

Management Plan for the Victorin's Water-hemlock (*Cicuta maculata* var. *victorinii*) in Canada

Victorin's Water-hemlock



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PREFACE

The federal, provincial, and territorial government signatories under the Accord for the Protection of Species at Risk (1996) agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Under the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the federal competent ministers are responsible for the preparation of management plans for listed Extirpated, Endangered, and Threatened species and are required to report on progress within five years.

The Minister of the Environment and the Minister responsible for the Parks Canada Agency are the competent ministers for the conservation of the Victorin's Water-hemlock, which is listed as a species of special concern in Schedule 1 of SARA. This management plan was developed in accordance with section 65 of SARA in cooperation with the Government of Quebec (Ministère du Développement durable, de l'Environnement et des Parcs (MDDEP), under subsection 66(1) of SARA.

Success in the conservation of this species cannot be achieved by Environment Canada, Parks Canada Agency or any other jurisdiction alone; it depends on the commitment and cooperation of many interested parties that will be involved in implementing the recommendations set out in this management plan. All Canadians are invited to support the management plan and to contribute to its implementation in the interest of Victorin's Water-hemlock and Canadian society as a whole. Implementation of the plan is subject to the appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

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EXECUTIVE SUMMARY

Victorin's Water-hemlock (*Cicuta maculata* var. *victorinii*) is a perennial herbaceous plant measuring 0.5 to 2 metres tall. It is endemic to the upper freshwater estuary of the St. Lawrence, where it occurs only in the freshwater or slightly brackish intertidal zones. It was assessed as a species of special concern in Canada by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in May 2004 and was added to Schedule 1 of the *Species at Risk Act* in July 2005.

The Victorin's Water-hemlock population is estimated at between 1700 and 6500 fruiting individuals. To date, the species has been recorded in 45 element occurrences¹ (herein referred to as occurrences) along the St. Lawrence River between the municipalities of Batiscan in the southwestern part of its range and Saint-Jean-Port-Joli (south shore) and Saint-Joachim (north shore) in the northeastern part. Three of these occurrences have not been observed for over 25 years, two have been extirpated and one is questionable. Habitat loss by shoreline in-filling and infrastructure construction is the most serious threat to Victorin's Water-hemlock. Trampling, invasive plants and shoreline mowing also pose a threat to the species.

The management objective has two distinct time frames. In the long term, the objective is to maintain and, if possible, increase the population size and area of occupancy of Victorin's Water-hemlock throughout its range in Quebec. In the short term, the objective is to maintain and, if possible, increase the species' population size and area of occupancy for each of the 18 occurrences identified as priorities.

The broad management strategies for Victorin's Water-hemlock are to ensure the conservation and management of occurrences, to reduce the main threats to the species and its habitat, and to increase knowledge of the species' demographics, biology and taxonomy. The implementation activities and schedule associated with these strategies are presented in this management plan.

¹ Element occurrence: area of land and/or water in which a species is, or was present (NatureServe, 2010).

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1. COSEWIC SPECIES ASSESSMENT INFORMATION

Date of Assessment: May 2004

Common Name: Victorin's Water-hemlock

Scientific Name: *Cicuta maculata* var. *victorinii*

COSEWIC Status: Special Concern

Reason for Designation: A geographically highly restricted perennial that is endemic to the freshwater or slightly brackish shoreline areas of the St. Lawrence River estuary in Quebec. It is present at about 33 localities but in very small localized habitats where it is at risk from a wide range of impacts. These impacts include: actual destruction of plants due to ATV traffic and human trampling, and mowing of shoreline vegetation; losses of suitable potential shoreline habitat also occurs through shoreline in-filling and development and potential loss of plants may occur due to confusion with the common variant of the species that is considered a noxious weed. Oil spills may also pose a potential risk.

Canadian Occurrence: Quebec

COSEWIC Status History: Designated Special Concern in April 1987. Status re-examined and confirmed in May 2004.

2. SPECIES STATUS INFORMATION

Victorin's Water-hemlock is endemic to Quebec, which means that the entire population occurs in Canada. It was listed on Schedule 1 of the *Species at Risk Act* (S.C. 2002, c. 29) (SARA) as a species of special concern in July 2005. It was designated as threatened in Quebec under the *Quebec Act Respecting Threatened and Vulnerable Species* (R.S.Q., c. E-12.01) in 2001. Victorin's Water-hemlock has been given a global rank of G5T2 (species widespread and abundant at the global level with imperiled subspecies), a national rank in Canada of N2 (imperiled) and a subnational rank in Quebec of S2 (imperiled) by NatureServe (2010).

3. SPECIES INFORMATION

3.1 Species Description

Victorin's Water-hemlock is one of three known varieties (var. *victorinii*, var. *maculata* and var. *angustifolia*) of Water-hemlock (*Cicuta maculata*) in Canada (COSEWIC, 2004). This herbaceous perennial of the family Umbelliferae is between 0.5 and 2 metres (m) tall. Its erect stem, which is often streaked with purple, is hollow, except at the nodes, and is encircled by the

leaf stalk. The leaves are alternate, lanceolate² to ovate lanceolate, 10 to 80 cm long and 4 to 8 cm wide. Each leaf is divided into three linear-lanceolate, finely toothed leaflets. The inflorescence is composed of umbellets² with unequal pedicels² that bear small white flowers. The fruit, produced from August to October, is a light to dark brown double achene, 3.5 to 4 mm long, that separates into two seeds at maturity, each with corky ribs. The lateral ribs are more prominent than the dorsal ribs, which are sometimes absent. All parts of the plant are toxic (COSEWIC, 2004).

3.2 Populations and Distribution

The varieties *victorinii* and *maculata* occur in Quebec. Victorin's Water-hemlock (var. *victorinii*) is endemic to the upper freshwater estuary of the St. Lawrence River. The southwestern limit of its range is at Batiscan on the north shore of the river and the northeastern limit is at Saint-Jean-Port-Joli on the south shore and at Saint-Joachim on the north shore (Figure 1). A disjunct occurrence was reported at Chandler at the time of the review of the Water-hemlock specimens of the Marie-Victorin herbarium (COSEWIC, 2004). This historical observation is based on a specimen collected in 1931 and must be validated.

