

**MANAGEMENT PLAN FOR THE ALEUTIAN SHIELD FERN  
(*Polystichum aleuticum*) ON ADAK ISLAND, ALASKA**



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March 2007

Cite as: Byrd, G.V., and J.C. Williams. 2007. Management plan for Aleutian shield fern (*Polystichum aleuticum*): an endangered species. U.S. Fish and Wildlife Service Report. AMNWR 07/07. Homer AK.

The endangered Aleutian shield fern, *Polystichum aleuticum* is known from only two locations, Atka and Adak islands in the Aleutian Islands, Alaska (Lipkin 1985), making it one of the rarest and most restricted plants in North America. The Atka population has not been relocated since its original discovery in 1932 (Christensen 1938), in spite of repeated attempts (e.g., Smith and Davidson 1988). In 1975, Aleutian shield ferns were discovered at Adak (Smith 1985, Anderson 1992), and subsequently 3 additional populations have been found there (Talbot et al. 1995a, Talbot and Talbot 2002). Population, as used in this report, is defined as a clustering of individual plants within a discrete area. Following the listing of Aleutian shield fern in 1988, a recovery plan was completed (Anderson 1992). The recovery plan called for developing a management plan to: “expand on protective measures already in place through refuge regulations, such as the prohibition of unauthorized plant collecting on refuge lands ... restrictions on access, frequency and timing of population monitoring, and contingency actions to be taken if a catastrophic event occurs (e.g. landslide)” (Anderson 1992, p. 12). This document is the management plan for the Aleutian shield fern on lands managed by Alaska Maritime National Wildlife Refuge.

## Background

### 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” (Anderson 1992: p.1-2).

Taxonomy-- *Polystichum aleuticum* is a fern in the family Polypodiaceae. Lellinger (1987) suggested Aleutian shield fern may be an isolated population of *Polystichum lachenense*, but Talbot et al. (1995) indicate there is no quantitative evidence to support that claim. Further discussion on the taxonomic distinction of *P. aleuticum* is found below under the Research section.

Range—Currently all known populations occur on Mount Reed, Adak Island (Fig. 1), although the species formerly was found on Atka Island and it may occur elsewhere in the Aleutians. Numerous dedicated surveys have been conducted in apparently suitable habitat, but no new populations have been found (Table 1). In addition, S.S. Talbot has incidentally searched, without success, for shield ferns in habitat similar to Mt. Reed on 11 other Aleutian islands while conducting botanical surveys (Talbot and Talbot 2002; Adugak, Aiktak, Amlia, Buldir, Chagulak, Davidof, Kasatochi, Khvostof, Kiska, Nizki, and Uliaga islands).

Current Population Status--Four populations, comprising at least 142 “clumps” (i.e. plants) on Mount Reed comprise the currently known extent of the species’ range (Table 2, Fig. 2)

Description of Current Habitat--All populations of shield ferns are found between 360 m and 526 m elevation on southeast or east-facing steep mountain slopes of Mt. Reed, within about 400 m of each other (Figs. 2 and 3). The substrate is “exposed, weathered basaltic and pyroclastic rock outcrops with rooting substrate confined to fissures, crevices, and thinly mantled horizontal ledges” (Anderson 1992: p. 6). Shield ferns are associated with dwarf willow-moss, dwarf willow-sedge-moss, and sedge-anemone-arnica-moss, community; a list of associated mosses and liverworts has been published (Talbot et al. 1995).

