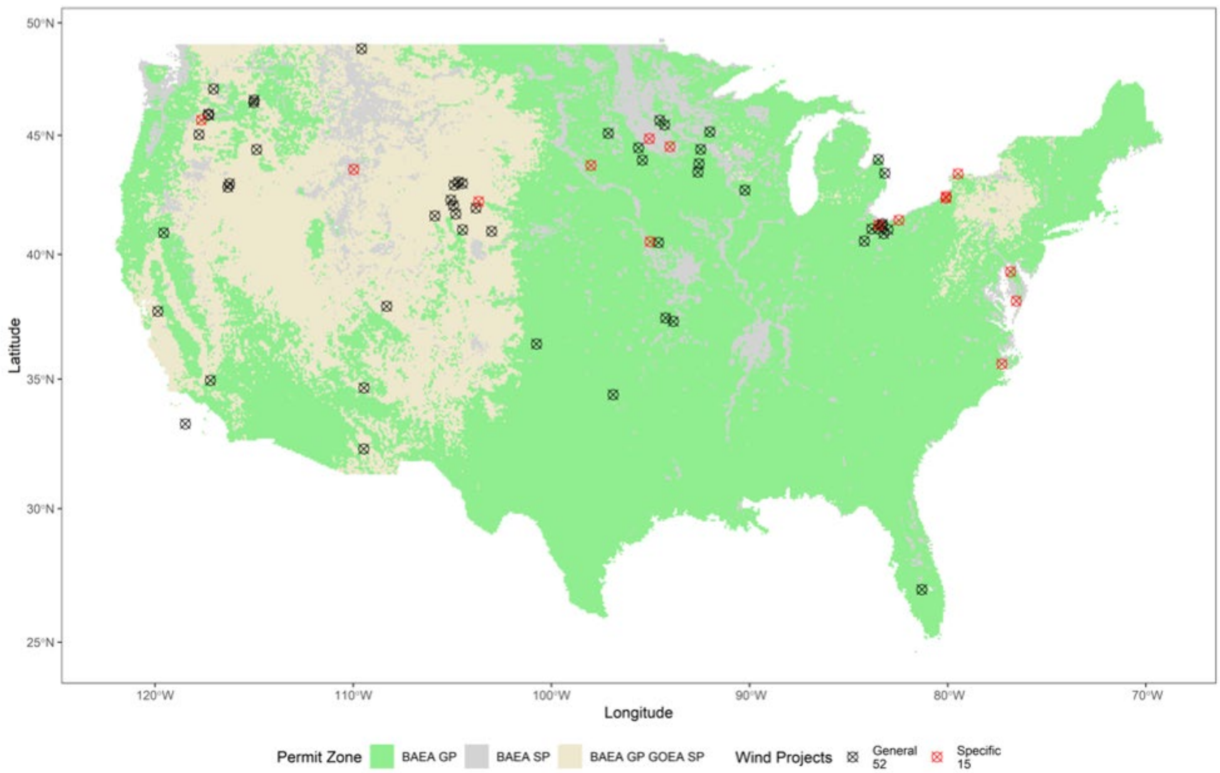


Figure 3. Map showing bald eagle general (BAEA GP) and specific (BAEA SP) permit zones based on eBird bald eagle relative abundance at the 95th quantile, areas where bald eagle general permit zone overlaps golden eagle specific permit zone based on eBird golden eagle relative abundance at the 50th quantile (BAEA GP GOEA SP), and locations of wind energy projects that were included in the estimation of the general and specific permit zone-specific bald eagle exposure priors. All of Alaska (not shown) is in the specific permit zone.

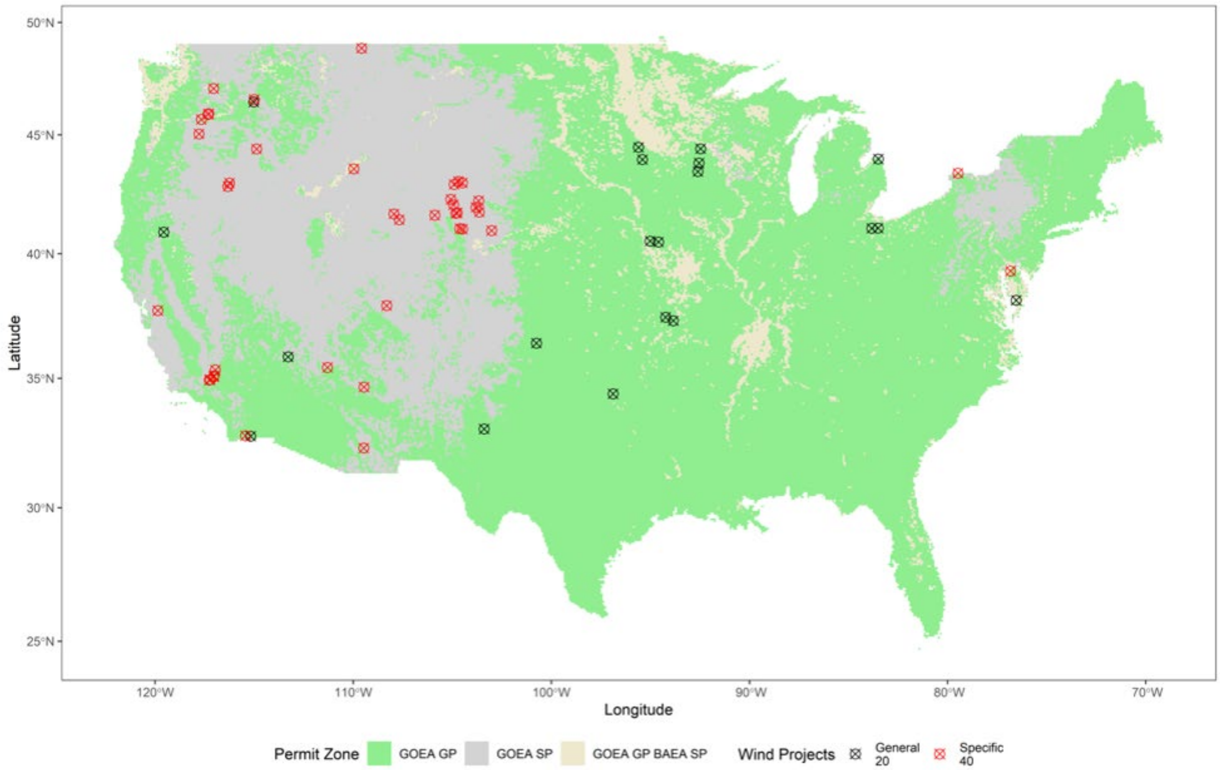


Figure 4. Map showing golden eagle general (GOEA GP) and specific (GOEA SP) permit zones based on eBird golden eagle relative abundance at the 50th quantile, areas where golden eagle general permit zone overlaps bald eagle specific permit zone based on eBird bald eagle relative abundance at the 95th quantile (GOEA GP BAEA SP), and locations of wind energy projects that were included in the estimation of the general and specific permit zone-specific golden eagle exposure priors. All of Alaska (not shown) is in the specific permit zone.

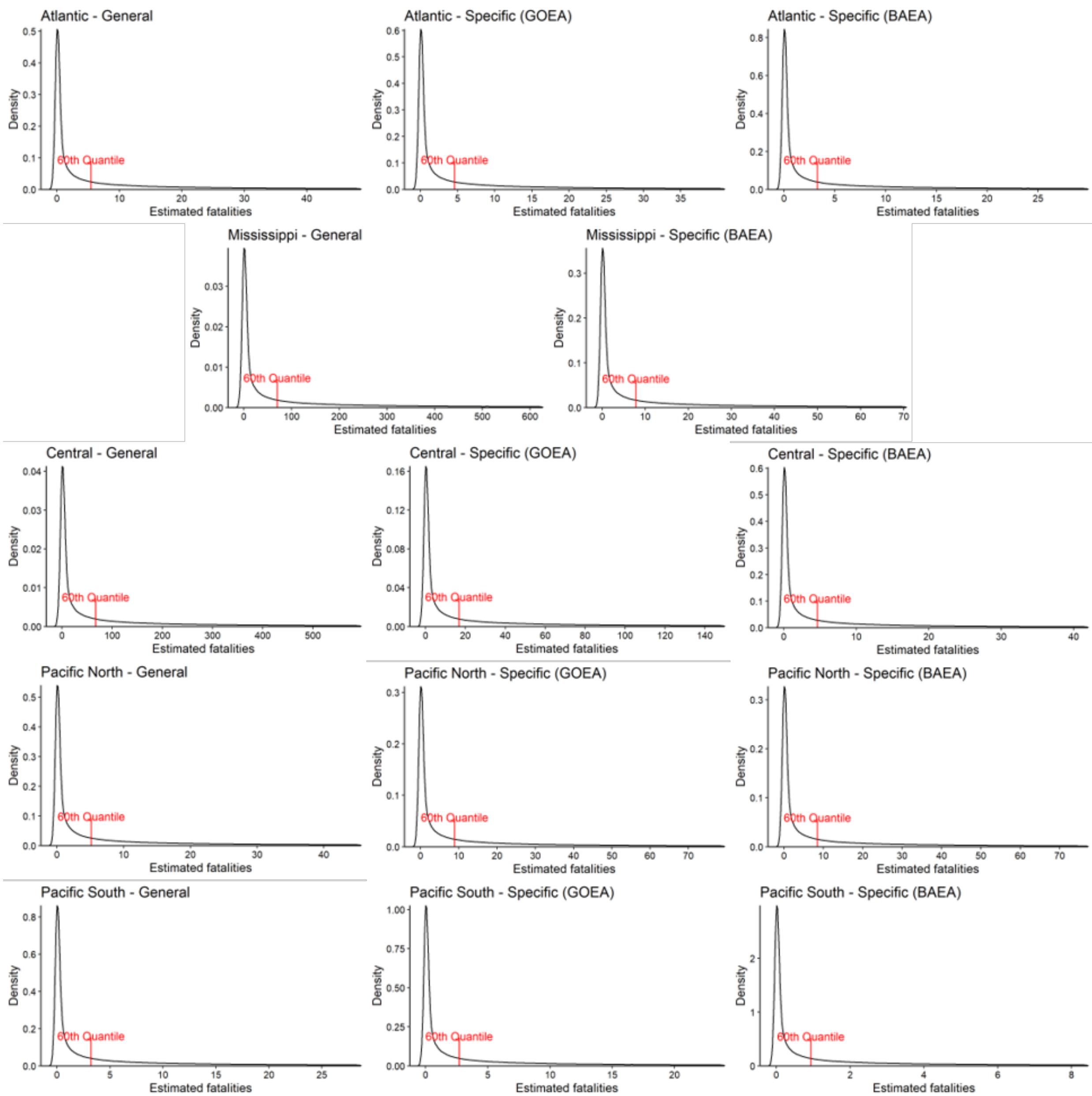


Figure 5. Bald eagle posterior density distributions of annual fatality estimates by bald eagle management unit and permit zone (General or Specific) in Alaska and the coterminous U.S. The eagle species in parentheses refer to the specific permit zone for that species.

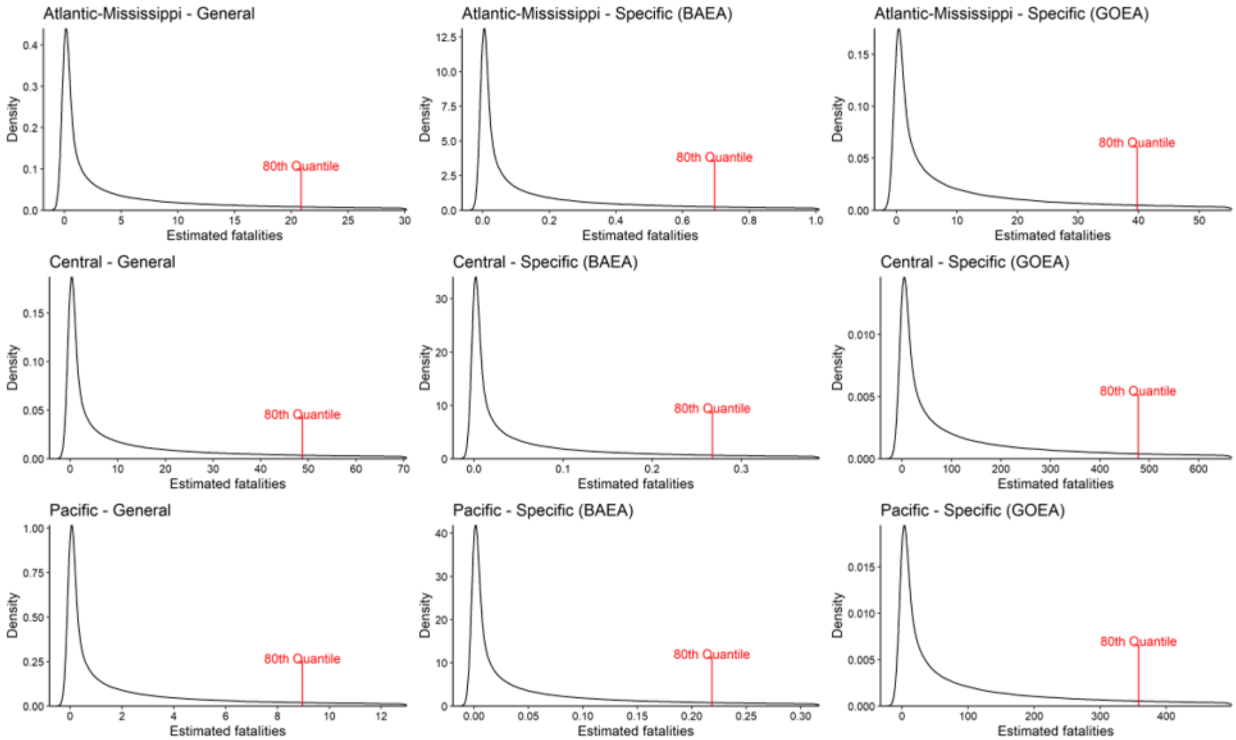


Figure 6. Golden eagle posterior density distributions of annual fatality estimates by golden eagle management unit and permit zone (General or Specific) in Alaska and the coterminous U.S. The eagle species in parentheses refer to the specific permit zone for that species.

Attachment 2: Eagle Monitoring

Introduction

The Service is responsible for developing a monitoring plan for estimating take, or number of fatalities, for each eagle management unit (EMU) in the general permit zone. As part of the process for revising the permitting process, the Service used a collision risk model (CRM) to project expected take as a result of the updated permitting process to assess whether expected fatalities would be less than what was estimated to be allowable. The Service has adopted a risk management policy that avoids underestimating eagle take by using the 60th and 80th quantile of the fatality probability distributions as the take estimate for bald and golden eagles, respectively. Therefore, the objective for this monitoring plan is to estimate whether take in the general permit zone within each eagle management unit is < the critical quantile of the estimated take from the CRM for each species.

