Stewardship Account for Coastal Microseris

Microseris bigelovii

Prepared by
Andrew MacDougall for
the BC Conservation Data Centre and
the Garry Oak Ecosystems Recovery Team
March 2002

Funding provided by the Habitat Stewardship Program of the Government of Canada and the Nature Conservancy of Canada

STEWARDSHIP ACCOUNTS

1. Species information

2. Names: ***Microseris bigelovii (A. Gray) Schultz-Bip.***
3. Synonyms: **none**
4. English name(s): **coastal microseris; coastal silverpuffs**
5. Family name (Latin and English): **Asteraceae (Sunflower Family)**
6. Classification: include any taxonomic changes or problems: **none**
7. Similar species: Latin and English: (1) ***Uropappus lindleyi*** **(formerly *Microseris lindleyi* - rare in BC; known only from the Gulf Islands);** (2) ***Microseris laciniata*** **(Hook) Schultz-Bip. (cut-leaf microseris - perennial herb occurring from Washington to California).**

2. Range and Known Distribution

a) Global range: **British Columbia, Washington, Oregon, California**
b) Canadian range: **southwestern British Columbia**
c) British Columbia range: **southeastern Vancouver Island, and possibly lower Fraser River Valley**

- range changes during last three generations or 10 years: **very recent changes unknown. Longer-term trends indicate decline in BC: ten element occurrences in the Victoria region no longer apparent (NOTE: unclear if these disappearances have been confirmed by recent site visits; some historical records date back several decades).**
- range of species: **restricted**
- general localities of Canadian populations and number of specific locations of occurrence within each population: (**1) greater Victoria region (BC CDC. Royal BC Museum Herbarium) (2) Hornby Island (Helliwell Park - BC CDC).**

3. Habitat Description

a) General habitat requirements of the species
- general habitat type: **exposed and sparsely vegetated coastal bluffs; may be restricted to areas that experience frequent fog (i.e., offsets moisture stress from wind exposure and shallow sandy soils).**
- specific habitat type: **moist open grassy or mossy areas; sea cliffs (California); small rock crevices with little soil (Oregon); prefers**

sandy soils such as old sand dune deposits or soil pockets on rocky cliff-sides (K. Chambers, personal communication).

- specific characteristics: **this species is apparently distinguished by its preference for sandy soils, as opposed to, for example, two closely related *Microseris* species in California (*M. douglasii* and *M. elegans*) which prefer clay soils (K. Chambers, personal communication).**
- dynamic factors (e.g. erosion, flooding, nutrient deposition): **population occurrences often in exposed habitats (wind, solar radiation, thin soils) and occasionally in ultra-fertile guano deposits.**
- associated native & non-native species: **BC herbaria records describe associated native species typical of exposed coastal habitats (*Plantago elongata*) and, to a lesser degree, of *Quercus garryana* ecosystems in slightly less exposed areas (*Lomatium utriculatum*). These records also indicate that some sites are invaded by exotic herbs (e.g., *Poa spp., Spergularia rubra, Plantago lanceolata*) and, in some cases, the shrub *Cytisus scoparius*. The effect of invasives on *M. bigelovii* in unknown.**
- other species at risk occurring in same habitat: **unknown**

b) Habitat availability and net trends in habitat change:

- sufficient habitat protected for long term survival: **unclear. On one hand, coastal cliffs, bluffs, and meadows may not be at high risk of development or disturbance in some areas compared to other habitat types. On the other hand, many of the occurrences for this species are near settlements (Victoria), which may cause direct (e.g., trampling) or indirect (e.g., displacement of nesting or roosting seabirds valued for dispersal) disturbance. Also, exposed seaside cliffs have tended not to be targets for reserves.**
- net gain or loss of habitat; recommended critical habitat: **ten element occurrences are no longer extant, all in the vicinity of Victoria. A similar trend is evident in Washington (San Juan County), where this species is now considered extirpated. Recommended critical habitat is sandy substrates on exposed coastal cliffs, steep slopes, and coastal meadows. Critical habitat may also be restricted to coastal fog zones (this applies to California; may be less important in Canada?).**
- cause of trends: **trampling by humans, seaside developments (houses, golf courses?), displacement of bird roosting/nesting areas**
- threats to habitat: **same as above**
- habitat trends across border: **identical problems exist in Oregon (K. Chambers, pers. comm.) and Washington (extirpated). From all accounts, the species appears to be stable in California though its habitat in this state is under increasing development pressure.**

c) Habitat ownership/protection:
   - type of ownership and management responsibility: **Exact ownership pattern unknown, though BC occurrences would be a mix of private, municipal, crown, and possibly Department of National Defence.**
   - amount legally protected; future land use: **Exact amount protected unknown. Occurrences in Uplands Park (Cattle Point), Thetis Lake Park, Saxe Point Park, and Rocky Point/Church Point suggest that all remaining sites in the Victoria vicinity may have some level of protection.**

