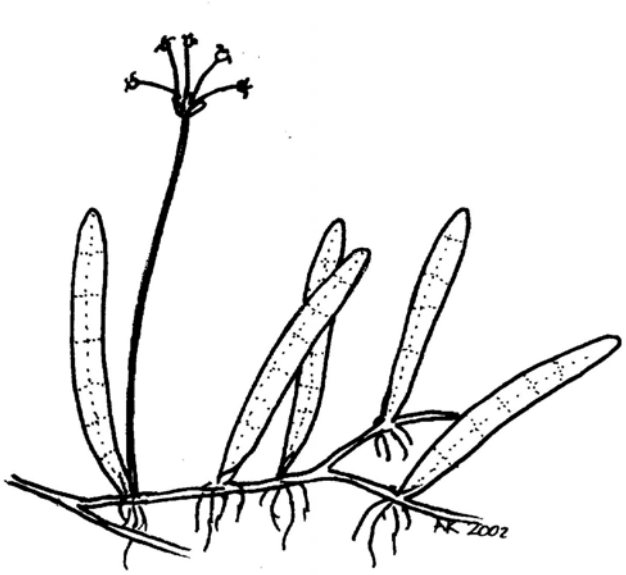
COSEWIC
Assessment and Update Status Report

on the

Eastern Lilaeopsis
Lilaeopsis chinensis

in Canada



SPECIAL CONCERN
2004

COSEWIC
COMMITTEE ON THE STATUS OF
ENDANGERED WILDLIFE
IN CANADA

COSEPAC
COMITÉ SUR LA SITUATION
DES ESPÈCES EN PÉRIL
AU CANADA

COSEWIC status reports are working documents used in assigning the status of wildlife species suspected of being at risk. This report may be cited as follows:

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Production notes:

1. COSEWIC acknowledges Matthew L. Holder for writing the status report on the eastern lilaeopsis *Lilaeopsis chinensis* in Canada. The report was overseen and edited by Erich Haber, COSEWIC Co-chair (Vascular Plants) Plants and Lichens Species Specialist Subcommittee.
2. Formerly designated by COSEWIC as Lilaeopsis, *Lilaeopsis chinensis*.

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COSEWIC
Assessment Summary

Assessment Summary – May 2004

Common name
Lilaeopsis, eastern

Scientific name
Lilaeopsis chinensis

Status
Special Concern

Reason for designation
Small perennial herb reproducing both by seed and extensively by vegetative spread. It is geographically highly restricted and present in Canada at only three estuaries in Nova Scotia. The area of occupancy is very small but the population is large. No declines of significance have been documented over the past 15 years. It does not appear to have any imminent threats; however, future shoreline development or degradation could destroy extant populations.

Occurrence
Nova Scotia

Status history
Designated Special Concern in April 1987 and in May 2004. Last assessment based on an update status report.

COSEWIC
Executive Summary

Eastern Lilaeopsis
Lilaeopsis chinensis

Species information

Lilaeopsis chinensis (Eastern Lilaeopsis) is a small maritime plant in the Apiaceae (parsley family). The plant may be identified by its dark linear leaf-like structures that arise from a thin rhizome and grow a few centimetres in height. Eastern Lilaeopsis produces short clusters of small white flowers in August and September.

Distribution

Eastern Lilaeopsis occurs along the Atlantic and Gulf coasts from Maine to Louisiana. In Canada, it is restricted to estuaries on the southern coast of Nova Scotia.

Habitat

This species is found most commonly on gentle mud slopes in the intertidal zone along estuary shorelines, although it has also been found on gentle gravel slopes. Eastern Lilaeopsis appears to be a facultative species of brackish water. This species appears to be associated with Cordgrass (*Spartina alterniflora*), and possibly Sea Milkwort (*Glaux maritima*) and Seaside Plantain (*Plantago maritima*).

Biology

Eastern Lilaeopsis grows in high densities at known Canadian sites, although flowering plants are sparsely distributed. Vegetative reproduction appears to be most important in maintaining populations.

Population sizes and trends

The species is restricted to several estuaries on the southern shore of Nova Scotia, where it is locally abundant. No recent change in distribution or population size has been noted, although it has not been recorded in Rhode Island since 1900. It is apparent the Eastern Lilaeopsis' rarity in Canada is due to its presence at the northernmost edge of its range rather than due to human influence.

Limiting factors and threats

Although the species has a restricted range in Canada, it does not appear to have any imminent threats. However, future shoreline development or degradation could destroy extant populations, and sea level rise due to global warming may further stress populations on the long term.

Special significance of the species

Eastern Lilaeopsis is restricted to the Atlantic Coastal Plain and Gulf Coast. In Nova Scotia, it is found at the northernmost edge of its range. As a relict of a once continuous population along the Atlantic coast, Eastern Lilaeopsis is one of many plant species restricted in Canada to southern Nova Scotia.

Existing protection or other status designations

No specific protection exists for Eastern Lilaeopsis. It is considered very rare in Maine, New Hampshire and New York, rare in Connecticut and North Carolina, and has not been recorded in Rhode Island for many years. In at least Delaware and New Jersey, it is considered common and secure.

