



**U.S. Fish and Wildlife Service
INTRA-SERVICE BIOLOGICAL OPINION**

For

**2016 Aleutian Shield Fern (*Polystichum aleuticum*) Field
Survey at Atka Island, Alaska**



To the
Anchorage Fish and Wildlife Field Office

Prepared by:
Fairbanks Fish and Wildlife Field Office
Anchorage, Alaska

July 25, 2016

Table of Contents

1. Introduction.....	1
2. Description of the Proposed Action.....	1
Project Overview	1
Minimization Measures	3
Action Area.....	3
5. Status of the Species	4
6. Environmental Baseline	6
7. Effects of the Action on Listed Species.....	7
8. Cumulative Effects.....	7
9. Conclusion	8
10. Incidental Take Statement.....	8
14. Reinitiation Notice	8
15. Literature Cited	10

List of Figures

Figure 1.1 Aleutian shield fern (<i>Polystichum aleuticum</i>), Adak Island, Alaska.....	5
--	---

1. INTRODUCTION

This document is the U.S. Fish and Wildlife Service's (Service) final Biological Opinion (BO) on the Anchorage Fish and Wildlife Field Office's (AFWFO) 2016 field research designed to search Atka Island for Aleutian shield fern (*Polystichum aleuticum*) populations and for the collection of materials for genetic analysis at both Atka and Adak islands. This BO describes effects of the proposed research on Aleutian shield fern pursuant to section 7 of the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. 1531 et seq.). Fieldwork associated with the proposed project is planned for the summer of 2016.

Section 7(a)(2) of the ESA states that Federal agencies must ensure that their activities are not likely to:

- Jeopardize the continued existence of any listed species, or
- Result in the destruction or adverse modification of designated critical habitat.

The Service has determined the proposed action *may affect, but is not likely to adversely affect* endangered Aleutian shield fern. Following review of the status and environmental baseline of listed Aleutian shield fern, and analysis of potential effects of the proposed action to this species, the Service has concluded the proposed action *is not likely to jeopardize* the continued existence of Aleutian shield fern.

If you have comments or concerns regarding this BO, please contact Bob Henszey, Planning and Consultation Branch Chief, Fairbanks Fish and Wildlife Field Office at (907) 456-0323.

2. DESCRIPTION OF THE PROPOSED ACTION

Project Overview

The primary objective of the Aleutian shield fern (*Polystichum aleuticum*) Recovery Plan (USFWS 1992) is to protect and maintain the existing population of Aleutian shield fern and its habitat on Mount Reed, Adak Island, Alaska. The Recovery Plan indicates that due to the rarity and restricted occurrence of Aleutian shield fern delisting in the foreseeable future is considered to be unlikely; therefore, no delisting criteria were identified. The discovery of significant new populations was identified as potential criteria for down-listing the species. At the time of the listing in 1988 and completion of the Recovery Plan in 1992, listing was based solely on morphological characteristics of the species. More recently, studies focused on genetic diversity have questioned the taxonomic placement of this species. It has been suggested that Aleutian shield fern may be conspecific with a common Asian variety, *P. lachenense*. In order to elucidate the genetic relationship between Aleutian shield fern and *P. lachenense*, a study was funded during 2015 to better assay genetic diversity within and among populations on Adak Island. Additionally, during 2016, a field survey is proposed at Atka Island, Alaska to search for populations of Aleutian shield fern. Locating populations of Aleutian shield fern on Atka Island would provide essential information that could inform future Recovery Plan efforts. If Aleutian shield fern is located on Atka Island, collection of plant materials would allow a more robust and

comprehensive genetic analyses that would help elucidate the taxonomic placement of this species and inform the 2017 five-year review process.

The primary objective of the proposed action is to conduct an intensive field survey for approximately three weeks during August 2016, in order to locate and sample Aleutian shield fern on Atka Island. Objectives of the Atka Island field survey are to: 1) locate the original population of Aleutian shield fern; 2) identify any new populations of Aleutian shield fern; and 3) collect samples that could be used to better assay and compare genetic diversity within fern populations from both Atka and Adak islands. If populations of Aleutian shield fern are not found on Atka Island, materials for genetic analyses will be collected from known populations on Adak Island. Specifically, the proposed 2016 activities include:

Field survey. Beginning in early August, a crew of three experienced botanists would establish a remote field camp at Egg Bay, Atka Island. The camp would consist of three small personal tents and would be established from around 5–26 August, 2016. Researchers would be transported to and from Atka Island via the Alaska Maritime National Wildlife Refuge research vessel, R/V Tiglax. An additional crew of four Fish and Wildlife Service employees would fly to Atka Island and stay in the village from approximately 5–15 August, 2016. Both field crews would hike the mountains south and southeast of the village and the remote camp site, respectively.