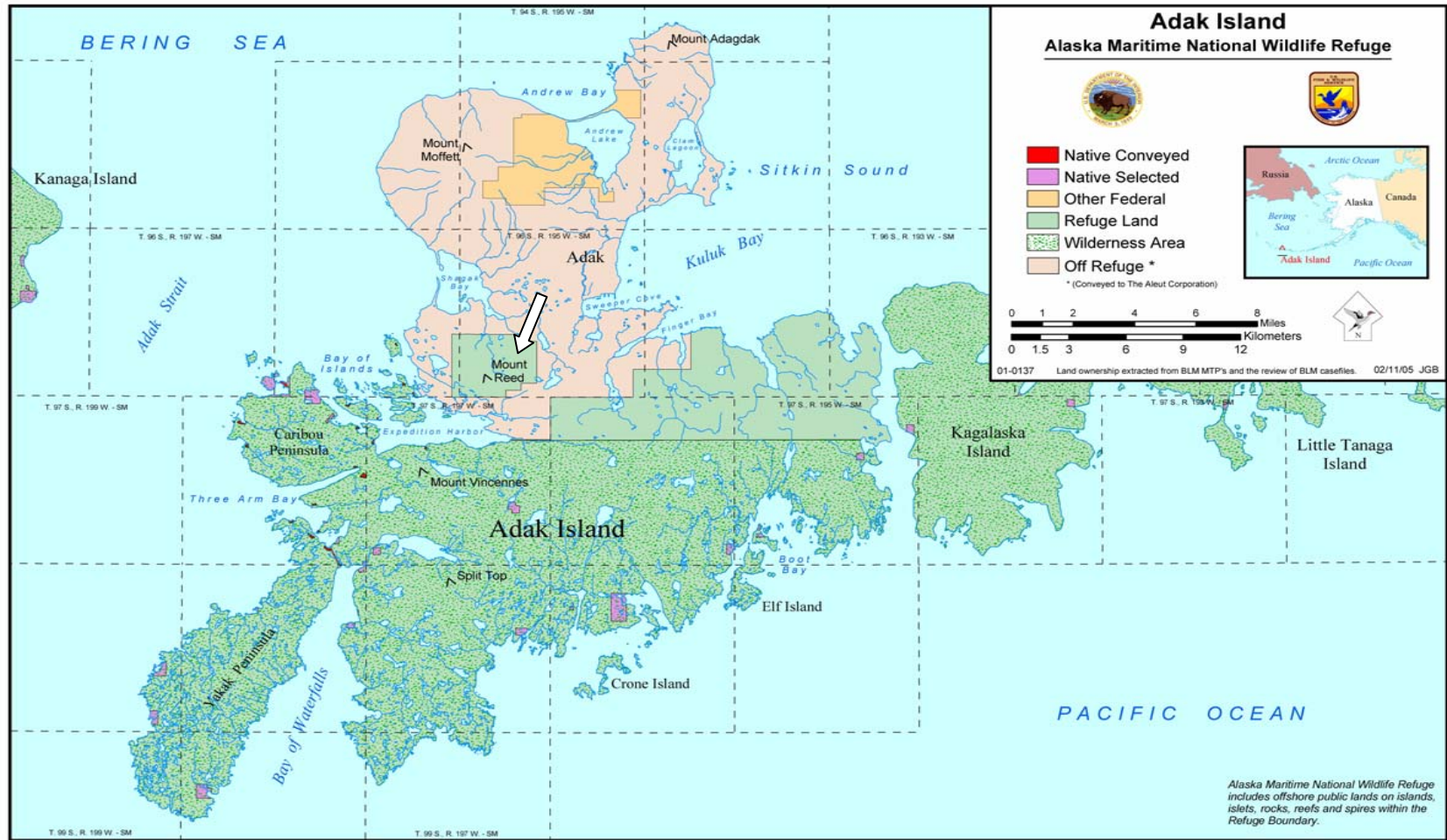


Figure 1. Map of Adak Islands showing Mount Reed where Aleutian shield ferns occur (arrow). Note the green refuge land status surrounding Mt. Reed.

