

**The Status of**  
**Mackenzie's Sweetvetch**  
*(Hedysarum boreale subsp. mackenzii)*  
**in Newfoundland and Labrador**



photo © Nathalie Djan-Chékar

**THE SPECIES STATUS ADVISORY COMMITTEE**  
**REPORT NO. 3**

**April 12, 2006**

## ASSESSMENT

<b>Assessment:</b>  Endangered	<b>Current designation:</b>  None
<b>Criteria met:</b>  B1. Extent of occurrence <5,000 km <sup>2</sup> B2. Area of occupancy <500 km <sup>2</sup>  (a) Known to exist at < 5 locations  (b) Continuing decline observed, inferred or projected in iii) area, extent and/or quality of habitat	
<b>Reasons for designation:</b>  Qualifies as " <i>endangered</i> " under the SSAC/COSEWIC criteria B1, B 2. (a) and B 2.(b) iii): <ul style="list-style-type: none"><li>• Only found in 2 adjacent populations in restricted area of the island portion of the province</li><li>• Boreal - Arctic disjunct</li><li>• Habitat degradation due to human activity</li><li>• Site is highly degraded and under threat with the quality of the habitat declining over the past 15 years based on expert observation over that time period</li><li>• Data pertaining to the rate of decline or fluctuations in number of mature individuals are not known at this time</li><li>• No rescue effect possible due to disjunction</li></ul>	

This report was completed by Ms. Claudia Hanel, under contract to the SSAC.

## STATUS REPORT

### ***Hedysarum boreale* Nutt. subsp. *mackenzii* (Richardson) Welsh**

Mackenzie's sweetvetch, boreal sweetvetch, sweet-broom, northern hedysarum; Fr: sainfoin de Mackenzie

Synonyms (Meades et al. 2000):

- *Hedysarum mackenzii* Richardson in Franklin
- *Hedysarum americanum* (Michx.) Britton var. *mackenzii* (Richardson) Britton
- *Hedysarum boreale* var. *mackenzii* (Richardson) C.L. Hitchc.

Name of population(s) or subspecies: subspecies *mackenzii*, sometimes also spelled *mackenziei* (Aiken et al. 1999 onwards, Plant Gene Resources of Canada (PGRC) 2002), Newfoundland population.

Family: Fabaceae

Life Form: Herbaceous perennial plant, forb

## Distribution

### **Global: (from Nature Serve (2005) unless otherwise noted)**

*Hedysarum boreale* as a whole: Amphi-Beringian, northeastern Siberia (Kamchatka (Plant Gene Resources of Canada (PGRC) 2002) and Chukot (White 2005), boreal to arctic North America, south to Newfoundland and all of Canada except for the Maritime Provinces; Western United States south to Texas.

Subspecies *mackenzii*: Of the three subspecies listed by Nature Serve (2005) this is the most widely distributed and most northern subspecies. Its distribution is amphi-Beringian and it occurs in northeastern Siberia (Kamchatka and Chukota), boreal to arctic North America, south to Newfoundland, Quebec, Manitoba, Montana, and Oregon.

### **National: (from Nature Serve (2005) unless otherwise noted)**

*Hedysarum boreale* as a whole: Its range includes most of Canada except for Labrador, the Maritime Provinces, and much of the northern and eastern Arctic (Baffin Island, Axel Heiberg Island, Devon Island and Ellesmere Island (Aiken et al. 1999 onwards)). The occurrences in Newfoundland and Quebec represent disjunct populations.

Subspecies *mackenzii*: In Canada the range of this subspecies includes all of the range occupied by the species as a whole. It is the only subspecies found east of Manitoba. In the Canadian West it may be partially replaced by subspecies *boreale*, but this is not apparent from the Nature Serve (2005) maps.

### **Provincial:**

*Hedysarum boreale* (represented in Newfoundland only by subspecies *mackenzii*): Within the province this species is only known from the Cape St. George area in the western part of the Port au Port Peninsula in Western Newfoundland.