COSEWIC HISTORY

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. On June 5, 2003, the *Species at Risk Act* (SARA) was proclaimed. SARA establishes COSEWIC as an advisory body ensuring that species will continue to be assessed under a rigorous and independent scientific process.

COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the national status of wild species, subspecies, varieties, or other designatable units that are considered to be at risk in Canada. Designations are made on native species and include the following taxonomic groups: mammals, birds, reptiles, amphibians, fishes, arthropods, molluscs, vascular plants, mosses, and lichens.

COSEWIC MEMBERSHIP

COSEWIC comprises members from each provincial and territorial government wildlife agency, four federal organizations (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biosystematic Partnership, chaired by the Canadian Museum of Nature), three nonjurisdictional members and the co-chairs of the species specialist and the Aboriginal Traditional Knowledge subcommittees. The committee meets to consider status reports on candidate species.

DEFINITIONS (AFTER MAY 2004)

Species	Any indigenous species, subspecies, variety, or geographically or genetically distinct population of wild fauna and flora.
Extinct (X)	A species that no longer exists.
Extirpated (XT)	A species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A species facing imminent extirpation or extinction.
Threatened (T)	A species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)**	A species that has been evaluated and found to be not at risk.
Data Deficient (DD)***	A species for which there is insufficient scientific information to support status designation.

* Formerly described as “Vulnerable” from 1990 to 1999, or “Rare” prior to 1990.

** Formerly described as “Not In Any Category”, or “No Designation Required.”

*** Formerly described as “Indeterminate” from 1994 to 1999 or “ISIBD” (insufficient scientific information on which to base a designation) prior to 1994.

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Canada

The Canadian Wildlife Service, Environment Canada, provides full administrative and financial support to the COSEWIC Secretariat.

Update
COSEWIC Status Report

on the

Eastern Lilaeopsis
Lilaeopsis chinensis

in Canada

2004

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SPECIES INFORMATION

Name and classification

Scientific Name:	*Lilaeopsis chinensis* (L.) Kuntze
Bibliographic citation:	Kuntze, C.E.O. 1898. Revisio Generum Plantarum 3(2): 114.
Synonyms:	*Lilaeopsis lineata* (Michx.) Greene
	Lilaeopsis fistulosa A.W.Hill
	Crantzia chinensis (L.) Druce
	Crantzia lineata (Michx.) Nutt.
	Crantziola lineata (Michx.) Koso-Poljansky
	Hallomuellera lineata (Michx.) Kuntze
	Hydrocotyle chinensis (L.)
	Hydrocotyle ligulata Bosc ex DeCandolle
	Hydrocotyle lineata Michx.
	Hydrocotyle sinensis J.F.Gmel.
English Names:	Lilaeopsis, Eastern Lilaeopsis, Eastern Grasswort, Lily-Parsley
French Names:	Liléopsis de l'Est
Family Name:	Apiaceae (Parsley Family)
Major plant group:	Dicot flowering plant

L. chinensis is a small perennial herb growing low to the substrate with dark linear leaf-like structures that arise from a thin rhizome and grow to a few centimetres in height. Short umbels of 5-7 small white flowers are produced in August and September. Flowers have five petals. Descriptions of *L. chinensis* are found in Affolter (1985), Gleason (1978) and Zinck (1998), and the species is illustrated in these publications and in Figure 1.

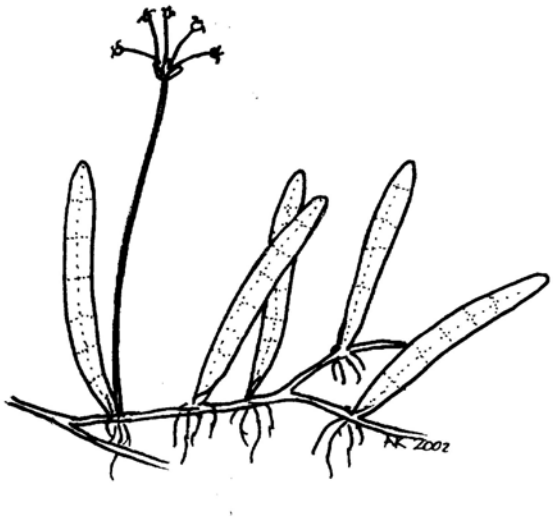

Figure 1. Illustration of *Lilaeopsis chinensis* .

DISTRIBUTION

Global range

Reported from the Atlantic Coast of the USA, from Maine to Florida, west along the Gulf Coast to Texas (BONAP 1998; Figure 2). A disjunct population occurs in southern Nova Scotia.