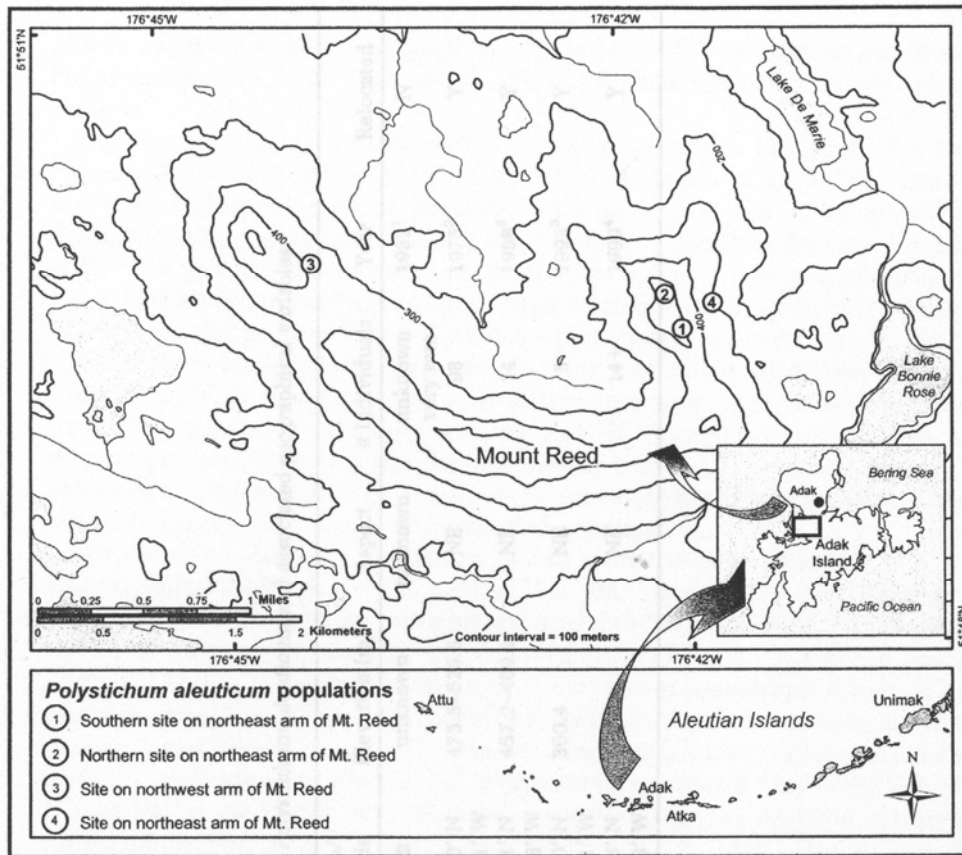


Figure 2. Location of the four known populations of the Aleutian shield fern on Mt. Reed, Adak Island (from Talbot and Talbot 2002).



Figure 3. The Aleutian shield fern is currently found only on Mt. Reed, Adak Island. View looking south from above Lake DeMarie.

Table 1. Field surveys conducted for Aleutian shield ferns.

Year	Location	Investigator	Results	Reference
1932	Atka	W. Eyerdam	Discovered species	Christensen 1938
1975	Adak	D. Smith	Discovered at Adak	Smith 1985
1977	Adak	M. Williams	Did not find any ferns	M.P.Williams in litt.
1983	Atka	B. Friedman	Did not find any ferns	Friedman 1984
1984	Adak, Atka	R. Lipkin	Did not find any ferns	Lipkin 1985
1985	Adak, Kiska, Rat	S.S. Talbot	Did not find any ferns	Talbot 1986
1987	Adak	D. Smith	Re-discovered his 1975 population	Smith 1987
1988	Adak, Attu	S. Talbot	Discovered 2 <sup>nd</sup> Adak population, nothing at Attu	S.S. Talbot unpubl.
1988	Adak, Kagalaska, Unalaska	R. Lipkin, K. Kincheloe	Mapped Adak populations, did not find elsewhere	Lipkin and Kincheloe 1988
1988	Adak, Atka	D. Smith, P. Davison	Did not find at Atka, no new population at Adak	Smith and Davison 1988a,b
1989	Adak	G. Tande	Set up monitoring of Adak population	Tande 1989
1990	Adak, Atka	D. Smith P. Davison	Did not find at Atka, no new population at Adak	Smith and Davison 1990
1991	Adak	R. Lipkin	Monitor Adak population, no new population	Lipkin, unpubl.
1993	Adak	S.S. and S.L. Talbot	Found 3 <sup>rd</sup> population on Mt. Reed	Talbot and Talbot 1995
1994	Adak	SS and S.L. Talbot	Did not find new population	Talbot et al. 1995b
1999	Adak	S.S. and S.L. Talbot	Found 4 <sup>th</sup> population on Mt. Reed	Talbot and Talbot 2002

Table 2. Description of known populations of Aleutian shield ferns, all on Mt. Reed, Adak Island, Alaska (see Talbot and Talbot 2002).

Discovery Date	Location	Number of Plants	Elevation (m)	Latitude/ Longitude	Source
1975	NE Arm	98	475-526	51°49.640'N 176°41.861'W	Talbot et al. 1995a
1975	NE Arm	14	457-469	51°49.491'N 176°41.776'W	Talbot et al. 1995a
1993	NW Arm	5	360	51°49.960'N 176°44.141'W	Talbot et al. 1995a
1999	NE Arm	14+	338	51°49.378'N 176°41.733'W	S.S. Talbot unpubl.