## Annotated range map

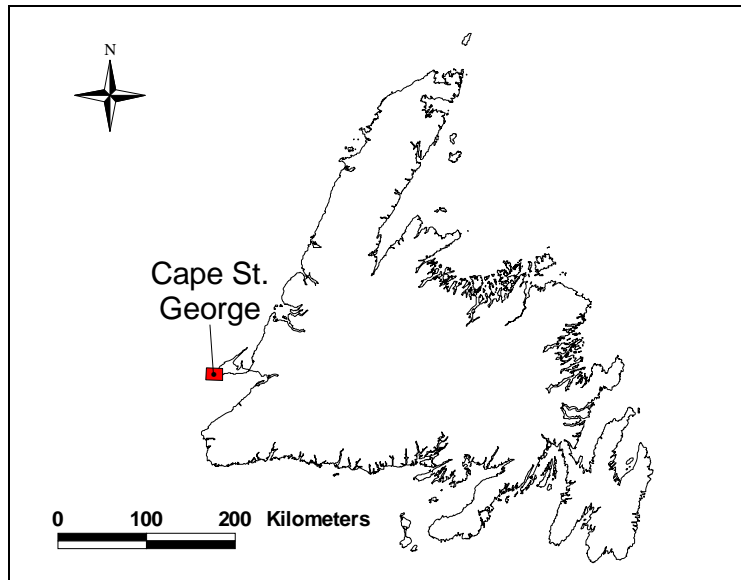


Figure 1. Location of the Western Port au Port Peninsula, the site of *Hedysarum boreale* subsp. *mackenzii* in Western Newfoundland.

## Description and habitat



Figure 2. Plant of *Hedysarum boreale* subsp. *mackenzii* in its habitat of low limestone heath. Photo used with permission by John E. Maunder.

### Description (adapted from Aiken et al. (1999 onwards))

The plants are perennial herbs; 15–40 cm high; with basal leaves or spreading stems and a thick and fibrous taproot. Aerial stems erect, or ascending; sparsely or densely hairy. Leaves are distributed along the stems; usually opposite; pinnately compound, hairy and have scale-like, sheathing; brown stipules. Leaf stalks 5–25 mm long and leaf blades 2–8 cm long and (10–)2–3 cm wide. Leaflets 5–11(–13) mm wide and (5–)10–15 mm long. Flowering stems without leaves; hairy or not. Inflorescence racemose; 2–8 cm long, with 5–15 flowers; Flowers are large, pea-like, purple, more than 15 mm in diameter or length, and showy and sweet scented; Calyx brown, or black; tubular; 5-lobed; hairy (mostly on inside of lobes and on veins). Fruit a loment with constrictions between the seeds. Fruits are dry and brown at maturity, and are elongate-cylindrical; 3–4 cm long; 6–8 mm wide; Seeds are 3–6; 2.5–3 mm long; brown; with smooth surfaces.

### Habitat

In the arctic, the plant grows in dry tundra, on flats and slopes, in gravel to clay soils (Aiken et al. (1999 onwards)). A preference for calcareous soils was noted by Fernald (1950). In Newfoundland this plant has only been found in open, relatively dry limestone barrens covered with low heath.

## **Overview of Biology**

*Hedysarum borale* has been extensively studied in Utah in the process of developing a cultivar to seed for range improvement in the intermountain West (Upper Colorado Environmental Plant Center, 1994). Although not specified specifically, the source plants are likely subspecies *boreale*. The species fixes nitrogen, and this capability can be enhanced by inoculation of the seeds with *Rhizobium* bacteria and mycorrhizal fungi (Redente and Reeves 1981). In a nursery the plants started to produce seed in their second year (Johnson et al. 1989). *Hedysarum boreale* plants are long-lived (up to 20 years) (Treshow and Harper 1974). During trials to select for seed yield it was noted that the seed yield per plant varied greatly from year to year and from plant to plant (Upper Colorado Environmental Plant Center, 1994.) The plant is not very tolerant of competition and is susceptible to grazing damage from wild ungulates and livestock due to its high palatability (Upper Colorado Environmental Plant Center, 1994). Most of these biological details would likely apply to the Newfoundland plants as well. A figure for a potential seed production of 450 plants per plant was derived using the individual shown in Figure 2 (details in Appendix A).

