Species at Risk Act
Recovery Strategy Series

Recovery Strategy for the Cobblestone Tiger Beetle (*Cicindela marginipennis*) in Canada

Cobblestone Tiger Beetle

2013

Canada

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For copies of the recovery strategy, or for additional information on species at risk, including COSEWIC Status Reports, residence descriptions, action plans, and other related recovery documents, please visit the Species at Risk (SAR) Public Registry (www.sararegistry.gc.ca).

Cover illustration: M. McGarrigle. Cobblestone Tiger Beetle at Grand Lake, NB, 2007.

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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 recovery strategies for listed Extirpated, Endangered, and Threatened species and are required to report on progress within five years.

The Minister of the Environment is the competent minister under SARA for the recovery of the Cobblestone Tiger Beetle and has prepared this strategy, as per section 37 of SARA. It has been prepared in cooperation with the Province of New Brunswick and Aboriginal organizations.

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this strategy and will not be achieved by Environment Canada, or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this strategy for the benefit of the Cobblestone Tiger Beetle and Canadian society as a whole.

This recovery strategy will be followed by one or more action plans that will provide information on recovery measures to be taken by Environment Canada and other jurisdictions and/or organizations involved in the conservation of the species. Implementation of this strategy is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

ACKNOWLEDGMENTS

Mark McGarrigle prepared the initial draft of this recovery strategy. Drafts were produced in collaboration with Samara Eaton of Environment Canada, Canadian Wildlife Service - Atlantic, and Maureen Toner of the New Brunswick Department of Natural Resources. The Species at Risk Program, Fish and Wildlife Branch of the New Brunswick Department of Natural Resources (NB DNR) had a draft provincial recovery strategy which provided a starting point for the development of this recovery strategy. This strategy, as well as the draft document from the province, benefited from the surveys and studies conducted by Reginald Webster.
Dwayne Sabine (NB DNR) assisted in the planning of surveys and contributed to our understanding of habitat use. The Nature Trust of New Brunswick has initiated stewardship efforts for this species and provided comments on this document. Also, John Klymko from the Atlantic Canada Conservation Data Centre provided valuable input and comments during the development of this recovery strategy.

EXECUTIVE SUMMARY

The Cobblestone Tiger Beetle is a predatory insect endemic to eastern North America. Adults are easily identified as they are brown or dull olive-green in colour, roughly one half-inch long, with a narrow, unbroken, cream coloured band along the edge of elytra (wing covering), and a red-orange abdomen that is visible during flight. Adults and larvae occupy sandy cobblestone beaches of treed islands and lakeshore that is subjected to frequent flooding during the spring of the year. It was first discovered in Canada at Grand Lake, New Brunswick, in 2003. Although it has not been re-discovered at the original site, it is currently known from 8 sites in New Brunswick (3 on Grand Lake, 5 on Saint John River). These represent the only known occurrences of the species in Canada. The use of lakeshore habitat is not known to exist outside Canada.

Cobblestone Tiger Beetle was assessed as Endangered by COSEWIC in 2008, and listed as Endangered under Schedule 1 of SARA in 2011, due to the fragmented habitat, small area of occupancy, and continued pressures on its habitat. Current and historic threats to the species include development and shoreline alterations, off-road vehicle use, dam construction and habitat fragmentation, as well as specimen collection, pollution and flooding.

Recovery is considered feasible for this species. The objective of the recovery strategy is to maintain the current distribution of Cobblestone Tiger Beetle at all eight known sites.

The four broad strategies that are to be taken to meet the objective and address the threats to the survival and recovery of the species include: monitoring and surveying populations, habitats, and threats; stewardship and education; habitat management and conservation; and research to assist in recovery efforts.

Cobblestone Tiger Beetle habitat in New Brunswick is located only on non-federal land. Critical habitat is identified for Cobblestone Tiger Beetle in this Recovery Strategy at the eight sites where the species is found in New Brunswick, five sites on the Saint John River and three sites on Grand Lake. This is a partial identification of critical habitat because additional information is required with regards to the use of habitat between sites at the Grand Lake location; specifically, whether sufficient critical habitat has been identified at this location to meet the objective of maintaining the distribution at all known eight sites.

One or more action plans will be completed for this species within two years of this recovery strategy being posted on the Species at Risk Public Registry.

RECOVERY FEASIBILITY SUMMARY

Based on the following four criteria outlined in the draft SARA Policies (Government of Canada 2009), recovery of the Cobblestone Tiger Beetle in Canada is considered feasible. Therefore, a recovery strategy has been prepared as per section 41 (1) of SARA.

1. *Individuals of the wildlife species that are capable of reproduction are available now or in the foreseeable future to sustain the population or improve its abundance.*

   Yes. With the exception of one site that was not visited, and the original site of discovery, all sites had individuals present during mark-release-recapture surveys in 2007 and 2008, with mating pairs observed at some sites. Although no other individuals are known to occur in Canada other than at the sites mentioned here, numerous populations exist throughout the United States.

2. *Sufficient suitable habitat is available to support the species or could be made available through habitat management or restoration.*

   Yes. Suitable habitat is available and is sufficient to support the species' current distribution, and suitable unoccupied habitat exists at both locations as well.

3. *The primary threats to the species or its habitat (including threats outside Canada) can be avoided or mitigated.*

   Yes. The primary threats to recovery which include: habitat loss and degradation from off-road vehicles, and development and shoreline alterations, can be mitigated or removed through outreach and education, stewardship, and management.

