

# 9 | Monitoring and Evaluation



*Seabirds at Round Island, Bristol Bay, in southwest Alaska. A. Underwood, ADF&G.*

This chapter describes the existing efforts and proposed plans for monitoring “species of greatest conservation need” (SGCN) and their habitats, determining the effectiveness of conservation actions, and adapting these actions to respond appropriately to new information and changing conditions. The State Wildlife Action Plan (SWAP) is a strategic document that describes the Alaska Department of Fish and Game’s (ADF&G’s) overall strategy for conserving SGCN. It informs proposals that are later developed to monitor species and their habitats and implement conservation actions. Monitoring is designed to identify trends in wildlife populations (numbers, movements, reproductive success) and key habitats (condition and use) over time. This work occurs at different levels (population, species, species group, habitat) and may be designed to evaluate the impacts of threats, assess the effectiveness of programs or management actions, determine take thresholds, or collect ambient or baseline data.

The first part of this chapter describes current and ongoing SGCN monitoring efforts in Alaska and identifies needs for additional or improved monitoring in the future. Existing projects and datasets that ADF&G is aware of are listed in Appendix H. For convenience, these monitoring efforts are

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classified under the subheadings of Air and Climate, Land, Vegetation, Climate Change, Contaminants, Marine and Intertidal, Birds, Marine Mammals, Terrestrial Mammals, Invertebrates, Amphibians and Fish, Non-native and Problematic Species, Fire Ecology, Human Use, and Biodiversity.

The second part of this chapter provides an evaluation of ADF&G's progress toward meeting its conservation and management goals (see the "Priority Conservation and Management Actions" section in Chapter 10). This evaluation uses the following guidelines adapted from Stem et al. (2005):

- Is the work appropriate for the species and/or habitats with the greatest needs?
- Is the work being done in a cost-effective manner?
- Is the work successfully achieving goals?
- Is the monitoring plan flexible enough to respond to new information and changing conditions?

## Challenges in Alaska

Monitoring Alaska wildlife populations and their habitats presents unique challenges. Alaska's terrestrial and marine biogeographic regions are extensive, rugged, and inaccessible, which makes systematic or random sampling of large areas of the state costly and difficult. Many species, particularly invertebrates, are poorly studied, and insufficient information is available to assess their population status or trends. Appendix E lists estimated population sizes for a subset of SGCN based



*Augustine Volcano, located in Cook Inlet, about 175 miles from Anchorage. ADF&G.*

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on published estimates in the peer-reviewed literature, stock assessments for marine mammals, and estimates provided in partner organization databases and conservation plans. Statistically reliable population abundance, trend, and stock estimates for SGCN are currently available for aerial surveys for large waterbirds (Schmidt et al. 2009, Amundson et al. 2019), mark-recapture bird-banding studies (Wilson et al. 2007, Sedinger et al. 2019), mark-resight bird studies (Lyons et al. 2016), population modeling (Bentzen and Powell 2012, Wilson et al. 2012), ship-based and aerial surveys of seabirds (Arimitsu et al. 2023, Kuletz et al. 2024), stock assessments for marine mammals (Young et al. 2024), razor clam population assessments (Kerkvliet et al. 2021), salmon in-river abundance estimates (e.g., Decovich et al. 2024), rockfish stock assessments (ADF&G unpublished data), whitefish research (Gryska 2021, Albert and Tyers 2022), *Anadromous Waters Catalog* surveys (Giefer and Graziano 2024a–f), and aquatic invasive species distribution and early detection (Bradley et al. 2024, ADF&G 2025e).

Population index counts can also be used if it is assumed that trends in the index areas are representative of trends across the species' range during the assessed time periods. Examples of such index counts include Christmas Bird Counts (Audubon 2025), Breeding Bird Surveys (USGS 2025), Alaska Landbird Monitoring Surveys (ALMS; Handel and Sauer 2017), Program for Regional and International Shorebird Monitoring (PRISM) surveys, modified PRISM surveys (Bart and Johnston 2012, Martin et al. 2020), and beluga whale surveys in Cook Inlet (Goetz et al. 2023). There are biases inherent in some of these efforts (Sauer et al. 1994, Keller and Scallan 1999), but they are not so large as to overly influence estimated population trends.