Monitoring for eagle take has historically been conducted at specific energy development sites to estimate whether take at those facilities is within authorized limits and to improve accuracy and certainty of the fatality estimates through an adaptive management process. Take estimates are also used to determine how much compensatory mitigation is required to offset fatalities that exceeds the allowable limit. Because the purpose of this plan is to develop a design that could be used to estimate observed take at scales larger than individual facilities, which has not been done for eagles before, we explored two alternative monitoring approaches. We recommend that both be implemented with the rule revision to assess which approach may be the most reliable for ensuring permitted take is less than what has been deemed sustainable; or if integrating information from both will be the best way to monitor take at large scales over the long term. The first approach would require monitoring fatalities at specific turbines (Dalthorp et al. 2017) throughout the general permit zone of both eagle species. Given expected limitations in resources, we suspect we would not be able to monitor all turbines and sites within a year, so we would randomly select a subset of sites to monitor each year and then adjust estimates for the proportion of facilities that were not monitored to obtain a total fatality estimate for each eagle management unit. These turbine-specific surveys could be extended to monitor post construction eagle use to improve parameters of the CRM used to estimate take within EMUs. The second approach is to develop an operational program to mark eagles with satellite transmitters (PTT tags) where data can be used in a cause of death model to estimate fatalities from specific causes and monitor survival (Millsap et al. 2022). We describe each of these monitoring approaches below and provide recommendations for sample sizes and expected costs.

Fatalities at sites

Overview of design

To derive an estimate of total mortality among all turbines within the general permit zone of each EMU, we propose a design where: (1) a randomly selected subset (n = X) of wind facilities within the general permit zone of each EMU are monitored each year using suggested methods based on characteristics of the facility (ECPG Appendix H); (2) the site-specific mortality estimates are aggregated to a total among the sampled sites; and (3) the total among the sampled areas is adjusted by the proportion of turbines not sampled in the other facilities throughout the EMU. The X sites would be monitored once a month for a year to estimate annual mortality. Using these data, we would estimate the number of fatalities at each of the randomly sampled sites (indexed by *i*) and year (indexed by *t*) within each EMU ($\hat{F}_{i,t}^{EMU}$, SE $\hat{F}_{i,t}^{EMU}$) with an unbiased estimator that accounts for uncertainty, such as Evidence of Absence (Dalthorp et al. 2017). The $\hat{F}_{i,t}^{EMU}$ and sampling variance of $\hat{F}_{i,t}^{EMU}$ would then be aggregated across the sampled sites to get a total F for the sampled sites ($\hat{F}_{.,t}^{EMU}$, var $\hat{F}_{.,t}^{EMU}$) (the "." subscript represents the total for all sampled sites across *i* within the EMU). Lastly, $\hat{F}_{.,t}^{EMU}$ would be adjusted by the proportion of total turbines in the EMU that were in the sampled sites (*p*). The final estimator for total mortality (*F*) for year *t* is:

$$\hat{F}_t^{EMU} = \frac{\hat{F}_{.,t}^{EMU}}{p_t^{EMU}}$$

The $\hat{F}_{.,t}^{EMU}$ component of the estimator is a random variable while p_t^{EMU} is a known constant within a year and EMU. Therefore, uncertainty in the estimate of overall mortality $\hat{F}_t^{EMU}$ is strongly related to uncertainty in $\hat{F}_{.,t}^{EMU}$ (see simulated example in Figure 1). Therefore, we recommend that more effort should be placed into surveying the sampled areas effectively to reduce uncertainty in $\hat{F}_{.,t}^{EMU}$ than trying to increase p_t^{EMU}.

We simulated a hypothetical example to understand how increasing detection probabilities (i.e., defined as "*g*") influenced uncertainty in mortality estimates (Figure 2) and observed that detection probabilities should be ≥0.35 to achieve the desired precision around a theoretical fatality estimate of 250. Note that this simulation result is specific to sites that are being sampled rather than the estimator for $\hat{F}_t^{EMU}$, which is a combination of detection at sites and expanding those estimates to a larger area (see description of these simulations in the "*Final recommended sample sizes and cost"* section below). Therefore, we suggest that field effort at the X sampling sites should be enough to achieve a detection probability of ≥0.35. We can improve sampling at sites to increase detection rates by sampling sufficient turbines, increasing observers' ability to detect carcasses that are present in the search area (hereafter "searcher efficiency"), or increasing the likelihood that carcasses are not removed before searchers occur (hereafter "carcass persistence") by increasing the frequency of surveys. We used existing representative carcass persistence data and a searcher efficiency estimate of 0.65 and note that the proportion of turbines sampled at a facility scales linearly with detection rates (Figure 3). Sampling all turbines resulted in a maximum detection rate of 0.64, and sampling 55% resulted in detection rate of 0.35. Increasing searcher efficiency may be achieved by alternative sampling designs (e.g., double observer, additional crews, repeated sampling). Improving carcass persistence estimates may only be possible by increasing the frequency or duration of sampling. Increasing searcher efficiency and carcass persistence would require substantial resources (e.g., additional staff, equipment, locating enough appropriate carcasses for carcass persistence), so increasing effort by sampling more turbines (preferably all turbines at a site) may be the most effective way to reduce uncertainty in $\hat{F}_{.,t}^{EMU}$.

Stratification

Stratifying the general permit zone for sampling mortality may be important for reducing variability and uncertainty in estimates. For example, most of the take may occur at the boundary of general and specific zones or in other areas with higher densities of eagles and wind turbines. Sampling with higher intensity in the areas with expected higher take would give as better estimates of take in those regions and will reduce variability by analyzing data from those areas separately from areas where take is much more infrequent. Any stratification would require expanding data from samples in a particular stratum to that stratum first before calculating an EMU total (e.g., samples from high take regions would be expanded to that portion of the EMU only, whereas samples from the low take areas would be expanded to that area with the overall estimate being the sum from the two regions).

Field sampling for fatalities

Estimating fatalities at sites requires observers to search the area around individual wind turbines for eagles that may have struck the turbine and died. Detection of eagles that have died from collisions with wind turbines is not 100% due to multiple factors including searcher efficiency, scavengers consuming or moving carcasses away and/or natural decay before a searcher can survey the turbine reducing carcass persistence, and a carcass falling beyond the designated search area around the turbine. The objective of these surveys is to enumerate the total number of carcasses resulting from all turbines at a particular site. However, searchers often sample a subset of turbines at a site due to limited resources, so counts of carcasses must be adjusted for proportion of turbines sampled in addition to searcher efficiency and carcass persistence. These three factors (i.e., searcher efficiency, carcass persistence, and proportion of area sampled) are combined into an estimate of g for a particular site. The size of search plots should be designed to minimize the probability that carcasses land outside of the sampling area based on hub height and rotor size. The Service uses the fall zone distributions from Hull and Muir (2010) to give proper credit to carcass searches made in areas that were sampled when the total possible area carcasses could fall was not searched. The proportion of area searched is then extrapolating to all unsearched turbines to acknowledge that portions outside the search plot could have contained carcasses when estimating g.

Field surveys for estimating fatalities at sites include carcass searches, and searcher efficiency and carcass persistence trials. Carcass searches are conducted by observers around wind turbines to locate dead eagles associated with collisions. Searcher efficiency and carcass persistence trials are used to estimate components of g and may not be associated with specific turbines and carcass searches. We recommend sampling all turbines at the X selected facilities each year, and that searcher efficiency trials be conducted at each site to improve estimates of g and reduce uncertainty in $\hat{F}_{i,t}^{EMU}$ and $\hat{F}_{.,t}^{EMU}$. We recommend that the large raptor database of carcass persistence information compiled by the Service (currently consisting of data from 1006 large raptor specimens placed in carcass persistence trials) be used in all analyses and that turbines are searched at least once a month to increase the probability that carcasses persist between surveys. Data from any additional carcass persistence studies that are conducted can be added to that database.

Searcher efficiency may be influenced by sampling methods, vegetation (tall vs short), terrain (rugged vs gentle), area sampled (high, medium, low proportion sampled), cropland, and snow cover. Searcher efficiency trials should be conducted at every site sampled and the factors that may influence searcher efficiency recorded. The trials can use raptor carcasses and test whether raptor decoys are viable surrogates if raptor carcasses are not available. Including carcasses in various levels of decay will also be useful to estimate how that may influence searcher efficiency. We assume that the density of carcasses does not influence searcher efficiency. If searcher efficiency trials cannot be conducted at every site, then searcher efficiency conditions that match what we learn (e.g., Table 1) can be used as a surrogate.

As recommended above, we suggest using the existing raptor carcass persistence database to estimate carcass persistence, and that turbines be surveyed monthly to reduce the loss of carcasses between surveys. However, if additional carcass persistence surveys are conducted to add information to the existing database, we describe some factors for consideration when designing future trials. Persistence is likely influenced by scavenger density (higher density = lower persistence) and scavenger species due to the large size of eagles. Without information on the local scavenger community, it may not be possible to pre-classify a site based on scavenger density at this time. Unlike searcher efficiency, real raptor carcasses (as opposed to surrogates or synthetic materials) need to be used in trials because scavengers may be more likely (e.g., game birds) or not likely (e.g., decoys) to remove non-raptor specimens. Productive carcass persistence trials would be designed to help explore whether environmental or other variables could be used to accurately predict rates of avian/mammalian scavenging. Such variables could include vegetation/climate types, season, surrogate carcasses (e.g., raptors >1 kg such as turkey vultures, red-tailed hawks, etc.), or other variables. We note that carcass persistence studies are more resource intensive because they require more effort (multiple visits) and real carcasses that may be limiting.

Eagle exposure

The CRM used to estimate number of fatalities from wind energy development in the general permit zone for each EMU (i.e., $\hat{F}_t^{EMU}$) was developed by New et al. (2015, 2021) and uses expected exposure of birds to a hazardous area associated with a wind facility (number of minutes birds are exposed per hour and cubic km), probability of collision with a turbine given exposure (collisions per minute birds are exposed), and the hazardous footprint of a facility (hours of cubic km per year). Specifically, the number of fatalities at a site (i.e., $\hat{F}_{i,t}^{EMU}$) equals the product of the footprint, exposure, and collision probability. The footprint can be calculated based on the characteristics of the wind facility. Exposure has been estimated by surveys where observers record the time eagles spend within the area of proposed development prior to the construction of wind facilities. The collision probability has been estimated indirectly by recording the number of fatalities and using data on post-development exposure and the footprint to update priors for the collision parameter.

Fatality monitoring at specific sites as described in the previous section could help improve estimates of the parameters in the CRM used to estimate take for the proposed rule revision and potentially assess whether the CRM is a viable approach for estimating mortality within EMUs in the future. Additional information on post-construction modeling fatalities ($\hat{F}_{i,t}^{EMU}$) from site-specific fatality surveys in the previous section, and additional exposure information could help improve estimates of collision probability. Additional information on exposure could be gathered by observers spending additional time at turbines already being monitored for fatalities to conduct exposure surveys, or by integrating previous/new exposure information with available eBird data from overlapping or adjacent pixels. eBird data have been integrated with other survey data by comparing relative differences between eBird indices and other survey data where the two surveys overlap (Howell et al. 2022, Stuber et al. In Press). We could explore whether a similar approach can be used between exposure data and eBird data at and around wind facilities.

Final recommended sample sizes and cost

We developed a simulation to explore the influence of various sample sizes of turbines selected to monitor in a year, and different levels of effort at each turbine (expressed as a detection rate) on overall estimates of fatalities in each EMU. Our objective is to ensure that take is <80th quantile of what was predicted in the CRM. To meet this objective, we assumed that for each simulation, the minimum sample size of turbines for a given year and EMU should be the smallest size of turbines for which the upper 95% CI of fatalities is below the 80th quantile of the CRM estimate for that EMU.

The simulations were based on the known number of turbines and expected (median) mortality from the CRM. We allocated the expected mortalities (1 in the PF, 7 in the CF, and 3 in the AF/MF) across the turbines within an EMU. We then generated 4 "data" sets by adjusting the expected carcasses by detection rates (g) from 0.35, 0.45, 0.55, and 0.65 (i.e., not all the carcasses will be detected during actual surveys). We ran EoA with beta parameters for the appropriate detection rate used to generate the data on all turbines in each of the EMUs. Lastly, we randomly sampled turbines from small samples sizes to large ones and estimated total fatalities using the estimator for $\hat{F}_t^{EMU}$ described previously. Specifically, we generated sample sizes of 25 to 4,923 in increments of 25 turbines in the PF, 100 to 31,161 in increments of 100 in the CF, and 50 to 18,792 in increments of 50 in the AF/MF. We conducted 100 replicates for each sample size and each detection probability. For example, for the sample size of 500 and detection rate of 0.65 in the PF, we: (1) randomly sampled 500 turbines from the 4,923 available to sample in the EMU and derived EoA estimates using beta parameters for detection of 356.9431 and 191.4451; (2) summed the $\hat{F}_{i,t}^{EMU}$ to calculate $\hat{F}_{\cdot,t}^{EMU}$; (3) divided $\hat{F}_{\cdot,t}^{EMU}$ by (p = 500/4,923) to calculate $\hat{F}_t^{EMU}$ for that replicate; (4) and then repeated steps 1-3 another 99 times randomly selecting 500 turbines with replacement each time. We summarized the 100 replicates to estimate mean, median, and 95% quantiles.

We estimated the per-turbine cost of monitoring turbines using transect, scan, and a 50:50 combination of transect and scan surveys. We included estimates of travel costs (a vehicle and 750 miles per month), 2022 per diem rates, and 20% overhead. These costs include resources for searcher efficiency and carcass persistence trials (4 trials per 150 turbines 4 times a year), and extra time at a proportion of turbines to monitor post-construction eagle use (5 eagle use surveys per 150 turbines). We estimated that the cost to survey a turbine ranged from $2,114 for scan surveys to $3,635 for transect surveys, and that a 50:50 transect and scan cost approximately $2,874. Our simulations indicated that the sample size of turbines required to reach our objective increased rapidly with decreasing detection. Therefore, we recommend investing effort to increase detection rates at the turbines being sampled and reducing the number of turbines surveyed per year. Estimated minimum sample sizes are 525 turbines (~ 11% of the total turbines) in the PF, 600 (~ 2% of the total turbines) in the CF, and 850 (~ 4.5% of the total turbines) in the AF/MF (Table 1). We estimate that the overall cost of these surveys would range from approximately $4.2 million to $7.2 million depending on the types of surveys conducted (Table 1). The costs do not include inflation and increases in salary over time. These sample sizes and costs assume that a detection rate of 0.65 can be attained at sampled turbines.

PTT Monitoring (GOEA only)

Use of PTT data. Previously, we used PTT data from 512 individual golden eagles in an integrated population model to estimate survival and cause of death from 1997–2016 (Millsap et al. 2022). Eagles were banded by several independent researchers throughout the coterminous US, which provided a reasonable representation of vital rates throughout the region. Specifically, we were able to estimate survival rates for first-year (Y1), second-year (Y2), third-year (Y3), and after third-year (AY3) (Table 2); and cause of death from 9 sources (i.e., collision, electrocution, shooting, poisoned, caught in trap, fight, disease, accident, and starvation) for two age classes (i.e., first-year, and after first-year) (Table 3). The cause of death model accounts for PTT failure and the probability that cause of death can be determined. Thus, the probabilities in Table 3 represent the probability of cause of death due to each factor given that the cause of death could be determined.