Threats and Limiting Factors— The reasons for the rarity of Aleutian shield fern are not understood and are probably associated with natural processes. Factors limiting the growth of the existing populations are not known. Direct threats to the populations on Adak and to any remaining populations on Atka potentially include:

- introduced ungulates (caribou [Adak] and reindeer [Atka])
  - trampling
  - grazing
- human foot traffic.

A major indirect threat to shield ferns is the slumping of growing substrate from steep rock faces causing the loss of ferns. Many of the shield ferns on Mt. Reed are located on small soil mats only a few inches thick which rest directly on smooth rock faces. Slumping is most likely to be caused by:

- earthquakes
- introduced ungulates
- human foot traffic

The Aleutian Islands are a seismically active region. It is likely that a future earthquake could cause shield fern soil mats to slump off rock faces and destroy a significant portion of the population.

At Adak, caribou are regularly seen on the lower slopes of Mt. Reed. To date, no obvious sign of grazing or trampling has been noted in the immediate vicinity of the known shield fern locations. However the caribou population is rapidly expanding. Williams and Tutiakof (2005) found that the caribou population had increased to 2,751 animals – at least 3 times the number of the previous survey in 1998. As rangeland quality diminishes from too many animals, caribou are bound to seek out locations not previously grazed in their search for lichens and mosses. This could lead caribou to eat, trample, or cause slumping of shield fern habitat. Williams and Tutiakof (2005) observed many caribou distributed around Adak in locations very similar to the steep slopes of the known Aleutian shield fern populations. Habitat destruction and trailing by caribou is now widespread and common on Adak.

Previous and Ongoing Research Activities--Surveys for shield ferns have been conducted not only at Adak and Atka, but also at other islands in the Aleutians in promising areas with characteristics similar to occupied habitat on Mt. Reed, Adak (Table 2). A summary of all collections of the species is shown in Table 3. Besides looking for new populations of ferns, research at Adak has focused on establishing a monitoring program for known populations and collecting material for greenhouse propagation studies and genetics research.

The monitoring program was initiated in 1989 (Tande 1989) and was conducted periodically until a decision was made to stop monitoring by using counting frames (see Tande 1989) because there was a potential for damaging ferns or the microhabitat where the ferns grow (V. Moran, S.S. Talbot, in litt.).

Fronds with ripe sori were collected from clumps of shield ferns on several occasions to supply material for greenhouse propagation studies and for genetic work (Table 3). From 1991-1994, a study of the growth and reproductive biology of Aleutian shield ferns was conducted at the University of Alaska, Fairbanks. Attempts to propagate shield ferns in a greenhouse resulted in production of sporophytes, but it became apparent that Aleutian shield fern sporophytes were very slow-growing. These propagated sporophytes never produced spores, and after two years the majority of the original population died (Halloway 1994).

Additional greenhouse work was conducted in 1995 at Kew Gardens, England, and at the New York Botanical Society (NYBG). Kew Gardens sowed spores using established techniques for fern spore germination, but the spores never germinated and were discarded in 1998

(Margaret Ramsey, pers. comm.). John Mickel, curator emeritus of ferns at the NYBG ([jmickel@nybg.org](mailto:jmickel@nybg.org)), recalled that the spores sent to him did not germinate or were not viable.

Limited genetics work was conducted at the University of Alaska and at Washington State University but insufficient samples of *Polystichum lachenense* were available to make conclusive statements about whether *P. aleuticum* is distinct (Halloway 1994, Pam Soltis, WSU, unpubl.). More recently, S.L. Talbot, J. R. Rearick, and S.S. Talbot have evaluated additional samples of *Polystichum lachenense* and *P. aleuticum*, and have tentatively concluded that these two species “share an extremely close evolutionary relationship, consistent with a conspecific or sister-species relationship”. In contrast,, D. Britton of the University of Guelph “suggests the differences in spore morphology between the taxa are substantial, consistent with differences observed among other species.” (Talbot et al. 2003). More work is continuing on morphology and genetics of the two species (S.L. Talbot, pers. comm.), but whatever the outcome, Aleutian shield fern is obviously an isolated population that will continue to need special protection.

Table 3. Collections of Aleutian shield ferns at Adak.

Date	Number of Fronds	Collector	Destination
August 1989	10	Wagner	Univ. of Alaska Fairbanks
September 1991	11	Williams	Univ. of Alaska Fairbanks
September 1995	10	Williams	NY Bot. Garden, WSU, KEW gardens
September 1996	6	Williams, Rappaport	USFWS Anchorage

**Research Needs**—DNA analysis of Aleutian shield ferns and *P. lachenense* could be used to evaluate taxonomy and determine whether *P. aleuticum* is a unique species. A new population monitoring method is needed that will pose no risk to the ferns or their habitat. Additional surveys for new populations should be conducted.

