THE STATUS OF THE YUKON ASTER (*ASTER YUKONENSIS*) AND RECOMMENDATIONS FOR MANAGEMENT IN GATES OF THE ARCTIC NATIONAL PARK AND PRESERVE

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INTRODUCTION

The Yukon aster (*Aster yukonensis* Chronq.), one of 15 plant species in Alaska identified by the U. S. Fish and Wildlife Service (USFWS) as a "Species of Concern," has been discovered in Gates of the Arctic National Park and Preserve (GAAR) in the central Brooks Range. A Species of Concern may or may not be threatened or endangered with extinction: information regarding its abundance and distribution is lacking (Endangered Species Act 1973). Due to the unknown status of this category of species, a Memorandum of Understanding between USFWS and the National Park Service (NPS) commits the agency to address the conservation needs of these species before they reach the point where listing may be necessary (Endangered Species Act 1973). From 1994 through 1997, the NPS at GAAR sponsored 4 field surveys to locate and document populations of *A. yukonensis* within the park.

The discovery in 1993 of an *A. yukonensis* population along the Middle Fork Koyukuk River several miles from the only documented population of Yukon asters in Alaska (Hulten 1968; Murray and Lipkin 1987) initiated the rare plant surveys in GAAR that followed. Other locations where *A. yukonensis* was known to occur at that time was at Kluane Lake in Yukon, Canada (Hulten 1968; Murray and Lipkin 1987; Harris 1992) and remote sites in the Mackenzie Mountains and middle Mackenzie valley of Northwest Territories (Porsild and Cody 1980). New populations of Yukon asters were documented along parts of the Middle Fork Koyukuk, North Fork Koyukuk and Hunt Fork John rivers in GAAR. Concurrent botanical studies in the Great Kobuk Sand Dunes in Kobuk National Park (KOBU) (Hunt, pers. com.) and along the North Fork of the Squirrel River west of KOBU (Meyers, pers. com.) also discovered populations of *A. yukonensis*. These surveys have greatly increased the known range and distribution of the Yukon aster in Alaska (Fig. 1).

This report describes the population status of *A. yukonensis* in GAAR, discusses possible factors which may contribute to its distribution, propagation and vulnerability, and recommends actions for management regarding the conservation of this species.

Several people contributed to the expansion of the Yukon aster's range in GAAR. Susan Holly made the first discovery of *A. yukonensis* near the park in 1993. Survey teams from 1994 to 1997 included Ann Corson, Carol De Voe, Liz Evenson, Mike Haubert, Susan Holly, Laurene