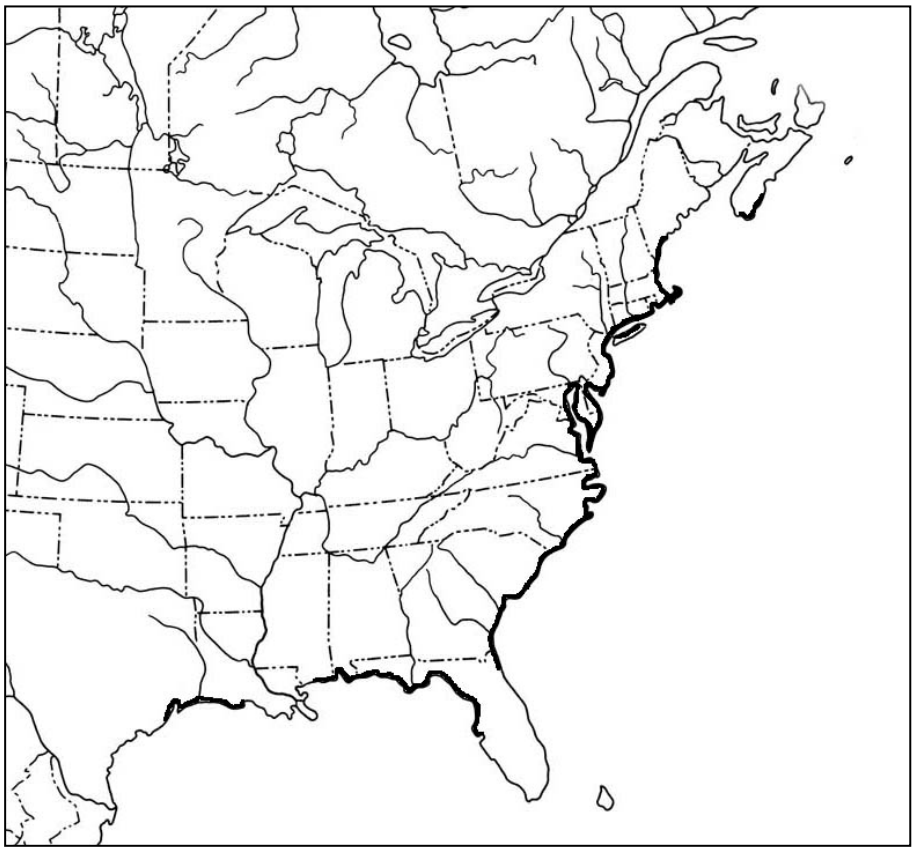

Figure 2. North American range of *Lilaeopsis chinensis*, based on Affolter (1985), BONAP (1998) and Pronych and Wilson (1993).

Canadian range

L. chinensis is found in Canada only on the southern coast of Nova Scotia (Figure 3). In Nova Scotia, the species has been confirmed at three estuaries at the mouths of the Tusket, Medway and LaHave rivers. Keddy (1987) found *L. chinensis* at the Tusket and Medway rivers, but only the Tusket River had been visited with the purpose of looking for *L. chinensis* since 1986; a specimen from that site was retained in 1998. Despite searches at other estuaries in the area, Keddy (1987) found no other population of *L. chinensis*. However, a voucher was collected near the mouth of the LaHave River in 1992 (Pronych and Wilson 1993). Pronych and Wilson (1993) also map

an additional site, without specimen data, in the Ten Mile Lake area (Holder and Kingsley 2001); mapped records in Pronych and Wilson (1993) are often not accurate (Holder and Kingsley 2001).

Field investigations in 2002 found populations at the three previously reported collection sites, but no other population was located.

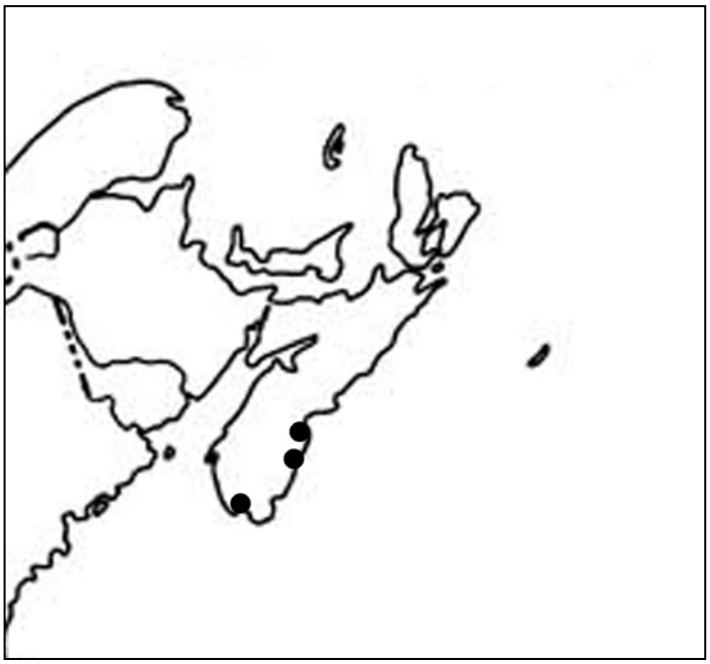

Figure 3. Canadian distribution of *Lilaeopsis chinensis*.

HABITAT

Habitat requirements

In Nova Scotia, Keddy (1987) identified the site characteristics of the two populations she noted during 1986 fieldwork: estuaries at the mouths of large rivers, which are long and narrow with an almost rectangular shape, and separated from the open ocean. Although Keddy (1987) did not visit the mouth of the LaHave River, this area shares the above characteristics.

Lilaeopsis chinensis is a plant of the intertidal zone, most often found in association with *Spartina alterniflora* on gently sloping muddy shorelines, but also on shorelines with fine gravel. The species has been found to grow most often on intertidal mudflats and in areas between large shoreline boulders.