Victorin's Water-hemlock is known from 45 occurrences, all located downstream of Batiscan along the St. Lawrence River (Appendix A). That figure is up from the 39 occurrences reported in the COSEWIC status report (2004) and is the result of the discovery of six new occurrences since the species assessment.

The Centre de Données sur le Patrimoine Naturel du Québec (CDPNQ, 2009) has demographic data for 34 of the 45 occurrences³ and ranks them as follows (see Appendix B for the definition of the quality ranks):

- 11 occurrences with a quality rank of A (excellent)
- 6 occurrences with a quality rank of B (good)
- 3 occurrences with a quality rank of C (fair)
- 12 occurrences with a quality rank of D (poor)
- 7 occurrences with a quality rank of E (recent)
- 1 occurrence with a quality rank of F (not relocated)
- 3 occurrences with a quality rank of H (historical)
- 2 occurrences with a quality rank of X (extirpated).

All occurrences located in the western part of the species' range are of poor quality. There is no apparent reason for this, particularly since there is excellent-quality habitat at those occurrences. According to Jolicoeur and Couillard (2007), the population is estimated at between 1700 and 6500 fruit-bearing individuals. However, more recent surveys suggest that the total population is much higher. For instance, Gilbert (2009, 2010) reports that the population (fruit-

² Lanceolate: lance-shaped; umbellet: a small umbel of a compound umbel (type of inflorescence whose many flowers extend outwards like the radii of a sphere); pedicel: stalk of each flower. Adapted from Marie-Victorin (1964).

³ The 11 occurrences for which CDPNQ has no demographic data are occurrences that either have not been surveyed for over 25 years or have never been surveyed.

bearing plants and vegetative plants; that is, young plants that have not yet developed flowers) in five of these occurrences is over 10 000 individuals and that fruit-bearing plants represent approximately 5% of the species's total population.

According to the COSEWIC report (2004), the population trend is stable. Surveys conducted since the publication of that report suggest that this is still the case. The increase in the number of occurrences since the species assessment does not necessarily indicate an increase in population size or range, but rather reflects a more intensive search effort.

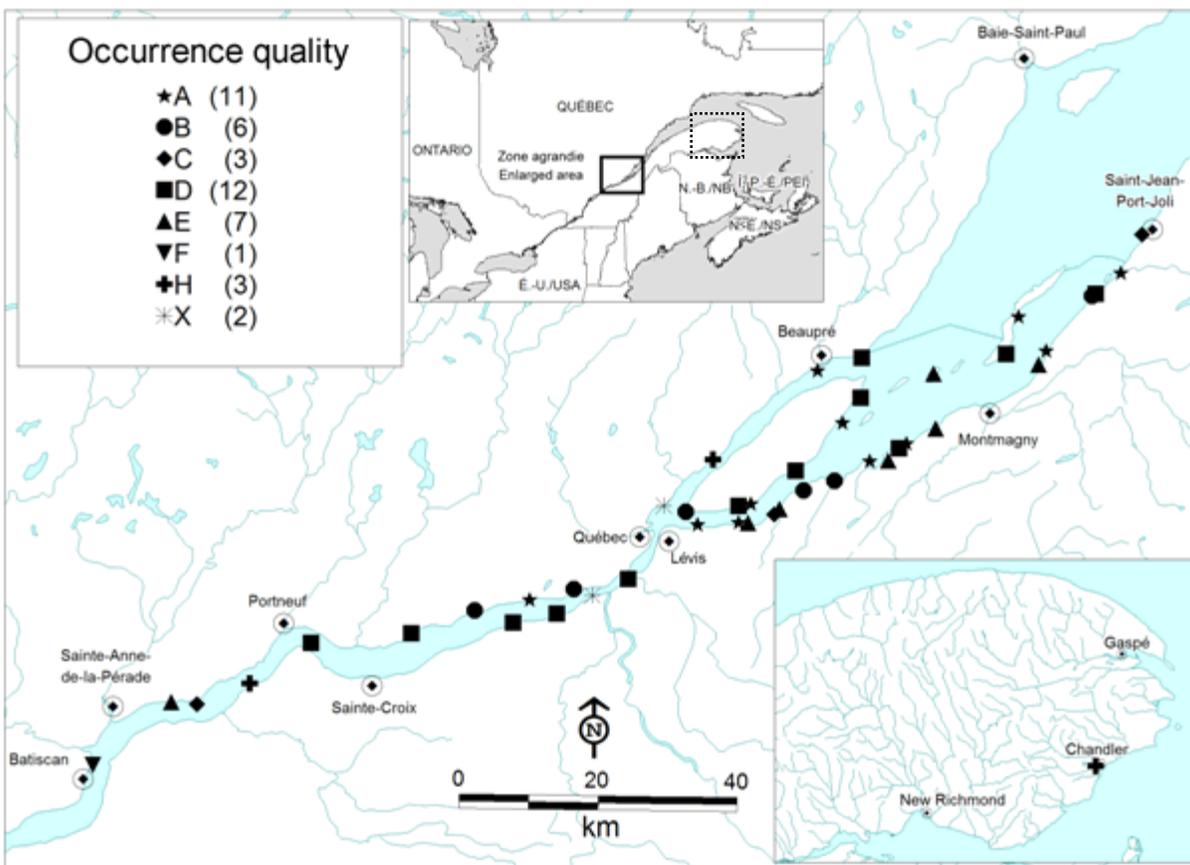


Figure 1. Distribution of occurrences of Victorin's Water-hemlock in Quebec (CDPNQ, 2009).
Note: The dotted area shown in the upper insert is enlarged in the lower insert.