4. *Recovery techniques exist to achieve the population and distribution objectives or can be expected to be developed within a reasonable timeframe.*

   Yes. Recovery techniques exist to achieve the population and distribution objective which is to maintain the current distribution of Cobblestone Tiger Beetle at each of the eight known sites.

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1. COSEWIC* SPECIES ASSESSMENT INFORMATION

Date of Assessment: November 2008

Common Name (population): Cobblestone Tiger Beetle

Scientific Name: *Cicindela marginipennis*

COSEWIC Status: Endangered

Reason for Designation: This distinctive species of tiger beetle has a fragmented distribution with a very small extent of occurrence and area of occupancy, and is currently only found in two small regions of the St. John River system. There is evidence for decline of habitat and population in one region and the pressures on the habitat from development and recreation appear to be continuing.

Canadian Occurrence: New Brunswick

COSEWIC Status History: Designated Endangered in November 2008.

*COSEWIC: Committee on the Status of Endangered Wildlife in Canada

2. SPECIES STATUS INFORMATION

Cobblestone Tiger Beetle (*Cicindela marginipennis*) was assessed in 2008 by COSEWIC as Endangered and listed on SARA Schedule 1 as Endangered in 2011. It is considered to be of conservation concern throughout its range (Nature Serve 2010) (Table 1). The percentage of the global population located in Canada is less than 10%.

Table 1. Conservation status ranks* for the Cobblestone Tiger Beetle (from NatureServe 2010, with year of assessment in brackets).

Global (G) Rank	National (N) Rank	Sub-National (S) Rank
G2 (2005)	Canada N1(2008) USA N2 (2005)	*Provincial Status: NB (S1?)* *State Status (USA):* Alabama (S1), Indiana (S2), Maine (S1), Massachusetts (SNR), Mississippi (SX), New Hampshire (S1), New Jersey (S1), New York (S1), Ohio (S2), Pennsylvania (S1), South Carolina (SNR), Vermont (S1), West Virginia (S1)

* The conservation status of a species is designated by a number from 1 to 5, preceded by a letter reflecting the appropriate geographic scale of the assessment (G = Global, N = National, and S = Subnational). The numbers have the following meaning: 1 = critically imperiled, 2 = imperiled, 3 = vulnerable, 4 = apparently secure, 5 = secure. SX = Presumed Extirpated. SNR = Unranked.

3. SPECIES INFORMATION

3.1 Species Description

Adult Cobblestone Tiger Beetle are between 11-14 mm in length, with a narrow and continuous cream-coloured border along the margin of the elytra (wing coverings) and a bright red-orange abdomen which is visible during flight. These two distinctive traits make them easily identifiable in the field (COSEWIC 2008). Adults are typically brown or dull olive green in colour, with individuals in New Brunswick showing a range of colouration which includes green and blue (Webster 2009).

No information exists on Cobblestone Tiger Beetle reproduction, egg laying (and associated habitat requirements), incubation (length of time or habitat requirements), or larval development. In New Brunswick, adults are active between late July and mid August (COSEWIC 2008). Mating pairs were observed during mark-release-recapture adult surveys in New Brunswick during 2007 (Webster 2008). Information on other closely related species suggests mating occurs shortly after adult emergence (Pearson and Volger 2001 *in* COSEWIC 2008).

Observations of other species of *Cicindela* show that females lay eggs in the soil up to 1 cm below the surface; after hatching, the larvae create a vertical burrow, enlarging it over the course their development (Pearson and Volger 2001 *in* COSEWIC 2008). The head and protonum (upper surface or plate over the thorax) of the larvae create a flattened disc which is used to plug and camouflage the opening of the burrow. Abdominal hooks anchor larvae to the walls of the burrow so that they can capture and subdue prey (COSEWIC 2008).

3.2 Population and Distribution

Globally, the Cobblestone Tiger Beetle is endemic to eastern North America. In the United States, it occurs as disjunct populations along major river systems from Mississippi (Graves & Pearson 1973 *in* COSEWIC 2008) as far north as Vermont, New Hampshire (Dunn 1979, Leonard and Bell 1999 *in* COSEWIC 2008), and most recently (2009) Maine (Ward and Mays 2010).

In Canada, all eight known sites for the Cobblestone Tiger Beetle are located in New Brunswick. Sites are found in two distinct locations: the Saint John River (5 extant sites) and Grand Lake (3 extant sites) (Figure 1). On the St. John River the five extant sites are on 5 different islands and at Grand Lake there are 3 extant sites along the shoreline. An additional site at Grand Lake was the original discovery in 2003 but the species has not been found in subsequent surveys at this site (Webster 2005).