4. Status of Species

a) Endemic/relict/indicator or keystone species: **could be considered endemic to coastal regions of western North America.**
b) Species at risk world wide: **extirpated in Washington (SX); imperilled in Oregon (S2); known only from four counties. Not at risk in California (SR); reported from many coastal counties with at least 63 known element occurrences (CalFlora Database; UC Berkeley Herbarium Database).**
c) Global rank; North American **(G4)** and provincial rank **(S1)**
d) Any related forms threatened: ***Uropappus lindleyi*** **known apparently from only one station in Canada (southern Gulf Islands).**
e) Special scientific interest: **yes. This species has been the subject of considerable scientific interest (at least 20 published papers). Studies have focused on genetic structure, hybridization, geographical variations in morphology and flowering time, and other related issues. Primary investigators are Dr. K. Chambers (Oregon State University) and Dr. K. Bachmann (University of Amsterdam, Netherlands).**
f) Possibility to be confused with another common species: ***Uropappus lindleyi, Microseris laciniata.*** **The number of closely related, and possibly confusing,** ***Microseris*** **taxa increases to the south into California.**
g) Genetic importance: **Very. British Columbia populations are highly disjunct from the distributional center of *M. bigelovii* in California, and are confirmed to be genetically distinct (van Heusden and Bachmann 1992). These authors hypothesize that the Victoria populations (Upland Park, Cattle Point, Saxe Point - collected for the study by Adolf Ceska and Kenton Chambers) were established by a single founder event. These populations share the only known chloroplast mutation for *M. bigelovii* with a population from San Mateo County south of San Francisco. Also, in a greenhouse experiment, British Columbia populations flowered two months**

slower than the southern-most Californian populations (Bachmann et al 1987) and also possess distinct leaf morphologies (e.g., Bachmann et al. 1982, Bachmann et al. 1984)

h) Other uses (e.g. pharmacological, ethnobotanical, horticultural): **none**

i) Plant & pollinator interactions: **appears to be mostly self-pollinated. Low levels of out-crossing are known to occur, possibly by wind or even insect pollination (though this is speculative).**

j) How much of range is in protected areas: **the exact percentage is unknown. Occurrence in Uplands Park in Victoria believed to be protected (?).**

5. Life History

a) General: **One of approximately 30 *Microseris* species world-wide, most of which are native to western North America, especially California. Eight species, including *M. bigelovii*, occur in the Pacific Northwest (Cronquist 1984, Douglas et al. 1998, Hitchcock and Cronquist 1998). Taxon is a spring-flowering annual herb from a taproot, growing from 4-35 cm in height. Lacks the showy yellow flower heads of the perennial *Microseris* taxa; flower heads of *M. bigelovii* are smaller, inconspicuous with yellow or yellow-orange ray flowers (Chambers 1955, Douglas et al. 1998). Outside of California, and to a lesser extent Oregon, this species has a highly disjunct distribution. This range pattern is almost certainly caused by bird dispersal; many occurrences are associated with nesting sites of coastal-nesting avian species (K. Chambers, pers. comm., see also Chambers 1963 - highly disjunct *Microseris* taxa also occur down the western coast of South America to Chile). Threats to these bird species, and to their coastal nesting grounds, may in turn threaten the occurrence and dispersal of *M. bigelovii* in BC and elsewhere.**

b) Phenology: **Germinates following the onset of winter rains and flowers in the spring or early summer.**

c) Pollination Biology: **This species shows a high degree of self-pollination, with occasional low-level outcrossing (K. Chambers, pers. comm.).**

d) Pollinators and pollination mechanisms; structures (e.g. nectaries corolla type); crossing; fl. sequence; blooming period; seed viability; dormancy and germination requirements: **Blooms in May or June. Seed viability and dormancy unknown. Mostly self-pollinated; out-crossing mechanisms unknown.**

e) Reproductive ecology: longevity; sexual/asexual reproduction; reproductive success; growth rate; seedling ecology; hybridization; limiting factors: **This species apparently hybridizes readily with other closely related *Microseris* species, though fertility is negatively affected to varying degrees (Chambers 1955).**

f) Survival – factors affecting species survival; population age structure; recruitment rate; causes of mortality; rate of survival to maturity; potential for growth of population; seedling survival: **Much of this information is unknown. Dr. Kenton**