Fish and wildlife monitoring is often time-consuming and costly. Counts from the air are often not feasible except for large animals using open habitats, and counts from the ground or aboard vessels are laborious and expensive. An unknown number and potentially high percentage of animals are missed, requiring some estimate of detection probability if absolute abundance is desired (Thompson 2002). In some cases, species misidentification and the allocation of survey effort spatially and temporally can yield unreliable trend estimates (Pollock et al. 2002, Hodges and Kirchhoff 2012). These limitations can be partially addressed through replication, specifically by conducting enough surveys over a long time period and a broad area (e.g., regional Breeding Bird Surveys) to identify meaningful trends that inform conservation and management actions.

Remote monitoring tools and techniques can also address some of the monitoring challenges in Alaska and have improved substantially in terms of reliability, accuracy, and availability in the last decade. Devices such as passive acoustic monitors, small-form time-lapse cameras, and video cameras allow continuous monitoring of a wide variety of species and environments. Additionally, observation networks such as the North American Bat Monitoring Program and eBird have developed advanced modeling tools and datasets that management agencies now use for tracking and evaluating the status of wildlife populations.

The availability of funding for wildlife research can also be challenging and vary depending on which species group is being studied. Available funding is not typically commensurate with the overall need. Some of the funding for research comes from sources that ADF&G directs, whereas other funding requires applying for competitive grants. For example, much of ADF&G's monitoring and evaluation work of terrestrial, nongame wildlife, and aquatic invasive species is supported by funding from the State Wildlife Grants (SWG) program, while marine mammal monitoring and invasive species management rely on competitive external grants from other agencies that guide the

direction of these efforts. These efforts include Cooperative Endangered Species Act Conservation Fund (Section 6) grants administered by the U.S. Fish and Wildlife Service (USFWS) and National Oceanic and Atmospheric Administration (NOAA), as well as other grants administered by the North Pacific Research Board, the Alaska Fish and Wildlife Fund, and the Alaska Sustainable Salmon Fund.

## Current Monitoring Efforts

Monitoring efforts in Alaska fall into two broad categories: environmental monitoring and wildlife monitoring. Environmental monitoring measures variables such as air and water temperature, ocean currents, salinity, carbon dioxide levels, ice extent, forest cover, and land use patterns. Measurement of these variables can predict habitat changes that may affect future fish and wildlife populations. Environmental data can often be collected remotely from satellites, buoys, or data loggers, providing large-scale, long-term, and often inexpensive monitoring. By contrast, wildlife monitoring is generally more resource-intensive and involves collecting data on the abundance, distribution, behavior, composition, health, and harvest of fish and wildlife populations. These data can be used to detect trends in fish and wildlife abundance over time, guiding conservation and management efforts.

Due to limited SWG funding, ADF&G prioritizes monitoring to fill data gaps and avoids duplication of work already being conducted by other agencies. Examples of SGCN monitoring projects conducted by ADF&G are listed in Table 1.1 in Chapter 1, and statewide monitoring efforts by other organizations are listed in Appendix H. ADF&G takes a lead or supporting role in monitoring efforts for SGCN depending on staff capacity and expertise, funding availability, and roles identified in interagency species working groups. The Marine Mammals Program utilizes external competitive federal funding to monitor SGCN under their purview across the state. Partnerships with other agencies increase effectiveness and efficiency in allocating funding toward specific monitoring objectives.



*North Pacific right whale. J. Durban, NOAA, used with permission.*

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Monitoring efforts vary depending on the objectives and the degree of statistical rigor required to meet these objectives. Many monitoring programs in Alaska are overseen by resource management agencies, with the monitoring work conducted by trained biologists and ecologists. These efforts tend to be extensively planned, with designs that consider statistical power to detect trends (Hatch 2003, Seavy and Reynolds 2007). Typically, these monitoring efforts are restricted to the lands and waters (e.g., parks and refuges) or species for which a particular agency has management responsibility.