Survey efforts would be conducted in August and follow similar methodologies reported in Talbot et al. (1995) and Talbot and Talbot (2003). Due to the rarity of the species and the limited field time, survey efforts would be biased toward areas in which Aleutian shield fern is presumed more likely to be present. Field searches would focus specifically on areas that demonstrate microhabitat characteristics where: 1) Aleutian shield fern is found on Mount Reed, Adak Island (e.g., bases of steep rock outcrops on northeast facing slopes, with angles of approximately 60° to 90°, at elevations between 300 m and 600 m), that are; 2) within view of the village of Atka (based on notes documented from the original discovery in 1932), and; 3) in general locations predicted based on bioclimatic envelope modeling (Talbot et al. 1995, Talbot and Talbot 2003, Duarte et al. 2012).

Briefly, search pathways would be recorded via GPS (with datum), and locations of any populations found would be recorded and described following (and augmenting) those reported in Talbot et al. (1995). For any populations observed, aspect, slope, altitude, number of clumps and fronds per clump (for all accessible clumps), and associated plant community members (vascular only) would be recorded. Populations would be documented via photography.

Genetics analysis. Assess phylogenetic, phylogeographic, and population genetics characteristics of Atka Island Aleutian shield fern relative to the species currently known from Adak Island and from the conspecific *P. lachense*. Given the importance of polyploidy in speciation of the genus *Polystichum*, a subset of individual ferns would be sampled to assess ploidy levels, using flow cytometry and/or chromosome analyses. Flow cytometry can be performed on any leaf tissue stored in silica gel, as long as the analysis is completed fairly quickly. One pinna from each of any ferns located on Atka Island, up to 30 individual ferns would be collected.

Flow cytometry. An additional pinna from one to five different fern clumps located on Atka Island would also be collected in order to assess levels of ploidy in Aleutian shield fern, using flow cytometry. Flow cytometry analysis will be conducted by Dr. David Barrington at the University of Vermont. Additionally, one pinna from each of one to five different fern clumps in at least one of the four subpopulations on Adak Island would also be collected.

Chromosome analysis. Given the requirement to sample young fertile leaves when making meiotic preparations from ferns, the success of chromosome analysis in this case is less likely to yield success than is flow cytometry for assessing ploidy levels. This is because it is unlikely a 'young fertile' leaf would be located during August. However, in the case that a young fertile leaf is located, during the August 2016 field season, sori would be sampled from underneath the indusia in one to five fern fronds in individual ferns found on Atka Island, and/or individual ferns on Adak Island. This can be accomplished using the same pinna selected for the genetics and flow cytometry analyses.

Growing ferns from spores. Dr. Barrington has had success growing spores of different *Polystichum* species for both flow cytometry and cytological work. Thus, any black spores found on pinna sampled for genetic and/or flow cytometry analyses would be sent to Dr. Barrington for culturing Aleutian shield fern in the event the flow cytometry samples collected in the field fail.

Minimization Measures

The proposed work is not anticipated to have negative impacts on the species. Pinna from ferns have previously been collected from the populations on Adak Island for genetic analyses and greenhouse propagation. Subsequent trips to the populations on Adak Island failed to yield any evidence of detrimental impact on the species at the collection location that could be attributed to collection of a single pinna from an individual for genetic analyses (Talbot and Talbot, pers. comm.). If Aleutian shield fern is found on Atka Island, researchers would minimize activities near the location of identified plants in order to avoid unintentional trampling of individual plants.

Action Area

The action area includes all sampling locations associated with the proposed research on Atka Island (52.138N, -174.445W) and Adak Island (51.883N, -176.645W), within the central Aleutian Islands, Alaska. Atka Island is 65 miles long (105 km) and 2–20 miles (3–30 km) wide and Adak Island is 33.9 miles long (54.5 km) and 22 miles wide (35 km). Both islands are bounded by the Bering Sea to the north and the North Pacific Ocean to the south. Both islands are part of the Alaska Maritime National Wildlife Refuge.