Chambers speculates that the distribution of this species along the western North American coast can be attributed to bird dispersal (of the achenes). Many occurrences are found on or near nesting colonies, and the species may possess a tolerance of high nitrogen/fertility levels (i.e., guano). Dr. Chambers says that such nesting sites have become uncommon along the entire west coast; in some cases the birds are now restricted to offshore (island) nesting areas.

g) Physiology - range of climatic conditions; physiological adaptations; pH, soil/substrate and moisture requirements; dormancy period: **Moisture requirements unknown but propensity for sandy soils suggest a degree of desiccation tolerance. On the other hand, it may require frequent coastal fogs to offset such desiccation. May have tolerance of abnormally high fertility levels associated with guano deposits.**

h) Dispersal – mechanisms and distance (pollen, spores, seeds). **Most likely gravity, wind, and bird, though the relative importance of each is unknown. Bird dispersal likely explains the wide-ranging and highly disjunct occurrences that are observed for this species (e.g., Chambers 1963).**

i) Nutrition & Interspecific Interactions – nutritional requirements; obligate or facultative associations; toxic or allelopathic associations: **Unknown. It is not clear whether dry and ultra-fertile conditions are required physiologically by the species, or whether it is tolerant of these conditions to escape competition (i.e., it could grow in other habitat types if there was no competitively superior species present). Anecdotal evidence suggests that latter. First, the species tends to be restricted to sparely vegetated areas. Second, the species grows considerably larger in a non-stressful greenhouse environment (i.e., it does not appear to require low moisture etc. to persist).**

j) Behaviour/Adaptability - specialized species; ability to adapt to changes; disturbance type & tolerance; horticultural varieties; breeding or transplant studies: **Various greenhouse experiments suggest that this species can be easily grown from seed (e.g., Bachmann et al. 1987). However, observations from these experiments indicate that greenhouse seedlings reach larger sizes than naturally establishing seedlings, presumably due to reduced stress. This may indicate that greenhouse-raised seedlings are less hardy and may have low survival when transplanted into the field (i.e., restoration projects that use transplanted greenhouse stock commonly experience this problem - Falk et al. 1996). If restoration of *M. bigelovii* uses greenhouse-raised seedlings, such matters need to be investigated beforehand.**

6. How the species is at risk

Long-term and recent changes in the species number and range due to limiting factors (biological, environmental, others) and threats (both natural and human):

a) Description of threat (e.g. loss of habitat, fragmentation or degradation): **loss of habitat, direct disturbance (e.g., trampling, shoreside development), indirect disturbance (displacement of roosting and nesting seabirds that may serve as dispersal agent, invasion by exotic vascular plants).**
b) Susceptibility to disturbance: **unknown but probably depends on the type, intensity, and frequency of the disturbance(s).**
c) Successional factors: **appears to require sparsely vegetated sites. If extant sites become overrun with vegetation, invasive or native, this species may be displaced.**
d) Specific notes on threats and limitations on population size or distribution of species or population: **see above**
e) Dispersal/pollination restrictions: **see description of seabird dispersal above; other restrictions unknown.**
f) Competition: **appears to be a poor competitor with other plant species.**
g) Disease: **unknown**
h) Other (e.g. invasive species such as Scotch broom/orchard grass): **if extant sites become inundated with weeds, *M. bigelovii* could be displaced.**

7. Management Recommendations

a) Current management policies and actions: **none (sporadic monitoring?). Recommendation: historical sites of occurrence should be re-surveyed (if this has not been done recently) and areas previously unsurveyed but possessing appropriate habitat should be visited.**
b) Management prescriptions relative to locations of populations: **none**
c) Specifics and timing of prescriptions (e.g. mowing, controlled burning, invasive species control/removal): **this annual species flowers in spring/early summer, and probably germinates following the commencement of winter rains in the fall. Any intervention into areas of occurrence (including botanical surveys!) should be wary of trampling at these times.**
d) Potential to stabilize or reverse any decline: **unclear. Occurrences of this species in BC may fluctuate naturally (i.e., some populations may blink out naturally, others may establish elsewhere) due to life history (annual), habitat (exposed coastal areas), and distribution (northern range limit). Best bet may be to protect areas of known occurrence, and explore collecting and planting seeds in suitable habitat to increase germination/establishment success elsewhere.**

8. References/Literature Cited and General Bibliography

(note: not all listed references cited in the text; all listed scientific papers contain work on *Microseris bigelovii*)

Bachmann K (1992) Phenotypic similarity and genetic relationship among populations of *Microseris bigelovii*. Bot. Acta 105: 337-342.