*A Redpoll in late winter. D. Hejna, used with permission.*

For example, biologists in Denali National Park and Preserve have conducted systematic, repeated surveys of songbirds since the 1990s to determine trends in songbird abundance and distribution (Mizel et al. 2016); understand the effects of threats, such as recreational activities, on songbirds (Meeker et al. 2022); and evaluate the efficacy of survey and analysis techniques (Schmidt et al. 2013). Several decades-long raptor monitoring projects, including Golden Eagles in Denali National Park and Preserve (Schmidt et al. 2018), Peregrine Falcons in Yukon-Charley Rivers National Preserve (Ambrose et al. 2016), and cliff-nesting raptors in Nome conducted by ADF&G staff (Bente 2011), have yielded information about their population status and recovery. Surveys designed specifically for an SGCN can often consider unique aspects of its distribution, habitat, and behavior to produce trend estimates with adequate precision (Kissling et al. 2007, Kirchhoff 2011). Federal and state agencies can often ensure a long-term commitment to funding, staffing, and reporting this work, which is essential for effective monitoring.

Citizen science monitoring efforts typically have lower statistical rigor; however, many citizen science data products have yielded scientifically useful indices, such as relative abundance measurements and long-term trends, for various species. For example, eBird, managed by the Cornell Lab of Ornithology, allows bird watchers to enter bird sightings into an app that aggregates these data into an online, publicly available database. SWG grants originally funded Alaska's participation in the program in the 2000s. Since then, the dataset has become more robust, and sophisticated analysis tools have been developed (Cornell Lab of Ornithology 2024). Analyses of these data have provided insights into the distribution, habitat use, migration, and population trends of bird species found in Alaska (Scurr et al. 2023). Also, agencies in the contiguous United States have used eBird data to identify sites for wind energy development that minimize bird collision risk (Ruiz-Gutierrez et al. 2021). Similarly, sightings and photographs of whales by scientists and citizens have been aggregated into several databases managed by agencies and independent researchers (e.g., Happywhale, Whale Alert, Cook Inlet Beluga PhotoID Project). New algorithms have enabled researchers to match these and other photos more effectively to identify individual whales, their movements, and population trends (Calambokidis et al. 2017; Cheeseman et al. 2023, 2024).

Other citizen science wildlife monitoring projects in Alaska include the Alaska Bee Atlas (ACCS 2025), Christmas Bird Counts (National Audubon Society 2025), Gunsight Mountain HawkWatch (HawkWatch International 2025), bat monitoring (ADF&G 2025a), and the Coastal Observation and Seabird Survey Team (University of Washington 2024). ADF&G uses SWG funding to facilitate and support a community-based citizen science network in coastal communities statewide. This



*The Yukon River flows 1,980 miles from its headwaters in Canada through Alaska, ending in the Bering Sea. T. Christopherson, NPS, used with permission.*

network facilitates early detection and understanding of population shifts of marine invasive species, particularly European green crab, and their impact on nearshore ecosystems. Although the types of questions citizen science can address are limited, its key strength lies in the ability to collect large quantities of data across broad spatial and temporal scales at relatively low cost (Shively and Barboza 2017, McDuffie et al. 2019, Snively et al. 2021).

SWG funds have supported monitoring efforts around the state, including some projects described above and those that either fill survey gaps or are designed to improve survey methodology. Examples include recent work to understand Aleutian Tern population status and diet (Tengeres 2022), tracking of Lesser Yellowlegs (Christie et al. 2023), bat monitoring and research in Southeast Alaska (Rae et al. 2025), and research on collared pika ecology (ADF&G 2025b). Alaska has used SWG funding for Birds ‘n’ Bogs (formerly the Loon and Grebe Watch Program; ADF&G 2025c), a citizen science monitoring project focused on documenting the distribution and abundance of birds that breed in the boreal forest bogs in Southcentral Alaska. Such efforts engage the public, promote awareness and support for wildlife conservation, and provide data on distribution and habitat use.