5. STATUS OF THE SPECIES AND CRITICAL HABITAT

This section presents biological and ecological information relevant to the BO. Appropriate information on species' life history, habitat and distribution, and other factors necessary for their survival is included as background for subsequent sections.

Aleutian Shield Fern

The Aleutian shield fern is known from only two locations, Atka and Adak islands in the Aleutian Islands, Alaska, making it one of the rarest and most restricted plants in North America. The Atka Island population has not been relocated since its original discovery in 1932 (Christensen 1938), in spite of repeated attempts (e.g., Smith and Davidson 1988; Talbot 1995). In 1975, Aleutian shield fern were discovered at Adak Island (Smith 1985; USFWS 1992), and subsequently three additional populations have been found there (Talbot et al. 1995; Talbot and Talbot 2003). Aleutian shield fern was listed as an endangered species in 1988 primarily due to its rarity. No critical habitat has been designated for this species at the time of listing.

Description. Aleutian shield fern is “a small, tufted, solitary fern from a stout rhizome with many chestnut-brown old stipe bases. The fronds, present only during the growing season, grow to 15 centimeters (6 inches) long, are dark green to olive green in color, gradually tapering above and below the middle. The leaf blades (fronds) are divided into overlapping, ovate segments (pinnae), incised with short bristle tips. Straw-colored scales are sparingly to abundantly distributed along the main leaf axis and especially on the under surface of leaf segments. The spore masses are aggregated into 6–8 patches (sori) forming two rows on the under-surface of leaf segments” (USFWS 1992).

Taxonomy. Aleutian shield fern is a member of the family Dryopteridaceae. Lillinger (1987) suggested Aleutian shield fern may be an isolated population of *P. lachenense*.

Range. Currently all known populations occur on Mount Reed, Adak Island, although the species formerly was found on Atka Island and it may occur elsewhere in the Aleutians Islands.

Current Population Status. Four separate populations have been discovered on Mount Reed, Adak Island comprising at least 131 “clumps” (i.e., plants; Talbot and Talbot 2003).

Description of Current Habitat. All known populations of Aleutian shield fern are found between 338 m and 526 m elevation on southeast, northeast, or east-facing steep mountain slopes of Mount Reed, Adak Island (Talbot and Talbot 2003; Byrd and Williams 2007). The substrate is “exposed, weathered basaltic and pyroclastic rock outcrops with rooting substrate confined to fissures, crevices, and thinly mantled horizontal ledges” (USFWS 1992). Aleutian shield ferns are associated with dwarf willow-moss, dwarf willow-sedge-moss, and sedge-anemone-arnica-moss, and a list of associated mosses and liverworts has been published (Talbot et al. 1995). The occurrence of all known sub-populations of Aleutian shield fern on east-facing slopes suggests that these habitats offer protection from the west-southwest winds that predominate on Adak Island from June to November, the period of time during which habitat would likely be snow-free (Talbot and Talbot 2003).



Figure 1.1 Aleutian shield fern (*Polystichum aleuticum*), Adak Island, Alaska.

Aleutian Shield Fern Recovery Criteria

The Aleutian shield fern Recovery Plan (USFWS 1992) presents research and management priorities that are re-evaluated and adjusted periodically, with the objective of recovery so that protection under the ESA is no longer required. When Aleutian shield fern was listed as endangered in 1988, factors related to the rarity of this species were unknown, although potential threats were identified including trampling (by humans and introduced caribou; *Rangifer tarandus*), unauthorized collecting, and natural process (e.g., seismic events, slumping).

The stated objective of the Recovery Plan is to protect and maintain the existing known population of Aleutian shield fern, and its habitat on Mount Reed, Adak Island. At the time the Recovery Plan was developed, no precise recovery goals were set for reclassification status, largely due to the lack of known causes of rarity. However, the Recovery Plan did emphasize consideration of re-classification to threatened status if additional populations were discovered. The main elements of the Recovery Plan include: 1) monitor the extant population, 2) conduct

research on reproductive biology (including genetic analyses), and 3) survey for new populations.