Its distribution in the intertidal zone, from the bottom of the intertidal zone inland to a level that is covered by more than a metre of water at high tide (Keddy 1987, pers. obs.), would indicate that tidal fluctuations may influence its growth. However, Affolter (1985) compared plants grown under different submergence regimes and determined that survivorship was not affected, although growth differed.

Salinity changes both temporally and spatially in *L. chinensis*' environment, but the magnitude of its influence is unknown. Affolter (1985) found that *L. chinensis* grew and flowered profusely when given only freshwater, indicating the species is an obligate shoreline species but a facultative species of brackish water. Although it has been suggested *L. chinensis* is restricted to the intertidal zone due to an inability to compete with taller vegetation found further inland, *L. chinensis* was found growing in abundance and flowering within dense stands of *Spartina alterniflora* (Keddy 1987, pers. obs. in Nova Scotia). Other plants in association with *L. chinensis* include *Solidago sempervirens*, *Glaux maritima* and *Plantago maritima* (Keddy 1987, pers. obs.).

Trends

Intertidal mudflats are present throughout southern Nova Scotia, and although small areas of habitat were destroyed by infilling of bricks and stones for highway construction along the Tusket estuary, there is no clear change in habitat availability within the species' Canadian range. It is expected that habitat loss due to development is responsible for its possible extirpation from Rhode Island and is a potential threat to the species' survival in some parts of its range, but no recent trends have been identified.

Protection/ownership

L. chinensis occurs on private land in Nova Scotia, except for land owned by the Nova Scotia government along a highway rights-of-way at Tusket.

BIOLOGY

General

L. chinensis is placed in the family Apiaceae. It is a semi-aquatic perennial herb found in maritime environments, growing on the shoreline in the intertidal zone. The species is a facultative brackish water species, known to grow well in a controlled environment when provided with freshwater only (Affolter 1985). Densities are known to be very high at three sites in Nova Scotia (Keddy 1987, pers. obs.). More specific aspects of the species' biology are provided below.

Reproduction and physiology

L. chinensis produces small clusters of five to seven tiny white flowers within an umbel, which emerges several centimetres from a node along a thin rhizome. Flowering

takes place in August and September, and with most plants producing seed by mid-September in Nova Scotia (Keddy 1987).

Reproduction is through asexual and presumably sexual means. Most plants are thought to arise from a rhizome through vegetative reproduction, which is thought to be the main means of reproduction necessary for maintaining populations. Self-pollination of flowers is also known to occur in a controlled environment, without artificial manipulation (Affolter 1985). Mechanisms of cross-pollination are not known.

Germination success, seed viability and seed production have not been quantified for *L. chinensis*, but with an assumed production success of 100%, five to seven seeds per umbel would be produced; it is expected germination success would be a lot lower, as qualitatively noted by Affolter (1985), perhaps closer to the 28-60% germination success he found for the related *L. carolinensis*. All populations in Nova Scotia found by Keddy (1987) and during the recent investigation had flowering plants that had produced seeds. Germination is assumed to be epigeous (embryo cotyledon or seed leaf appears above ground as in most other dicot species and as in the related *L. carolinensis* (Affolter 1985)).

With respect to edaphic requirements, *L. chinensis* has been found growing in both muddy environments and those covered with fine gravel. Although the species appears to grow well in semi-aquatic environments, submerged under several metres of water for up to half of every day, Affolter (1985) found plants grew well under relatively well-drained conditions without any submergence. *L. chinensis* grows well in controlled environments with pure freshwater, but its upper limit of salinity tolerance is unknown. *L. chinensis* appears to exhibit a fair amount of phenotypic plasticity dependent on light exposure and submergence, such as number, density and length of leaves and number of flowers, but linkage between these effects and fitness have not been made (Affolter 1985). *L. chinensis* was the least plastic of the *Lilaeopsis* species cultivated by Affolter (1985).

Survival

Based on personal observations of this species, “recruitment” would appear to be mainly through vegetative growth; it is expected to have the ability to remain viable for short periods even if no or little growth is possible during a given year. Certainly, recruitment through sexual reproduction or self-pollination need not be significant for *L. chinensis* to sustain populations. However, nothing has been noted regarding individual survivorship, mainly due to the nature of its growth; plants grow as masses of rhizomes in high densities, which makes it very difficult to quantify survivorship of an “individual”. Through management (i.e., introduction into other areas), population growth and range expansion could be facilitated if thought to be necessary. Natural population growth and range expansion is possible, although is presumably slow and at a fine spatial scale.

Dispersal

Dispersal of individuals is mainly at a fine spatial scale through vegetative growth, spreading vegetatively over a scale of several decimetres within a growing season (Affolter 1985). Clumps of vegetation disrupted through wave action or other water movement may provide the means for colonization and dispersal (Stevenson 1947). Seeds are presumably dispersed through tidal fluctuations and water current, aided by the spongy tissue in the seed that allows them to remain buoyant for considerable time (Affolter 1985). There is the potential for birds to be dispersal vectors over long distances (Affolter 1985). Mechanisms of pollination are unknown.