We extracted the PTT survival and cause of death submodel from the IPM and used the data to explore how various sample sizes of PTT would influence estimates of survival and cause of death. For this assessment, we randomly sampled transmitters from the full data set and ran the survival and cause of death models to generate estimates and standard errors. We used sample sizes from 50 to 1,000 (20 different sample sizes) and ran 10 replicates for each sample size (200 model runs). Each run of the model took approximately 6 hours to complete. We used the full dataset and then randomly sampled individuals to enter the analysis for a second time in the dataset for that run. Therefore, some individual records were used twice for an individual run at sample sizes >552. We collapsed the number of categories for cause of death from the 9 above to 2 (electrocution vs other) to explore how different sample sizes could help us monitor specific causes of mortality (e.g., is electrocution less likely a cause of death over time due to mitigation efforts). We calculated concentration (Link and Barker 2009) as a measure of relative uncertainty at different sample sizes (e.g., a binomial form of a CV). We presented three plots for each of the six parameters of interested (Y1, Y2, Y3, and AY3 survival; and Y1 and AY1 electrocution probability): (1) box plots to illustrate quantiles and outliers for the 10 replicates at each sample size; (2) mean and sd of concentration of the 10 replicates against each sample size to explore how expected relative uncertainty changes as a function of sample size; and (3) a plot comparing the results from each replicate for each sample size to the estimates from the full sample (512) of birds. Figures 4-7 illustrate the influence of sample size on point estimates, bias, precision, and outliers for survival (Fig 4 = Y1, Fig 5 = Y2, Fig 6 = Y3, and Fig 7 = AY3), and Figures 8-9 illustrate the influence of sample size on estimates of the probability of electrocution given cause of mortality is known (i.e., our ability to estimate the cause of death associated with a particular source of mortality; Figure 8 = Y1 and Figure 9 = Y2). These figures appear to indicate that at low sample sizes, cause of death could be very imprecise and greatly biased (high) compared to survival.

Annual effort, total sample size, and cost

GOEA population growth rates are, by far, most sensitive to AY3 survival (Millsap et al. 2022), so we assumed that obtaining reliable estimates of that parameter would be the priority for estimating sample sizes. We observed that at a sample size of 150 transmitters, concentration for the survival parameter dropped below 10% (Figure 7b). Given the importance of this demographic parameter in driving populations trends, and concerns over energy development influencing this demographic rate directly, we suggest a design that yields a sample size of ~ 150 transmittered AY3 GOEA per year. Such a sample could enable us to precisely estimate annual survival rates to detect potential declines in AY3 survival and explore potential factors that correlate with changes in survival (e.g., mitigation efforts, climate, density).

We incorporated our best estimates of survival and transmitter failure from the GOEA IPM to estimate expected sample sizes of PTT-transmittered eagles under a consistent annual banding effort. Estimated transmitter failure rate from the IPM was 0.128 (SD = 0.010) annually. Therefore, if a transmitter was fitted on an eagle, we assumed that the probability that the transmitter would still be working after 5 years was (1-0.128)^5. We assumed that transmitters from most (95%) birds that died could be recovered and redeployed on a new bird. We used the estimate and SD for transmitter failure and age-specific survival (Table 2) to incorporate uncertainty in sample size estimates from these variables. We found that a design where 50 new PTT transmitters are deployed on Y1 birds for 5 years, followed by operational efforts to deploy 35 new PTT transmitters on Y1 birds; along with re-deploying recovered and refurbished transmitters from birds that died, achieved our desired sample size (Figure 9). We estimate that the annual cost for hiring crews and climbers, purchasing equipment, travel, cost of new PTT tags, and cost of satellite service fees would increase from approximately $320,000 to approximately $450,000 dollars from year 1 to year 5 and then level off at approximately $445,000 from year 6 onward (Table 4).

Although the PTT monitoring is targeting precise and annual estimate of AY3 survival, we note that sample sizes of 150 PTT also resulted in unbiased estimates of collision risk (Figure 9a). The PTT data will also provide a wealth of additional information including: age at first breeding and probability of breeding, which are important gaps in information useful for estimating allowable take and population status; migration and movement patterns, which will help ensure that our operational population survey is occurring in the right areas and optimal times; and habitat use. The annual overall sample sizes (Figure 11) and cumulative total number of birds tracked over time (Figure 12) generated from this monitoring design will provide a strong data set for improved monitoring of GOEA take and population monitoring to inform conservation.

Table 1. Estimated annual sample size (number of turbines surveyed) and cost by survey method for monitoring mortality and eagle use at wind facilities in the general permit zone.

EMU	TotalTurbines	Recommended Sample (# turbines)	Cost by Survey Method[a]		
			Transects	Scans	50:50 Transect:Scan
Atlantic/Mississippi	18,792	850	$3,089,750	$1,796,900	$2,442,900
Central	31,161	600	$2,181,200	$1,268,400	$1,724,400
Pacific	4,923	525	$1,908,375	$1,109,850	$1,508,850
Total	54,876	1,975	$7,179,325	$4,175,150	$5,676,150

[a]Assuming per turbine cost for monitoring mortality and eagle use is $3,635 for transect surveys, $2,114 for scan surveys, and $2,874 for a 50:50 mix of transect and scan surveys.

Table 2. Golden Eagle survival probabilities estimated from IPM developed by Millsap et al (2022).

Age Class	Mean	SD	Lower 95CI	Median	Upper 95CI
First-year	0.70	0.02	0.66	0.70	0.74
Second-year	0.83	0.02	0.79	0.83	0.86
Third-year	0.88	0.02	0.84	0.88	0.91
After Third-year	0.90	0.01	0.88	0.90	0.91

Table 3. Golden Eagle cause of death (COD) probabilities for known sources of mortality estimated from IPM developed by Millsap et al. (2022).

Age	COD_Type	Mean	SD	Lower 95CI	Median	Upper 95CI
First-year	Collision	0.04	0.02	0.01	0.04	0.10
First-year	Electrocution	0.06	0.03	0.02	0.05	0.12
First-year	Shot	0.06	0.03	0.02	0.05	0.12
First-year	Poison	0.03	0.02	0.00	0.02	0.08
First-year	Trap	0.07	0.03	0.02	0.07	0.14
First-year	Fight	0.03	0.02	0.00	0.02	0.08
First-year	Disease	0.07	0.03	0.02	0.07	0.14
First-year	Accident	0.14	0.04	0.07	0.14	0.23
First-year	Starve	0.50	0.06	0.38	0.50	0.62
After First-year	Collision	0.19	0.04	0.11	0.18	0.28
After First-year	Electrocution	0.15	0.04	0.08	0.14	0.24
After First-year	Shot	0.20	0.05	0.12	0.20	0.30
After First-year	Poison	0.13	0.04	0.07	0.13	0.22
After First-year	Trap	0.07	0.03	0.02	0.06	0.13
After First-year	Fight	0.07	0.03	0.02	0.06	0.13
After First-year	Disease	0.05	0.03	0.01	0.05	0.11
After First-year	Accident	0.09	0.03	0.04	0.09	0.17
After First-year	Starve	0.05	0.03	0.01	0.05	0.11

Table 4. Estimated annual costs for an operational PTT monitoring program targeting an annual sample 150 after third year (AY3) golden eagles for estimating survival and cause of death.

Year	Coordinator	Crew (non USFWS)	Crew (non USFWS)	Crew (USFWS)	GPS Tags - New	Argos satellite service	Total
1	$64,800 (1)	$34,250 (2)	$4,500 (1)	$4,500 (1)	$175,000 (50)	$36,000 (50, 12mo)	$319,050
2	$64,800 (1)	$34,250 (2)	$4,500 (1)	$4,500 (1)	$175,000 (50)	$77,760 (108, 12mo)	$360,810
3	$64,800 (1)	$34,250 (2)	$4,500 (1)	$4,500 (1)	$175,000 (50)	$111,600 (155, 12mo)	$394,650
4	$64,800 (1)	$34,250 (2)	$4,500 (1)	$4,500 (1)	$175,000 (50)	$141,840 (197, 12mo)	$424,890
5	$64,800 (1)	$34,250 (2)	$4,500 (1)	$4,500 (1)	$175,000 (50)	$169,200 (235, 12mo)	$452,250
6+	$64,800 (1)	$17,125 (1)		$4,500 (1)	$122,500 (35)	$237,600 (200, 12mo)	$446,525

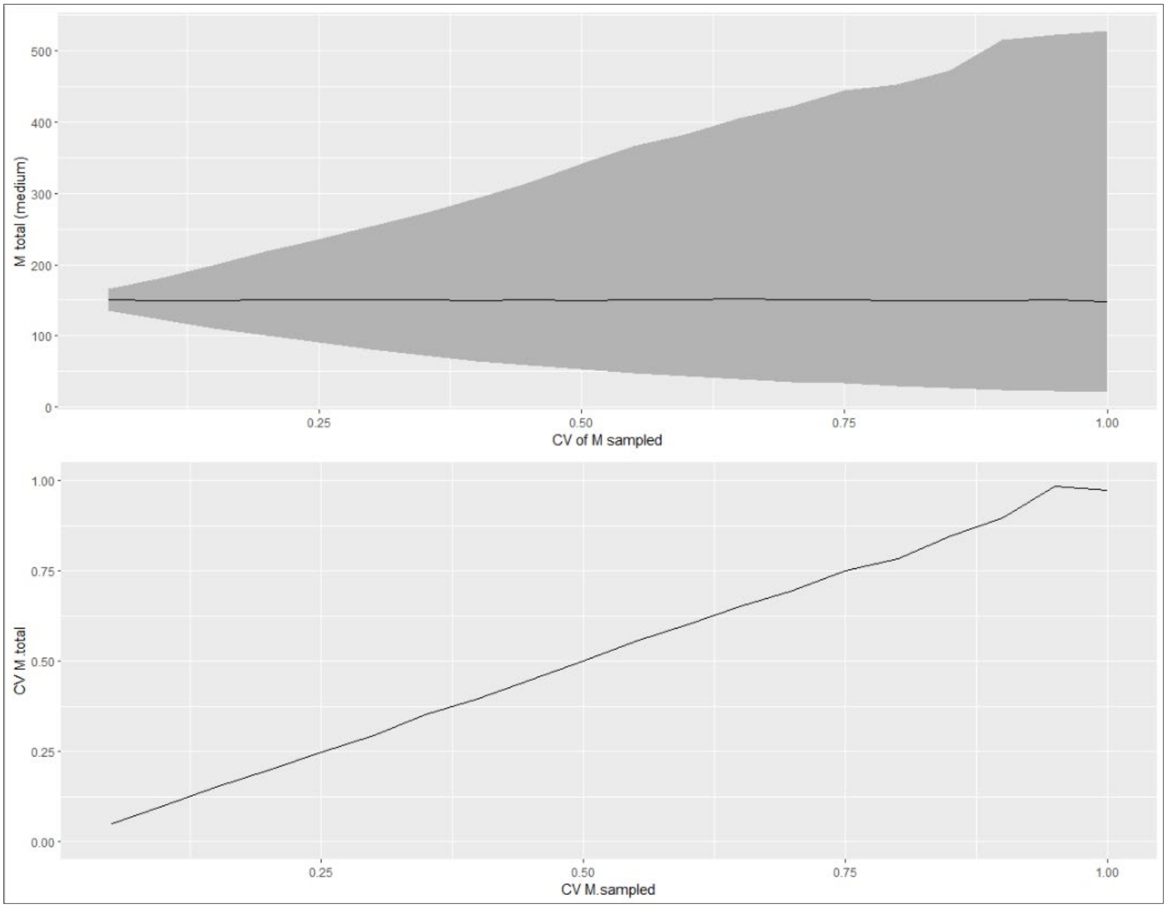


Figure 1. Top panel. Relationship between the coefficient of variation (CV) of summed fatalities across sampled turbines ($\hat{F}_{.,t}^{EMU}$) and total fatalities after adjusting for the proportion of turbines sampled ($\hat{F}_{t}^{EMU}$) in a hypothetical eagle management unit. Bottom panel. The relationship between $\hat{F}_{.,t}^{EMU}$ and $\hat{F}_{t}^{EMU}$ correlate in a linear fashion because the proportional adjustment is a constant.

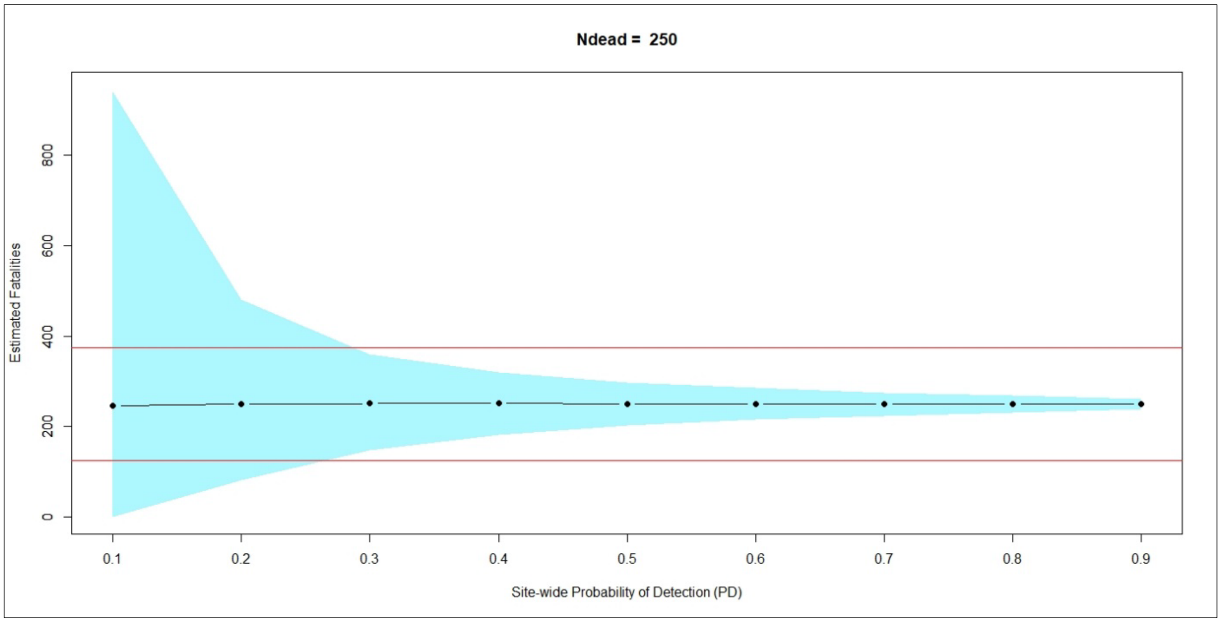


Figure 2. Relationship between detection rate and uncertainty in estimates of fatalities at a particular site. Black line depicts the best guess at what actual take will be across all general permits. Blue polygon depicts the upper and lower 80% confidence limit. Red lines provide visual aids to help the user see when the 80% confidence interval gets within 50% of the actual take (black line). If actual take from all general permits is 250 eagles over 5 years, our fatality estimates will have an upper 80% confidence limit that is less than or equal to 375 (1.5x the actual fatality rate) and a lower 80% confidence limit greater than or equal to 125 (0.5x the actual fatality rate) at a detection probability of approximately 0.28.