In the 24 years since the Recovery Plan was completed, additional subpopulations have been located and habitat described on Adak Island, investigations into the reproductive biology and artificial propagation of Aleutian shield fern have been undertaken and genetic and morphological analyses have been initiated. At the time of listing, Aleutian shield fern was known only from the original collection made by Eyerdam in 1932 on Atka Island, and one population on Adak Island originally discovered in 1975 (Smith 1985), then rediscovered in 1987 (Smith 1987). The estimated population at the time of listing was seven plants, and upon completion of the Recovery Plan in 1992, the population was estimated to be 112 plants. Discoveries in 1993 and 1999 have increased the known number of individuals to 131 (Talbot and Talbot 2003). In spite of repeated attempts, the Atka Island population has not been relocated since its original discovery in 1932 (Smith and Davidson 1988; Talbot et al. 1995).

6. ENVIRONMENTAL BASELINE

The environmental baseline provides an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, their habitat, and ecosystem in the action area.

Habitat Characteristics of the Action Area

Aleutian shield fern is associated with three vegetation types: 1) dwarf willow-moss type occupying rocky, protected alcoves and cliff ledges under overhanging rock walls; 2) dwarf willow-sedge-moss type in moist but more exposed and better drained mid-to-upper portions of rock gullies; and 3) sedge-anemone-arnica-moss type of lower gully/cliff base areas. Nine major vegetation types have been identified for the northeast arm of Mount Reed, Adak Island (Tande 1989).

Existing Conditions in the Action Area

Known only from habitat at upper elevations on Adak Island, Aleutian shield fern is isolated from most human disturbances. Human disturbance to the known populations of Aleutian shield fern is greatly reduced by the remote location, restrictions on visitor access to Adak Island, and protective management by the Alaska Maritime National Wildlife Refuge. Introduced caribou may pose a threat to Aleutian shield fern via trampling or foraging (Spitler 2012). Additionally, Norway rat (*Rattus norvegicus*) has recently been identified as a potential concern to Aleutian shield fern populations on Adak Island (Spitler 2012).

Recovery

The Recovery Plan does not provide an explicit assessment of threats and how they will be eliminated or moderated by the recovery criteria or their associated actions, nor does the Recovery Plan provide quantifiable criteria by which to objectively measure the species' progress towards recovery. However, the Recovery Plan states: "Pending additional

information, down-listing could be considered only if significant new populations are discovered” (USFWS 1992).

7. EFFECTS OF THE ACTION ON LISTED SPECIES AND CRITICAL HABITAT

This section of the BO provides an analysis of the effects of the action on listed species and, where appropriate, critical habitat. Both direct effects (effects immediately attributable to the action) and indirect effects (effects that are caused by or will result from the proposed action and are later in time, but are still reasonably certain to occur) are considered. Interrelated and interdependent effects of the action are also discussed.

Beneficial Effects

Beneficial effects are those effects of an action that are wholly positive, without any adverse effects, on a listed species or designated critical habitat. There are no wholly beneficial effects to Aleutian shield fern that would result from the proposed project: however, the proposed project would provide useful information on potential extant populations at Atka Island, where the fern was original described in 1932. If the proposed field activities are successful in locating Aleutian shield fern on Atka Island, it would enable further implementation of the Recovery criteria.

Direct effects

Individual plants may be harmed physically during tissue collection; however, any potential plant injury is expected to be non-lethal. We do not anticipate injury or death to individual plants as a result of pinna collection. We do not expect the potential collection of up to one pinna from no more than 30 individual plants to cause a significant reduction in future population size.

There is the possibility of inadvertent trampling while searching and/or during collection of plant tissues. The likelihood of these effects occurring will be minimized by using expert botanists with field experience working on the Aleutian shield fern.

Indirect Effects

Indirect effects are caused by or result from the proposed action, are later in time and reasonably certain to occur because of the proposed action. No indirect effects are anticipated, but there is the potential for erosion of Aleutian shield fern habitat during search efforts. We do not expect any long-term impact to the habitat based on the short duration of activity during this field season.

Summary of Effects

We expect only a small number of individual plants to suffer non-lethal injury through the collection of pinna. We do not expect any lasting effect to the population nor to the plant's habitat. The primary purpose of the project is to advance recovery efforts for the species, so we anticipate an overall beneficial effect to result from the project.

8. CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this BO. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. When analyzing cumulative effects of a proposed action, it is important to define both the spatial (geographic), and temporal (time) boundaries. Within these boundaries, the types of actions that are reasonably foreseeable are considered.

Additional scientific research is not likely to occur in the action area. While there is the possibility future scientific research may occur in the action area that does not require consultation under the ESA, we have determined that such research is not reasonably certain to occur.