In Newfoundland the plants have been observed to flower from early June to late July. The species as a whole, including subsp. *mackenzii*, requires insect pollination to set seed, and in Alaska and the Yukon Territory this service was performed by bees of the genus *Megachile*, and to a lesser degree *Bombus* (McGuire 1993). It is not known whether the same bee genera are the chief pollinators in Newfoundland.

The larvae of *Colias Colias philodice* subsp. *philodice* (a sulphur butterfly that also occurs in Newfoundland) have been reported to feed on *Hedysarum boreale* subsp. *mackenzii* leaves (Markku no date). However, this butterfly prefers agricultural legumes, such as alfalfa and clovers (Canadian Biodiversity Information Facility 2003a). Another Newfoundland butterfly, *Colias eurytheme*, has similar food preferences (Canadian Biodiversity Information Facility 2003a) and may feed on the sweetvetch as well. The rust fungus *Uromyces hedysari-obscuri* (DC.) Car. & Picc. was collected on *Hedysarum boreale* subsp. *mackenzii* in Alaska (Anderson 1940), and this fungus also exists in Newfoundland (Louise Lefebvre, Assistant Curator, National Mycological Herbarium, personal communication, February 14, 2006). No evidence of herbivory or fungus infection was recorded during the plant surveys.

If increasing population size or maintaining plants ex situ were considered, direct seeding would probably be preferred. The plants dislike root disturbance (Plants for a Future 2004) and are not easily transplanted (Ontario Rock Gardening Society 2002).

### **Population size**

In Newfoundland there are two populations, separated by approximately 7 km, hereafter referred to as the “Cape St. George” and “Road to Mainland” populations. The Cape St. George population includes approximately 400 individuals (extrapolated from population subsample and population area), and it is believed by the author of this report that the majority of the plants in this population have been located. The Road to Mainland population contains >100 individuals (from actual counts). However, at some patches the plants were not counted, and some patch counts were incomplete. It is very likely that not all patches in this population have been located, and that this population is larger than the Cape St. George population.

### **Traditional and local ecological knowledge**

Chief Jasen Benwah of the Benoit First Nation reported that a plant called licorice root was used by the Mi'kmaq as a blood purifier and general tonic to soothe the stomach (personal communication, February 16, 2006). However, he was not absolutely sure that it was this species and not another species whose common name is also licorice root.

### **Trends**

The populations have not been sampled with sufficient frequency and intensity to conclusively determine any population trends. However, some estimates can be made. At Cape St. George the population may have been reduced by the establishment of the gravel road, but has likely been stable since then. No signs of recent disturbances were detected at any of the locations between Cape St. George and Mainland, and it is likely

that the population is stable. Juvenile plants, or at least plants without flowers in the survey year were observed at all patches.

## **Threats and limiting factors**

### Cape St. George

This population is the most threatened. The plant site is a scenic lookout over the Gulf of St. Lawrence and is located in or near Boutte du Cap Park. This is a community day use park managed by the municipality of Cape St. George and the regional francophone association (ARCO), and these two organizations are closely cooperating to further develop the park and encourage tourism to the area (Robert Cormier, Deputy Mayor of the Municipality of Cape St. George, personal communication, Jan. 31, 2006). A gravel road from Cape St. George runs north above the sea cliff on the limestone barren and from there into a more vegetated small valley. This road is estimated to be at least 50 years old, and has likely reduced the amount of available habitat at the site. Between two site visits by the author of this report in 2000 and 2005, this road had been blocked to car traffic with a barrier south of the *Hedysarum* population. However, fresh ATV skid marks were observed on both occasions. The population is also accessible to foot traffic, which might increase with an increase in tourism.

### Road to Mainland

The habitat of the northern population was likely reduced by the construction of the road between Cape St. George and Mainland, which was completed in 1995. No actual threats have been observed in this area since then; however several land uses in the area might impact the population in the future.