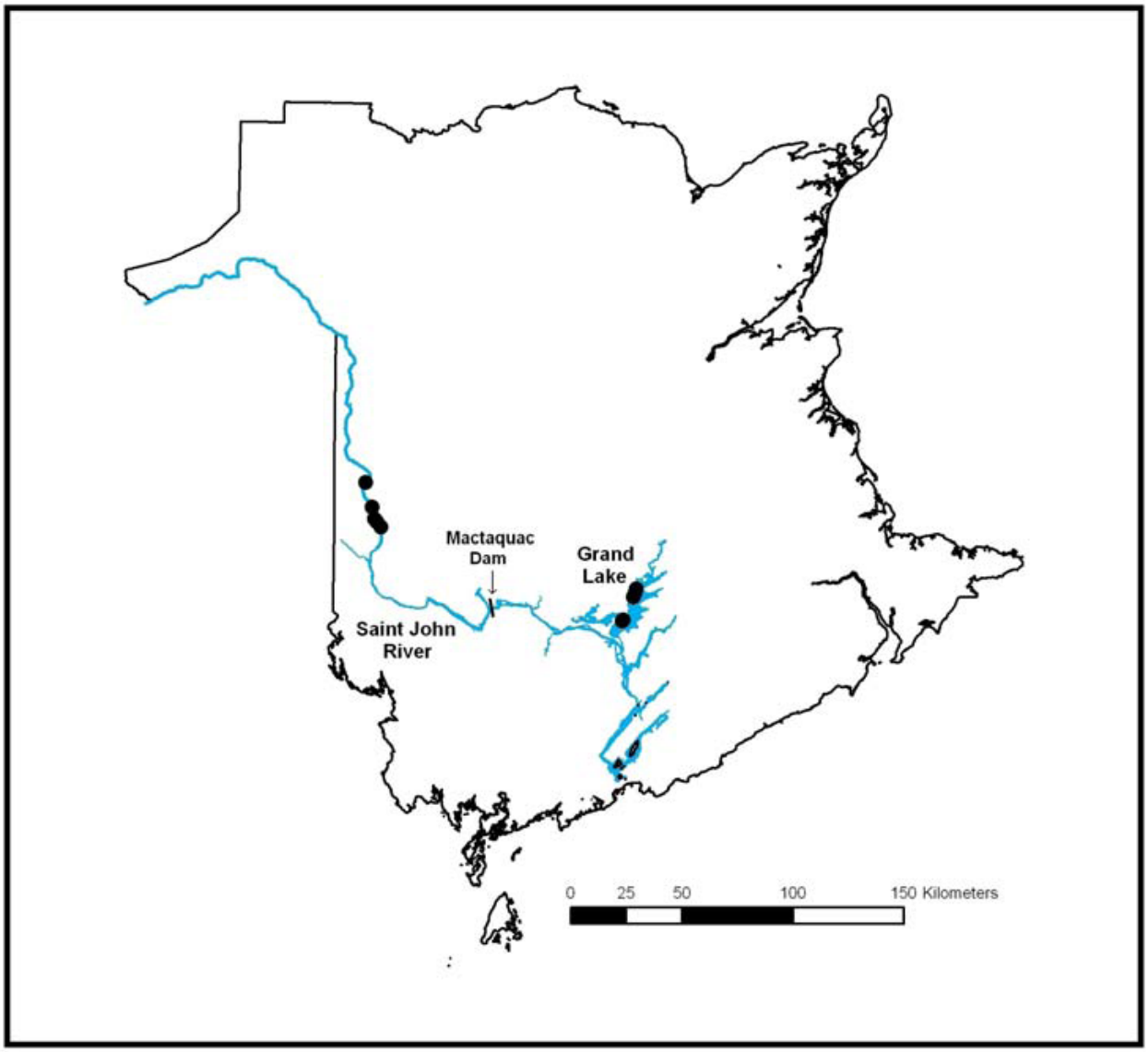

Figure 1. Distribution of the eight Cobblestone Tiger Beetle sites in New Brunswick. Source: COSEWIC 2008.

The population size was estimated to be 3588-11655 individuals (COSEWIC 2008), based upon mark-release-recapture experiments conducted in 2007 (Webster 2008). Surveys conducted at three sites in 2008 indicated higher population estimates (Table 2) which is likely due to sub-optimal sampling conditions in 2007. The total population size is thus likely higher than the 2007 estimate, given the 2008 data and because the 2007 estimate did not have data available for one site on Saint John River and one site at the Grand Lake location.. Population trends are not known for this species.

Table 2. Locations of eight known sites of Cobblestone Tiger Beetle in Canada, including adult population estimates and years the surveys were conducted. For sites where no population estimates are available, survey date refers to the last site visit.

Location	Site Name	Population Estimate	Year of Survey
Grand Lake	Grand Lake Site 1	N/A	2005
	Grand Lake Site 2	14	2007
	Grand Lake Site 3	473-986	2007,2008
Saint John River	St. John River Site 1	400-3128	2007,2008
	St. John River Site 2	2740	2007
	St. John River Site 3	851-933	2007,2008
	St. John River Site 4	496	2007
	St. John River Site 5	N/A	2005

Source: Webster (2009)

3.3 Needs of the Cobblestone Tiger Beetle

Cobblestone Tiger Beetle adults and larvae are predatory. No information exists on type of prey consumed by adults or larvae (COSEWIC 2008); however, tiger beetle larvae in general feed on other insects and arthropods (Pearson and Vogler 2001, Pearson et al. 2006 *in* COSEWIC 2008). In general, Cobblestone Tiger Beetles require sparsely-vegetated shoreline habitat, high beaches that are infrequently flooded, and a high cobblestone content with fine sand and gravel in between. The fine sand/gravel between the cobbles is necessary in order to allow for egg deposition and for larvae to form burrows. These areas are typically found at the upstream end of islands. In New Brunswick, sites are located on both river islands and lakeshore habitat; this lakeshore habitat represents the only known occurrence of this species that is not based on a river system. Flooding is a natural occurrence in this habitat and spring flooding is thought to be beneficial in maintaining appropriate habitat for the species through the removal of encroaching vegetation (COSEWIC 2008). The direct impact on individuals is unknown; forested areas of the islands and high cobblestone beaches where adults occur are likely above the high mark for normal flooding regimes, but survivability of larvae during the spring freshet is unknown. Limiting factors for this species include a very specialized and fragile habitat, a limited distribution and small isolated populations.