**Management Needs**—Effective ways to restrict human access to the fern areas are needed. Access restrictions, permits, fencing and education are all possible management tools which could be used. Historically, when caribou numbers were relatively low it seemed unlikely that introduced caribou would directly trample ferns because of the steep terrain where the ferns are found. With the current large number of caribou on Adak, the possibility of trampling, eating, or fern habitat destruction is much more likely. Periodic surveys are needed to see if caribou are using the general vicinity of the north side of Mt. Reed. If caribou frequently use the area, fencing might be an option. Effective fencing methods for steep slopes would need to be devised and regular maintenance of the fence would be required in such a harsh location. Any fencing method devised would have to encompass enough area so that that it does not change the microhabitat for the ferns. Fencing out caribou would also have the side effect of letting humans know exactly where the Aleutian shield fern grows.

### **Proposed Refuge Management Actions/Policies**

**Protective Measures and Other Management Actions**— In the late 1990’s and early 2000’s during land exchange negotiations with the Aleut Corporation the Alaska Maritime National Wildlife Refuge successfully lobbied to retain ownership of the entirety of Mt. Reed on Adak. This action simplified institution of protection measures since all known Aleutian shield ferns are still located on refuge lands (Fig. 1).



The U.S. Fish and Wildlife Service will undertake the following management and outreach actions:

- (1) Annual visits to known population sites on Adak will be made by refuge personnel or other authorized botanists to simply photograph the sites and note any changes to the known sites. Because of the potential for habitat disturbance and probability of land slides caused by humans, the monitoring plan developed by Tande (1989) will no longer be used. Refuge personnel will be careful to remain outside the fern locations to avoid damage to sensitive areas. No counts of ferns will be made unless habitat changes (e.g. land slides, caribou tracks in the area, signs of human disturbance) are noted. In such cases, consultations with the Regional Botanist will determine the best approach to document damage and determine course of action.
- (2) Fencing a portion of the known Aleutian shield fern populations should be considered and implemented, if necessary, to serve as an enclosure to the increasing caribou population. In consultation with the Regional Botanist, the fence should be located at a distance that it does not affect the microhabitat around known shield fern locations (e.g. snow retention/ collection) or give indication as to the location of the populations.
- (3) General locations of the shield ferns will be closed to public access. Signs will designate closure areas and public notices will be distributed to Adak residents and visitors as appropriate.
- (4) The refuge will inform the public of the status of the Aleutian shield fern and reasons for limiting entrance to sensitive areas by caribou and humans. Because of the extremely limited distribution of the Aleutian shield fern, exact locations of the existing populations will be confidential. Signs and fences will be located as to exclude use of the area yet not pinpoint actual sites.
- (5) Surveys for new populations of ferns by refuge staff and others will continue opportunistically on Adak and on other refuge islands. If new populations are discovered on the refuge, similar access restrictions similar to Mt. Reed will be implemented.
- (6) The refuge will work with the Alaska Department of Fish and Game to develop a cooperative caribou management plan for Adak to minimize the potential effects of caribou on shield ferns.
- (7) The refuge will assist Ecological Services to locate experts in fern culture and provide material for groups equipped to propagate ferns to try to raise shield ferns to preserve the gene pool.

### **Status Assessment**

Consultation between the refuge and the Endangered Species office will occur any time the status of the shield fern populations changes or new threats are discovered. Status will be reviewed every five years by the Endangered Species office.

This management plan should be adopted as a step-down plan under the Refuge's Comprehensive Conservation Plan.

## Costs

Annual Costs: Annual caribou surveys in the fern areas on Mt. Reed, Adak, report writing, and periodic meetings for consultation requiring travel likely will cost approximately \$ 3,000/year.

Periodic Costs: Costs for searches for other populations of fern will vary depending on location and transportation needs. Additional searches at places like Unalaska, Atka, or Adak where commercial transportation is available and where housing could be obtained, would have different costs than work on remote islands where researchers have to fly to Dutch Harbor or Adak and then be transported by boat to study sites where camps would need to be maintained. For example a two-week field study at Unalaska could cost \$5,000 plus salary expenses for an Anchorage-based crew.