Bachmann K, Chambers KL (1978) Pappus part number in annual species of *Microseris* (Compositae, Cichoriaceae). Plant Syst. Evol. 129: 119-134.

Bachmann K, Chambers KL (1989) Heritable variation for heterocarpy in *Microseris bigelovii* (Asteraceae, Lactuceae). Bietrage zur Biologie der Pflanzen 65: 123-146.

Bachmann K, Chambers KL (1990) Genetic variation for the timing and site of trichomes on the leaves of *Microseris bigelovii* (Asteraceae). Biol. Zentralbl. 109: 151-159.

Bachmann K, Hombergen EJ (1996). Mapping genes for phenotypic variation in *Microseris* (Lactuceae) with molecular markers. In: Compositae: Biology and Utilization (eds: PDS Caligari and DJN Hind. Royal Botanic Gardens, Kew, England. Pp 23-43.

Bachmann K, Price HJ (1981) Genetic determination of pappus part number in the annual hybrid *Microseris* B87. Plant Syst. Evol. 138: 235-246. (Note: hybrids discussed in this and other papers cited below derived from *M. bigelovii + M pygmaea*).

Bachmann K, Price HJ (1981) Genes regulating the appearance of two kinds of fruit in *Microseris* strain B87. Experientia 37: 29-31.

Bachmann K, Chambers KL, Price HJ (1984) Differential geographic distribution of spatulate and pointed leaf shapes in *Microseris bigelovii* (Asteraceae, Lactuceae). Bietrage zur Biologie der Pflanzen 59: 5-14.

Bachmann K, Price HJ, Konig A (1982) Four additive genes determining pappus part numbers in *Microseris* hybrid C34. Plant Syst. Evol. 141: 123-141.

Bachmann K, Price HJ, Konig A (1984a) A second marker enzyme in the genetics of pappus part numbers in Microseris hybrid B87. Plant Syst. Evol. 145: 243-258.

Bachmann K, Chambers KL, Price HJ, Konig A (1982) Spatulate leaves: a marker gene for the evolution of Microseris bigelovii. Bietrage zur Biologie der Pflanzen 57: 167-179.

Bachmann K, van Hausden AW, Chambers KL, Price HJ (1987) Genetic variation for the onset of flowering in Microseris bigelovii (Asteraceae, Lactuceae). Bietrage zur Biologie der Pflanzen 62: 23-41.

Bachmann K, van Hausden AW, Chambers KL, Price HJ (1987a) A second gene determining spatulate leaf tips in *Microseris bigelovii* (Asteraceae-Lactuceae). Bietrage zur Biologie der Pflanzen 62: 97-106.

Chambers K L (1955) A biosystematic study of the annual species of *Microseris.* Contributions from the Dudley Herbarium 4: 207-312. Natural History Museum of Stanford University, Stanford, California.

Chambers KL (1963) Amphitropical species pairs in *Microseris* and *Agoseris*. Quarterly Review of Biology 38: 124-140.

Cronquist A (1984) Compositae. In: Vascular Plants of the Pacific Northwest. Volume 5. University of Washington Press, Seattle, Washington.

Douglas GW, Straley GB, Meidinger D, Pojar J (1998) Illustrated Flora of British Columbia. Volume 1. Gymnosperms and Dicotyledons (Aceraceae through Asteraceae). Province of British Columbia, Victoria, British Columbia.

Douglas GW, Straley GB, Meidinger DV (1998) Rare Native Vascular Plants of British Columbia. Province of British Columbia, Victoria, British Columbia.

Falk D, Millar CI, Olwell (1996) Restoring Diversity: Strategies for Reintroduction of Endangered Plants. Island Press, Washington DC.

Hickman, JC (1993). The Jepson Manual: the higher plants of California. University of California Press, Berkeley, California.

Hitchcock CL, Cronquist A (1998). Flora of the Pacific Northwest. University of Washington Press, Seattle, Washington.

Price HJ, Chambers KL, Bachmann K (1981) Genome size variation in diploid *Microseris bigelovii* (Asteraceae). Botanical Gazette 142: 156-159.

Price HJ, Chambers KL, Bachmann K, Riggs J (1983) Inheritance of nuclear 2C DNA content variation in intraspecific and interspecific hybrids of *Microseris* (Asteraceae). American Journal of Botany 70: 1133-1138.

Price HJ, Chambers KL, Bachmann K, Riggs J (1985) Inheritance of nuclear 2C DNA content in a cross between *Microseris douglasii* and *Microseris bigelovii* (Asteraceae). Biol. Zentrabl. 104: 269-276.