## **Monitoring Plans for the Next 10 Years**

Over the next 10 years, ADF&G will continue to focus on gaining a better understanding of trends in fish and wildlife populations and their habitats, as well as impacts from invasive species, to help prioritize conservation and management actions. SWAP implementation can be challenging due to limited funding, so ADF&G considers many factors before deciding what species and objectives will receive SWG funding, such as conservation need, stewardship responsibility, and efficiency (see “Funding Decisions” section in Chapter 11). The ADF&G Marine Mammal Program maintains the list of SWAP priority actions for the next 10 years for marine mammal SGCN in Alaska (ADF&G 2025f). Additionally, monitoring some raptors and harvested species such as Alaska hare, salmon, rockfish, and razor clams will inform recommendations on take thresholds, permitting, and regulatory decisions. New and current development projects across the state may provide additional opportunities for ADF&G and its collaborators to partner with industry to monitor wildlife

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populations. Monitoring may provide insights for simple mitigation actions at development sites that will promote sustained yield of SGCN, especially as these species may face threats that are cumulative. Although insufficient SWG funds are available for ADF&G to be the sole or primary sponsor of monitoring all SGCN, the agency can provide technical, logistical, and financial support for a range of existing and future monitoring efforts. ADF&G's support of other agencies' monitoring projects may include providing funding, training, biostatistical support (including survey design and analysis), and participating in surveys. ADF&G will continue to lead monitoring efforts for SGCN within its available capacity and identify data gaps in ongoing wildlife and habitat monitoring efforts in Alaska. Our goal is to monitor the highest priority SGCN and habitats in the plan (Chapter 10).



*Lesser Yellowlegs. K. Christie, ADF&G.*

ADF&G will continue collaborating with organizations and working groups that study individual wildlife species and species groups. For example, organizations such as the Alaska Shorebird Group and Boreal Partners in Flight have identified the need to continue long-term population monitoring efforts (e.g., PRISM surveys) and to compare the efficacy of traditional surveys (e.g., ALMS) to that of remote sensing methods (e.g., Autonomous Recording Units) for monitoring breeding bird populations. Historical datasets from these surveys could be imported into eBird to facilitate and improve the precision and ability to forecast population and distribution trends. Improving these surveys and tools can assist resource managers in understanding and evaluating the impacts of threats to SGCN and the habitats on which they depend.



*Sabine's Gull adult and chick resting on the tundra. A. Bankert, used with permission.*

Given Alaska's geographic extent and relative inaccessibility for research, basic information on many species and species groups is needed. Poorly studied species include most small mammals, shorebirds in alpine and boreal ecosystems, and invertebrates, many of which may be endemic to Alaska. For example, Sikes and Allen (2016) reported that over 300 species of nonmarine arthropods are only known from Alaska. Many of these potential endemics are blind, wingless, and soil-dwelling, making them poor dispersers and potentially vulnerable to environmental change (Sikes and Allen

2016). More research on Alaska’s potential endemic species is warranted to confirm their taxonomy, distribution within the state, and whether their distribution extends outside it.

Data gaps are particularly notable for Alaska’s small mammal populations, including bats, since many species have unknown population trends and incomplete knowledge of range, distribution, or understanding of factors regulating population size (Droghini et al. 2022). Small mammals are not only important prey for many predatory SGCN, they also serve important ecosystem functions. For example, small mammals in the boreal forest, Alaska’s largest terrestrial habitat, distribute root-associated fungi critical to tree regeneration, providing a promising benefit to managed forests (e.g., Paragi et al. 2020). ADF&G led a workshop with the Alaska Small Mammal Group to determine priority conservation needs. A coordinated statewide network to monitor small mammal population dynamics is necessary to understand trends, factors limiting growth, and responses to environmental change. The network should develop steps that efficiently link data collection between field studies and museum collections. Other priorities for small mammal monitoring include genetic mark-recapture studies focused on estimating population sizes and a better understanding of diet.