3.3 Needs of the Victorin's Water-hemlock

3.3.1 Habitat and biological needs

The habitat of Victorin's Water-hemlock is defined as the freshwater and brackish intertidal zone of the St. Lawrence estuary. The species typically grows in tall, dense Prairie Cordgrass (*Spartina pectinata*) beds on the upper littoral (that portion of the littoral that dries completely at low tide) (Robert, 1993; Brouillet et al., 2004). The upper littoral is covered by water for two to three hours a day during equinoctial high tides, but seldom reached by low high tides.

In the mid-littoral zone or on thin substrate, the species can also occur in open, low grassbeds, but the plants are smaller than those of the upper littoral (Robert, 1993). In the study by Brouillet et al. (2004), 75% of the observations of Victorin's Water-hemlock were located in the upper littoral, with the remaining 25% in the upper part of the mid-littoral zone. Victorin's Water-hemlock occupies thick (> 15 cm), fine- or mixed-grained (never coarse), non-stony to slightly stony (seldom very stony) surface deposits. The density of individuals is markedly lower on gravel and pebble substrates (Robert, 1993). The water pH measured at several occurrences ranges from 8.0 (Anse de Berthier and L'Islet) to 8.5 (Anse de Saint-Vallier) (Rousseau, 1930; 1932). The surface deposits consist of fragmented schist and suspended silt (Legault, 1986), with a pH of 7.5 (Rousseau, 1930).

3.3.2 Limiting factors

Because of its very specific ecological requirements, Victorin's Water-hemlock is confined to the freshwater or slightly brackish intertidal zone. Its distribution in Quebec is limited by the small-amplitude tides upstream of Batiscan and the higher water salinity in the region of Saint-Jean-Port-Joli, the L'Isle-aux-Grues archipelago and Beaupré. The Chandler occurrence must be confirmed and the habitat of the Victorin's Water-hemlock has not been described at that location. It is highly likely that it resembles the occurrence found in the freshwater or slightly brackish intertidal zone of the St. Lawrence.

Although it is toxic to mammals, as is also the variety *maculata*, signs of browsing by Muskrats (*Ondatra zibethicus*) and White-tailed Deer (*Odocoileus virginianus*) were observed in 2009 at some locations, but it is believed to be random and not targeted specifically at this species (Gilbert, 2010). Aphids have been observed in large numbers on umbellets and fruits (COSEWIC, 2004), and the larvae of Black Swallowtail butterflies are known to feed on the flowers and seeds (Morisset, 2008; P. Désilets, pers. obs.).

4. THREATS

4.1 Threat Assessment

Table 1. Threat Assessment Table

Threat	Level of concern ¹	Extent	Occurrence	Frequency	Severity ²	Causal certainty ³
Habitat loss or degradation						
Shoreline in-filling and infrastructure construction	High	Widespread	Historical/ Anticipated ⁴	One-time/ Unknown	High	High
Human trampling	High	Localized	Current/ Anticipated	Continuous/ Recurrent	High	High
Erosion	Low	Widespread	Current	Recurrent	Moderate	High
Ice scouring	Low	Widespread	Current/ Imminent	Seasonal	Low/ Unknown	Low
Dumping of debris on the littoral	Low	Localized	Current	Seasonal	Low	Low
Exotic, invasive or introduced species/genome						
Invasive plants	High/Medium	Localized	Current	Continuous	High/Low	Low
Changes in ecological dynamics or natural processes						
Mowing	Medium	Localized	Current	Continuous/ Recurrent	High/Low	High
Overabundant wildlife populations	Medium/Low	Localized	Current	Seasonal	Moderate/ Low	Medium/ Low
Climate and natural disasters						
Changes in water salinity due to climate change	Low	Localized	Anticipated	Continuous	High/ Unknown	Medium / Low
Pollution						
Fertilizer discharges	Low	Widespread	Current	Unknown	Low/ Unknown	Low
Oil spills	Low	Localized	Anticipated	One-time	Unknown	Low

¹ Level of Concern: signifies that managing the threat is of (high, medium or low) concern for the recovery of the species, consistent with the population and distribution objectives. This criterion considers the assessment of all the information in the table.

² Severity: reflects the population-level effect (high: very large population-level effect, moderate, low, unknown).

³ Causal certainty: reflects the degree of evidence that is known for the threat (high: available evidence strongly links the threat to stresses on population viability; medium: there is a correlation between the threat and population viability e.g. expert opinion; low: the threat is assumed or plausible).

⁴ Each threat assessment criterion is assessed for each occurrence and for the entire range. When two qualifiers are indicated in a box, that means the identified threat does not have the same impact at both levels (scale of occurrences/entire range).

4.2 Description of Threats

The threats are presented in decreasing order of concern.

Shoreline in-filling and infrastructure construction

Shoreline in-filling for the construction of infrastructure such as homes, roads, piers, railway lines and marinas is responsible for significant loss of Victorin's Water-hemlock habitat in the Quebec City region, and has resulted in local extinctions (COSEWIC, 2004). For example, the construction of the railway line at Cap-Rouge almost destroyed the entire natural shoreline between Saint-Augustin-de-Desmaures and Cap-Rouge, preventing recolonization by Victorin's Water-hemlock. Shoreline in-filling has been prohibited since 1987 under the Quebec *Environment Quality Act* (R.S.Q., c. Q-2, s. 2.1). However, the number of projects requiring access to the shoreline continues to grow. Harbour expansion and marina construction projects, such as those at Saint-Jean-Port-Joli, destroy the upper littoral where Victorin's Water-hemlock occurs. The restoration of deteriorating retaining walls and shoreline excavation activities also cause habitat loss and degradation. These problems appear to be widespread throughout the species' range, with the exception of the L'Isle-aux-Grues occurrences.