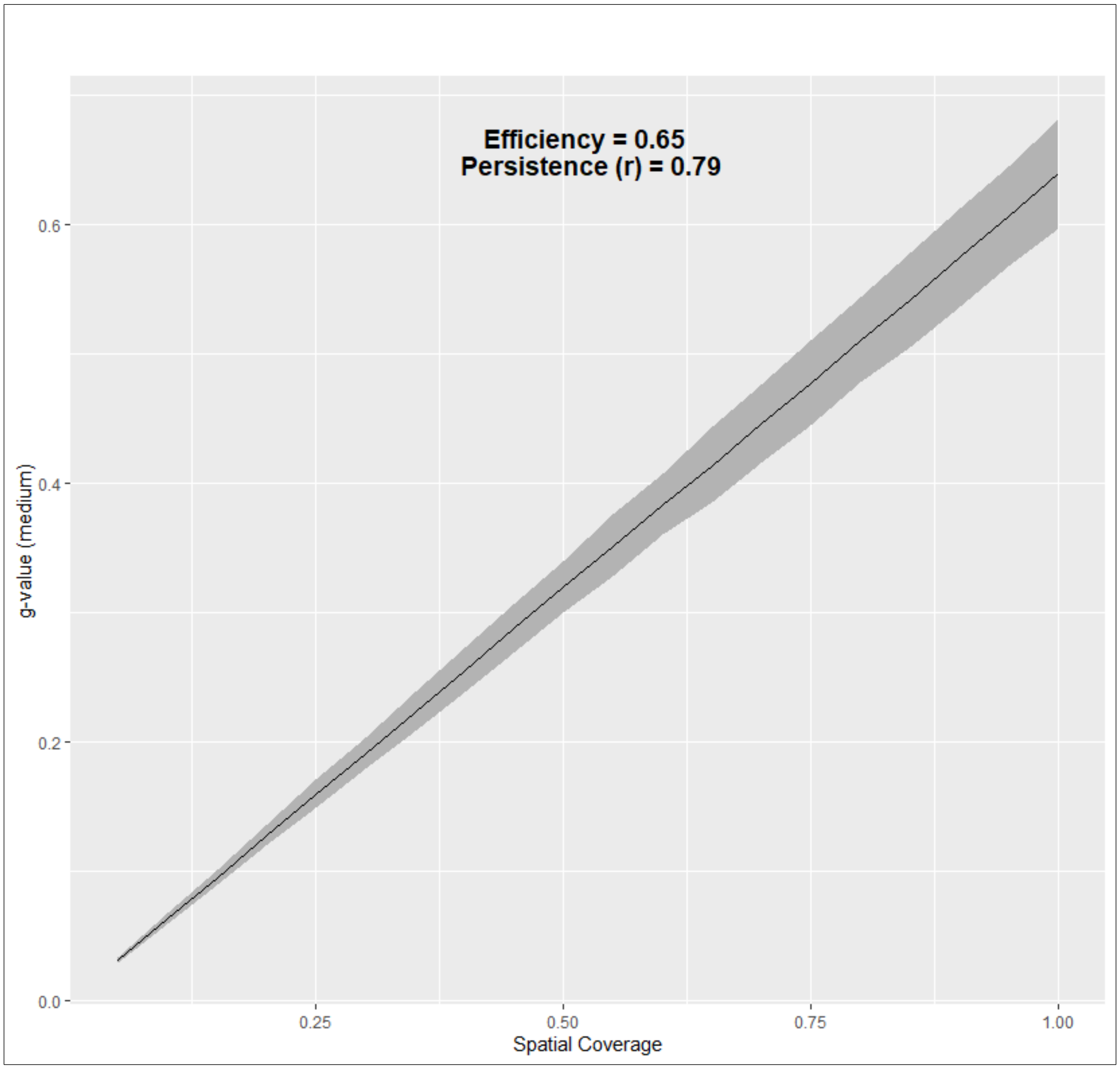


Figure 3. Changes in g-value as the proportion of turbines monitored increases at a hypothetical wind facility. Maximum detection probability (g) attained (with 100% of turbines scanned) is 68% based on existing carcass persistence data and a searcher efficiency of 0.65.

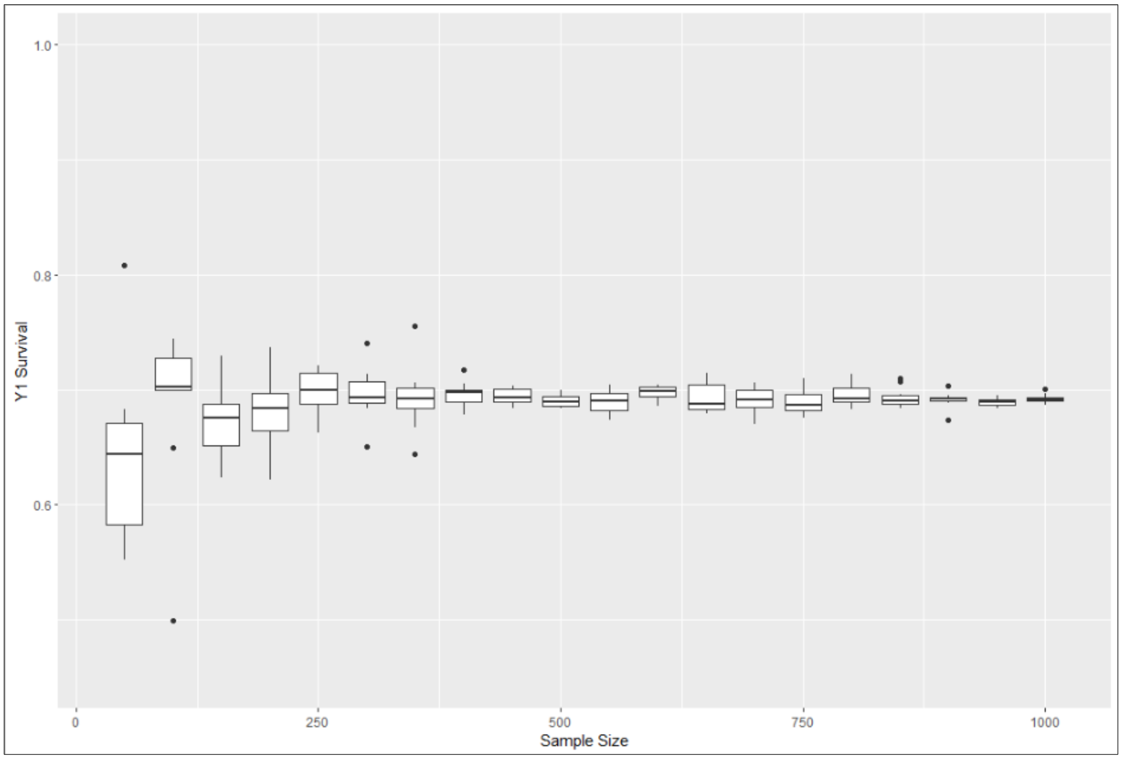


Figure 4a. Box plots showing quantiles for 10 runs of Y1 survival at each sample size. Vertical line shows median, and the upper and lower edges of the boxes are the 75th and 25th quantiles. Whiskers extend up to 1.5 times the mid-point of median and box boundary. Dots represent outliers beyond whisker range.

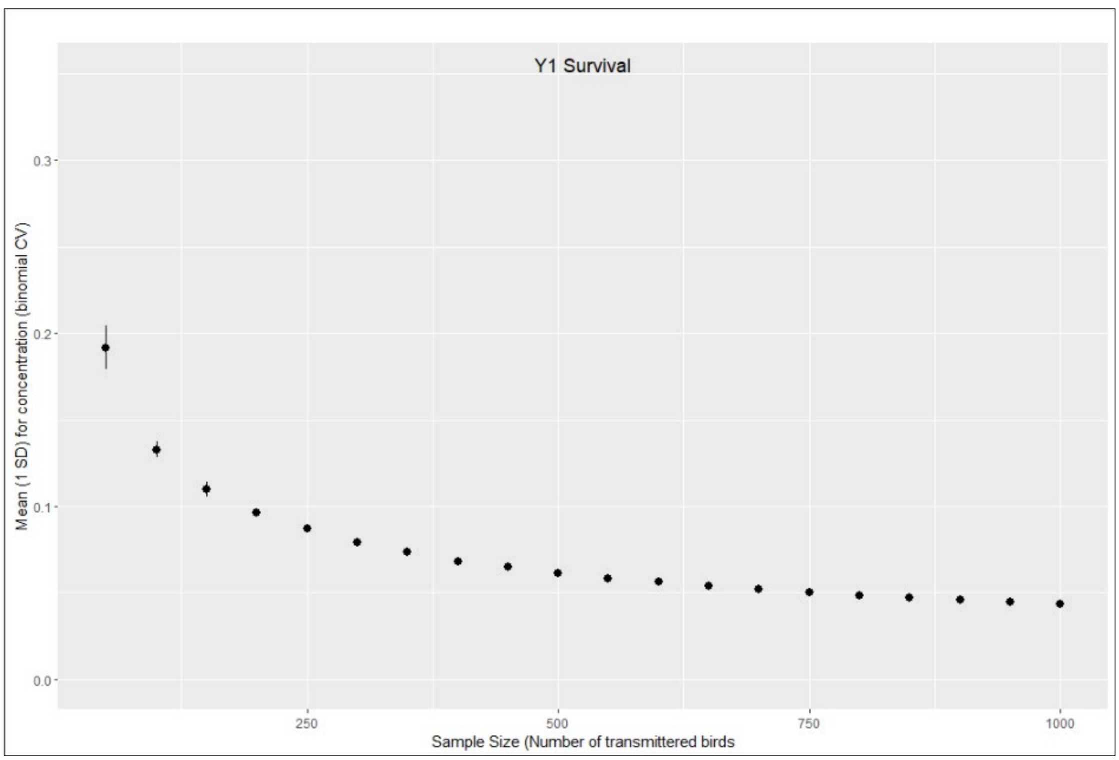


Figure 4b. Mean concentration (lines represent 1 SD) for 10 estimates of Y1 survival at each sample size.

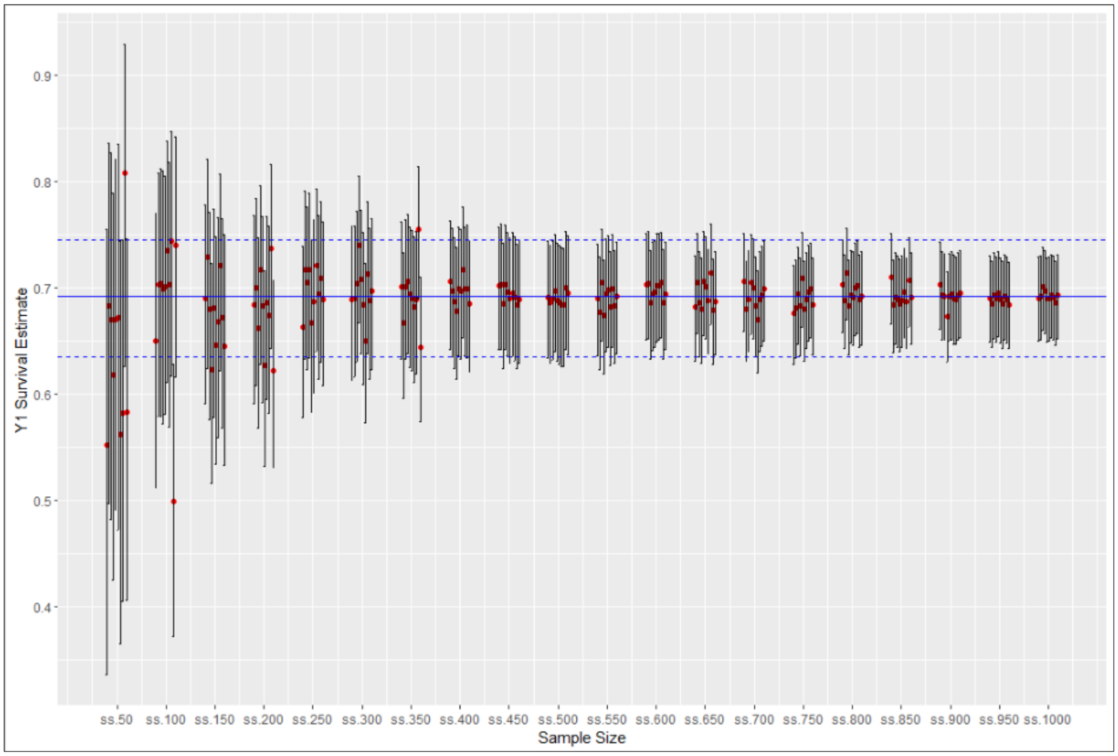


Figure 4c. Median (red dot) and 95% CI for each of 10 estimates of Y1 survival at each sample size. Blue lines represent the median (solid line) and 95% CI (dotted lines) for survival using the full sample of 512 individuals.

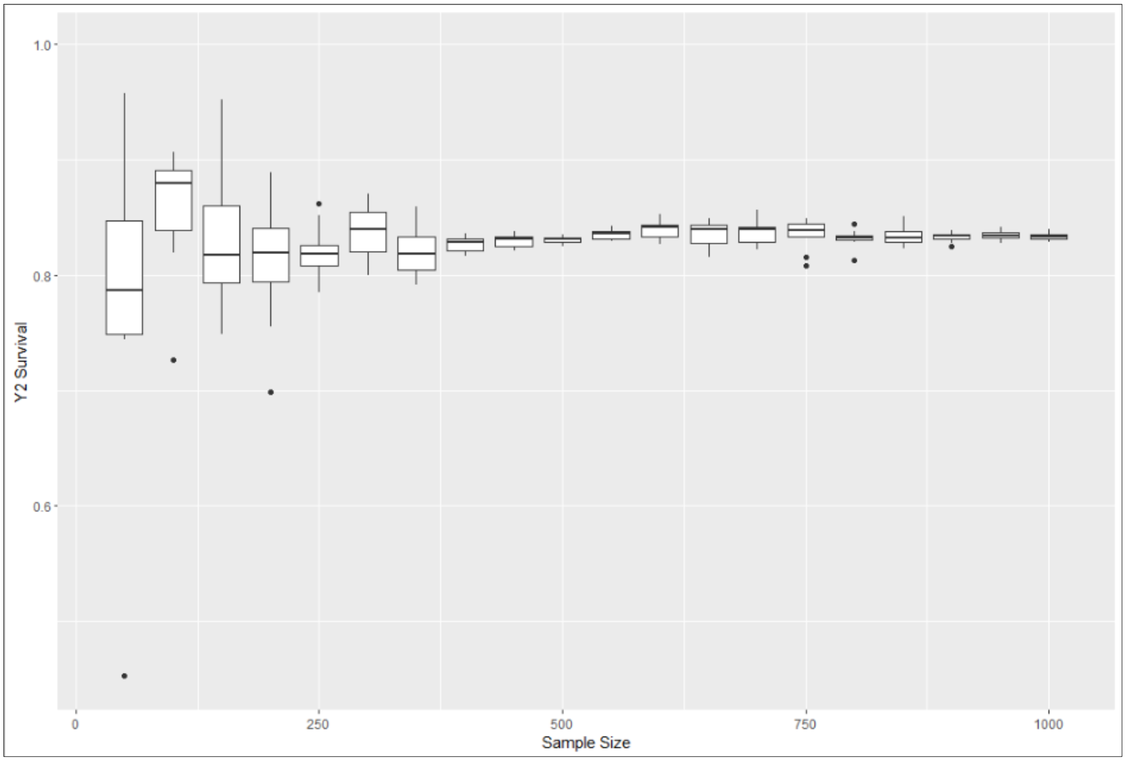


Figure 5a. Box plots showing quantiles for 10 runs of Y2 survival at each sample size. Vertical line shows median, and the upper and lower edges of the boxes are the 75th and 25th quantiles. Whiskers extend up to 1.5 times the mid-point of median and box boundary. Dots represent outliers beyond whisker range.