Along the road, approximately equidistant from the two populations, several land uses have the potential to represent threats if the uses are intensified. The Crosswinds Resort will re-open under new management this summer, and Oil drilling has been carried out nearby by Imperial Ventures of St. John's. Some 3D seismic work is planned for the summer of 2006 (Robert Cormier, Deputy Mayor of the Municipality of Cape St. George, personal communication, Jan. 31, 2006).

## **Existing protection**

Neither population is protected.

## **Special significance**

No special scientific significance is known. *Hedysarum boreale* subsp. *mackenzii* has been listed as a plant suitable for rock gardening (Ontario Rock Gardening Society 2002) and its root has been described as edible in the spring with a liquorice-like flavour (Facciola 1990, Kunkel 1984). A cultivar of *Hedysarum boreale* named "TIMP" from Utah

(most likely derived from subsp. *boreale*) has been released in the United States to be sold commercially as a plant for rangeland improvement and revegetation in the western United States (Upper Colorado Environmental Plant Center, 1994). In British Columbia *Hedysarum boreale* subsp. *mackenzii* has been found to be the major nitrogen fixing agent in glacier moraines (Blundon and Dale 1990). It is likely that in its Newfoundland locations it is also a major fixing agent of this soil nutrient, which often limits plant growth.

**Ranks or Status**

**Rank or Status**

<b>Global</b>	
G-rank	G5T5?
IUCN	Not listed
<b>National</b>	
N-rank	N5?
National General Status	Not available
COSEWIC	Not listed
<b>Provincial</b>	
Provincial General Status	2, may be at risk
Newfoundland S-rank	S1
Newfoundland General Status	2, may be at risk
Labrador S-rank/ General Status	not present in Labrador
<b>Adjacent Jurisdictions</b>	
Quebec S-Rank	S1 (but on the borderline of S2, Jacques Labrecque, Développement Durable, Environnement et Parcs, Québec, February 6, 2006)
Quebec General Status	2, may be at risk

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### **Collections examined**

The author of this report was present during the sampling of all known population patches and collection of specimens from these. Seven recent specimens (from 1996, 2000 and 2001) are located at the Herbarium of the Provincial Museum of Newfoundland and Labrador (NFM). Four of these specimens have duplicates at the Herbarium Marie Victorin at the Université de Montréal (MT), and duplicates of two older specimens are also located at MT. A duplicate of one of the recent specimens was also deposited at the herbarium of Sir Wilfred Grenfell College, Memorial University of Newfoundland.

The 7 specimens at NFM were recently examined by John Maunder (Curator Emeritus of Natural History at the Provincial Museum of Newfoundland and Labrador, personal communication, February 16, 2006).

[1] NFM 1398 [not in Wildlife database, coll. by J. Maunder.], Cape St. George, July 17, 1996

Four sheets, total of 7 individuals, all flowering [buds and/or mature flowers].

Sheet 1: several racemes with 4-11 flowers each

Sheet 2: 4 racemes with (1-) 3-8 flowers each

Sheet 3: 3 racemes with 1-7 flowers each

Sheet 4: 5 racemes with 4-7 flowers each

[2] NFM 8130, CH 000726-15, Road to Mainland, July 26, 2000.

Two sheets with the same number.

Sheet 1: One whole plant, plus a scrap, in advanced pod development. (11 pods with 2-4 developed/developing seeds each). Some minor aborting of racemes, probably late developing ones, was observed.

Sheet 2: Two plants. Two clusters of mature flowers.

[3] NFM 8132, CH 000724-3, Cap St. George. July 24, 2000.

One sheet with two plants.

plant 1: Mature flowers [N = 9]

plant 2: Developing capsules.

Head 1 - Five capsules with seeds (2-4 seeds per capsule), one capsule without seeds.

Head 2 - Four capsules with seeds ((1-) 2-3 seeds per capsule).

[4] NFM 7568, NDC 01-22 Road to Mainland. June 9, 2001.

One plant with one raceme with mature, large flowers (8 per raceme)

[5] NFM 7575, NDC 01-24, Road to Mainland, June 9, 2001.