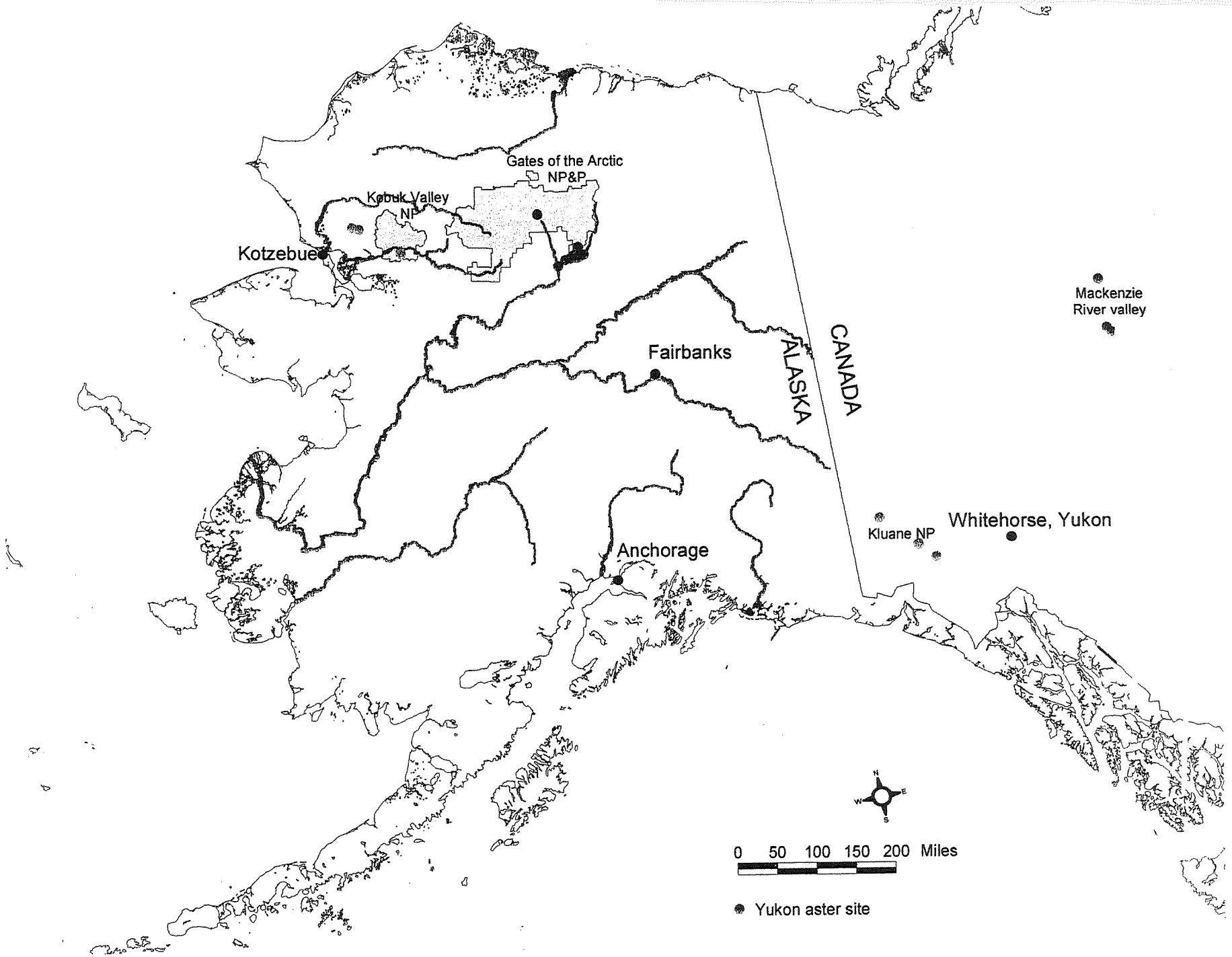

Fig. 1. Known locations of the Yukon aster (*Aster yukonensis*) in Alaska and Canada (Yukon and Northwest Territories). Locations in the Mackenzie valley, NWT, are approximate.

Kovalinki, Sherie Maddox, Timmy Maddox, and Sheri Yatlan. Carolyn Parker, of the University of Alaska Fairbanks Museum, verified that our collected specimens were, indeed, *Aster yukonensis.* I'm also grateful to Diane Hunt of NPS at KOBU and Randy Meyers of the Bureau of Land Management in Kotzebue for sharing information from their surveys on the Great Kobuk Sand Dunes and along the North Fork of the Squirrel River, respectively. The helpful criticism by Shelli Swanson and Carol M^{c}Intyre during the preparations of this and previous reports on *A. yukonensis* is also greatly appreciated.

STUDY AREA

Gates of the Arctic National Park and Preserve lies north of the Arctic Circle (66° 33' N latitude) in the central Brooks Range, Alaska (Fig. 2). Two climatic zones occur in the park and preserve: the subarctic zone at lower elevations south of the continental divide and the arctic zone to the north and at high elevations. Precipitation is low within the park and preserve and yearly averages fall between 30 - 45 cm in the west and 13 - 25 cm in the north (National Park Service 1986). Snowfall averages south of the divide range between 152 - 203 cm and averages of 89 - 127 cm are typical in the north. Yearly temperatures in the south fluctuate from an average July maximum of 21° C (70° F) to an average January minimum of -34° C (-30° F). Temperatures in the north fluctuate from an average July maximum of 18° C (65° F) to an average February minimum of -23° C (-10° F).

Boreal forest, tundra, and shrub thicket are the major vegetation communities in the park and preserve (National Park Service 1986). Boreal forest covers the southern flanks and valleys of the Brooks Range and is composed of black spruce (*Picea mariana*), white spruce (*P. glauca*), paper birch (*Betula papyrifera*), quaking aspen (*Populus tremuloides*), and balsam poplar (*Populus balsamifera*). Willow (*Salix* spp.)/alder (*Alnus* spp.) thickets up to 3.5 m in height occur along stream channels and gravel bars.