Rarity at northern locales reduces the expectancy of successful natural recolonization from American populations, with a slim likelihood of this happening. Dispersal and reproduction in this species needs to be researched further.

Nutrition and interspecific interactions

Little is known regarding the nutrient requirements of *L. chinensis*. However, Affolter (1985) found plants produced more flowers and leaves in well-drained and sunnier sites than in shady or submerged conditions.

Although interspecific competition has been thought to limit the distribution of this species (Stevenson 1947, Affolter 1985), restricting it to the intertidal environment, evidence suggests this is not entirely true. Keddy (1987) found *L. chinensis* growing in high densities both in open mudflats and within dense stands of much taller *S. alterniflora*. At some sites, it has been found in association with this species and up to three others (*Glaux maritima*, *Plantago maritima*, *Solidago sempervirens*). Without detailed maps showing change over time, it is difficult to determine if these associations are stable or representative of a transitional take-over of habitat by larger plants. However, *L. chinensis* was found more often within stands of *S. alterniflora* than outside of these stands during recent field investigations, with no apparent difference in leaf health or flowering density.

Adaptability

It is apparent through previous surveys that *L. chinensis* can withstand sometimes hostile and widely fluctuating environments. Wave action, periodic weather events (e.g., high water levels, strong winds, ice), and fluctuations in temperature, moisture and salinity at both short and long temporal scales provide a dynamic and unstable environment in which *L. chinensis* grows. Populations have withstood anthropogenic changes in water flow and nearby disturbance at one site in southern Nova Scotia. However, the extent of its tolerance to human disturbance is largely unknown.

Plants have been successfully grown in controlled, greenhouse environments (Affolter 1985), and individuals could be introduced from such sources. Transplants of *L. chinensis* have not been attempted.

POPULATION SIZES AND TRENDS

Keddy (1987) found the species to be abundant at sites in the Medway and Tusket river estuaries, estimating that *L. chinensis* extended for several kilometres of coastline wherever suitable habitat (gently sloping muddy or gravel shoreline) existed. Keddy (1987) reported very high densities of plants (1,250 / 25 cm^2) at these two sites, although how she determined individuals is unclear (presumably individual leaves). Extrapolating from this value, an estimate of 2.2 billion plants or more (*sensu stricto* per Keddy 1987) may be found along Nova Scotia's south shore, localized at several sites in the Tusket and Medway river estuaries. This is based on a band of growth with an estimated length equal to the extent to which Keddy successfully found *L. chinensis* (Keddy 1987), with a conservative width of two metres. However, A. Kingsley (pers. comm., 2002) estimated in one stretch of the Tusket population a density ranging from 5-50 clumps per m^2 during a 1998 site visit, indicating a discontinuous and patchy distribution. It is very doubtful the simple extrapolation based on Keddy's observation gives an accurate estimate of population size.

Field investigations in 2002 were conducted by Holder over a period of 6 days, with a total of 10 areas searched (supplementary maps of search areas were provided to COSEWIC), including the three estuaries where the species was confirmed to be extant. Two Nova Scotia government employees searched the LaHave site, also in 2002, but found no new sites beyond that reported in this report by Holder. Field investigations by Holder in 2002 confirmed the extent of *L. chinensis* at the Tusket River estuary reported by Keddy (1987). Indeed, the population was found along a greater length of shoreline during 2002 than was found earlier, but this certainly reflected greater search effort rather than a range extension.

In agreement with Kingsley's 1998 observation, distribution was patchy and discontinuous at Tusket, with *L. chinensis* absent from some large sections of shoreline. Along a 450m stretch of shoreline at the mouth of the Tusket, a total of 110m of shoreline hosted *L. chinensis* plants. Where leaves were present, two types of quadrats were thrown to help estimate density. Leaf density as measured by 10cm x 10cm quadrats ranged from 20 to 81 leaves/ 100cm^2, the average being 57 leaves/ 100cm^2. However, five 1m x 1m quadrats showed that extrapolation from these data was inappropriate since densities measured at this scale were far lower than extrapolated values, ranging from 440 to 870 leaves/m^2, with an average of 605 leaves/m^2. Nowhere was density as high as that reported by Keddy (1987), even in small quadrats with dense rhizome growth.

All patches of *L. chinensis* had flowering plants, with densities that similarly ranged with scale. Within 100cm^2 quadrats, flower density ranged from 5 to 24 flowers (average 14 flowers/100cm^2). At a larger spatial scale, density was lower, ranging from 56 to 73 flowers/m^2 (average of 64 flowers/m^2). The size of the population at Tusket is estimated to be between 660,000 and 1,300,000 leaves, or between 84,000 and 110,000 flowers.

The presence of *L. chinensis* at the Medway River estuary was confirmed during 2002. Its distribution was widely scattered along the estuary, occurring in discrete clumps of $1m^2$ up to $100m^2$, up to a hundred or more metres apart. At this location, *L. chinensis* grew in association with *S. alterniflora* and *P. maritima*, almost always within dense stands of the grass. Rarely was it found in open patches within dense *Spartina* stands, and it was not found in the open mudflats further down the intertidal zone. Of the approximately $15,000m^2$ searched in one area near the mouth of the Medway River, *L. chinensis* populated approximately $320m^2$ (~2% of the area).