One sheet with three whole plants plus 2 scraps. Leaves just expanding.

plant 1: Advanced buds to mature flowers. About 12 flowers [difficult to count hidden underside ones] on the most mature raceme.

plant 2: Early buds.

plant 3: Youngish buds.

[6] NFM 7567, NDC 01-21, Road to Mainland

Leafy shoot only.

[7] NFM 8131, CH 000726, Road to Mainland, July 26, 2000.

One whole plant plus scrap. Early buds [N=4-5] and young flowers [N=5], plus 2 aborted racemes.

## TECHNICAL SUMMARY

<b>Distribution and Population Information</b>	<b>Criteria Assessment</b>
<i>Extent of occurrence (EO)(km<sup>2</sup>)</i>	7.7
<i>Area of occupancy (AO) (km<sup>2</sup>)</i>	>0.004, but <1
<i>Number of extant locations</i>	2
<i>Specify trend in # locations, EO, AO (decline, stable, increasing, unknown)</i>	Unknown, probably stable or slightly declining
<i>Habitat trend: specify declining, stable, increasing or unknown trend in area, extent or quality of habitat</i>	Probably declining in area and quality
<i>Generation time (average age of parents in the population) (indicate years, months, days, etc.)</i>	Unknown, but >1 yr
<i>Number of mature individuals (capable of reproduction) in the Provincial population (or, specify a range of plausible values)</i>	probably between 300 1,000
<i>Total population trend: specify declining, stable, increasing or unknown trend in number of mature individuals or number of populations</i>	unknown
<i>Are there extreme fluctuations (&gt;1 order of magnitude) in number of mature individuals, number of locations, AO and/or EO?</i>	Unknown, but unlikely
<i>Is the total population severely fragmented (most individuals found within small and isolated populations)</i>	Yes, only 2 populations in NF, Quebec populations widely scattered in the province
<b>Rescue Effect (immigration from an outside source)</b>	
<i>Does species exist elsewhere?</i>	yes
<i>Status of the outside population(s)?</i>	Abundant in western and northwestern Canada, disjunct in Eastern Canada
<i>Is immigration known or possible?</i>	Probably not possible, nearest population ~350 km away
<i>Would immigrants be adapted to survive here?</i>	Unknown, but likely
<i>Is there sufficient habitat for immigrants here?</i>	unknown

## Appendix A. Population Information

### Recently verified occurrences/range use (verified within the last 25 years)

Verified occurrences consist of observations supported by the collection of a voucher specimen (i.e. a sample to be identified/confirmed by experts and deposited in a herbarium). An observer familiar with the species may collect only one voucher specimen to document occurrence within a given area .

The following data were taken from the plant database of the Wildlife Division (2006) unless otherwise noted. Three clusters of plant patches have been observed, one in or near Boutte du Cap municipal park at Cape St. George, the second approximately 7 km to the northeast, and the third approximately 1 km to the north of the second. All of these plants were located west of the road between Cape St. George and Mainland. In the absence of detailed data on pollination and seed dispersal distances, the decision tree proposed by Nature Serve (2004) was used to infer that these three plant clusters represent two populations. The two northern clusters can be considered to be one population, hereafter referred to as the “Road to Mainland” population.

#### Cape St. George:

- Plant first collected by K.K. Mackenzie and L. Griscom in 1922 near Cape St. George.
- The next observation was made in the same general area by E. Rouleau in 1967. For both of these early observations location data was inferred from location descriptions and other information available from the herbarium labels and are only accurate to 1 km. When mapped, the plant patches do not coincide with each other, or the patch documented more recently, but it is quite possible that they all represent the same patch, or at least fewer patches than appear on the map (see Appendix B).
- A. Bouchard and S. Hay of the Université de Montréal documented a Cape St. George patch in 1986. Location accurate to 100 m.
- John Maunder (Curator Emeritus of Natural History at the Provincial Museum of Newfoundland and Labrador, personal communication, February 9, 2006) definitely observed the plants in the mid-80's.
- The Newfoundland Chapter of the Canadian Wildflower Society definitely observed the plant at Cape St. George in 1997. (John Maunder, Curator Emeritus of Natural History at the Provincial Museum of Newfoundland and Labrador, personal communication, February 9, 2006).
- S. Powell and the author of this report located the population in 2000 following directions given by J. Maunder. Location coordinates accurate to 100 m were recorded with GPS.
- John Maunder photographed some plants of the population on June 9, 2001 and August 7, 2003 (John Maunder, Curator Emeritus of Natural History at the Provincial Museum of Newfoundland and Labrador, personal communication, February 9, 2006).