4. THREATS

4.1 Threat Assessment

Table 3. Threat Assessment Table

Threat	Level of Concern[1]	Extent	Occurrence	Frequency	Severity[2]	Causal Certainty[3]
Habitat Loss or Degradation						
Off-Road Vehicles	High	Widespread	Current	Continuous	High	High
Development and shoreline alterations	High	Widespread	Current	Continuous	Unknown	Medium
Dam construction	Low	Widespread	Historic	One-time	Unknown	Medium
Dam operation	Low	Widespread	Current	Seasonal	Unknown	Unknown
Biological Resource Use						
Specimen collection	Medium	Widespread	Anticipated	Seasonal	Unknown	High
Pollution						
Agriculture discharge	Low	Localized	Current	Recurrent	Unknown	Low
Climate Change and Natural Disasters						
Flooding due to extreme weather events	Low	Widespread	Current	Seasonal	Unknown	Medium

[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).*

4.2 Description of Threats

Threats are presented in decreasing level of concern.

Off-road vehicles
Off-road vehicles have a detrimental impact on Cobblestone Tiger Beetle (COSEWIC 2008) through the removal of shoreline vegetation, soil compaction, and the direct loss of adults and larvae. This is not considered a widespread threat to sites at the Saint John River location, however at Grand Lake it is of high concern. At Grand Lake evidence suggests that the use of off-road vehicles is impacting the habitat and may have contributed to lower numbers observed in a 2008 survey compared with 2007 (Webster 2009). Work in 2011 by the Nature Trust of New Brunswick has reconfirmed high off-road vehicle use, despite education efforts.

Development and shoreline alteration
At the Grand Lake location there is a high level of concern associated with development and shoreline alterations. This includes residential and cottage development and shoreline alteration, which encompasses such activities as the clearing of land for development, increased access to the shoreline, alteration of the shoreline through the removal of vegetation, building structures, and leveling of beach areas. Such activities can result in the direct loss of habitat as well as changes to substrate such as an increased risk of soil compaction (COSEWIC 2008). In addition, increased access as a result of development increases the risk of loss of these sites. According to COSEWIC (2008), development on Grand Lake is "*increasing rapidly*". Cobblestone Tiger Beetle sites at the Saint John River location are considered less suitable for residential development, however there is potential for commercial and industrial development and thus is still considered a potential threat (COSEWIC 2008).

Specimen collection
Specimen collection has been identified as a potential threat to the species (COSEWIC 2008). Populations at a number of sites are considered small and the removal of large numbers of individuals could severely impact the long-term viability of populations at these sites (COSEWIC 2008).

Dam construction
The effects of dams are dramatic and long term, affecting long stretches of the watercourse both upstream and downstream of the dam location. Although the environmental impacts of dam creation are well known (e.g. Baxter 1997), the most significant impacts to the Cobblestone Tiger Beetle are likely the loss of habitat and the increased landscape fragmentation resulting from the creation of the Mactaquac dam and reservoir in the 1960s (COSEWIC 2008).
An analysis of the historical impact of the dam resulted in the identification of 23 islands (19 upstream, 4 downstream) with potentially suitable habitat which were lost in the filling of the reservoir, and an unknown number of which could have supported populations (D. Sabine pers. comm.). Moreover, the separation of the Grand Lake and Saint John River sites would have been further increased through the creation of the 100 km-long reservoir. It should be noted that this is a historical threat to the species, as there are currently no new dam projects identified for the Saint John River.

Dam operation
The flow regime, that impacts sites at the Saint John River location, is subject not only to large natural seasonal fluctuations, but it is also influenced by the operation of the Beechwood and Tobique dams (completed in the 1950's). These can result in artificial daily fluctuations in water levels and attenuation of low water flows (CRI 2011). Water level management may alter natural hydrologic disturbance, reducing available substrate if islands or shorelines are inundated for prolonged periods or if vegetation clearing floods are absent. However, the severity and certainty of this threat are unknown at this time.

Agricultural discharge
This is not considered a threat to sites on Grand Lake; however, agriculture activities surround the sites found on the Saint John River. Agricultural runoff can result in nutrient loading and siltation, which could result in significant changes to the water chemistry of the sites, changes to the vegetation along the shoreline, and/or changes to the prey base (COSEWIC 2008). The impact of this threat to the Saint John River sites is unknown and warrants further investigation.

Flooding due to extreme weather events
Spring flooding of varying magnitudes is thought to be beneficial in maintaining appropriate habitat for the species through the removal of encroaching vegetation (COSEWIC 2008). Summer floods, and abnormally high floods due to extreme weather events, have the potential to detrimentally impact Cobblestone Tiger Beetle larvae and habitat. Adults and larvae are found in areas of treed islands that are infrequently flooded, and these areas likely provide a refuge from the effects of flooding. It is unknown how larvae in the burrow survive spring flooding (COSEWIC 2008).