Van Heusden AW, Bachmann K (1992) Nuclear DNA polymorphisms among strains of *Microseris bigelovii* (Asteraceae, Lactuceae) amplified from arbitrary primers. Bota. Acta 105: 331-336.

Van Heusden AW, Bachmann K, Chambers KL (1989) Variation in time and place of trichome appearance in Microseris hybrid J05 (*M. pygmaea* x *M. bigelovii*, Asteraceae). Biol. Zentralbl. 108: 153-161.

Vlot EC, van Houten WHJ, Mauthe S, Bachmann K (1992) Genetic and nongenetic factors influencing deviations from five pappus parts in a hybrid between *Microseris douglasii* and *M. bigelovii* (Asteraceae, Lactuceae). International Journal of Plant Science 153: 89-97.

Zentgraf J, Bachmann K, Chambers KL, Price HJ (1984) Single-gene heterozygotes derived from the polygenic pappus part system of Microseris hybrid C34. Plant Syst. Evol. 147: 205-226.

Zentgraf J, Bachmann K, Chambers KL, Price HJ (1985) Modifiers of heterocarpy determine capitulum size in Microseris hybrid D14. Plant Syst. Evol. 151: 103-119.

9. Authorities Consulted

(a) Dr. Kenton Chambers
Emeritus Professor
Oregon State University
e-mail: chamberk@bcc.orst.edu

Dr. Chambers is the North American expert on *Microseris* taxonomy, ecology, and distribution. He is the author of the *Microseris* section in the "Jepson Manual" (Flora of California) as well as in the Flora of North America.

10. Personal communications

(a) Brenda Costanzo
BC CDC
Dates of Contact: various communications

(b) Dr Fred Ganders
UBC Department of Botany
Phone: 604-882-5862
FAX; 604-822-6089
Date of Contact: November 20, 2001

(c) Dr. Kenton Chambers
Oregon State University
e-mail: chamberk@bcc.orst.edu
Dates of Contact: November 21 26 27 28, 2001
Received: accounts of the taxonomy, distribution, and ecology of *Microseris bigelovii*, plus numerous references to studies on this species.

(d) Marta Donovan
BC CDC
e-mail: Marta.Donovan@gems4.gov.bc.ca
Dates of Contact: November 21 23 26 27, 2001
Received: extant and extirpated occurrence records for British Columbia.

(e) Please note that on November 20th I faxed an information request to the Washington Natural Heritage Program (Botany Data Manager) and sent an e-mail to the Oregon Natural Heritage Program (Susan Vrilakas - Botany Data Manager) requesting occurrence information on *Microseris bigelovii*. I received no reply in both cases. For these states, I had to rely on website occurrence data only. For Oregon, I also used information derived from communications with Dr. Kenton Chambers of Oregon State University.

(f) Website: USDA Natural Resources Conservation Service
www.plants.usda.gov
Received: general classification and distribution information on *Microseris bigelovii* in North America.

(g) Website: CalFlora Occurrence Database
www.calflora.org
Received: County-level occurrences records for California, including date of collection, location, and observer.

(h) Website: NatureServe Conservation Status Reports
www.natureserve.org
Received: Global and state/province level heritage status ranks, derived from Natural Heritage Programs and Conservation Data Centre databases.

(i) Website: Washington State Natural Heritage Program.
www.wa.gov/dnr/htdocs/fr/nhp
Received: County occurrences and state status of *Microseris bigelovii* within Washington

(j) Website: Oregon State Natural Heritage Program.
www.heritage.tnc.org/nhp/us/or
Received: County- and Ecoregion-level occurrences and state rank of *Microseris bigelovii* within Oregon

(k) Website: Puget Sound BioSurvey Ltd, Friday Harbour, Washington.
www.fidalgo.net
Received: list of endangered, threatened, and sensitive vascular plants of San Juan County, Washington, including *Microseris bigelovii.*

(l) Website: Department of Botany Herbarium, University of British Columbia.
http://www.botany.ubc.ca/
Received: occurrences records of *Microseris bigelovii* - one record from near Vancouver BC and one record from Oregon.

(m) Website: Royal BC Museum Herbarium
http://obj.royalbcmuseum.bc.ca/
Received: one occurrence record for *Microseris bigelovii* from Victoria.

(n) Website: Jepson Flora Project- University of California Berkeley
http://ucjeps.herb.berkely.edu/
Received: bioregional distribution data, including range maps, for *Microseris bigelovii* in California.