Where it was found, *L. chinensis* grew in densities greater than those found at Tusket. Within 10 quadrats measuring 10cm x 10cm, densities ranged from 93 to 213 leaves/$100cm^2$, with an average of 156/$100cm^2$. At a large scale, densities were lower than expected from a straight extrapolation of the $100cm^2$ data, but were higher than densities at Tusket. Five $1m^2$ quadrats had a range of 1430 to 1950 leaves/m^2, with an average of 1720/m^2.

Densities of flowers were smaller than at Tusket, somewhat surprising considering the higher densities of leaves within clumps at the Medway estuary. All clumps had flowers, but with a range of 3 to 10 flowers /$100cm^2$ (average of 6/$100cm^2$), or 38 to 64 flowers/m^2 (average 52/m^2), depending on the scale of measurement. Higher densities of leaves but lower densities of flowers seen at the Medway estuary suggests that vegetative reproduction predominates sexual reproduction to a greater degree than seen in the Tusket population. The size of the population at the Medway River is estimated to be between 1.7 and 2.3 million leaves, or between 46,000 and 77,000 flowers.

No information regarding past population size or extent is available for the LaHave River estuary, since Keddy (1987) did not visit the site. However, the species was first recorded at this site in 1992, and its presence was confirmed during 2002. There is no reason to believe that this population has been established recently considering that it is present as scattered colonies within the estuary as compared to perhaps just a single colony of restricted area of occurrence if only recently established.

The population at the LaHave River estuary is scattered and found in much lower densities than seen at either the Tusket or Medway river estuaries. Growth was sparse, with densities of leaves ranging from 10 to 20 leaves /$100cm^2$. Very few flowers were noted; only one or two occurred within clumps of leaves, and some clumps had not produced flowers. However, scattered clumps were found well along the estuary, associated with stands of *S. alterniflora*. The size of the population at the LaHave River is estimated to be between 56,000 and 110,000 leaves, or up to 300 flowers.

Other sites along Nova Scotia's southern coast were surveyed, including superficially similar habitats between known occurrences, but no other population was located.

Although densities observed during 2002 were much lower than those very high densities reported by Keddy (1987), the distribution of extant populations does not appear to have changed. Indeed, data from the Tusket and Medway populations show that measures of density do not remain consistent across spatial scales. These data indicate that *L. chinensis* populations have structure at several spatial scales, where within a populated stretch of shoreline plants grow in clumps between $100cm^2$ and $1m^2$ in size. This probably reflects colonization events at a fine spatial scale, and subsequent growth of individual rhizomes. Although this may appear to be a way one can identify individual plants, identifying discrete clumps of *L. chinensis* was very difficult. Patches of leaves varied in size, and large patches may represent either rhizomes that have been established for a greater length of time, or they may represent clusters of rhizomes that were established in close proximity to each other. It is probably best to use as indices of population size several measures of density, such as the number of leaves and flowers per unit area. Density measurements should be done at a scale of $100cm^2$ and $1m^2$ so as to facilitate future comparisons of density over time.

Population size is expected to fluctuate with local conditions (e.g. occasional storm events, localized disturbance), but the extent is unknown. *L. chinensis* is naturally rare in Canada, reaching the northernmost edge of its range in southern Nova Scotia, the southernmost part of Canada on the Atlantic Coast. Although certain specific and localized sites have been destroyed (Keddy 1987), no changes in population size, health or distribution have been documented for Nova Scotian populations. American populations in the northern Atlantic states are rare, and some localized populations may have been destroyed, such as in Rhode Island. However, it is apparent that it is naturally rare in the northern states for the same reasons *L. chinensis* is rare in Nova Scotia, and at least Delaware and New Jersey harbour common and stable populations of this plant. The likelihood of this species naturally repopulating Canadian shores if it becomes extirpated is very low, due to the apparent rarity of potential sources in the northern Atlantic states with the closest populations occurring in southern Maine about 500 km distant.

LIMITING FACTORS AND THREATS

L. chinensis appears to be an adaptable species able to withstand considerable natural disturbance. This species shares the same habitat as, and is associated with, *Spartina alterniflora* and other species, but its tolerance to interspecific competition is largely unclear. *L. chinensis* is able to grow well in controlled freshwater environments so its absence from natural freshwater environments may be due to an unmeasured inability to compete with species other than those with which it is associated, poor ability to disperse, physical barriers preventing dispersal (Affolter 1985), or unmeasured physiological or reproductive constraints.

Modification of the shoreline through human activity has been noted to destroy *L. chinensis* habitat and probably individual *L. chinensis* (Keddy 1987). Dumping of bricks at one site along the shoreline of the Tusket River estuary presumably destroyed

plants and altered the habitat (from mud to an artificial rocky shore), making recolonization impossible (Keddy 1987). Highway construction was also thought to have destroyed small areas of habitat elsewhere in the estuary (Keddy 1987).