As climate regimes continue to shift in Alaska, the need to assess the effects on wildlife has become more pronounced. Range shifts have already been documented in some species groups (Mizel et al. 2016, Tape et al. 2016, Baltensperger et al. 2024), and long-term monitoring of SGCN distribution and abundance will help prioritize species for conservation and management actions. This is especially important in the face of complex threats like climate change, which may affect SGCN unpredictably and in positive or negative ways.

## Habitat Monitoring

The conservation status of many species is linked to the amount and quality of suitable habitat. Recognizing this, ADF&G funded several projects to identify important habitats for wildlife conservation and management. Examples include Globally Important Areas for Marine Birds (Smith

### Species of Conservation Need: Insect Pollinators

Insect pollinators play a critical role in Alaska’s ecosystems by moving pollen between flowers, which facilitates plant reproduction. Many plant species that other wildlife and people rely on for food and habitat, such as willows, blueberries, and cloudberries, require insect pollinators to produce fruits and seeds. A wide diversity of insects, including bees, butterflies, moths, flies, and beetles, are pollinators, with flies being particularly important pollinators at higher latitudes. The conservation status of most species of insect pollinators is not well known, and aside from butterflies and bumble bees, the understanding of occurrence and distribution in Alaska is limited for most species.



Bee on valerian flower. A. Underwood, ADF&G.

et al. 2014), the Gap Analysis Program (Gotthardt et al. 2014), and the Anadromous Waters Catalog (ADF&G 2025d).

Alaska is fortunate to have large expanses of intact, functioning ecosystems, and habitat fragmentation is not a widespread issue for our wildlife. Because of this, there is an opportunity to implement landscape-level analyses to identify hotspots of occurrence, high-value habitats, and regions of importance for SGCN. State and federal agencies and NGOs have mapped high-use areas and important habitat types to inform decisions to improve compatibility between development and SGCN conservation. ADF&G also supports the Wildlife Habitat Enhancement and Spatial Analysis Program (WHESAP), which develops strategic approaches to enhance wildlife habitat across different land ownerships and vegetation types. WHESAP primarily focuses on providing forage and habitat for game species (e.g., moose, grouse, bison). Still, the program's activities include prescribed burns and projects related to forest health, which can also improve habitat and benefit nongame SGCN across the state. The Alaska Department of Natural Resources also considers important habitats and wildlife resources when creating land management plans across the state to provide for the "maximum public benefit" (DNR 2025).



*Black Oystercatcher. ADF&G.*

Climate change is expected to affect habitat availability for many SGCN by decreasing or increasing the amount of suitable habitat, depending on the species. For species projected to lose habitat, there is a need to identify future habitats and hotspots of occurrence that could serve as climate change refugia and contribute to resiliency of SGCN. This can be done by comparing current and projected future habitat values and identifying physical factors and ecosystem processes that influence current and future habitat suitability (Stralberg et al. 2020, Raiho et al. 2022). Many species, including SGCN, are already altering their distribution in response to climate change, and more research is needed to better understand these shifts. For example, recent work has documented range shifts for terrestrial mammals in Alaska using a combination of data collected by citizen scientists, agency biologists, and university researchers (Baltensperger et al. 2024).

Many migratory species face threats outside the state that impact their populations and, ultimately, their conservation status in Alaska (Chapter 7). Supporting appropriate management, conservation, and restoration activities across a species' entire life cycle, including breeding, migratory stopover, and wintering areas, is often key to maintaining healthy populations in our state. ADF&G can continue to build relationships with resource management personnel and conservation organizations in other states and countries, where politically feasible. For example, through the Pacific Flyway Council and in partnership with the Association of Fish and Wildlife Agencies' Southern Wings Program (Southern Wings 2025), ADF&G can address conservation concerns outside the state.