Proposals would have to be solicited for greenhouse studies to try to produce viable shield ferns. It is possible, that institutions might fund the work themselves if the Service provided necessary fern material from Adak. In that case the costs would be for the collections (possibly as little as \$1,000)

Costs for management actions like fencing or response to earth slides would have to be estimated based on very specific proposals in response to needs.

## Literature Cited

- Anderson, B.L. 1992. Aleutian shield fern (*Polystichum aleuticum* C. Chr. In Hulten) recovery plan. U.S. Fish and Wildl. Serv., Anchorage, AK.
- Christensen, C. 1938. *Polystichum aleuticum* C. Chr., a new North American species. Am. Fern J. 28:111-112.
- Friedman, B. F. 1984. Pages 3.4-3.28 In Feasibility study data collection program for the proposed hydroelectric project at Atka, Alaska. Northern Technical Services, Inc. and Van Gulik and Assoc. Inc. Final Rep. for Alaska Power Authority.
- Holloway, P.S. 1994. Reproductive biology of the Aleutian shield-fern, *Polystichum aleuticum*. Unpubl. progress report, Agricultural and Forestry Experiment Station, Univ. of Alaska, Fairbanks.
- Lellinger, 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.
- Lipkin, R. 1985. Status report on *Polystichum aleuticum* C. Chr. U.S. Fish and Wildl. Serv. Rep., Anchorage, AK.
- Lipkin, R., K. Kincheloe. 1988. 1988 *Polystichum aleuticum* field report: Unalaska, Adak, Kagalaska. U.S. Fish and Wildl. Serv. Rep., Anchorage, AK.
- Smith D. 1985. *Polystichum aleuticum* from Adak Island, Alaska, a second locality for the species. Am. Fern J. 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. 1988a. *Polystichum aleuticum* C. Chr. In Hulten. Site survey of Atka Island, Alaska 1988. U.S. Fish and Wildl. Serv. Rep. Anchorage, AK.

- Smith, D.K. and P.G. Davison. 1988b. *Polystichum aleuticum* C. Chr. In Hulten. Site survey of Adak Island, Alaska 1988. U.S. Fish and Wildl. Serv. Rep. Anchorage, AK.
- Smith, D.K. and P.G. Davison. 1990. Botanical field work in the Aleutian Islands, Summer 1990, Adak Island, Alaska. U.S. Fish and Wildl. Serv. Rep., Anchorage, AK.
- Talbot, S.S. 1986. A search for *Polystichum aleuticum* (Polypodiaceae) on Adak Island, Alaska: Status report supplement. U.S. Fish and Wildl. Serv. Rep., Anchorage, AK.
- Talbot, S.L., J. R. Rearick, and S.S. Talbot. 2003. Preliminary results of molecular investigations of *Polystichum aleuticum* C. Christen, and *Polystichum lachenense*(Hook.) Bedd. Unpubl. Rep. Alaska Science Center, U.S. Geol. Surv., Anchorage, AK.
- Talbot, S.S. and S.L. Talbot. 1995. Field surveys for the Aleutian shield-fern (*Polystichum aleuticum* C. Chr.) on Adak Island, Aleutian Islands, Alaska—1993. U.S. Fish and Wildl. Serv. Rep., Anchorage, AK.
- Talbot, S.S. and S.L. Talbot. 2002. A new population of Aleutian shield fern (*Polystichum aleuticum* C. Christens.) on Adak Island, Alaska. Am. Fern J. 92:288-293.
- Talbot, S.S., S.L. Talbot, and W.B. Schofield. 1995a. Contribution toward an understanding of *Polystichum aleuticum* C. Chr. on Adak Island, Alaska. American Fern Journal 85: 83-88.
- Talbot, S.S., S.L. Talbot, and W.B. Schofield. 1995b. Aleutian shield fern (*Polystichum aleuticum*) Field studies for 1994: search for additional populations. U.S. Fish and Wildl. Serv. Rep. Anchorage, AK.
- Tande, G.F. 1989. Aleutian shield-fern (*Polystichum aleuticum* C. Chr.) field studies for 1989: Establishment of permanent populations monitoring plots and habitat characterization. U.S. Fish and Wildl. Serv. Rep. Anchorage, AK.
- Williams, J.C., and V. Tutiakof, Jr. 2005. Aerial survey of barren-ground caribou at Adak Island, Alaska in 2005. U.S. Fish and Wildlife Service Report. AMNWR 05/14. Homer, AK.