Human trampling

Occurrences of Victorin's Water-hemlock are highly exposed to human trampling (hikers, water sports enthusiasts, kiteboarders, etc.) and all-terrain vehicle (ATV) traffic in the intertidal zone (COSEWIC, 2004). These activities not only result in the mortality of individuals, but also significantly alter the species' habitat by compacting the soil and creating openings that increase erosion of the substrate due to wave action.

Invasive plants

Invasive plant species, such as Common Reed (*Phragmites australis*), are significant threats to Victorin's Water-hemlock (Désilets et al., 2009), because, once established, they can replace all other species of the upper littoral. In addition, there are few known effective measures for controlling these species or limiting their spread (Gilbert 2009, 2010). Common Reed now occurs in high densities in the upper littoral of the Cap-Saint-Ignace occurrence and also covers part of the Saint-Jean-Port-Joli occurrence. There is a risk that it will become established and spread very quickly; in fact, pockets of dispersal exist both downstream and upstream of several recently visited occurrences (Gilbert 2009, 2010a, b). Occurrences of Victorin's Water-hemlock are highly exposed to human trampling. Habitat disturbances caused by human activities (hunting, ATV use, kayaking, etc.) promote the establishment of invasive species. This threat is not identified in COSEWIC (2004).

Mowing

Mowing of the littoral along the St. Lawrence estuary by shoreline residents has been observed at several locations (COSEWIC, 2004). Mowing deprives Victorin's Water-hemlock of its only means of reproduction by preventing the formation of flower stalks and can therefore lead to the extirpation of some occurrences. Mowing is common at sites along the shoreline where there are homes and cottages and in regions used by hunters and residents, such as Saint-Augustin-de-Desmaures and the Côte-de-Beaupré sector.

Overabundant wildlife populations

Increases in certain wildlife populations caused by human activity can pose a significant threat to Victorin's Water-hemlock. For example, the introduction of White-tailed Deer in the L'Isle-aux-Grues archipelago, and the subsequent spread of the population to Grosse-Île, has resulted in increased browsing, trampling and alteration of Victorin's Water-hemlock habitat. Signs of browsing by White-tailed Deer on Victorin's Water-hemlock was observed at Grosse-Île in 2009 (29% of plants browsed,⁴ Gilbert, 2010). The overabundance of Greater Snow Geese (*Chen caerulescens*), which is associated with the increasingly common presence of grain crops on resting and wintering grounds, can also modify the integrity of marshes and Victorin's Water-hemlock habitat (Bélanger and Lefebvre, 2006; Gilbert, 2010). This threat was not identified in COSEWIC (2004).

Changes in water salinity due to climate change

Climate change could have a number of effects on the dynamics of the St. Lawrence River. First, the reduction in flows caused by increased retention of the Great Lakes waters or by a decline in precipitation in the watershed could modify the salinity level in the estuary (Ouranos, 2004). Victorin's Water-hemlock tolerates low salinity conditions, and the upstream movement of salinity would likely lead to the disappearance of occurrences further downstream, particularly those of Saint-Jean-Port-Joli and the L'Isle-aux-Grues archipelago. Alternatively, the rise in sea level due to melting of glaciers could increase the water level of the St. Lawrence River and move the fresh-/brackish-water limit upstream, potentially resulting in the same effects (Gilbert, 2010a).

⁴ According to Frédéric Coursol (pers. comm.), the flower stalks can sometimes be torn off by tidal action, which can give the appearance of browsing. This percentage is probably overestimated.

Ice scouring

Ice scouring of rocks and shoreline during the daily tidal cycle and spring ice break-up can uproot plants (COSEWIC, 2004). However, it can also be beneficial by providing areas suitable for seed establishment. It is not known whether these natural events are more frequent, widespread or severe than they were before the construction of infrastructure along the banks of the St. Lawrence or before climate change affected the river. Pierre Morisset (pers. comm.) mentions a marked decline in the number of individuals in the Saint-Jean-Port-Joli occurrence due to abrasion by moving ice in winter. At one time, the intertidal zone was characterized by stable ice cover for the entire winter, limiting ice scouring to a shorter period in the spring. Gilbert (2010) also notes that several occurrences of Victorin's Water-hemlock are affected by this problem.

Pollution

Although the water quality of the St. Lawrence River is improving, it is still polluted by many different kinds of discharges, including phosphates from agricultural or residential sources (COSEWIC, 2004). In some areas, the presence of fertilizers in the St. Lawrence River causes blooms of algae and other aquatic plant species (e.g., *Vallisneria americana*, *Potamogeton* sp.) that can cover occurrences of Victorin's Water-hemlock. Subsequent tides stir up the water and uncover the plants, but their amplitude is variable.

Erosion

Changes in St. Lawrence water levels can delay freeze-up, thus enabling fall storms to cause significant damage to shorelines by accelerating the erosion of shorelines and structures designed to protect shoreline in-filling (Ouranos, 2004). Increased erosion results in net habitat loss, a phenomenon which is exacerbated by the wake of vessels operating in the St. Lawrence Seaway (Gilbert, 2010a). It is from this perspective that the conservation of the stream buffer is so important. Experts predict that water levels in the freshwater estuary will rise by 10 cm and that winter ice cover will gradually disappear, which should accelerate the rate of erosion of the upper marsh zone. The species that occur in this habitat (including Victorin's Water-hemlock) will be able to move to higher elevations only if there are natural areas left to support them (Line Couillard, pers. comm.). This threat was not identified in the COSEWIC report (2004).

Oil spills

An oil spill could destroy occurrences of Victorin's Water-hemlock along the freshwater estuary of the St. Lawrence by fouling individuals with toxic products and changing the abiotic conditions (Coursol, 1999; COSEWIC, 2004). The impacts associated with oilspill clean-up operations along the shoreline would also be considerable. This risk is increased by the narrowness of the St. Lawrence River at Quebec City.