*Sandhill Cranes. J. Dau, ADF&G.*

## Defining Success

Evaluating the effectiveness of ADF&G's efforts to conserve SGCN requires a clear statement of purpose. The SWG program (Chapter 1) encourages a conservation paradigm of working towards managing species before they become imperiled and to ensure sustained yield. To be successful, ADF&G must be able to:

- Identify which species are most vulnerable or declining (Chapter 4).
- Identify which factors are responsible for their vulnerable status (Chapter 7).
- Identify and employ actions that will reduce that vulnerability (Chapter 8).

ADF&G has emphasized work on species not yet listed but at high conservation risk (small, declining, or threatened populations) as described in Chapter 4. We have conducted research and supported work by others to validate or refine population trend estimates in Alaska. This has included support for developing Alaska eBird, Alaska hare studies, eagle and other raptor research and monitoring, mapping hotspots of biodiversity and possible climate change refugia, and analysis of multidecadal bird banding data. Additionally, we have supported research and monitoring on McKay's Bunting (Richardson et al. 2024), Olive-sided Flycatcher (Hagelin et al. 2021), Lesser Yellowlegs, collared pika, Aleutian Tern, Chinook salmon, Pacific walrus, and other species. SWG funding has also supported monitoring or research on SGCN species scheduled for Endangered Species Act (ESA) status reviews, such as the Gray-headed Chickadee (Booms et al. 2020; Table 9.1). In addition, it is important to monitor populations after a successful conservation action in order to detect any slowing or reversal of the population decline.

ADF&G's participation and support have improved monitoring and conservation efforts and, in some cases, affected ESA listing decisions (Table 9.1). For example, the Alexander Archipelago wolf, a game

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*Table 9.1. List of at-risk species in Alaska reviewed by the U.S. Fish and Wildlife Service (USFWS) or National Marine Fisheries Service (NMFS)<sup>a</sup> for listing under the federal Endangered Species Act (ESA) during the current State Wildlife Action Plan (SWAP) planning period (2015–2025). The table also lists whether State Wildlife Grant (SWG) funds were spent and the ESA listing status at time of publication. Multiple years in parentheses indicate multiple ESA listing decisions over the 10-year SWAP period.*

Species	Date of most recent petition	Funded by SWG?	ESA Listing Decision (year[s])
Tufted Puffin	Feb 12, 2014	Yes	Not warranted (2020)
Yellow-cedar	Jun 24, 2014	Yes	Not warranted (2019)
Iliamna Lake seal	Feb 6, 2020 <sup>b</sup>	Yes	Not warranted (2016, 2021 <sup>c</sup> )
Suckley's bumblebee	Apr 23, 2020	Yes <sup>d</sup>	Alaska excluded from species range. Listing proposed for contiguous U.S. only (2025)
Alexander Archipelago wolf	Jul 15, 2020 <sup>e</sup>	Yes	Not warranted (2016, 2023)
Short-finned mako shark	Jan 25, 2021	Yes	Not warranted (2022)
Bull kelp	Sep 1, 2022	No	Not warranted (2023)
Pacific walrus	Service-initiated review <sup>f</sup>	Yes	Not warranted (2017)
		No	Under review
Sunflower sea star	Aug 18, 2021	Yes	Proposed as threatened (2023)
Northern bog lemming	Sep 29, 2014	Yes <sup>d</sup>	Under review
Western bumblebee	Sep 15, 2015	Yes	Under review
Large marble butterfly	Oct 3, 2023	Yes	Under review
Gulf of Alaska Chinook salmon	Jan 11, 2024	Yes	Under review
Alaska glacier buttercup	Feb 1, 2024	Yes	Under review
Wilson's Phalarope	Mar 28, 2024	Yes	Under review
Little brown bat	Service-initiated review <sup>g</sup>	Yes <sup>d</sup>	Under review
Hoary bat	Service-initiated review	Yes <sup>d</sup>	Scheduled for review in FY28
Gray-headed Chickadee	Service-initiated review	Yes <sup>d</sup>	Scheduled for review in FY28

<sup>a</sup> USFWS implements the ESA for terrestrial and freshwater species, as well as the Pacific walrus, northern sea otter, and polar bear. In contrast, NMFS implements the ESA for anadromous fish and other marine mammals.