9. CONCLUSION

Regulations (51 CFR 19958) that implement section 7(a)(2) of the ESA define "jeopardize the continued existence of" as "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species."

In evaluating impacts of the proposed project to Aleutian shield fern, the Service determines that the proposed action is unlikely to adversely affect Aleutian shield fern through disturbance or collection of plant materials for genetic analyses. After reviewing the current status of the Aleutian shield fern, the environmental baseline for the action area, the effects of the proposed field study at Atka Island, it is the Service's biological opinion that *the project, as proposed, is not likely to jeopardize the continued existence of the Aleutian shield fern.*

10. INCIDENTAL TAKE STATEMENT

Sections 7(b)(4) and 7(o)(2) of the Act generally do not apply to listed plant species; however, limited protection of listed plants is provided at section 9(a)(2) to the extent that the Act prohibits the removal and reduction to possession of federally listed plants from areas under Federal jurisdiction, the malicious damage or destruction of such plants on areas under Federal

jurisdiction, and the destruction of listed plants on non-Federal areas in violation of State law or regulation or in the course of a violation of a State criminal trespass law.

13. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. No conservation recommendations have been developed for this project.

14. REINITIATION NOTICE

As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: 1) the amount or extent of incidental take is exceeded; 2) new information reveals effects of the action agency that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; 3) the agency action is subsequently modified in a manner that causes an effect to listed or critical habitat not considered in this opinion; or 4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation. AFWFO must also reinitiate consultation if it becomes evident that any activity that may impact directly or indirectly Aleutian shield fern resulting from the recovery permit may take place without separate consultation on that action. In addition if modifications are proposed for the activity then reinitiation will take place.

LITERATURE CITED

- Byrd G.V., Williams J.C. 2007. Management plan for Aleutian shield fern (*Polystichum aleuticum*): an endangered species. Homer, Alaska: U.S. Fish and Wildlife Service Report. Alaska Maritime National Wildlife Refuge. July 2007. Homer, Alaska.
- Christensen, C. 1938. *Polystichum aleuticum* C. Chr., a new North American species. American Fern Journal 28:111-112.
- Duarte, A., D.M. Wolcott, T.E. Chow, and M.A. Ricca. 2012. Identifying potential habitat for the endangered Aleutian shield fern using topographical characteristics. Journal of Fish and Wildlife Management 3:303–310.
- Lillinger, D.B. 1987. A field manual of the ferns and fern-allies of the United States and Canada. Second printing. Smithsonian Inst. Press, Wash. D.C.
- Smith, D.K. 1985. *Polystichum aleuticum* from Adak Island, a second locality for the species. American Fern Journal 75:72.
- Smith, D. 1987. *Polystichum aleuticum* C. Chr on Adak Island, Alaska: Status report for 1987. U.S. Fish and Wildl. Serv. Rep., Anchorage, Ak.
- Smith, D.K., and P.G. Davison. 1988. *Polystichum aleuticum* C. Chr. in Hultén. Site survey of Atka Island, Alaska, 1988. Unpublished field report, U.S. Fish and Wildlife Service, Fish and Wildlife Enhancement, Anchorage, Alaska.
- Spitler, L. 2012. Potential threats to Aleutian shield fern (*Polystichum aleuticum*) populations: summary of remote monitoring results on Adak Island, Alaska, 18 July 2011 - 9 August 2012. U.S. Fish and Wildlife Service Report, Alaska Maritime National Wildlife Refuge , April 2012. Homer, Alaska. 29 pp.
- Talbot, S.L. and S.S. Talbot. 2003. A new population of Aleutian shield fern (*Polystichum aleuticum* C. Christens.) on Adak Island, Alaska. American Fern Journal 92:288-293.
- Talbot, S.S., S.L. Talbot, and W.B. Schofield. 1995. Contribution toward an understanding of *Polystichum aleuticum* C. Chr. on Adak Island, Alaska. American Fern Journal 85:83-88.
- Tande, G.F. 1989. Aleutian shield-fern (*Polystichum aleuticum* C. Chr.). Field studies for 1989: establishment of permanent population monitoring plots and habitat characterization. Unpublished report, U.S. Fish and Wildlife Service, Office of Ecological Services, Anchorage, Alaska.
- [USFWS] U.S. Fish and Wildlife Service. 1992. Aleutian shield fern recovery plan. U.S. Fish and Wildlife Service, Anchorage, Alaska. 20pp.