A. yukonensis surveys were conducted south of the divide along major river corridors in the boreal forest zone (although some surveys began above timberline). River bars in this region tend to be dominated by the same species, including: *Salix alaxensis, Populus balsamifera, Alnus crispa, Artemisia tellesii, Aster sibiricus, Hedysarum alpinum, Parnassia palustris, Castilleja caudata, Equisetum* spp., *Eriophorum* spp., *Carex* spp. and *Agropyron boreale.* The rivers surveyed include portions of the Middle Fork of the Koyukuk, North Fork of the Koyukuk, Hunt Fork of the John, and the Alatna (Fig. 3).

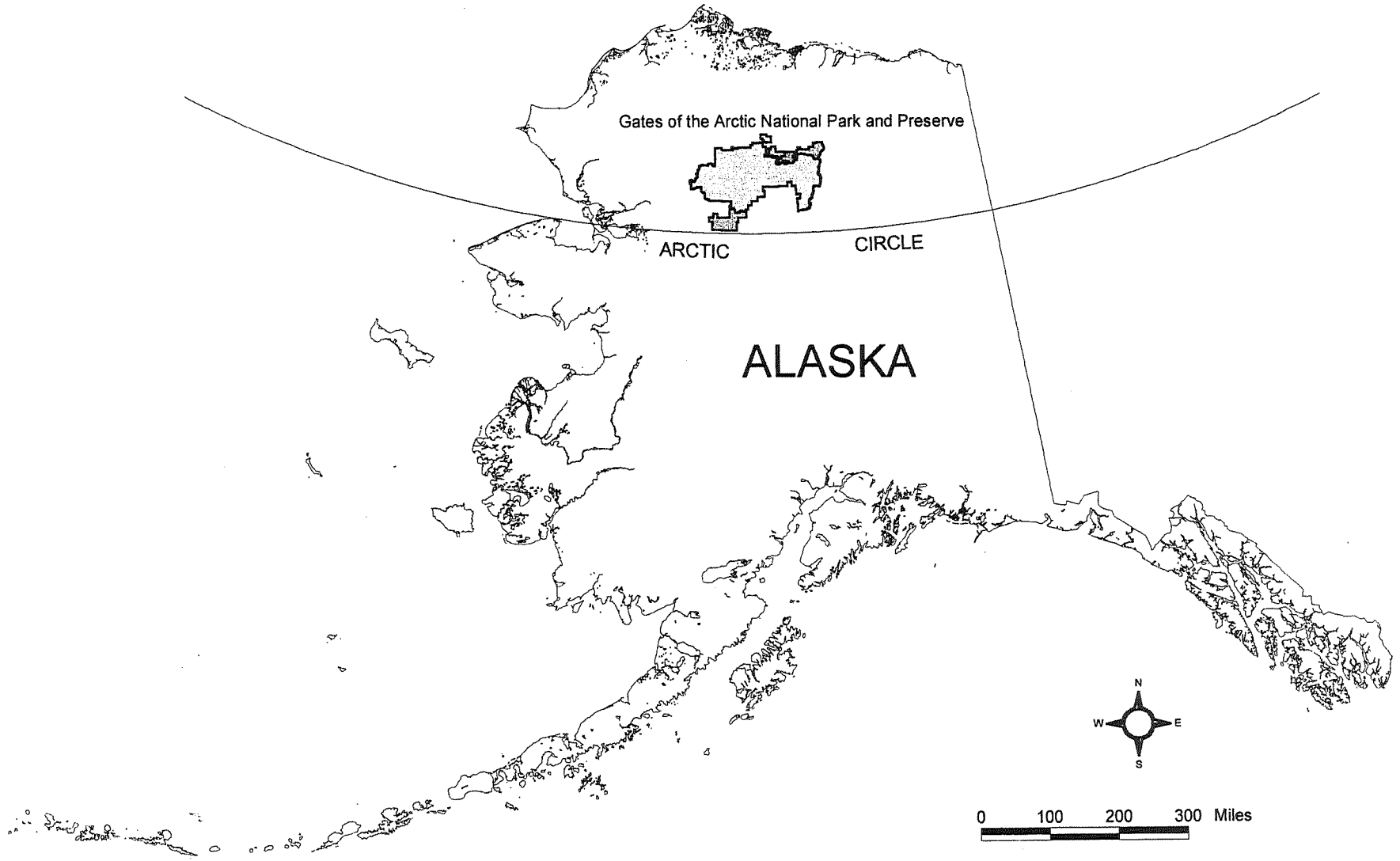

Fig. 2. Gates of the Arctic National Park and Preserve, located north of the Arctic Circle in the central Brooks Range, Alaska.