<sup>b</sup> The Iliamna Lake seal was also petitioned for listing in 2012, but the listing was found to be "not warranted" in 2016.

<sup>c</sup> NMFS issued a "negative" 90-day finding on the 2020 petition to list the Iliamna Lake seal, indicating that listing is not warranted.

<sup>d</sup> SWG funds yielded monitoring data or other distribution and habitat use information.

<sup>e</sup> The Alexander Archipelago wolf was also petitioned for listing in 1996 and 2011. USFWS found that listing was not warranted for each petition.

<sup>f</sup> The Pacific walrus was petitioned for listing in 2008, with an initial finding of "listing warranted but precluded." A "not warranted" finding was issued in 2017, but in response to a court finding, USFWS initiated a new listing review, which is ongoing.

<sup>g</sup> The little brown bat was also petitioned for listing in 2010, with a finding of "listing not warranted."

species previously listed as SGCN due to several petitions for ESA listing, is not on the 2025 SGCN list due to the efforts of ADF&G staff to provide data showing that ESA listing was not warranted (Table 9.1). Additionally, ADF&G biologists worked with the University of Alaska Museum to confirm the status of Suckley’s cuckoo bumblebee, a species proposed for ESA listing in 2020. They determined that the species did not occur in Alaska. Those findings were weighed by the USFWS, resulting in the removal of Alaska from the species’ range in the proposed endangered species listing under the ESA (89 FR 102074). This example illustrates the cost-effectiveness of investing in conservation work, including filling data gaps, before a species gets listed.

During the current SWAP planning period (2015–2025), federal agencies received 14 petitions to list species as threatened or endangered under the ESA and initiated four other reviews themselves. Final decisions were issued for eight reviews; all eight were determined to be “not warranted,” and SWG funding contributed to seven of the eight not warranted outcomes (Table 9.1). The remaining proposal to list the sunflower sea star as threatened under the ESA has not yet been finalized. SWG funding specifically contributed to monitoring efforts or other research on distribution and habitat use for five species proposed for listing (Table 9.1). For example, research on little brown bat hibernation behavior demonstrated that bats in Alaska likely have a reduced threat of white-nose syndrome compared with bats in the continental United States due to their use of dispersed hibernacula, among other variables (Blejwas et al. 2021). ADF&G’s efforts contribute directly to better-informed decisions by the USFWS and NOAA fisheries.

### Species of Conservation Need: Alaska Hare (*Lepus othus*)



Alaska hare. C. Barger, ADF&G.

Alaska hares are one of the world’s largest species of lagomorphs and are endemic to western and southwestern Alaska’s maritime and tundra environments. Notably, Alaska hares are three times larger than snowshoe hares and differ remarkably in their ecology. Recent ADF&G research has shown that the home ranges of Alaska hares can be upwards of 7,000 acres, compared to 35 acres for snowshoe hares. Additionally, an adult Alaska hare can travel as far as 13 kilometers in one day through open tundra, dense willow and alder thickets, and high rocky outcroppings. Alaska hares hold cultural significance as a furbearer, known for their beautiful, solid white coat with black-tipped ears during the

long winters. For a brief period in the short summer months, they can be observed with dusky brown fur. These herbivores primarily feed at dusk and dawn on a variety of leafy and woody vegetation, as well as crowberry fruits. Alaska hares tend to be difficult to study due to their remote and challenging habitats, elusive nature, low densities, and large home ranges. Historical accounts from the 1970s suggested a greater abundance of Alaska hares, with groups ranging from 300 to 800 individuals; however, more recently, it is rare to find groups of hares larger than three or four individuals. ADF&G’s research and monitoring of Alaska hares has led to changes in both state and federal harvest regulations, reducing bag and season limits to help ensure sustained yield.