5. POPULATION AND DISTRIBUTION OBJECTIVES

The objective of the Cobblestone Tiger Beetle Recovery Strategy is to maintain the current distribution of Cobblestone Tiger Beetle at each of the eight known sites.

Information is not available on historical distribution and abundance of this species in Canada because of its relatively recent discovery in 2003. In addition, insect species are known to vary in abundance year-to-year due to a variety of factors relating to their environment and biology. Thus, the quantification of population objectives for this species, in terms of abundance at each site, location, or the Canadian population as a whole, is not possible at this time.

Further clarification of population structure within each location, such as the changes in the number of sites over time, perhaps due to extinctions at small sites and colonization of unoccupied habitat (NatureServe 2011) and understanding the use of habitat between sites, will assist in the development of recovery actions, particularly stewardship approaches.

6. BROAD STRATEGIES AND GENERAL APPROACHES TO MEET OBJECTIVES

6.1 Actions Already Completed or Currently Underway

Surveys were conducted in 2005, 2006, 2007, and 2008 by Dr. Reginald Webster, Entomologist, in partnership with the New Brunswick Department of Natural Resources. Survey efforts in 2005 and 2006 identified eight additional sites to the original site discovered in 2003 (Sabine 2004). In 2007 and 2008, mark-release-recapture experiments were conducted at sites on Grand Lake and Saint John River to provide baseline population estimates for the development of a COSEWIC status report on the species.

The Nature Trust of New Brunswick secured one site for this species and has contacted the landowners of the remaining sites to make them aware of the presence of the species on their properties and to discuss potential conservation options. In addition, they have prepared educational materials, which have been used for community outreach including school visits.

6.2 Strategic Direction for Recovery

Table 4. Recovery Planning Table

Threat or Limitation	Priority	Broad Strategy to Recovery	General Description of Research and Management Approaches
All threats	High	Monitoring and surveying of populations, habitat, and threats	• Develop and implement monitoring protocol and establish priorities based on criteria such as level of threat
All threats	High	Stewardship and education to reduce human disturbance	• Develop a stewardship plan which enables participation of local residents in conservation issues around these shores. • Increase awareness of Cobblestone Tiger Beetle, its threats and habitat through the development of education programs for audiences identified in the stewardship plan.
Agricultural discharge, development and shoreline alterations, dam construction and habitat fragmentation	Medium	Habitat management and conservation	• Examine extent to which current best management practices mitigate known threats, use these where possible and develop best management practices when needed. • Examine approaches to the conservation of habitat on private lands.
Knowledge gaps	Medium	Conduct research to assist in recovery efforts	• Clarify the spatial population structure at each of the two locations. • Improve our understanding of the life cycle and natural history of the beetle.

6.3 Narrative to Support the Recovery Planning Table

The broad strategies and approaches recommended in Section 6.2 *Strategic Direction for Recovery* are necessary to mitigate threats and facilitate the conservation and recovery of Cobblestone Tiger Beetle.

A monitoring and surveying protocol is needed in order to determine whether the population and distribution objective is being met. This will require monitoring at known sites, but also surveys of historically occupied and potential sites (i.e. unoccupied sites with apparently suitable habitat). In addition, recent work by Hudgins et al. (2011) identified key habitat characteristics that may be useful in identifying and prioritizing potentially suitable habitat along Grand Lake for further survey work.

Stewardship is a key strategy for the conservation and recovery of Cobblestone Tiger Beetle since the main threats include off-road vehicle traffic, development, and shoreline alterations, as well as collection. It will be important to secure the support of the community and develop a local stewardship plan which addresses the threats to this species and the shoreline habitat. This would provide an opportunity for meaningful participation of local stakeholders.

A number of best management practices already exist, and where applicable the use of these practices should be encouraged and new best management practices developed if needed. Integrating the management of this species with these pre-existing approaches to conserving this habitat and co-occurring species would be particularly effective. A variety of approaches for the conservation of habitat for Cobblestone Tiger Beetle on private land should be examined, including conservation easements, donations, and acquisition.

Knowledge gaps exist, including a lack of understanding of some of the natural history of the beetle and its life cycle, information that is important in ensuring that appropriate recovery approaches are adopted. A priority for research is clarifying the spatial population structure at each of the two locations, i.e. does it follow the meta-population model as described by Levin (1974). Key questions include: whether Cobblestone Tiger Beetles at a site move into unoccupied habitat; whether there is movement between sites; and if populations within a location are stable. Determining the population structure at each of the two locations will assist in the development of appropriate recovery measures.

7. CRITICAL HABITAT

7.1 Identification of the Species' Critical Habitat

Critical habitat is identified for Cobblestone Tiger Beetle in this recovery strategy at the eight sites where the species is found in New Brunswick, five sites on the Saint John River and three sites on Grand Lake (Table A-1). This is a partial identification of critical habitat because additional information is required with regards to the use of habitat between sites at the Grand Lake location; specifically, whether sufficient critical habitat has been identified at this location to meet the objective of maintaining the distribution at all known eight sites.