Dumping of debris on the littoral

Debris discarded by residents along the shoreline (e.g., very dense piles of wood chips, mowing debris along the shoreline, grass clippings, leaves in fall) has been observed in some occurrences. If plants in these occurrences are covered with debris for too long a period, flowering and survival are compromised. However, given the species's position in the upper littoral, it is subject to natural plant debris (e.g., algae) deposition, which occurs twice a day with the tides. This threat was not identified in the COSEWIC report (2004).

5. MANAGEMENT OBJECTIVE

The management objective has two distinct time frames. In the long term, the objective is to maintain and, if possible, increase the population size and area of occupancy of Victorin's Water-hemlock throughout its range in Quebec. In the short term, the objective is to maintain and, if possible, increase the population size and area of occupancy of Victorin's Water-hemlock for each of the 18 occurrences identified as priority targets.

The approach used to identify priority targets is taken from the Quebec government's Victorin's Water-hemlock conservation plan (Jolicoeur and Couillard, 2007), which identifies priority targets on the basis of four criteria: 1) protection of all known occurrences of excellent (A) and good (B) quality; 2) protection of at least one viable occurrence per currently occupied physiographic unit; 3) protection of at least one viable occurrence per currently occupied habitat type; and 4) reintroduction of the species, where applicable, in all physiographic units in which it is extirpated or historically known.

The conservation plan identifies 17 occurrences as priority targets. However, on the basis of surveys conducted after the plan was published, a new occurrence with a quality rank of B (that of Neuville) was added and the quality ranks of several occurrences were revised. The application of the four priority target selection criteria to these more recent data led to the identification of 17 occurrences with quality ranks of A and B. One occurrence with a quality rank of C was added to represent the various sectors of the range (criterion 2). These occurrences meet the requirements of the third and fourth criteria without it being necessary to add other priority targets. A total of 18 occurrences are therefore identified as priority targets (Table 2).

The 18 priority occurrences alone represent approximately 90% of the fruit-bearing plants. In addition, several priority occurrences support other plant species at risk or listed as likely to be so designated (SARA, *Quebec Act Respecting Threatened or Vulnerable Species*), which increases their conservation value.

Table 2. Priority Occurrences of Victorin's Water-hemlock¹

No.	Occurrence	Quality Rank	Number of Other Plant Species at Risk ²	Administrative Region/ Regional County Municipality	Ownership/Protection ³
1	Deschambault Grondines	C	11	Capitale-Nationale/ Portneuf	Public
2	Saint-Augustin-de-Desmaures	A	13	Capitale-Nationale/ Québec	Private/ Protected private site
3	Cap-Rouge	B	8	Capitale-Nationale/ Québec	Public
4	Sainte-Pétronille	B	1	Capitale-Nationale/ L'Île-d'Orléans	Public
5	Lévis, Pointe de La Martinière	A	5	Chaudière-Appalaches/ Lévis	Private
6	Beaumont, Anse de Vincennes and area to the west	A	4	Chaudière-Appalaches/ Lévis	Public
7	Saint-Laurent-de-l'Île-d'Orléans	A	1	Capitale-Nationale/ L'Île-d'Orléans	Public
8	Saint-Michel de-Bellechasse	B	7	Chaudière-Appalaches/ Bellechasse	Public / Plant habitat
9	Pointe à Labrecque, Anse Saint-Vallier (Saint-Michel-de-Bellechasse, Saint-Vallier)	B	8	Chaudière-Appalaches/ Bellechasse	Public
10	Beaupré	A	2	Capitale-Nationale/La Côte-de-Beaupré	Public
11	Pointe Dauphine (Saint-Jean-de-l'Île-d'Orléans)	A	9	Capitale-Nationale/ L'Île-d'Orléans	Public
12	Pointe de Saint-Vallier, Anse de Bellechasse	A	7	Chaudière-Appalache/ Bellechasse	Mixed/ Protected private site
13	Anse de Berthier	A	9	Chaudière-Appalaches/ Montmagny	Public / Plant habitat
14	Île aux Grues	A	-	Chaudière-Appalaches/ Montmagny	Public
15	Anse du Cap (Cap-Saint-Ignace)	A	4	Chaudière-Appalaches/ Montmagny	Public / Plant habitat
16	L'Islet, Rocher Panet	B	-	Chaudière-Appalaches/ L'Islet	Public
17	Saint-Jean-Port-Joli, Anse de Trois-Saumons	A	-	Chaudière-Appalaches/ L'Islet	Public
18	Neuville, south of the Provencher marsh	B	10	Capitale-Nationale/ Neuville	Mixed / Protected private site (partial)

¹ Adapted from Jolicoeur and Couillard (2007).² Number of plant species designated as threatened or vulnerable under the Quebec *Act Respecting Threatened or Vulnerable Species* or listed as likely to be so designated according to the CDPNQ.³ Certain occurrences are located in aquatic bird gathering sites (status assigned by the Quebec Ministère des Ressources Naturelles et de la Faune) and migratory bird sanctuaries. Although these status designations can help to limit certain threats, they do not have the explicit objective of protecting plants. They are not mentioned in this table, nor are they considered as affording protection to Victorin's Water-hemlock.

6. BROAD STRATEGIES AND MANAGEMENT ACTIONS

6.1 Actions Already Completed or Currently Underway

Monitoring of occurrences

A monitoring method was developed in 2008 as part of the initiatives of the recovery team for threatened vegetation of the St. Lawrence freshwater estuary. The monitoring work made it possible to specify certain demographic parameters of several occurrences of Victorin's Gentian (*Gentianopsis virgata* ssp. *victorinii*), Victorin's Water-hemlock, and Parker's Pipewort (*Eriocaulon parkeri*) (Gilbert, 2009; 2010). The Saint-Augustin-de-Desmaures, Grosse-Île, Pointe de Saint-Vallier, and Cap Tourmente occurrences, as well as a new occurrence at Pointe aux Pins on Île aux Grues, were targeted and monitored. It has been proposed that some 20 permanent quadrats be subject to annual monitoring (Gilbert, 2009). Monitoring was conducted from 2008 to 2010 and revealed significant variations in annual abundance at several occurrences (Gilbert, 2009, 2010a, b).