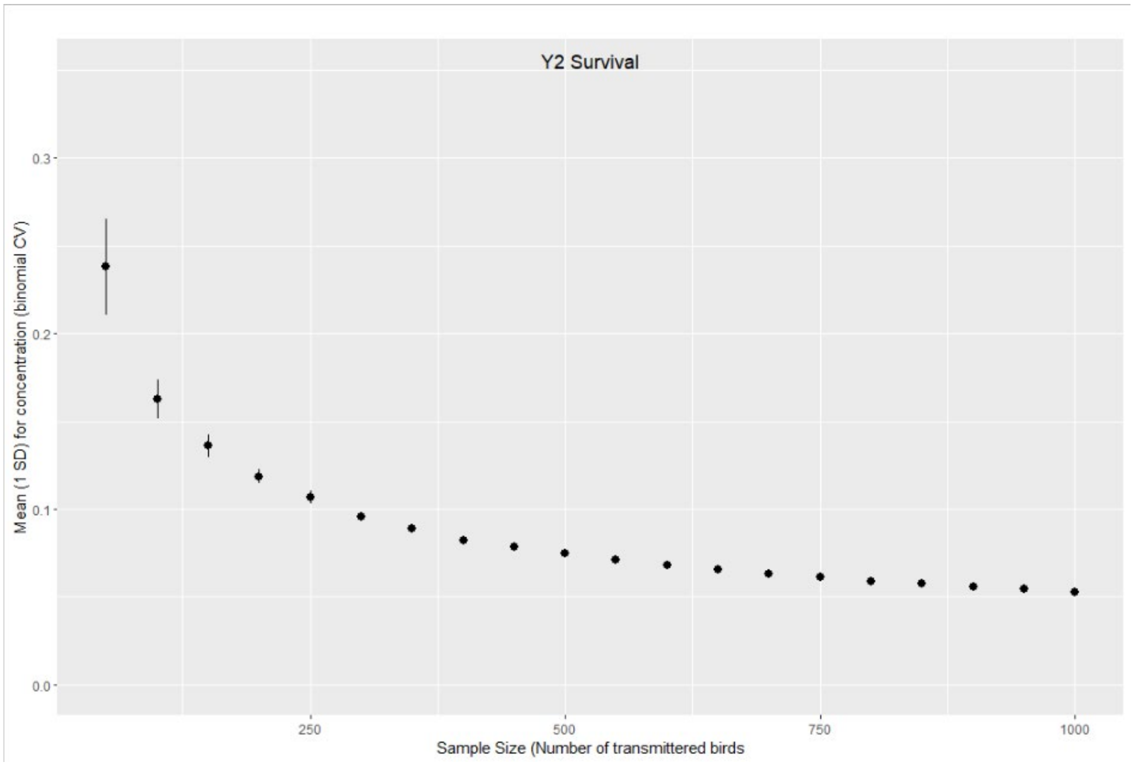


Figure 5b. Mean concentration (lines represent 1 SD) for 10 estimates of Y2 survival at each sample size.

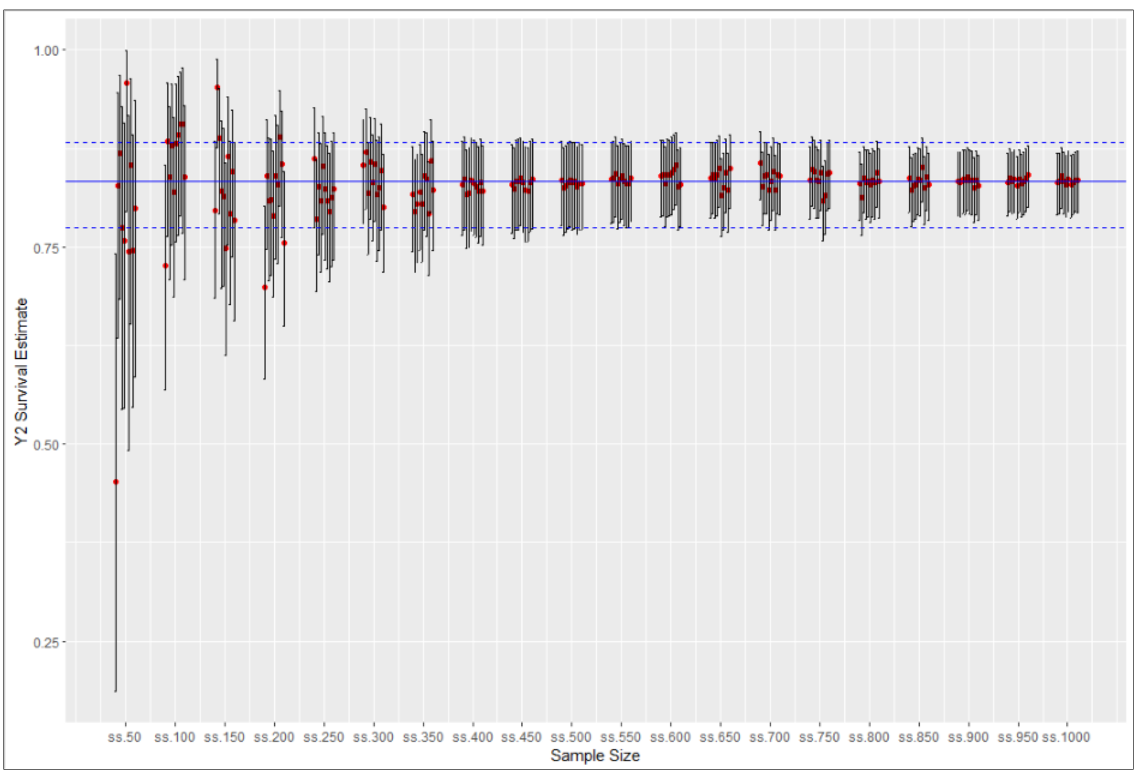


Figure 5c. Median (red dot) and 95% CI for each of 10 estimates of Y2 survival at each sample size. Blue lines represent the median (solid line) and 95% CI (dotted lines) for survival using the full sample of 512 individuals.

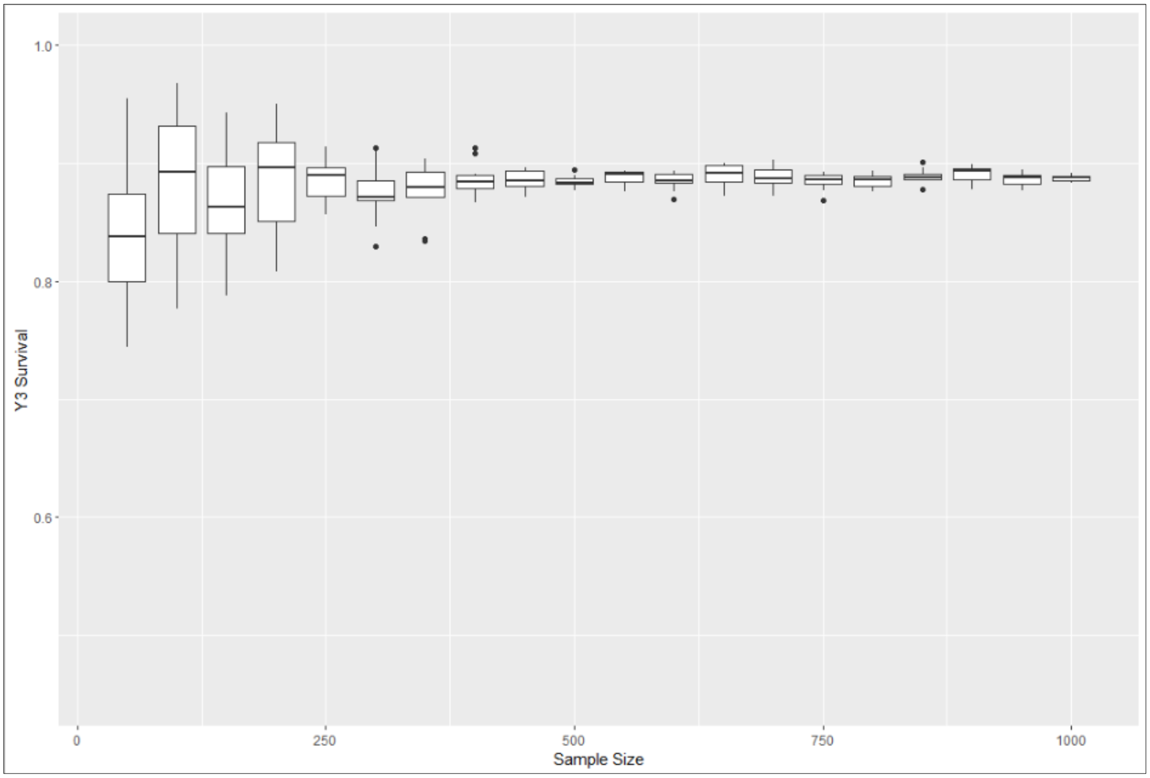


Figure 6a. Box plots showing quantiles for 10 runs of Y3 survival at each sample size. Vertical line shows median, and the upper and lower edges of the boxes are the 75th and 25th quantiles. Whiskers extend up to 1.5 times the mid-point of median and box boundary. Dots represent outliers beyond whisker range.

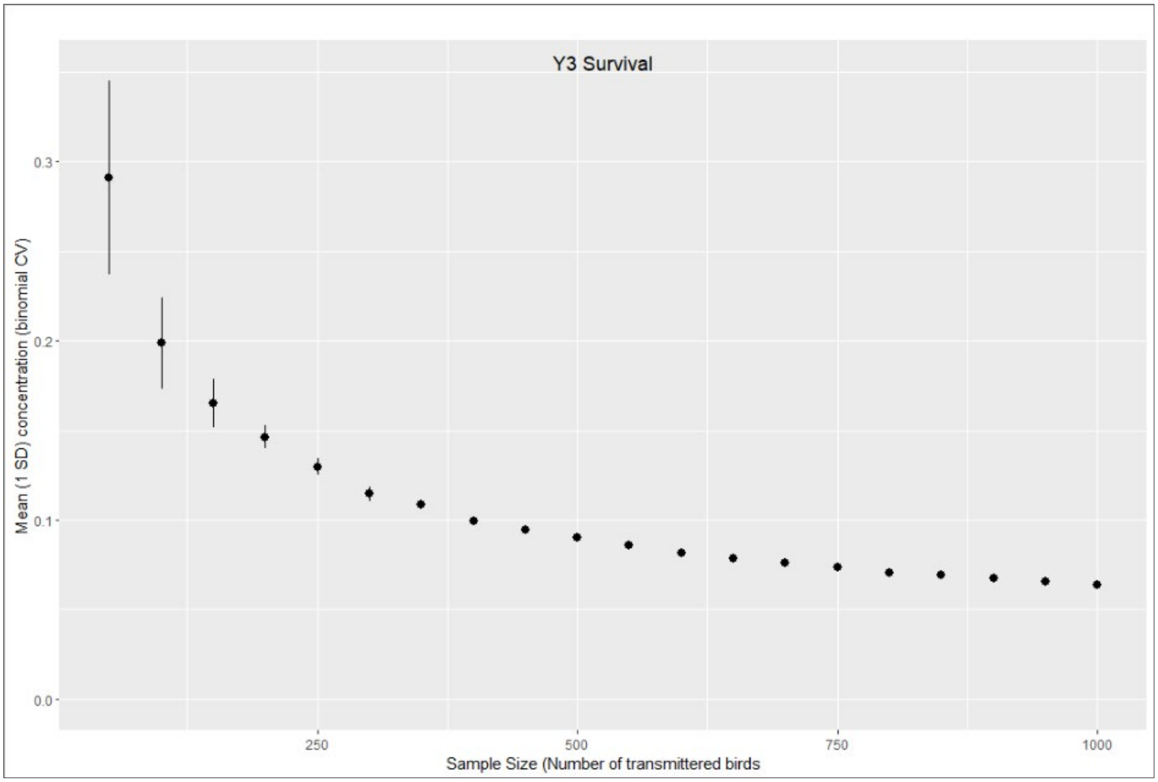


Figure 6b. Mean concentration (lines represent 1 SD) for 10 estimates of Y3 survival at each sample size.

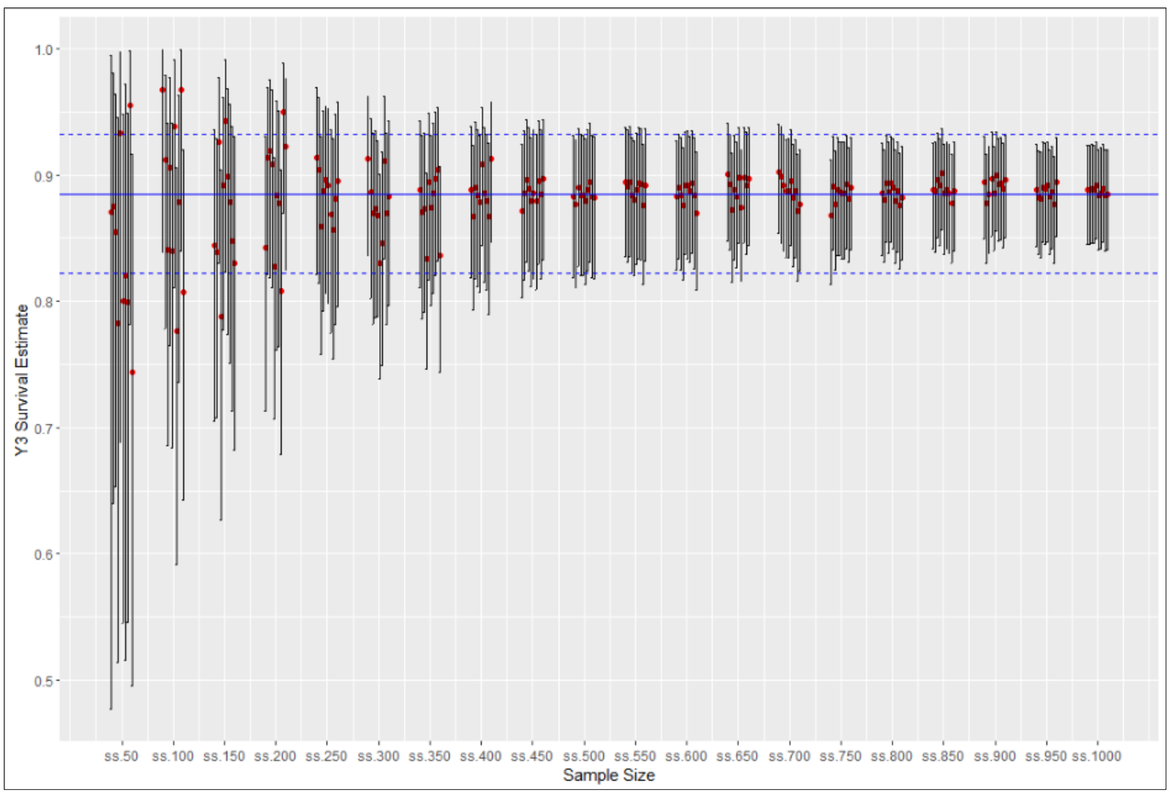


Figure 6c. Median (red dot) and 95% CI for each of 10 estimates of Y3 survival at each sample size. Blue lines represent the median (solid line) and 95% CI (dotted lines) for survival using the full sample of 512 individuals.