The biophysical attributes of suitable habitat for Cobblestone Tiger Beetles are sparsely-vegetated, scoured shoreline of high cobblestone content and a mixture of fine sand and gravel between the cobbles. Hudgins et al. (2011) found that cobble beaches with a larger area between the water's edge and the forest, with fewer large boulders, and a greater elevational relief, were occupied by Cobblestone Tiger Beetle. The natural hydrologic disturbance (i.e. spring freshet, flooding, ice scour) that exists at both the Grand Lake and Saint John River locations is thought to be necessary in order to maintain appropriate habitat conditions, such as the removal of encroaching vegetation. The sites where Cobblestone Tiger Beetle are found on Grand Lake, represents the only known occurrences of this species that is not on a river system. It is speculated that the riverine characteristics of the lake (high beach areas, and scouring floods) likely resulted in the formation of suitable habitat (Sabine 2004). The sites for Cobblestone Tiger Beetle at the Saint John River location are on islands.

At the Saint John River location critical habitat of Cobblestone Tiger Beetle is identified as the suitable shoreline habitat around the entire perimeter of the island (Appendix A). Suitable habitat is habitat that contains the biophysical attributes described above which is typically found at the upstream end of islands.

At the Grand Lake location critical habitat is partially identified as the suitable shoreline habitat within a 500 m radius of the observation points at each of the three sites (Appendix A). This distance was selected based on a mark-recapture study of Cobblestone Tiger Beetle, in New York State, that determined a maximum dispersal distance of 480 m (Hudgins et al. 2011). If the 500 m surrounding adjacent observation points overlap, they are merged in a single continuous area containing suitable habitat. Suitable habitat is habitat that contains the biophysical attributes described above. This is a partial identification because additional work is required to determine if Cobblestone Tiger Beetles use the habitat between sites on the lakeshore and the suitable habitat within the 500 m radius may not be sufficient to meet the objective of maintaining the distribution at all known eight sites. The schedule of studies below indicates the activities necessary to complete the identification of critical habitat for this species.

7.2 Schedule of Studies

Table 5. Schedule of Studies to Identify Critical Habitat

Description of Activity	Rationale	Timeline
Determine if Cobblestone Tiger Beetles use the habitat between sites on the lakeshore beyond the known movement distances for the sites at the Grand Lake location	Needed in order to determine whether sufficient habitat is identified to meet the objective of maintaining the distribution at all known eight sites	2013-2017

7.3 Activities Likely to Result in the Destruction of Critical Habitat

Understanding what constitutes destruction of critical habitat is necessary for the protection and management of critical habitat. Destruction is determined on a case by case basis. Destruction would result if part of the critical habitat were degraded, either permanently or temporarily, such that it would not serve its function when needed by the species. Destruction may result from a single or multiple activities at one point in time or from the cumulative effects of one or more activities over time (Government of Canada 2009).

Any anthropogenic activity which alters or disturbs the biophysical attributes described in Section 7.1 or that causes a loss in function of the habitat is considered an activity likely to result in the destruction of critical habitat for Cobblestone Tiger Beetle. The critical habitat of the Cobblestone Tiger Beetle can be destroyed by, but is not limited to, the following activities:

- *Habitat loss.* Direct loss of habitat can result from activities related to shoreline alterations such as the removal of shoreline vegetation, building structures, and leveling of beach areas.

- *Alteration of the substrate.* Shoreline activities such as building structures on the beaches or removal of vegetation, as well as activities such as off-road vehicle use can alter the habitat for Cobblestone Tiger Beetle. These activities can lead to changes in the substrate including altering the proportion of vegetation to substrate and changing the substrate through compaction of the soil such that it cannot be used for burrowing by larvae or egg laying. Development of buildings, above the shoreline, can also lead to sediment runoff and thus alteration of the substrate.

- *Alteration of natural hydrologic disturbance.* Activities such as hydroelectric dam water level management may alter natural hydrology disturbance. Natural disturbance such as seasonal flooding is required to create wide, sparsely vegetated shorelines and if natural fluctuations are altered such that islands or shorelines are inundated for prolonged periods suitable habitat may be lost.

- *Pollution.* Run-off or discharge events from agricultural practices could result in the accumulation of sediments on the shoreline. This could physically alter the substrate making it unsuitable for adults and young and could impact prey availability by altering nutrient levels.

8. MEASURING PROGRESS

The performance indicator presented below provides a way to define and measure progress toward achieving the population and distribution objectives.

- The current distribution of Cobblestone Tiger Beetle is maintained at each site where it is currently found.

9. STATEMENT ON ACTION PLANS

An action plan for the Cobblestone Tiger Beetle will be developed within two years of this recovery strategy being posted on the Species at Risk Public Registry.

10. REFERENCES

Baxter, R.M. 1977. Environmental effects of dams and impoundments. Annual Review of Ecological Systems 8: 255-283.

Canadian River Institute. 2011. The Saint John River: A State of the Environment Report. Fredericton, New Brunswick, Canada. Editors: Scott D. Kidd, R. Allen Curry, Kelly R. Munkittrick.

COSEWIC. 2008. COSEWIC assessment and status report on the Cobblestone Tiger Beetle *Cicindela marginipennis* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 27 pp.

Government of Canada. 2009. Species at Risk Act Policies, Overarching Policy Framework [Draft]. Species at Risk Act Policy and Guidelines Series. Environment Canada. Ottawa. 38 pp.

Hudgins, R., C. Norment, M.D. Schlesinger, and P.G. Novak. 2011. Habitat selection and dispersal of Cobblestone Tiger Beetle (*Cicindela marginipennis* Dejean) along the Geneese River, New York. American Midland Naturalist 165: 304-318.