Conservation

At the provincial level, the Quebec government published a conservation plan for Victorin's Water-hemlock in 2007 (Jolicoeur and Couillard, 2007). It lists the occurrences identified as priority conservation targets, the conservation issues and the various response strategies for 2007–2011. The response strategies are as follows: the creation of plant habitats in the Crown hydrological domain, support for conservation organizations in their acquisition or voluntary conservation projects, outreach initiative directed at municipalities on the management of designated plant habitats and involvement of municipalities in their management, and support for the initiatives of the recovery team for threatened vegetation of the St. Lawrence freshwater estuary.

A draft awareness-raising plan was developed by various organizations in 2007 (P. Désilets, pers. comm.). Various communications activities aimed at raising public awareness of the precarious status of Victorin's Water-hemlock and other species endemic to the shores of the freshwater estuary of the St. Lawrence have been implemented by conservation organizations. The presence of species endemic to the freshwater estuary of the St. Lawrence, including Victorin's Water-hemlock, was taken into account in the environmental assessment of the Rabaska liquefied natural gas terminal construction project at Lévis, and measures to mitigate the environmental impacts associated with that project have been proposed.

Protection

A number of private properties were acquired by various organizations for conservation purposes, and legal habitat protection status has been assigned to several sites. Approximately one-third of the occurrences enjoy some form of direct legal protection, including three provincial plant habitats (see s. 17 of the *Act Respecting Threatened or Vulnerable*

Species), two sites protected by non-governmental organizations and a national wildlife area (Cap Tourmente). Several occurrences also support other plant species that are either threatened, vulnerable or likely to be designated threatened or vulnerable, which increases their conservation value. Some occurrences are located in waterbird concentration areas and migratory bird sanctuaries; however, such areas do not afford any special protection for plant species, such as Victorin's Water-hemlock.

Research

A literature review of the genetic and biological aspects of estuary species has been conducted.

6.2 Strategic Direction for Management and Implementation Schedule

The strategies of this management plan are based on the conservation activities identified in the Quebec government's conservation plan for Victorin's Water-hemlock (Jolicoeur and Couillard, 2007). The activity implementation schedule is presented in Table 3.

Strategy 1: Conservation and management of occurrences and adjacent riparian areas

To maintain or increase the population size and area of occupancy of the priority occurrences of Victorin's Water-hemlock, it is critical to define their spatial boundaries. Improved delimitation of Quebec's Crown hydrological domain (high-water mark) should make it possible to facilitate the conservation and management of the priority occurrences located there given the Quebec government's rights on these lands.⁵ The land ownership of the lots on which the priority occurrences of Victorin's Water-hemlock are found must also be defined, primarily in the Côte-de-Beaupré and Côte-du-Sud sectors. Finally, the conservation plans, management plans and other administrative land-use management documents will have to be modified to take account of the requirements of Victorin's Water-hemlock.

Given that several plant species at risk share the same habitat as Victorin's Water-hemlock, a multispecies shoreline conservation approach will be used, supporting the work of the recovery team for threatened vegetation of the St. Lawrence freshwater estuary.

At the same time, it is critical to raise awareness among the various users of the St. Lawrence River (fishermen, kayakers, pleasure boaters) and its shoreline (hunters, waterfront property owners), who are responsible for many of the threats to Victorin's Water-hemlock. The general

⁵ Section 919 of the *Civil Code of Québec* states "The beds of navigable and floatable lakes and watercourses are property of the State up to the high-water line [with exceptions where there might have been lease or transfer of the bed or shore pursuant to historical privileges associated with the seigneurial regime]. The beds of non-navigable and non-floatable lakes and watercourses bordering lands alienated by the State after 9 February 1918 also are property of the State up to the high-water line; before that date, ownership of the riparian land carried with it, upon alienation, ownership of the beds of non-navigable and non-floatable watercourses. In all cases, the law or the act of concession may provide otherwise."

public and riverside communities will have to be informed of the fragility of the environment and the importance of this unique ecosystem, which supports many at-risk plant species.

Strategy 2: Increase knowledge of the species demographics, biology and taxonomy

Through the monitoring of the occurrences of Victorin's Water-hemlock (Gilbert, 2009; 2010), critical data have been collected on the temporal variability of the abundance and distribution of certain occurrences. Such monitoring is required to quantify the spatial and temporal dynamics of the occurrences in the medium term. The monitoring of poor-quality or historical occurrences and the performance of surveys in sectors that contain potential habitat would make it possible to specify the current range and population trend of this species, which is endemic to Quebec.

Studies are required to develop a reliable identification criterion that is not based on the fruit so as to be able to more easily differentiate Victorin's Water-hemlock from Spotted Water-hemlock. The priority occurrences are often found in proximity to Spotted Water-hemlock and many of the specimens that were identified in the field as the variety *victorinii* were subsequently identified as the variety *maculata* once the specimens were dried. This problem was encountered several times in occurrences east of Quebec City, primarily in the L'Isle-aux-Grues archipelago and the RCMs of Côte-de-Beaupré and Montmagny. The viability of the occurrences and the species reproductive and mortality rates must also be determined through scientific field work, together with experiments involving in situ or ex situ manipulations. Finally, the spatial proximity of the two varieties suggests that there could be genetic exchanges between them (introgression) and that the gene pool of Victorin's Water-hemlock could be threatened. It is important to address these issues.

The habitat dynamics must be characterized to understand the fluctuations in the population size of Victorin's Water-hemlock. Studies designed to quantify the importance of invasive plants and their effects on priority occurrences, as well as the importance of shoreline erosion and the identification of the underlying causes (e.g., ice scouring) are required to mitigate the impacts of these threats.