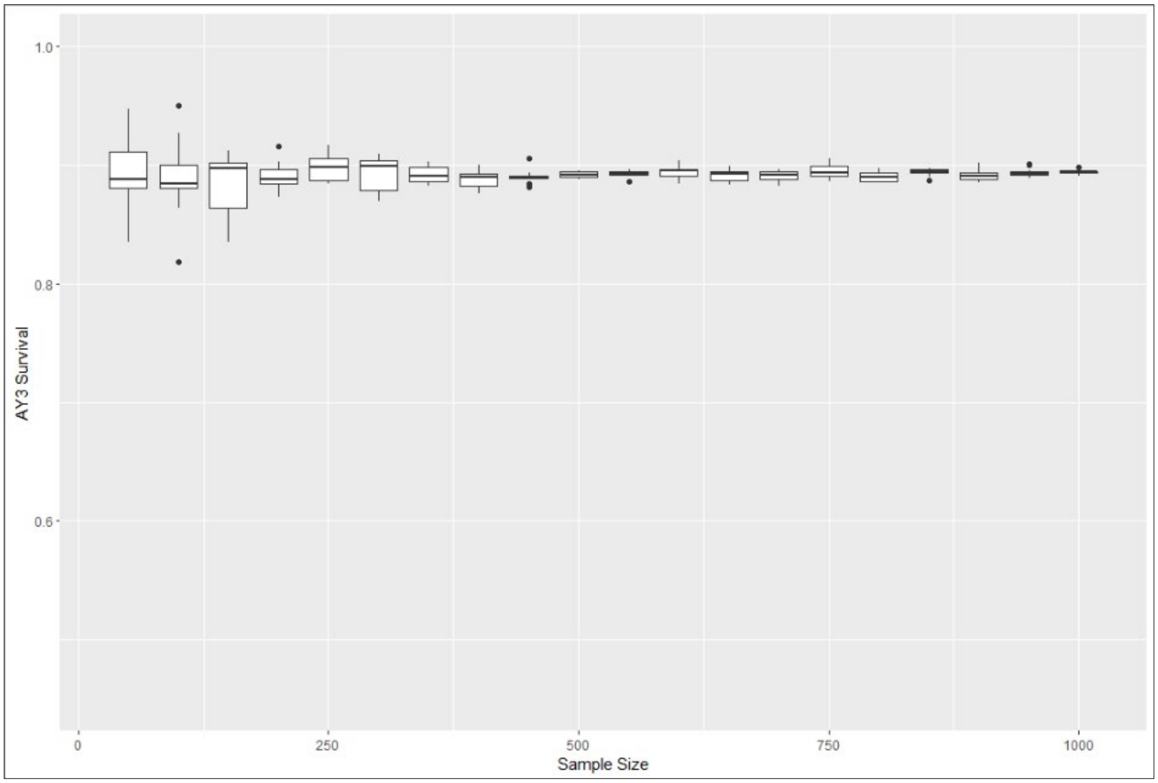


Figure 7a. Box plots showing quantiles for 10 runs of AY3 survival at each sample size. Vertical line shows median, and the upper and lower edges of the boxes are the 75th and 25th quantiles. Whiskers extend up to 1.5 times the mid-point of median and box boundary. Dots represent outliers beyond whisker range.

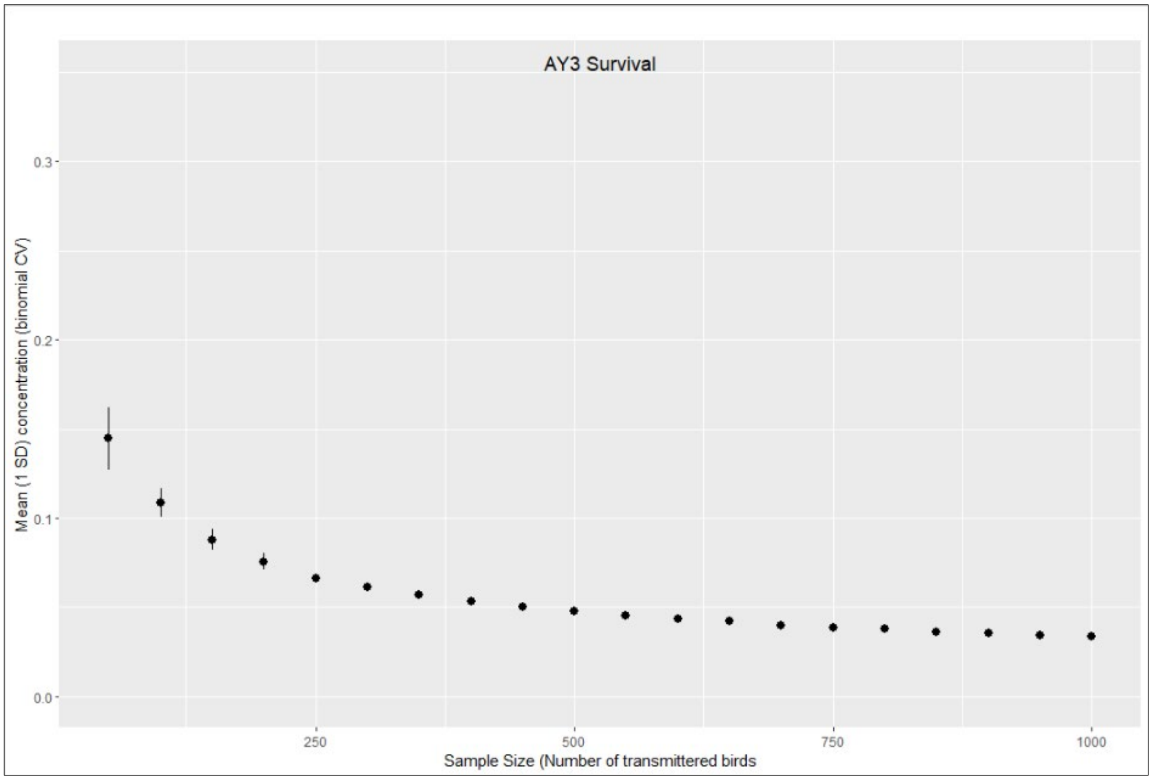


Figure 7b. Mean concentration (lines represent 1 SD) for 10 estimates of AY3 survival at each sample size.

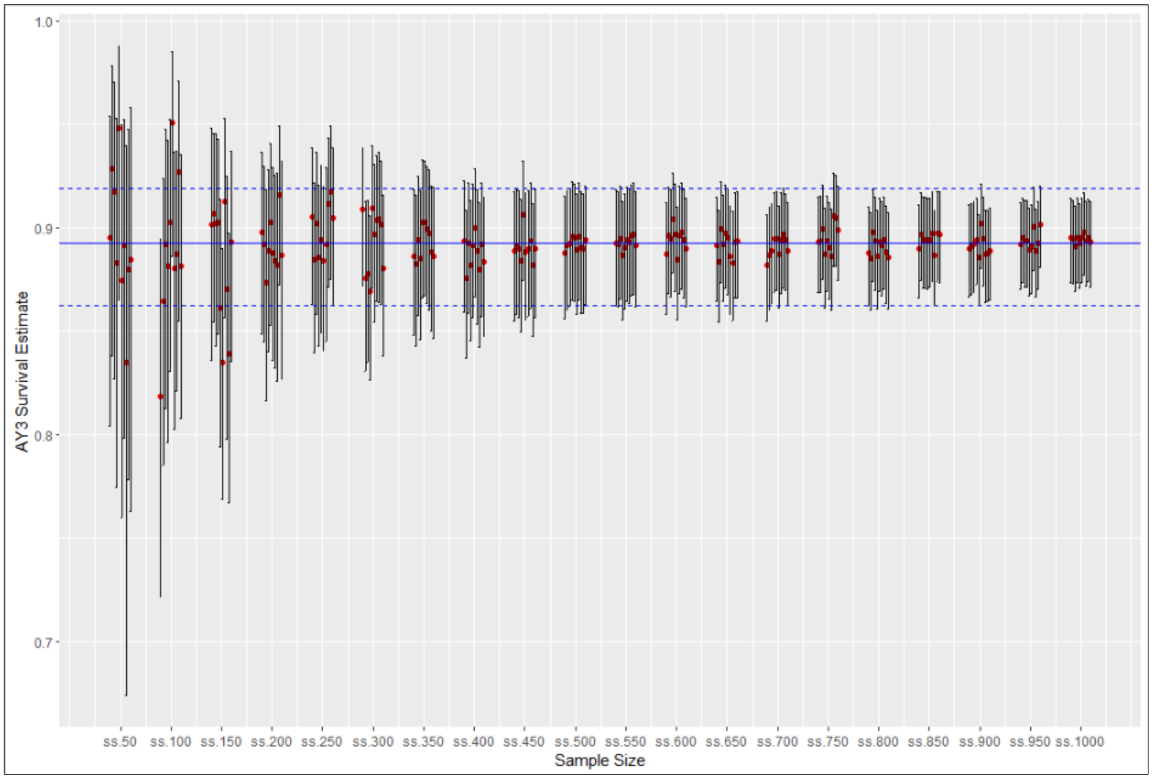


Figure 7c. Median (red dot) and 95% CI for each of 10 estimates of AY3 survival at each sample size. Blue lines represent the median (solid line) and 95% CI (dotted lines) for survival using the full sample of 512 individuals.

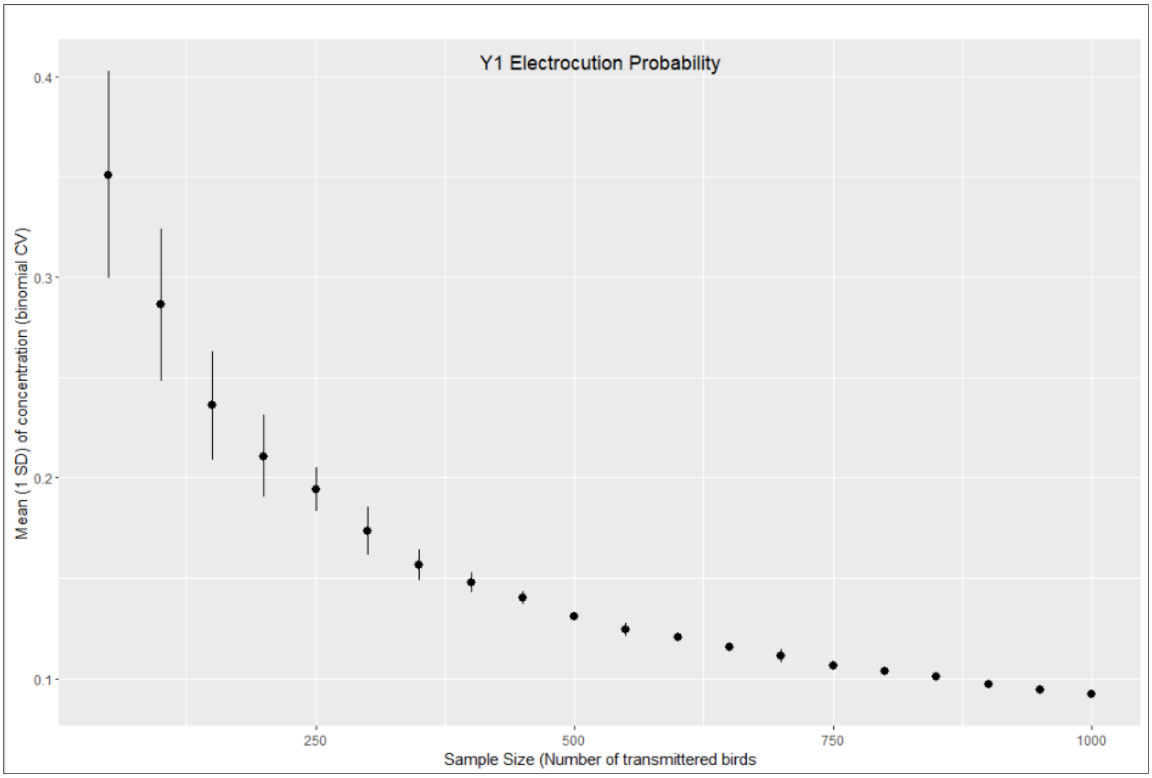


Figure 8a. Box plots showing quantiles for 10 runs of Y1 electrocution probability at each sample size. Vertical line shows median, and the upper and lower edges of the boxes are the 75th and 25th quantiles. Whiskers extend up to 1.5 times the mid-point of median and box boundary. Dots represent outliers beyond whisker range.

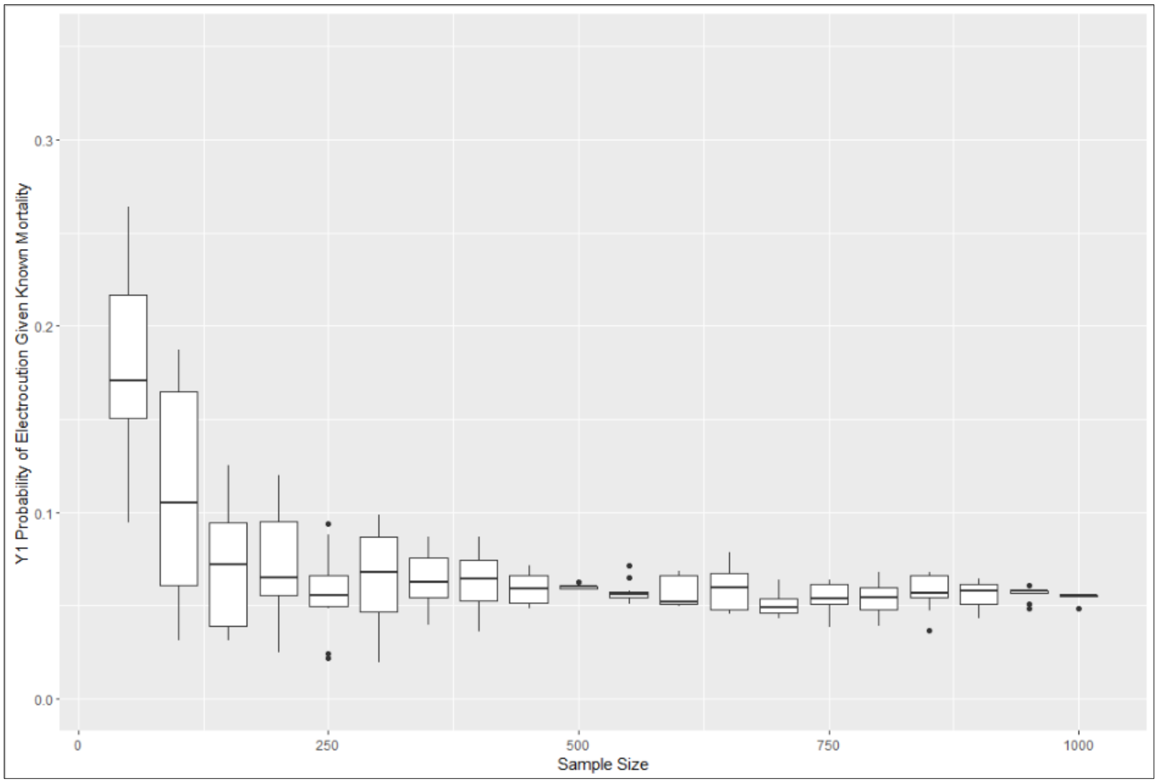


Figure 8b. Mean concentration (lines represent 1 SD) for 10 estimates of Y1 electrocution probability at each sample size.