Levin, S.A. 1974. Dispersion and population interactions. The American Naturalist 108(960): 207-228.

NatureServe. 2010. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: July 18, 2011).

Nature Trust of New Brunswick. 2011. Available http://www.naturetrust.nb.ca. (Accessed: July 19, 2011).

Sabine, D. L. 2004. First record of *Cicindela marginipennis* Dejean from Canada. Cicindela 36(3-4): 53-56.

Ward, M.A. and J.D. Mays. 2010. New records of the White Mountain Tiger Beetle, *Cicindela ancosisconensis* Harris (1852), and first record of the Cobblestone Tiger Beetle, *Cicindela marginipennis* DeJean (1831), in Maine. Cicindela 42(1): 11-21.

Webster, R.P. 2009. Population estimates of the Cobblestone Tiger Beetle, *Cicindela marginipennis* in New Brunswick during 2008. New Brunswick Wildlife Trust Fund report. 12 pp.

Webster, R.P. 2008. Population estimates of the Cobblestone Tiger Beetle, *Cicindela marginipennis* in New Brunswick during 2007. New Brunswick Wildlife Trust Fund report. 7 pp.

Webster, R.P. 2005. Survey for Cobblestone Tiger Beetle, *Cicindela marginipennis*: Report for 2004 survey. New Brunswick Wildlife Trust Fund report. 11 pp.

APPENDIX A: COBBLESTONE TIGER BEETLE CRITICAL HABITAT

Table A-1. Sites identified as critical habitat for Cobblestone Tiger Beetle in New Brunswick.

Location	Site Name	Latitude	Longitude
Grand Lake	Grand Lake Site 1	45.90546	66.10340
	Grand Lake Site 2	46.00316	66.03652
	Grand Lake Site 3	46.03763	66.01845
Saint John River	St. John River Site 1	46.30200	67.53270
	St. John River Site 2	46.28150	67.50737
	St. John River Site 3	46.31464	67.54446
	St. John River Site 4	46.36235	67.56151
	St. John River Site 5	46.46180	67.60100

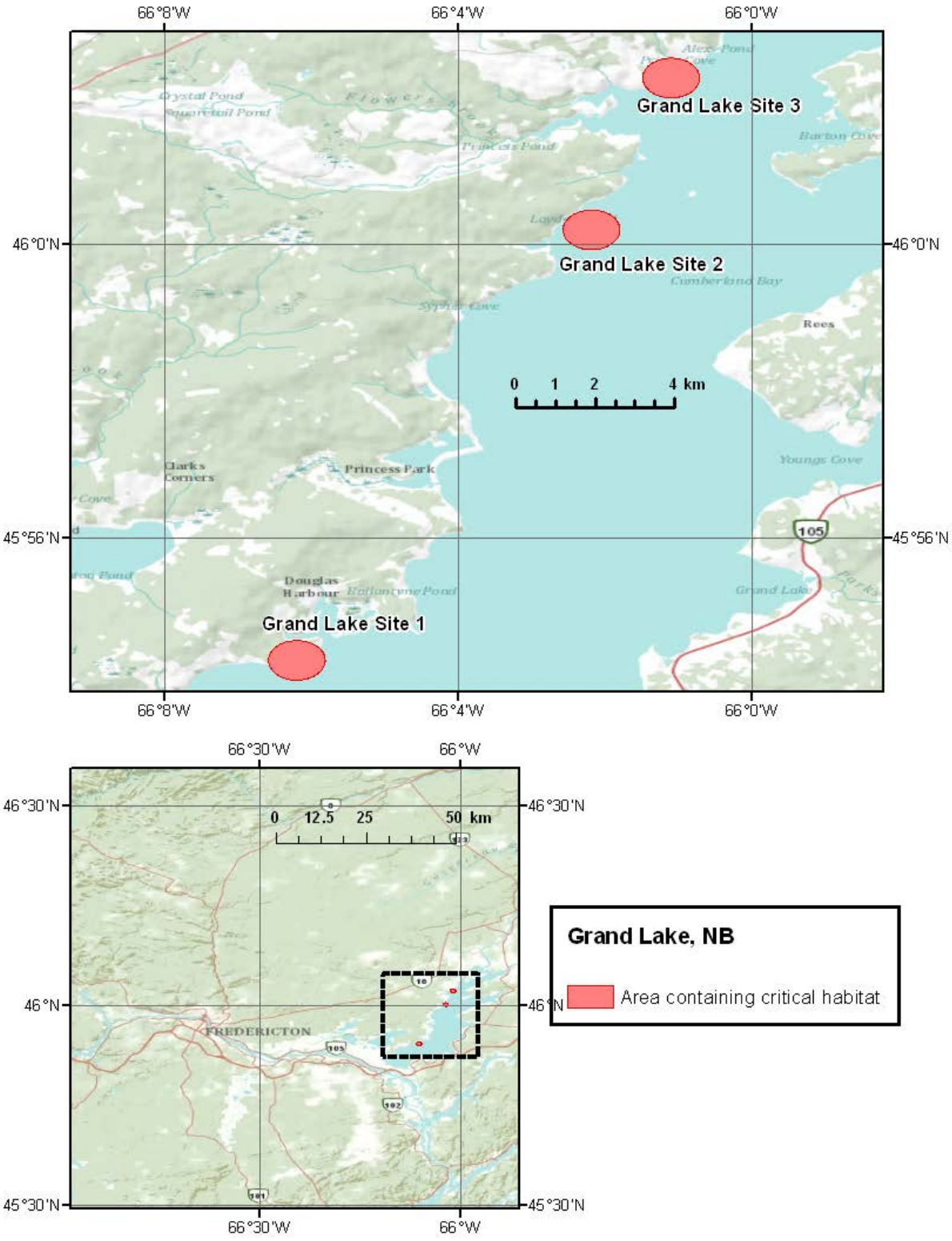

Figure A-1. Sites containing critical habitat for Cobblestone Tiger Beetle at the Grand Lake location.