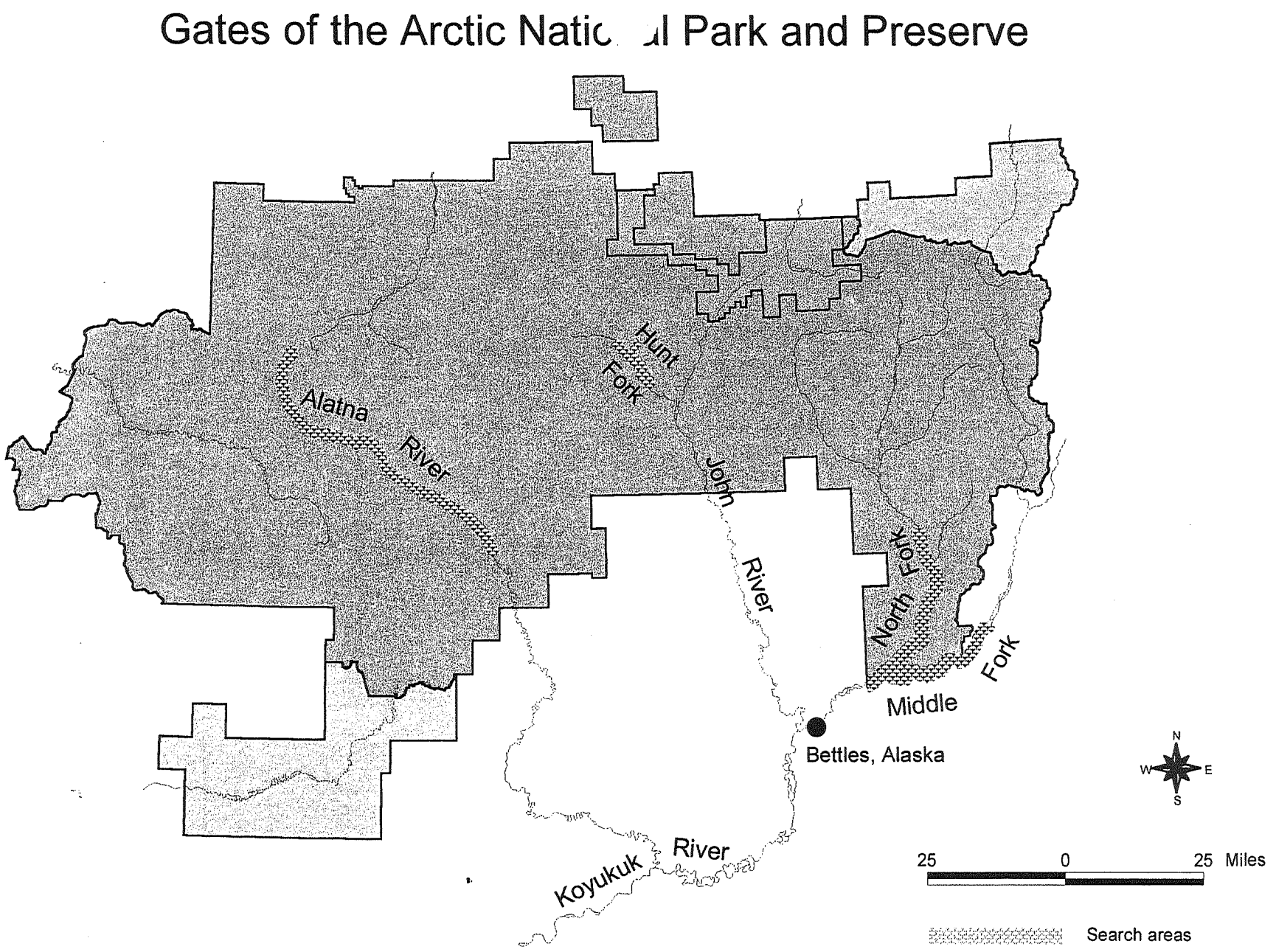

Fig. 3. Locations of *Aster yukonensis* surveys in Gates of the Arctic National Park and Preserve, Alaska, 1994 - 1997. The Middle Fork Koyukuk River was searched in 1994; North Fork Koyukuk River, 1995; Hunt Fork John River, 1996; and Alatna River, 1997. Yukon asters were found along portions of all rivers except the Alatna.