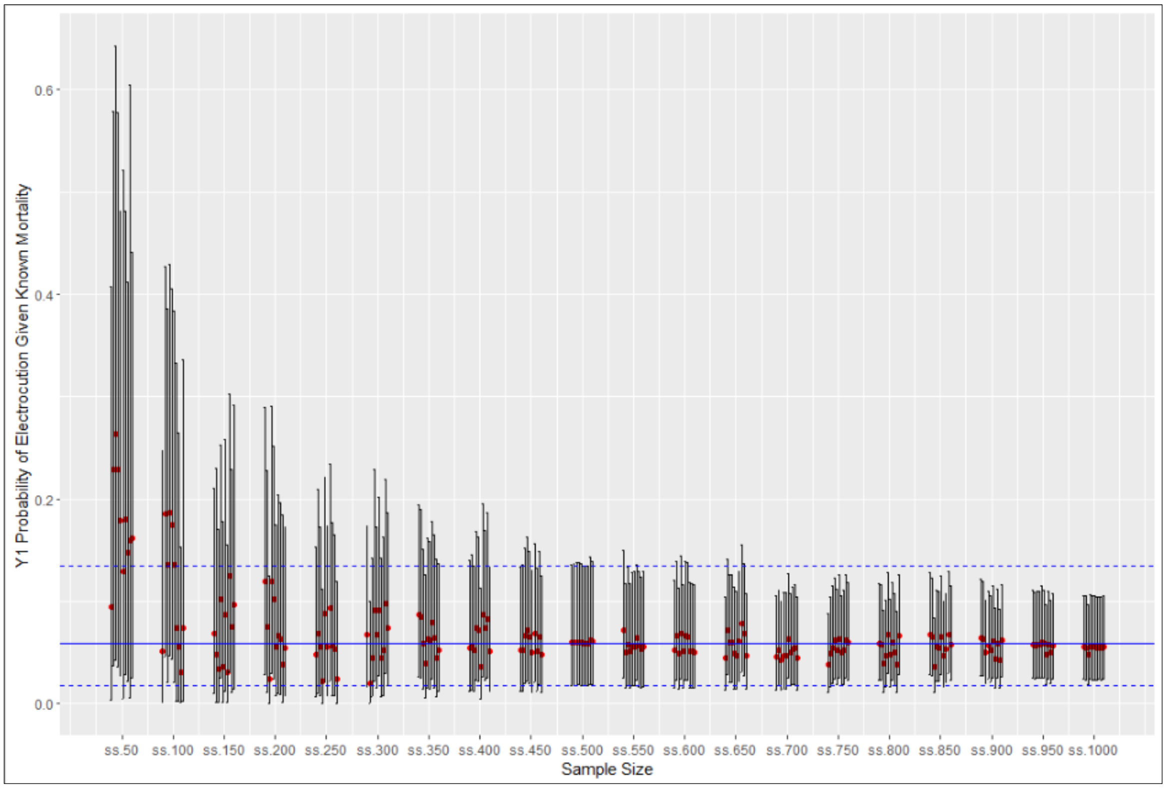


Figure 8c. Median (red dot) and 95% CI for each of 10 estimates of Y1 electrocution probability at each sample size. Blue lines represent the median (solid line) and 95% CI (dotted lines) for electrocution using the full sample of 512 individuals.

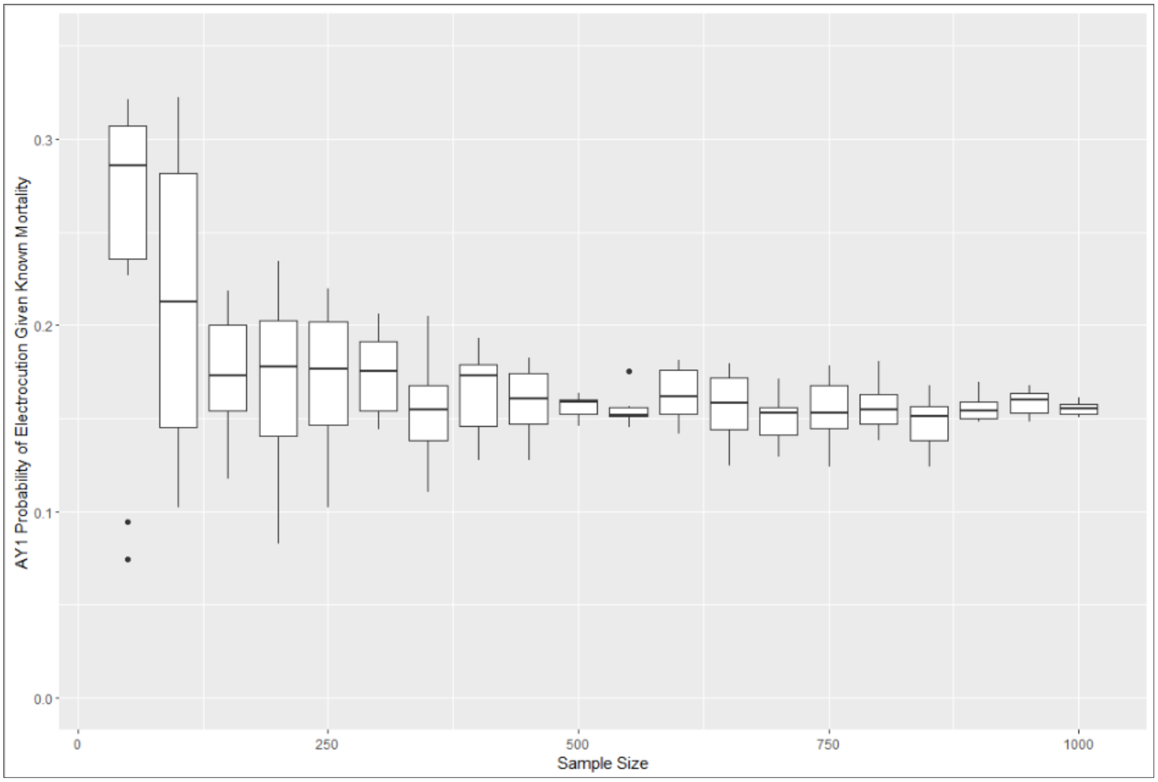


Figure 9a. Box plots showing quantiles for 10 runs of AY1 electrocution probability at each sample size. Vertical line shows median, and the upper and lower edges of the boxes are the 75th and 25th quantiles. Whiskers extend up to 1.5 times the mid-point of median and box boundary. Dots represent outliers beyond whisker range.

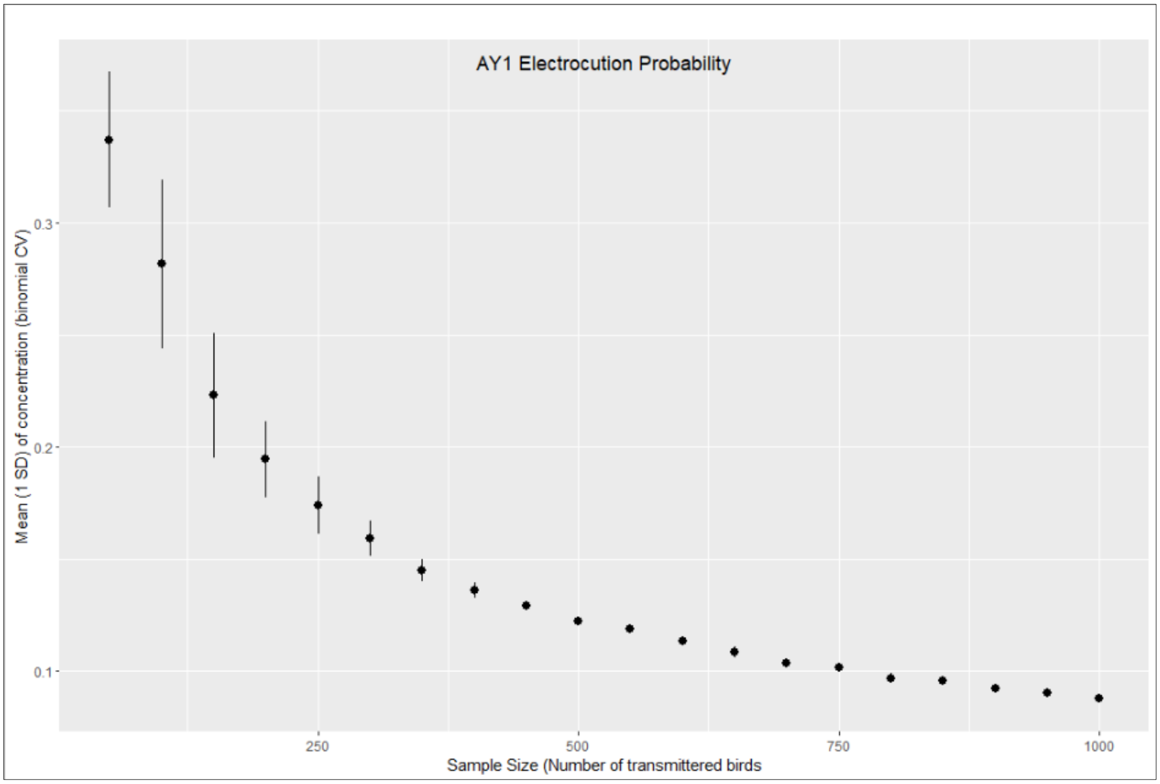


Figure 9b. Mean concentration (lines represent 1 SD) for 10 estimates of AY1 electrocution probability at each sample size.

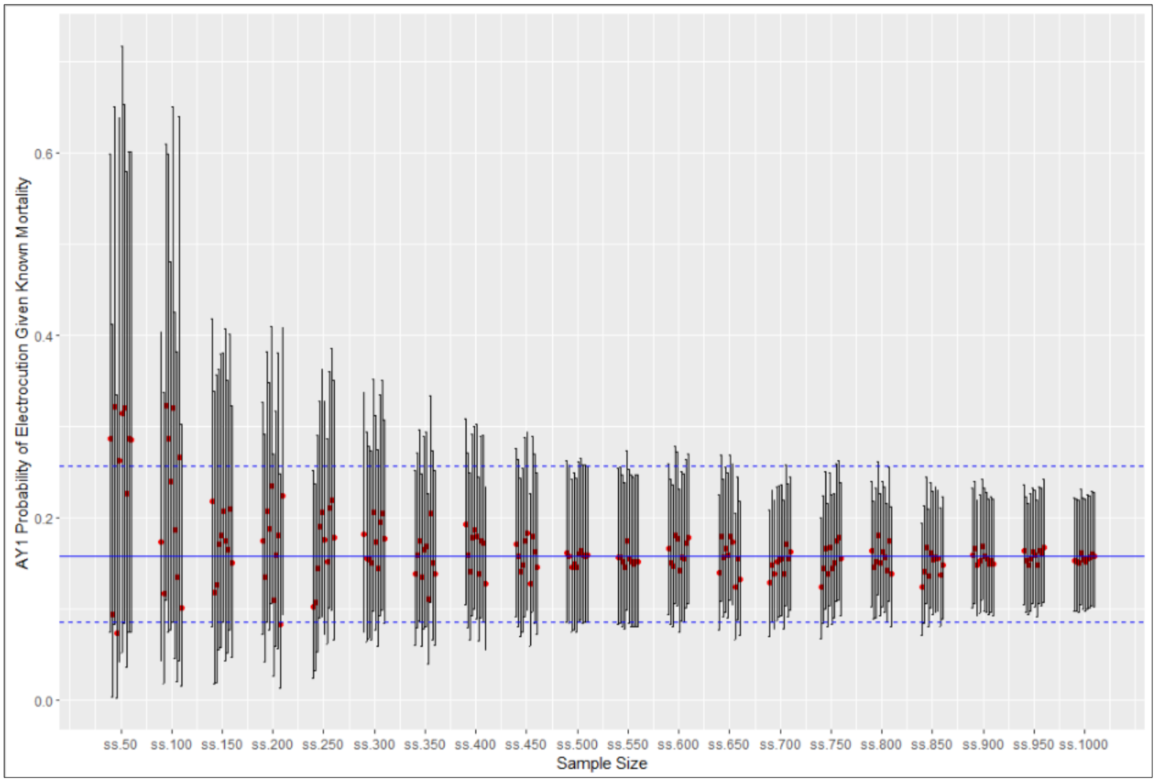


Figure 9c. Median (red dot) and 95% CI for each of 10 estimates of AY1 electrocution probability at each sample size. Blue lines represent the median (solid line) and 95% CI (dotted lines) for electrocution using the full sample of 512 individuals.

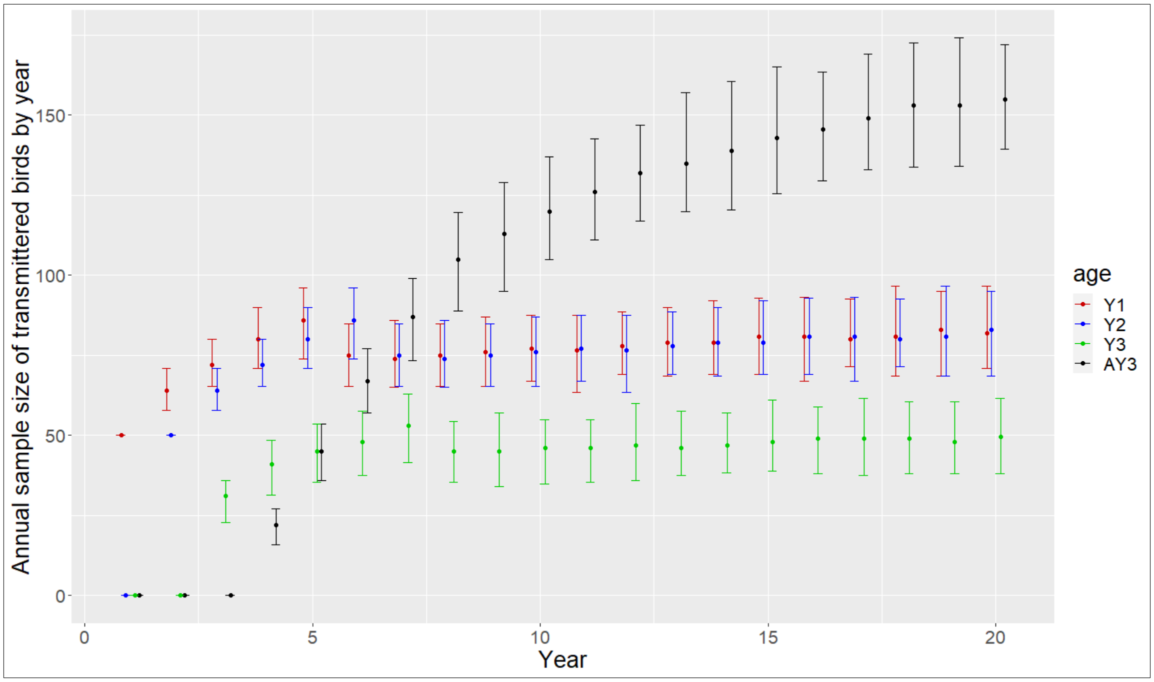


Figure 10. Distribution of transmitters among 4 age classes of GOEA over time for a PTT study where 50 new transmitters are deployed for 5 years, followed by operational annual deployment of 35 new PTT transmitters on Y1 GOEA. We assumed the approximately 95% of recovered transmitters from eagles that died each year were refurbished and re-deployed in addition to the new PTTs.