Table 3. Implementation Schedule

Action	Priority	Threats or concerns addressed	Responsibility*		Timeline
			Lead	Other	
Strategy 1: Conservation and management of occurrences and adjacent riparian areas					
1.1 Determine the land tenure and delineate the public hydrological domain of the 18 priority occurrences.	High	Shoreline in-filling and infrastructure construction, trampling, mowing	MDDEP	NGOs	2011–2012
1.2 Map and spatially delineate the 18 priority occurrences.	High	Shoreline in-filling and infrastructure construction, trampling, mowing	MDDEP	NGOs	As opportunities allow
1.3 Establish conservation and stewardship agreements with land managers and property owners at the 18 priority occurrences and in the adjacent riparian area.	High	Shoreline in-filling and infrastructure construction, trampling, mowing	MDDEP	PCA, NGOs	Annually
1.4 Promote the multispecies approach for the conservation of threatened plant species of the freshwater estuary of the St. Lawrence.	High	All	MDDEP, EC, PCA	NGOs, universities	Annually
1.5 Incorporate the recommendations of this management plan into existing administrative documents on the areas (e.g., municipal land-use plan) where occurrences are present.	Medium	All	MDDEP	EC, PCA, municipalities, RCMs	2011–2016
1.6 Carry out outreach and communications activities with property owners, interest groups and the general public in sectors where there are occurrences of Victorin’s Water-hemlock.	High	Shoreline in-filling and infrastructure construction, trampling, invasive plants, mowing	MDDEP, PCA	NGOs	2011–2016
1.7 Inform stakeholders called upon to participate in environmental assessments on the status of Victorin’s Water-hemlock.	Medium	All	MDDEP, EC, PCA	MRNF	Annually

Action	Priority	Threats or concerns addressed	Responsibility*		Timeline
			Lead	Other	
Strategy 2: Increase knowledge of the species demography, biology and taxonomy					
2.1 Continue the monitoring program of occurrences of Victorin's Water-hemlock (Gilbert, 2009; 2010) and expand it, as required.	High	All	MDDEP	NGOs, EC, PCA	Annually
2.2 Search for and monitor occurrences with a quality rank of D, E and H and characterize their habitat.	High	All	MDDEP	EC, NGOs	2011–2016
2.3 Locate sectors with habitat potential (including Chaleur Bay) and conduct surveys in those sectors.	Medium	Knowledge gaps	MDDEP	EC, PCA, NGOs	2011-2016
2.4 Incorporate monitoring data into CDPNQ on an ongoing basis.	Low	n/a	MDDEP		Annually
2.5 Develop a new identification criterion for the variety <i>victorinii</i> .	High	Knowledge gaps	Universities	MDDEP	2011–2016
2.6 Characterize the habitat and microhabitats of known occurrences.	Medium	All	MDDEP, universities	NGOs	2011-2016
2.7 Quantify the effects of invasive plants and overabundant species on extant occurrences.	Medium	Invasive plants, overabundant species	Universities		2011–2016
2.8 Measure shoreline erosion at extant occurrences and determine the factors responsible.	Medium	Changes in salinity, ice scouring, erosion	Universities		2011–2016
2.9 Determine the viability of the occurrences (in situ or ex situ manipulations) and assess the reproductive and mortality rates.	Low	Knowledge gaps	Universities		2011–2016
2.10 Assess the possibility of hybridization and introgression between the two varieties, as well as the genetic diversity between and within occurrences.	Low	Knowledge gaps	Universities		2011–2016

*PCA: Parks Canada Agency; EC: Environment Canada; MAPAQ: Ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec; MDDEP: Ministère du Développement durable, de l'Environnement et des Parcs; RCM: regional county municipality; MRNF: Ministère des Ressources naturelles et de la Faune; NGO: Non-governmental Organization. The governmental and non-governmental organizations indicated in the table are for illustrative purposes only, and their inclusion here does not commit them to implement the proposed measures. Implementation is subject to the priorities and budgetary constraints of each organization.

7. MEASURING PROGRESS

The performance indicators presented below propose an approach for defining and measuring progress towards the achievement of the population and distribution objectives. Success in implementing this management plan will be evaluated every five years on the basis of the following performance indicators:

- In the long term, the population size and area of occupancy of Victorin's Water-hemlock are maintained and, if possible, increased throughout its range;
- In the short term, the population size and area of occupancy of Victorin's Water-hemlock are maintained and, if possible, increased in each of the 18 occurrences identified as priority targets.

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APPENDIX A. LIST OF THE 45 KNOWN OCCURRENCES OF VICTORIN'S WATER-HEMLOCK IN QUEBEC (2010)