METHODS

Four surveys were conducted between mid July and early August: Middle Fork Koyukuk, July 25-29, 1994; North Fork Koyukuk, July 9-13, 1995; Hunt Fork John, July 17-19, 1996; and Alatna, July 29 to August 5, 1997. Survey teams ranged from 2 - 5 members. Searches were concentrated in habitat favored by *A. yukonensis*: sand bars with an accumulation of silt, generally found lining edges of sloughs or along the bottoms and sides of old sloughs. Surveys were conducted on foot, walking slowly over the search area, counting each *A. yukonensis* plant found. An individual plant was defined as one with all the stems originating from the same point. Thus a single stem would be one plant, and 5 stems growing from the same point would also be one plant. The first specimens located were examined carefully by looking for the densely glandular phyllaries to confirm identification. After this, macroscopic features were used to identify the species more quickly. The long, narrow clasping leaves were especially distinctive. On river bars where the density of *A. yukonensis* was very high, as along the Middle Fork Koyukuk, an abundance estimate was made rather than attempting to count every plant.

When populations of at least 50 Yukon asters were found, a specimen was collected, verified by the University of Alaska Museum, catalogued and stored in the GAAR herbarium in Bettles, Alaska.

RESULTS

About 91% of all *A. yukonensis* plants found in the park were located along the Middle Fork Koyukuk River. Populations there ranged from 10 to over 1,000 individuals; the majority of populations (74.1%) numbered at least 50 individuals. Along the North Fork Koyukuk and the Hunt Fork John rivers, populations were smaller and more scattered. The largest population found along the North Fork numbered about 100 plants, the smallest, only 2. Fewer than 8% of the North Fork populations had at least 50 Yukon asters. Although only 6 populations of *A. yukonensis* were located along the Hunt Fork, nearly 300 plants were found, most of them (225) on a single bar. *A. yukonensis* was not found along the Alatna River even though the habitat often appeared suitable. The Yukon asters were growing in silty sand, rocky gravel bars underlain by silty sand, or the silty bottoms and banks of old sloughs. Population data is summarized in Table 1; detailed results from each survey area can be found in their respective reports (DiFolco 1995; DiFolco 1996; DiFolco 1997).

Table 1. Results from *Aster yukonensis* (ASYU) surveys along rivers in Gates of the Arctic National Park and Preserve, central Brooks Range, Alaska, 1994 - 1997.

Survey Location	#km surveyed	#bars searched	#/% bars w/ ASYU	total # ASYU	% popn >50	largest popn	small popn
Middle Fork Koyukuk	58	43	27/63	5,846	74.1	1,000	10
North Fork Koyukuk	67	33	13/39	284	7.7	100	2
Hunt Fork John	11	-	6/ -	294	16.7	225	3
Alatna	100	-	0	0	-	-	-

DISCUSSION

Results of the past surveys, including the recent research of others (Hunt pers. com., Meyers pers. com.), have filled in some of the gaps within the disjunct range of *A. yukonensis*. In the Brooks Range of Alaska, the Yukon aster has been found in sparsely vegetated, open terrain (such as in wide valleys or low hills) in the subarctic regions south of the continental divide. They grow at 100 - 200 ft above sea level (ASL) in the troughs of the Great Kobuk Sand Dunes (Hunt pers. com.), and they are found at 1,500 ft ASL in the mountain valleys along the Hunt Fork of the John River. In Canada, they grow in similar habitat at roughly 2,500 ft ASL on the mud flats of the Slims River Delta in Kluane National Park in Yukon Territory (Harris 1992), and have been found in the Mackenzie Mountains and in the middle Mackenzie valley of Northwest Territories (ASL unknown) (Porsild and Cody 1980).