The U.S. Environmental Protection Agency states that sea levels have risen 15-20 cm over the last 100 years. Along the Atlantic coast of the U.S., and into the Canadian Maritimes, sea levels are increasing between 1 mm and 4 mm per year (US EPA 2003). Many factors have contributed to this sea level rise, including the melting of mountain glaciers and polar ice caps, and the increase in ocean water temperatures. Not all factors are connected to greenhouse gases, but global warming appears to be a major cause of rising sea levels seen across the world. What this means to *L. chinensis* is largely unknown, but one can expect that change in the intertidal zone brought about by changing sea levels may be a threat to this intertidal species over the long term.

Anthropogenic changes in water flow or salinity may have an adverse effect on *L. chinensis*. However, it has survived the construction of a dam along the Tusket River and withstood the resulting alteration of water flow and salinity (Keddy 1987). Despite its apparent resilience, further shoreline development that has the potential to destroy habitat and alter salinity, water flow and exchange of fresh and saltwater must be planned with consideration for its potential effect on *L. chinensis* populations. Presently, no threats are imminent.

SPECIAL SIGNIFICANCE OF THE SPECIES

L. chinensis is at the northern edge of its range in Nova Scotia, disjunct from the American part of its range due to historical sea level changes and elimination of habitat. As a relict of a once continuous population, it shares many attributes with other restricted plants in southern Nova Scotia classified as being Atlantic Coastal Plain flora. However, despite being restricted to three sites on Nova Scotia's south shore, it is locally abundant and in no imminent danger of extirpation. It is likely that Nova Scotian populations are genetically distinct from American populations in some way due to vicariance, but further work is needed to substantiate or refute this suggestion.

There is little evidence to suggest the general populace is aware of this species, despite the work of the Atlantic Coastal Plain Recovery Team and Nature Conservancy Canada. No traditional knowledge of this plant has been found in the literature.

EXISTING PROTECTION OR OTHER STATUS DESIGNATIONS

It has been designated as of Special Concern in 1987 by the Committee on the Status of Endangered Wildlife in Canada, but receives no legal protection. It is considered critically imperilled (S1) by the Atlantic Canada Conservation Data Centre, and is known or thought to be at risk by the Nova Scotia Department of Natural Resources. Nationally, although known from only Nova Scotia, it is given the

conservation rank of N2 (NatureServe Explorer 2001). It receives no specific protection under the Nova Scotia Endangered Species Act or under any other provincial legislation.

Globally, it is considered to be very common and demonstrably secure, given the rank of G5 (NatureServe Explorer 2001). It is reported from all states along the Atlantic and Gulf coasts, but has been given conservation subnational ranks in only eight states. It is considered very rare (S2) in Maine, New Hampshire and New York, rare (S3) in Connecticut and North Carolina, common (S4) in New Jersey and very common (S5) in Delaware (NatureServe Explorer 2001); it has not been reported from Rhode Island since 1900, and is given the rank of SH (Enser 2002). It is designated of Special Concern in Connecticut and Threatened in New York (Young 2001, Connecticut Department of Environmental Protection 2002).

TECHNICAL SUMMARY

Lilaeopsis chinensis
Eastern lilaeopsis — Liléopsis de l'Est
Range of Occurrence in Canada: Nova Scotia

Extent and Area Information	
• *Extent of occurrence (EO)(km²)* *(0.5 km band along approximate length of coast between Tusket and LaHave rivers)*	90 km²
• *Specify trend in EO*	Stable, based on distribution
• *Are there extreme fluctuations in EO?*	No evidence
• *Area of occupancy (AO) (km²)* *(0.5 km band along stretch of coastline where species has been found)*	9 km²
• *Specify trend in AO*	Stable, based on distribution
• *Are there extreme fluctuations in AO?*	No evidence
• *Number of known or inferred current locations*	3
• *Specify trend in #*	Stable
• *Are there extreme fluctuations in number of locations?*	No evidence
• *Specify trend in area, extent or quality of habitat*	Stable in area, extent and quality
Population Information	
• *Generation time (average age of parents in the population)*	Unknown, (herbaceous perennial)
• *Number of mature individuals*	130,000 – 187,000 *(based on estimated number of flowers at three sites)*
• *Total population trend:*	Unknown trend, but probably stable
• *% decline over the last/next 10 years or 3 generations.*	Not Applicable
• *Are there extreme fluctuations in number of mature individuals?*	No evidence
• *Is the total population severely fragmented?*	Yes
• *Specify trend in number of populations*	Stable
• *Are there extreme fluctuations in number of populations?*	No evidence
• List populations with number of mature individuals in each: Tusket: 84,000 – 110,000 Medway: 46,000 – 77,000 LaHave: <300 *(numbers represent estimated number of flowers at each site as a relative measure of reproductive capability of the primarily vegetative plants)*	
Threats (actual or imminent threats to populations or habitats)	
- No actual or imminent threats known at this time. Road construction and dumping of materials have destroyed localized habitat and likely eliminated some plants in the past, and may do so again in the future.	