Occurrence	CDPNQ No.	Last assessment*	Quality rank
Berthier-sur-Mer (Anse de Berthier)	3610	1995-09-13	A
Cap-Saint-Ignace (Anse à Gilles)	3633	1996-09-15	A
Sainte-Anne-de-Beaupré (Côté de Beaupré)	3612	2007-08-16	A
Île aux Grues	10706	1996-09-04	A
Lévis (Pointe Martinière)	10707	1996-09-04	A
Beaumont (Anse de Vincennes and area to the west)	3628	2005	A
Saint-Jean-de-l'Île-d'Orléans (Pointe Dauphine)	3624	1995-08-29	A
Pointe de Saint-Vallier (Anse de Bellechasse)	15253	2005-09-05	A
Saint-Augustin-de-Desmaures (Baie-de-Saint-Augustin)	3615	2005-09-04	A
Saint-Jean-Port-Joli (Anse de Trois-Saumons)	10715	1997	A
Saint-Laurent-de-l'Île-d'Orléans (Anse aux Frères)	10712	1997-09-02	A
Québec (Anse du Cap-Rouge)	3616	1995-08-17	B
L'Islet (Rocher Panet)	10722	1996-09-05	B
Neuville (south of Provencher marsh)	16711	2008-08-26	B
Sainte-Pétronille (Pointe chez Royer)	10700	2007-08-16	B
Saint-Michel-de-Bellechasse (Anse Saint-Vallier)	3607	1995-09-11	B
Saint-Michel-de-Bellechasse (Estran de Saint-Michel-de-Bellechasse)	3635	1995-09-12	B
Deschambault-Grondines (Anse chez Therrien)	3629	1996-09-20	C
Saint-Jean-Port-Joli (Wharf)	3623	1996-09-05	C
Bellechasse RCM (Entrée 27, Baie de Beaumont)	16030	2007-08-15	C
Berthier-sur-Mer (Trou de Berthier)	3636	1995-09-13	D
Saint-Antoine-de-l'Île-aux-Grues (Wharf)	10705	1996-09-04	D
L'Islet-sur-Mer (Estran de l'Islet-sur-Mer)	3632	1995-08-27	D
Neuville (Pointe à Alain)	3605	1995-09-19	D
Lévis (Saint-Nicolas -Anse Ross)	3617	1991-09-05	D
Saint-François, Île d'Orléans	10739	1997-09-02	D
Saint-Jean (west of the mouth of the Lafleur River)	3619	1995-08-28	D
Saint-Joachim (Pointe-aux-Prêtres –Cap Tourmente NWA)	15082	2004-09-02	D
Saint-Laurent-de-l'Île-d'Orléans (Village-des-Anglais - Trou Saint-Pierre)	3618	1995-09-20	D
Lévis (Saint-Nicolas -Anse du Vieux Moulin)	3637	1995-09-18	D
Saint-Romuald (cove west of the mouth of the Etchemin River)	3626	1995-08-26	D
TNO aquatique de la MRC de Lotbinière (Pointe Platon, sand flat to the east)	3621	1996-09-20	D
Beaumont (Anse à Margot)	14751	2003-09-12	E
Berthier-sur-Mer (Anse de Bellechasse)	16555	2004-01-01	E
Cap-Saint-Ignace	16159	2006-08-22	E
Saint-Antoine-de-l'Île-aux-Grues (Grosse-Île)	3620	1993-07-20	E
Montmagny (6 km northeast of the Berthier-sur-Mer marina)	16047	2006-10-20	E
Deschambeault-Grondines (Parish of Sainte-Anne-de-la-Pérade)	10666	2001	E
TNO aquatique de la MRC de Bellechasse (Baie de Beaumont - Anse au Moulin)	16034	2006-08-20	E

Occurrence	CDPNQ No.	Last assessment*	Quality rank
Batiscan	3614	1941-07-05	F
Chandler (Chaleur Bay)	18346	1931-08-06	H
L'Ange-Gardien	3611	1942-08-23	H
Lotbinière	3606	1985-08	H
Québec (Beauport)	3608	1913-08-19	X
Lévis (Saint-Nicolas - Pointe à Basile)	3609	1950-07-14	X

* The date indicates the last site visit during which the number of individuals was assessed for the entire occurrence. Although some occurrences have been monitored since 2008, the method used (counts in 10-m x 10-m plots) does not allow for updating the data on the number of individuals in the occurrences visited.

APPENDIX B. DEFINITION OF THE QUALITY RANKS OF OCCURRENCES OF VICTORIN'S WATER-HEMLOCK

Quality rank	Definition
A	Population of over 100 individuals in a habitat that is not or only slightly disturbed by human activity.
B	Population of 51 to 100 individuals in a habitat that is not or only slightly disturbed by human activity or population of 100 individuals disturbed by filling or pedestrian or vehicle traffic.
C	Population of 10 to 50 individuals in a habitat that is not or only slightly disturbed by human activity or population of 51 to 100 individuals disturbed by filling or pedestrian or vehicle traffic.
D	Population of less than ten individuals in a habitat that is not or only slightly disturbed by human activity or population of 10 to 50 individuals disturbed by filling operations, human trampling or vehicle traffic.
E	Recent population; the observation of the population dates back fewer than 25 years, but we have no information on its demographics.
F	Population not relocated despite major search efforts.
H	Historical population; the observation of the population dates back more than 25 years.
X	Extirpated population.

APPENDIX C. EFFECTS ON THE ENVIRONMENT AND NON-TARGET SPECIES

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision making.

The planning of the management of a species of special concern is intended to benefit species at risk and biodiversity in general. However, it is recognized that management plans may also inadvertently lead to environmental effects beyond the intended benefits. The planning process based on national guidelines directly incorporates consideration of all environmental effects, with a particular focus on possible impacts on non-target species or habitats. The results of the SEA are incorporated directly in the strategy itself, but are also summarized below.

The potential for this plan to inadvertently lead to adverse effects on other species was considered. Because the recommended actions are limited to non-intrusive activities, such as the monitoring of occurrences and outreach activities, it may be concluded that the management plan will not entail any significant adverse effects.

Victorin's Water-hemlock depends on the upper and mid-littoral zone. As a result, the conservation of this species may contribute to maintaining a few adjacent remnant riparian forests at risk of disappearing. The conservation of Victorin's Water-hemlock habitat will benefit many wildlife species that frequent this habitat, including breeding waterfowl and other plant species that are endemic to the freshwater estuary of the St. Lawrence and that live in association with Victorin's Water-hemlock, some of which are in a precarious state, such as Provancher's Fleabane (*Erigeron philadelphicus* ssp. *provancheri*) (listed as special concern in Schedule 3 of SARA and designated threatened under the *Quebec Act Respecting Threatened or Vulnerable Species*), most occurrences of Victorin's Gentian (listed as threatened in Schedule 1 of SARA and designated threatened under the *Quebec Act Respecting Threatened or Vulnerable Species*), and Parker's Pipewort (species designated threatened under the *Quebec Act Respecting Threatened or Vulnerable Species*). In addition, roughly ten other species listed as likely to be designated threatened or vulnerable in Quebec live in association with Victorin's Water-hemlock. The conservation activities aimed at sites that support occurrences of Victorin's Water-hemlock and outreach efforts aimed at the public and communities along the river will contribute directly to the conservation of the populations of these other rare species in the freshwater estuary of the St. Lawrence River.