- This site was visited in May 2005 by the author of this report. The plants were observed, but not counted, and no collections were made.

#### Road to Mainland:

- This population was first located during the excursion of the Newfoundland Chapter of the Canadian Wildflower Society in 1997 (John Maunder, Curator Emeritus of Natural History, Provincial Museum of Newfoundland and Labrador, personal communication, February 9, 2006). No location coordinates from this visit are available in the provincial database (Wildlife Division 2006).
- Collections were made by S. Powell and the author of this report in 2000 as part of the Newfoundland Rare Plant Project. Three clusters of plants (locations accurate to 100 m) were observed, and population estimates were made at two of them.
- Four more patches were observed within 1 km of the previous patches by N. Djan-Chékar and the author of his report and were documented by specimens and photographs. Plants were counted along a transect through one patch, but the patch size was not measured. Locations accurate to 10 m.

#### **Recent search effort (areas searched within the last 25 years with estimate of effort)**

- This plant has not been specifically searched for. However, general rare plant surveys in suitable habitat between Cape St. George and Mainland were made. Some of the limestone barrens visited in the Port au Port area did not include any suitable habitat, and their visitation is not included. Visits were made as part of the Newfoundland Rare Plant Project and the data were extracted from the rare plant database of the Wildlife Division (2006) unless otherwise noted.
  - 1999, 5 person days, Road to Mainland, Cape St. George.
  - 2000, 4 person days, Cape St. George, Road to Mainland.
  - 2001, 2.5 person days, Road to Mainland, and between the two populations.
  - 2005, 1/2 person day, Cape St. George, Personal visit by C. Hanel.
- Limestone barrens on Table Mountain, near Stephenville, were thoroughly searched (search efforts of at least 3 days by 3 people noted in database, but more recent search effort as part of the investigations of *Neotorularia humilis* populations are not included in the database).

#### **Historical verified occurrences/range use (not verified in the last 25 years)**

- None

#### **Other observations (unverified occurrences)**

- None

### **Potential sites unexplored (explain reason for potential)**

Limestone barrens represent one of the most thoroughly surveyed habitat types found in Newfoundland. However, along the road from Cape St. George to Mainland there remains an unsearched area which comprises approximately 60% of the barrens in this area (Figure 3). The unsearched area is generally less accessible than the searched area. Several other large limestone barrens in the south-central and southeastern portion (Pierways Hill) of the Port au Port Peninsula have not been surveyed at all. Whether the substrate and vegetation of these barren would be suitable for *Hedysarum boreale* subsp. *mackenzii* is not known. A rough evaluation of the habitat could be made from air photos, and sites deemed potentially suitable could be visited to further evaluate habitat suitability and to establish whether the species is present.

### **Calculation of estimated seed production**

To arrive at an estimate of yearly seed production potential, the plant in Figure 3 was taken as a model. The plant probably represents one of the larger ones encountered. With a total of 20 inflorescences, each bearing 9 flowers, and half of these bearing a fruit (McGuire 1993) with 5 seeds (see description above), a plausible value for potential seed production would be 450 seeds per plant. However, this figure would be lower for smaller plants. Some of the plant specimens examined contained only one raceme, with about 5 flowers per raceme and 3 seeds per flower. These smaller plants would have an estimated seed production of only 15 seeds. During cultivation trials of the sweetvetch cultivar TIMP the seed yield of some plants was 2 to 6 times greater in a good year than in a bad year (Upper Colorado Environmental Plant Center, 1994) and it is likely that variations in seed production of this scale would also occur in wild *Hedysarum boreale* subsp. *mackenzii* plants.