ADF&G also collaborates with federal and local partners to monitor listed ESA species. For instance, ringed and bearded seals are being monitored to understand productivity, movements, habitat use, and responses to a changing Arctic (Quakenbush 2020). Researchers from ADF&G and partner agencies have refined methods for locating polar bear dens using wildlife-detection dogs (Shideler 2013), collecting environmental DNA to track polar bear movements, and understanding prey availability for various species (Von Duyke et al. 2023). Fish abundance data are being analyzed to understand if there are potential ecological constraints on beluga whales in Cook Inlet (ADF&G unpublished data).

In addition to changing the course of regulatory action at the federal level, ADF&G's research on SGCN has also changed state policy. Research and monitoring of Alaska hares has led to changes in both state and federal harvest regulations, reducing bag and season limits to aid in the recovery of this now rare species (see Alaska hare vignette). Results of cliff-nesting raptor population monitoring conducted by ADF&G staff were used to inform Board of Game proposals to change falconry take thresholds and ensure take was within sustained yield limits.

ADF&G has also pursued projects on relatively abundant and secure species, such as bats, wood frogs, loons, and grebes. Although these species are not at risk of extinction, they often serve as useful indicators of ecosystem health and studying them allows for early detection of potential problems. Furthermore, these species provide a valuable opportunity to engage the public in conservation work through citizen science projects. In some cases, federal agencies have undertaken ESA listing reviews despite a species being relatively abundant (e.g., Chinook salmon and little brown bat), and such species can even become listed under the ESA (e.g., ringed and bearded seals). Data collected as part of ADF&G projects has been used to inform these reviews and avoid ESA listing (Table 9.1).

Finally, some projects have been funded due to a lack of data on a particular species of interest and an inability to assess its population status or trends using current information. Filling basic knowledge gaps is particularly relevant to fish and wildlife populations in Alaska, which are among the least studied populations in North America. Obtaining better information on abundance and habitat use is preliminary to establishing population monitoring programs and is critical to planning conservation and management actions. Research efforts motivated by the need to fill data gaps have focused on invertebrates, Golden Eagles, small mammals, bats, harbor porpoises, and potentially endemic species. Because data are lacking for most invertebrates, current efforts focus primarily on establishing presence or absence in Alaska, in addition to the species' range, rather than long-term population trends. For example, targeted surveys for species petitioned for listing under the ESA (e.g., western bumble bee) have provided valuable information. In the case of the western



*Sunflower sea star. J. Nichols, NOAA, used with permission.*

bumble bee, it was unknown if this declining species occurs in Alaska. Surveys thus far have found no evidence that it does.

The effectiveness of conservation actions often depends on identifying the life stage at which a species faces the greatest risks; this, in turn, depends on effective monitoring of a species during its entire life cycle. For example, SWG funds supported a project to remove invasive northern pike from Susitna River tributaries to ensure the survival of juvenile Chinook salmon (see the vignette, “Impact of an invasive species on SGCN: Northern Pike (*Esox lucius*),” in Chapter 8). Without invasive northern pike suppression efforts, Chinook salmon would likely be extirpated from the Alexander Creek drainage (Bradley et al. 2022). ADF&G has also conducted research on migratory species, including the Black Oystercatcher and Rusty Blackbird, two species of continental concern for which breeding populations in Alaska were productive and appeared stable (Greenberg and Droege 1999, Tessler et al. 2010). In such cases, it is unlikely that any conservation actions could be implemented on these species’ Alaska breeding grounds that would directly improve their conservation status. However, data from monitoring studies can be used to develop population models (e.g., integrated population models) to determine which portion of a species’ life cycle is most at risk, identify important habitats used during that life stage, and develop targeted conservation actions to reverse declines.



Alexander Creek. National Fish Habitat Partnership (identification number 10133), used with permission.

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Maritime tundra dominates the coastal areas of Western Alaska, and provides important breeding habitat for many waterfowl and shorebirds. A. Pokrzywinski, used with permission.

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