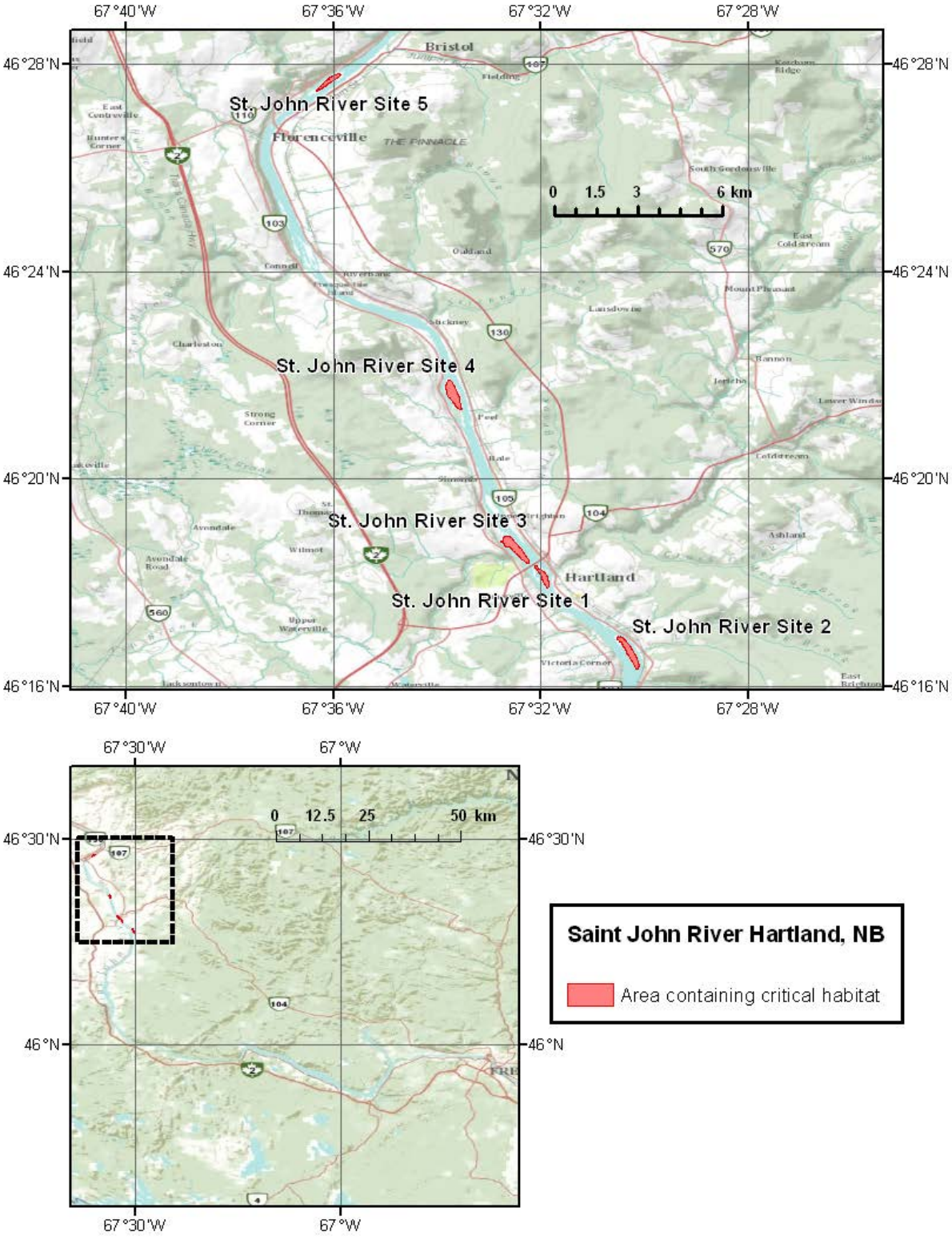

Figure A-2. Sites containing critical habitat for Cobblestone Tiger Beetle at the St. John River location.

APPENDIX B: EFFECTS ON THE ENVIRONMENT AND OTHER 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.

Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that strategies 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 upon non-target species or habitats. The results of the SEA are incorporated directly into the strategy itself, but are also summarized below in this statement.

This recovery strategy will clearly benefit the environment by promoting the conservation of the Cobblestone Tiger Beetle. The potential for the strategy to inadvertently lead to adverse effects on other species was considered. The SEA concluded that this strategy will clearly benefit the environment and will not entail any significant adverse effects. The reader should refer to the following sections of the document in particular: Section 3 which contains a description of the species' habitat and biological needs as well as Section 6 which includes the recovery planning table.