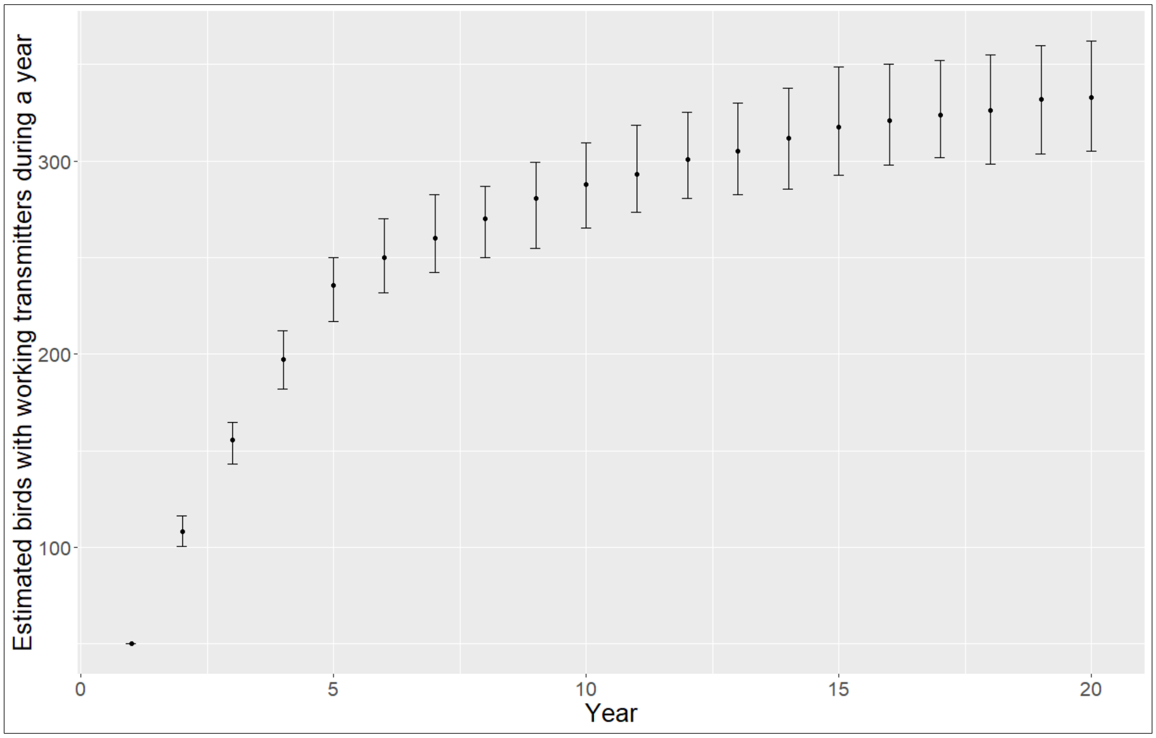


Figure 11. Expected annual sample size of transmittered GOEA providing data assuming 50 new transmitters were deployed the first five years, and 35 per year from year 6 to year 20. In addition, we assumed that 95% of transmitters from birds that died were recovered and re-deployed on new birds.

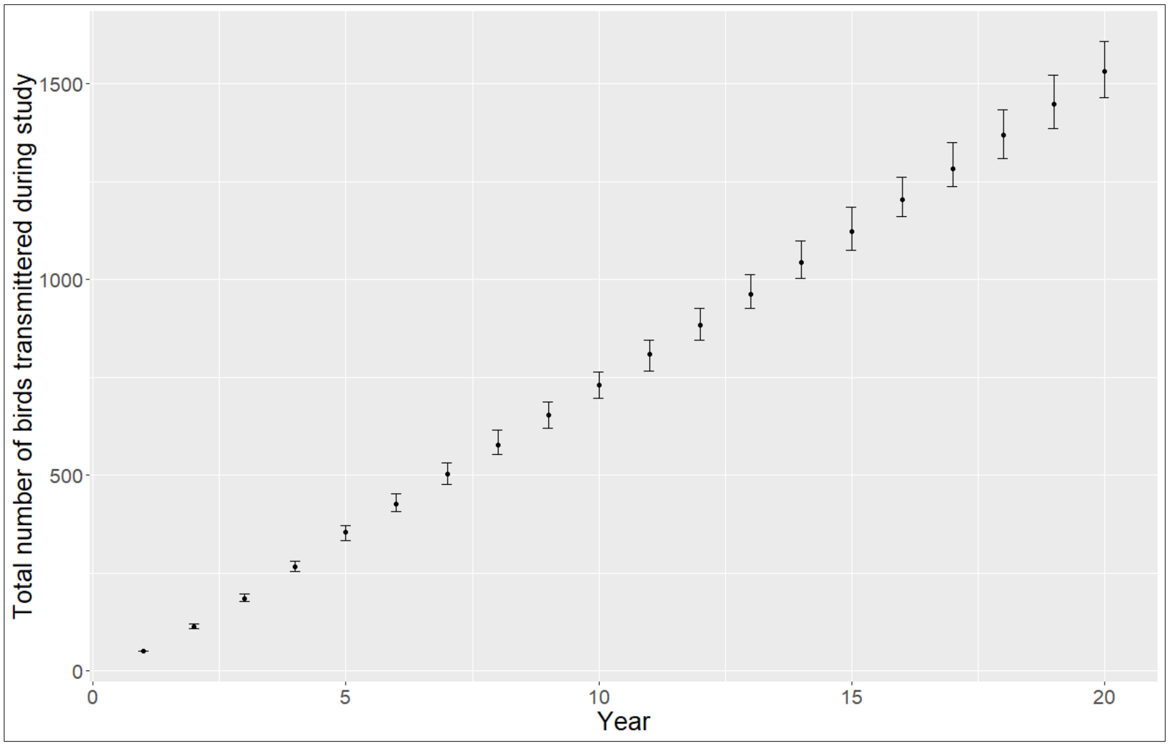


Figure 12. Cumulative increase in the total number of individual GOEA transmittered over time assuming 50 new transmitters were deployed the first five years, and 35 per year from year 6 to year 20. In addition, we assumed that 95% of transmitters from birds that died were recovered and re-deployed on new birds.

Attachment 3: Nest Failure Rates of Bald Eagles Exposed to Anthropogenic Activities in the United States

Introduction

Populations of bald eagles (*Haliaeetus leucocephalus*) have experienced two periods of severe decline from anthropogenic sources (Gerrard and Bortolotti 1988). The first was from persecution by humans during the first half of the 20th century and the second occurred in the mid-20th century, a result of widespread use of organochlorine pesticides (in particular DDT), which caused significant reductions in productivity or reproductive failure (Grier 1982; Buehler 2000; Dykstra et al. 2001). Following protection for bald eagles through the Bald and Golden Eagle Protection Act of 1940, an amendment of the Migratory Bird Treaty Act and a nationwide ban on DDT in 1972, and their listing under the Endangered Species Act in 1978, bald eagle populations were able to recover sufficiently for the species to be delisted by 2007. Furthermore, it is estimated that the bald eagle population in the United States experienced a more than 4-fold increase from 2009 to 2018 (Zimmerman et al. 2022). Consequently, the U.S. Fish and Wildlife Service (Service) implemented regulations allowing for permits for incidental take of bald eagles in association with otherwise lawful activities, provided the take is consistent with the goals of maintaining a stable or increasing population (USFWS 2016). This includes issuing permits authorizing activities that may cause incidental disturbance of breeding bald eagles (i.e., nest disturbance), as long as the activities comply with maintaining a sustainable population (USFWS 2016).

Furthering our understanding of the impact of nest disturbance on bald eagle populations requires assessing the demographic response to these activities. Several studies have demonstrated human activity negatively impacting bald eagle nest success or productivity (Bangs et al. 1982; Anthony and Isaacs 1989; Steidl 1994). However, there is a growing body of evidence suggesting that breeding bald eagle populations may be much more resilient to human disturbance than thought. For example, some studies found that anthropogenic activities were not adversely affecting reproductive rates (e.g., Fraser et al. 1985; Anthony et al. 1994; Millsap et al. 2004; Goulet et al. 2021). Clearly the response of breeding bald eagles to human disturbance is highly variable and may depend on the type of anthropogenic activity (e.g., recreation, construction, resource extraction) and/or the environment in which the nest is located.

Our objective was to examine the failure rate of used bald eagle nests that are listed in incidental take permits issued by the Service and estimate the probability of a nest under a permit failing to produce young. Results will inform bald eagle management and will be used to update the take (i.e., due to loss of productivity of a bald eagle nest) that the Service debits from bald eagle management unit take limits and local area population thresholds per used nest under a nest disturbance permit.

Methods

In 2007, the Service published the National Bald Eagle Management Guidelines (NBEMG; USFWS 2007) following delisting of the bald eagle and in anticipation of publication of nest disturbance permitting regulations. The NBEMG recommend various combinations of distance buffers, breeding season timing restrictions, and visual buffers according to the category of human activity. The assumption at the time was that activities not conforming to the NBEMG would result in nest failure due to disturbance, and therefore require a disturbance permit. The Service based these recommendations on expert opinion and best available science at the time of publication. Our aim was to assess and potentially update these recommendations based on our analyses of failure rates of bald eagle nests listed in the Service's incidental take permits. Therefore, we compiled data from bald eagle incidental take permits issued by the Service from 2009 to 2021 authorizing activities that could potentially disturb bald eagle nests, where the authorized activity did not adhere to the NBEMG, with or without required avoidance and minimization measures. We examined bald eagle nest failure; therefore, we only included data, (1) for nests that were in use (i.e., a nest that contains eggs, young, or an incubating bird, or has a pair of birds on or near it, or has been recently repaired or decorated [Postupalsky 1974]) during any phase of nesting behavior during the period(s) of the permitted activity for which sufficient monitoring and reporting was conducted to reliably determine nest failure, (2) from permits that were not combined with any other authorization, and authorized activity was for one nesting pair only (i.e., this could mean one nest or several nests presumed to be in the same territory), (3) where a single permit was issued to a single applicant for an activity (i.e., we did not include permits where an additional permittee was authorized for an activity for the same nest in the same nesting season unless the nest did not fail in any nesting seasons that were monitored during activity), and (4) from permits that were not amended once the first period of permitted activity commenced. We only address bald eagle nests that could be "disturbed" according to the following regulatory definition (50 CFR 22.3) for disturbance created by the Service (i.e., we exclude intentional or unintentional removal or destruction of bald eagle nests or nest trees): to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, (1) injury to an eagle, (2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior.

We gathered data on geographic location of bald eagle nests, including latitude, longitude, and state. We used information from the permits to determine whether the authorized activity adhered to the NBEMG, and if so, should not be included in the data. This included minimum distance (m) between the nest and the edge of the activity area (i.e., buffer) and degree of visibility of the activity from the nest (i.e., visible, partially visible, or not visible). For example, the NBEMG recommends a buffer of 100 m if the activity is not visible from the nest and 200 m if it is visible, and this depends on the type of activity (see NBEMG [USFWS 2007] pp. 11–14). For our purposes, when determining inclusion of data in our analyses, we treated *partially visible* the same as *visible*. When available, we also recorded data on nest failure for up to three nesting seasons prior to and following the years when the authorized activity occurred.

We ran generalized linear logistic regression models in R 3.6.2 (R Core Team 2019) in a Bayesian framework using NIMBLE 0.12.1 (de Valpine et al. 2017) to estimate the probability of bald eagle nest failure. The binary response variable was nest fail or success, with a nest considered failed if the breeding pair did not fledge any young. We used a Bernoulli model and the data were modeled on a logit scale as

$$y_i \sim \text{Bernoulli}(\rho_{fail_i}) yi \sim \text{Bernoulli}(\rho ifail)$$

$$\text{logit}(\rho_{fail_i}) = \beta_0 \; logit\rho ifail = \beta 0 \; ,$$

where, for the i^th^ nest-season (i.e., a nesting season during authorized activity in which nest outcome was determined), y_i was nest failure (0 = success, 1 = fail), ρ_{fail_i} was the probability of nest failure, and β_0 was the model intercept, which was assigned an uninformative *N*(0, 100) prior. Models were run for 100,000 MCMC iterations with the initial 20,000 MCMC samples discarded as burn-in.

Results

The Service's regional staff submitted data from 273 bald eagle incidental take permits issued by the Service (2009–2021), of which 68 permits met our criteria for inclusion in analyses, for a total of 103 nest-seasons. Data included bald eagle nests in 18 states in the coterminous U.S. distributed primarily across the north-central Midwest, northeast, southeast, and Pacific northwest regions (Figure 1). Gaps in the geographic distribution of the nests are due to, (1) spatial variation in frequency of anthropogenic activity coinciding with bald eagle nests, (2) willingness of projects or individuals to apply for permits, (3) variability among the Service's regions in conditions imposed on permits, (4) the Service regions that did not submit data (e.g., Region 6 [Montana, Wyoming, Utah, Colorado, North Dakota, South Dakota, Nebraska, Kansas] and Region 7 [Alaska]), and/or (5) geographic range and local density of bald eagles in the U.S.

Overall mean (± SD) probability of failure of bald eagle nests listed in incidental take permits issued by the Service (2009–2021) across nest-seasons was 0.162 ± 0.567 (80^{th} quantile estimate 0.195; *n* = 103 nest-seasons) (Table 1; Figure 2). Estimated probabilities of bald eagle nest failure by permit characteristics are provided in Table 1 and their posterior density distribution plots are provided in Figure 2.

Bald eagle nests listed in incidental take permits that were monitored in years prior to authorized activity (*n* = 23 nest-seasons) had a mean failure probability of 0.250 (95% credible interval: 0.097–0.476), and in those same nests during authorized activity 0.250 (0.107–0.454; *n* = 19 nest-seasons) (Table 1). Bald eagle nests listed in incidental take permits that were monitored in years following authorized activity (*n* = 25 nest-seasons) had a mean failure probability of 0.064 (0.010–0.211), and in those same nests during authorized activity 0.085 (0.014–0.273; *n* = 19 nest-seasons) (Table 2). There were four bald eagle nests that were monitored both in years prior to and following authorized activity, and for those nests, mean probability of failure prior to activity was 0.303 (0.053–0.717; *n* = 6 nest-seasons), during activity 0.111 (0.005–0.523; *n* = 6), and following activity 0.492 (0–1; *n* = 9 nest-seasons) (Table 2). Note that the uncertainty was high in the estimates from nests that were monitored both prior to and following activity due to very small sample sizes. These comparisons of nest failure before, during, and after years of authorized activity suggest that, generally, there was no apparent impact of anthropogenic activity on bald eagle nest failure.

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Table 1. Estimated bald eagle nest failure probabilities for nests listed in bald eagle incidental take permits issued by the Service in the U.S. (2009–2021) by nest-seasons and permit characteristics.

Dataset	Nest Failure Probability					
	n	Mean	SD	95% CI	Median	Q80
Nest-seasons	103	0.162	0.567	0.100–0.242	0.0163	0.195
All permits*	68	0.172	0.580	0.096–0.275	0.173	0.214
Single-year	32	0.081	0.658	0.020–0.214	0.245	0.309
Multi-year	36	0.243	0.597	0.124–0.401	0.245	0.309

*For a permit, if there was ≥ 1 year where a nest was unsuccessful, that permit was coded as a nest failure.

Table 2. Estimated bald eagle nest failure probabilities for nests listed in bald eagle incidental take permits issued by the Service in the U.S. (2009–2021) that were monitored in years prior to (Pre-monitor) and/or following (Post-monitor) years of authorized activity (Permit Years). Probabilities across rows are estimated from the same permits.

	Nest Failure Probability								
	Pre-monitor Years			Permit Years			Post-monitor Years		
Dataset	n	Mean (95% CI)	SD	n	Mean (95% CI)	SD	n	Mean (95% CI)	SD
Pre-monitor	23	0.250 (0.097–0.476)	0.633	19	0.250 (0.1070.454)	0.621			
Post-monitor				19	0.085 (0.014–0.273)	0.698	25	0.064 (0.010–0.211)	0.696
Pre/Post-monitor	6	0.303 (0.053–0.717)	0.724	6	0.111 (0.005–0.523)	0.797	9	0.070 (0.003–0.370)	0.791

Figure 1. Map of bald eagle nests included in analyses (red dots) where anthropogenic activities were authorized during nesting season under permits issued by the Service (2009–2021). Note that although we included 68 permits in our dataset, only 66 nests are shown; one permit did not include geographic location of the nest and one nest was covered by two permits.