Rescue Effect (immigration from an outside source)	
• *Status of outside population(s)?* **USA:** rare (S2) in Maine, New Hampshire and New York, rare (S3) in Connecticut and North Carolina, common (S4) in New Jersey and very common (S5) in Delaware	
• *Is immigration known or possible?*	Unlikely
• *Would immigrants be adapted to survive in Canada?*	Probably
• *Is there sufficient habitat for immigrants in Canada?*	Yes
• *Is rescue from outside populations likely?*	Unlikely
Quantitative Analysis	Not Applicable
Other Status COSEWIC: Special Concern (1987)	

Status and Reasons for Designation

Status: Special Concern	**Alpha-numeric code:** **Not Applicable**
Reasons for Designation: Small perennial herb reproducing both by seed and extensively by vegetative spread. It is geographically highly restricted and present in Canada at only three estuaries in Nova Scotia. The area of occupancy is very small but the population is large. No declines of significance have been documented over the last 15 years. It does not appear to have any imminent threats; however, future shoreline development or degradation could destroy extant populations.	
Applicability of Criteria **Criterion A** (Declining Total Population): N/A: No declines documented **Criterion B** (Small Distribution, and Decline or Fluctuation): N/A: No continuing decline documented; existing sites relatively stable. **Criterion C** (Small Total Population Size and Decline): N/A: Large population and no declines of significance documented. **Criterion D** (Very Small Population or Restricted Distribution): N/A: Although occupying a small range and present in only three estuaries but as large populations, there are no obvious threats that would result in the species becoming highly endangered in a short period of time. **Criterion E** (Quantitative Analysis): N/A	

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Newell, R. April 2002. Curator, E. C. Smith Herbarium, Acadia University, Wolfville, Nova Scotia B0P 1X0,

LITERATURE CITED

Affolter, J.M. 1985. A monograph of the genus *Lilaeopsis* (Umbelliferae). Systematic Botany Monographs 6: 1-140.

Biota of North America Program [BONAP]. 1998. A synonymized checklist of the vascular flora of the United States, Puerto Rico and the Virgin Islands. Web site: http://www.csdl.tamu.edu/FLORA/b98/c98use.htm. [accessed April 2002].

Connecticut Department of Environmental Protection. 2002. Endangered, threatened and special concern plants. Web site: http://dep.state.ct.us/cgnhs/nddb/plants.htm [accessed April 2002].

Enser, R.W. 2002. Rare native plants of Rhode Island. Rhode Island Natural Heritage Program. January 2002. 12 pp.

Gleason, H.A. 1978. The new Britton and Brown illustrated flora of the northeastern United States and adjacent Canada. Volumes 1, 2 & 3. Hafner Press, New York.
Holder, M., and A. Kingsley. 2001. Atlantic Coastal Plain flora in Nova Scotia - species data summaries. Report prepared for Nova Scotia Department of Natural Resources, Wildlife Division. 111 pp. + appendices.
Keddy, C. 1987. Status report on the Lilaeopsis, *Lilaeopsis chinensis*, in Canada. Committee on the Status of Endangered Wildlife in Canada. 11pp + iii + appendix.
NatureServe Explorer. 2001. An online encyclopedia of life [web application]. Version 1.6 . NatureServe, Arlington, Virginia. Web site: http://www.natureserve.org/explorer. [accessed February 2003].
Pronych, G., and A. Wilson. 1993. An atlas of rare vascular plants in Nova Scotia, vols. 1, 2. Curatorial Report No. 78, Nova Scotia Museum of Natural History.
Stevenson, G.B. 1947. The growth of a species of the genus Lilaeopsis in fresh-water reservoirs near Wellington. Transactions of the Royal Society of New Zealand, Botany 76: 581-588. Cited in Affolter 1985.
United States Environmental Protection Agency [US EPA]. 2003. Global Warming – Sea Level. Website: http://yosemite.epa.gov/oar/globalwarming.nsf/webprintview/ClimateTrendsSeaLevel.html [accessed August 2003].
Young, S.M. 2001. New York rare plant status list. New York Natural Heritage Program. April 2001. 62 pp.
Zinck, M. 1998. Roland's Flora of Nova Scotia. Volume 1. Nimbus Publishing, Halifax, Nova Scotia.

BIOGRAPHICAL SUMMARY OF THE REPORT WRITER

Matt Holder is presently employed as a biologist at Jacques Whitford Environment Limited. Mr. Holder has over ten years of work and research experience in biology, particularly ecology, encompassing many plant and animal taxa. His research interests include ecology of animals and plants in disturbed environments, landscape ecology and systematics of certain animal taxa. His academic research done as part of his Honours B.Sc. at the University of Toronto and his M.Sc. at Acadia University, reflect these interests.

Mr. Holder's past work relating to species-at-risk include field surveys of rare species in Maritime peatlands for the Atlantic Canada Conservation Data Centre, species-at-risk database creation and maintenance for the Ontario Natural Heritage Information Centre, and the development of a comprehensive database for dragonflies and damselflies. Recently, he completed a project for the Nova Scotia Department of Natural Resources, which included the compilation of existing data on rare Atlantic Coastal Plain flora, including *Lilaeopsis chinensis*.

COLLECTIONS EXAMINED

Collections at Acadia University (ACAD), Canadian Museum of Nature (CAN), Nova Scotia Provincial Museum (NSPM), Gray Herbarium of Harvard University (GH), and University of Toronto (TRT) were examined by Keddy (1987). ACAD and NSPM were examined for this report.