Harris (1992) suggests that the current distribution of *A. yukonensis* may partially reflect the former range of this plant during the late Pleistocene when glaciers covered the Brooks Range and much of Canada. Historically, *A. yukonensis* may have inhabited the flood plains receiving outwash from glacial lakes on the periphery of the ice sheets (Harris 1992). As the glaciers receded, suitable Yukon aster habitat diminished, and other plants became established. Today, Yukon asters are found in disjunct locations near the former glacial margins. The theory that *A. yukonensis* populations may be relics of the Pleistocene glaciation (Harris 1992) may explain why this species was found in abundance in some areas, such as along the Middle Fork Koyukuk River, but was absent in other areas of seemingly identical habitat, as was noted along the Alatna River.

Therefore, hydrology may play an important role in the present-day distribution of this species. *A. yukonensis* appears to be associated with hydrological disturbance, growing in areas frequented by floods or shifting substrate. Yukon asters have never been found in organic soils nor in high, dry alpine areas; rather, they grow in sandy areas or on mud flats, often near large

rivers. The timing and amount of flooding and patterns of substrate deposition may be critical in developing suitable habitat for this species. Likewise, seeds may be dispersed with suspended sediments during flooding, and deposited by receding waters. On the other hand, just as rivers may play a role in the dispersal of *A. yukonensis* populations, they may also restrict the species' distribution. Flooding may destroy local populations as old sand bars are eroded and new ones are deposited. Even so, the North Fork and Hunt Fork surveys, which were conducted after the catastrophic flooding of 1994, showed that *A. yukonensis* can survive a flood that sweeps across all populations of the species over a vast area.

Disturbance caused by flooding, or perhaps wind action in the case of Kobuk Sand Dunes, may not only help to create suitable habitat for *A. yukonensis*, it may also benefit the species by restricting the proliferation of other plants. Yukon asters tend to grow in sparsely vegetated areas, where total cover averages less than 25% (Harris 1992). The silty substrate of *A. yukonensis* habitat is saline, with soil pH values of 7.7 - 8.7 in the rooting zone (Harris 1992). A change in the water regime, such as a river channel shifting away from a gravel bar populated with Yukon asters, may encourage the establishment of other species. As succession progresses, the vegetation canopy gradually closes and new, organic soil builds, raising the soil pH to more acidic levels. These changing conditions may result in the extirpation of *A. yukonensis* from that area.

The dynamic relationship between *A. yukonensis* and its habitat may explain why this species has such a scattered and sparse distribution. Although the past years' surveys in GAAR have documented additional Yukon aster populations in Alaska, the plant should not be considered common, as surveys have shown that local populations are often extremely small. Most of the populations surveyed in GAAR tended to be small (anywhere from 3 to 300 individuals) relative to the abundance of associated species. On the other hand, there seem to be enough local populations spread over a wide area that *A. yukonensis* does not appear to be threatened with extinction. If a gravel bar is washed away or submerged under a new river channel, annihilating one Yukon aster population, chances are that another population is being established downstream. This dynamic balance between a constantly changing habitat and the small population sizes of *A. yukonensis* may be what holds this rare plant at vulnerable levels.

MANAGEMENT IMPLICATIONS

While *A. yukonensis* may still be considered a fairly rare species, management at GAAR need not be overly concerned about its survival. Results from the past several years' surveys have shown that the plant has a much wider distribution than previously believed, even though several individual populations appear to have a tenuous existence. After reviewing the data

currently known about this species, and upon consultation with the Alaska Rare Plant Forum, I have the following recommendations for the management of *A. yukonensis* in GAAR:

1. New surveys and monitoring need not continue on an annual basis; however, known populations should be monitored periodically, such as every 5 years, to confirm existence.
2. Field staff (in Resource Management and Ranger divisions) should be trained to distinguish between the Yukon aster and the common Siberian aster (*A. sibiricus*) (and other species that may be confused with Yukon asters) so that new populations of the rare plant may be identified should personnel come across them during other missions in the park.
3. Specific attention should not be drawn to the rarity of *A. yukonensis*, as this may result in visitors seeking out the plant and perhaps causing more damage than would otherwise occur. Visitors should continue to be advised on low-impact camping techniques.
4. Park staff should continue to participate in the Alaska Rare Plant Forum, which provides an avenue to keep abreast of the latest vegetation and rare plant research being conducted throughout the state, and also provides professional advice and support in the areas of plant investigation.
5. Assistance should be offered to D. Hunt of the NPS at KOBU, who is preparing a status report and range extension for *A. yukonensis*.

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