Fawnsfoot, Threehorn Wartyback and Lilliput

Ontario Government Response Statement

Protecting and Recovering Species at Risk in Ontario

Species at risk recovery is a key part of protecting Ontario's biodiversity. The *Endangered Species Act, 2007* (ESA) is the Ontario government's legislative commitment to protecting and recovering species at risk and their habitats.

Under the ESA, the government must ensure that a recovery strategy is prepared for each species that is listed as endangered or threatened. A recovery strategy provides science-based advice to government on what is required to achieve recovery of a species.

Generally, within nine months after a recovery strategy is prepared, the ESA requires the government to publish a statement summarizing the government's intended actions and priorities in response to the recovery strategy. The response statement is the government's policy response to the scientific advice provided in the recovery strategy. In addition to the strategy, the government response statement considers (where available) input from Indigenous communities and organizations, stakeholders, other jurisdictions, and members of the public. It reflects the best available local and scientific knowledge, including Indigenous Knowledge where it has been shared by communities and Knowledge Holders, as appropriate, and may be adapted if new information becomes available. In implementing the actions in the response statement, the ESA allows the government to determine what is feasible, taking into account social, cultural and economic factors.

The Recovery Strategy for Fawnsfoot (*Truncilla donaciformis*) and Threehorn Wartyback (*Obliquaria reflexa*) in Ontario and the Recovery Strategy for Lilliput (*Toxolasma parvum*) in Ontario were completed on January 25, 2023. Given their common threats and similar life histories, distributions, and habitat requirements the recovery efforts for these three species are being addressed collectively in a single government response statement.

Fawnsfoot is a small freshwater mussel that has a triangular shell with dark green chevron markings.

Threehorn Wartyback is a small to medium-sized freshwater mussel with a single row of two to five distinctive knobs, or horns.

Lilliput is a small freshwater mussel that has a smooth, oval-shaped shell with dark colouration.

Protecting and Recovering Fawnsfoot, Threehorn Wartyback and Lilliput

Fawnsfoot is listed as an endangered species, and Threehorn Wartyback and Lilliput are listed as threatened species under the ESA, which protects both the animals and their habitat. The ESA prohibits harm or harassment of the species and damage or destruction of its habitat without authorization or complying with the requirements of a regulatory exemption.

Globally, Fawnsfoot, Threehorn Wartyback and Lilliput are found in central North America extending from the coast of the Gulf of Mexico north to the Great Lakes watershed. United States (U.S.) populations of all three species are considered secure. In Canada, the three species occur only in southern Ontario. The healthiest population of Fawnsfoot is found in the Thames River, while others occur in the Grand and East and North Sydenham rivers. The species was also previously detected in the St. Clair River delta and Muskrat Creek (Saugeen River watershed); however, in both cases only a single live mussel was found, and more recent surveys suggest it is unlikely these populations still exist. Fawnsfoot is believed to be extirpated from the Detroit and Niagara rivers, Lake Erie, and the offshore waters of Lake St. Clair. Threehorn Wartyback is found in the Thames, Grand, and Sydenham Rivers, and recent collections suggest a population may persist in the Detroit River. It is considered extirpated from Lake St. Clair and the Canadian side of Lake Erie, although one fresh shell was collected from Rondeau Bay in 2001. Lilliput is known from four Lake St. Clair tributaries (East Sydenham, Thames [including Baptiste Creek], Ruscom, and Belle rivers), one Lake Erie tributary (Grand River), and three systems in the Lake Ontario drainage (Welland River/Oswego Creek, Hamilton Harbour and surroundings, and Jordan Harbour). Recent surveys have detected live specimens in waterbodies on Pelee Island and within the lower Canard River. Further sampling is required to determine whether these collections indicate larger, previously undetected populations. The species may be extirpated from the North Sydenham River, Thames River (McGregor Creek), and Detroit River. The collection of weathered (worn) shells from Rondeau Bay and the Feeder Canal (an artificial connection between the Grand and Welland rivers which is no longer operational) in recent years may indicate additional historical locations, but they are not believed to support current populations. Though all three species have likely always been rare in Ontario, their range has declined substantially when compared to their historical distribution in the province.

Fawnsfoot is typically found in sand or mud substrates, but it can also be found in areas with coarser substrates such as gravel and rubble. Extant (still existing) Ontario populations are usually found in the lower portions of large rivers in fine sand or gravel substrates. Threehorn Wartyback has been observed in a variety of substrate types including clay, detritus, silt, sand, gravel, rubble, and boulder, but sand and gravel seem to be preferred. The species is usually found in large rivers with moderate current and in shallow embayments and reservoirs with little current. Lilliput appears to have the ability to live in a broad range of habitats such as large rivers, wetlands, lakes, ponds, and reservoirs and use substrate types that include clay, detritus, silt, sand, gravel, rubble, and boulder, although finer particle sizes (e.g. clay, silt) may be preferred.

Like other freshwater mussels belonging to the Unionidae family, Fawnsfoot, Threehorn Wartyback and Lilliput exhibit complex life cycles including a unique reproductive strategy. Female mussels release larvae, known as glochidia, which are taken up into the mouth or gills of a suitable fish species (host fish). The glochidia attach to the fishes' gills and feed on the fishes' body fluids until the glochidia metamorphose (change into) juvenile mussels. After metamorphosis, juveniles release themselves from the host and fall to the substrate to begin life as free-living mussels. Juvenile mussels remain buried, feeding on particles in the substrate until they are sexually mature, at which point they move to the surface where they begin to filter feed (strain suspended particles from the water) and reproduce.

The host fish for Fawnsfoot in Canada is likely Freshwater Drum (*Aplodinotus grunniens*) based on U.S. reports and overlapping distribution. Sauger (*Sander canadensis*) has also been reported as a potential host. Although the host fish(es) have not been identified for Threehorn Wartyback populations in Canada, Common Shiner (*Luxilus cornutus*), Longnose Dace (*Rhinichthys cataractae*), Goldeye (*Hiodon alosoides*), and Silverjaw Minnow (*Notropis buccatus*) have been identified as hosts in U.S. populations. Common Shiner and Longnose Dace have also been confirmed to overlap Threehorn Wartyback's Canadian distribution. Similarly, host fishes have not been identified for Lilliput populations in Canada. Of the host fishes identified for U.S. populations, Johnny Darter (*Etheostoma nigrum*), Green Sunfish (*Lepomis cyanellus*), White Crappie (*Pomoxis annularis*) and Bluegill (*Lepomis macrochirus*) have been confirmed to overlap with Lilliput's Canadian distribution, suggesting that they may also be hosts for Canadian populations.

Like other freshwater mussels, Fawnsfoot, Threehorn Wartyback and Lilliput play an important role in the functioning of aquatic ecosystems. They filter materials out of the water column, including organic matter, bacteria, phytoplankton, and contaminants, which helps to improve water quality. They are a food source for several species

including Muskrat (*Ondatra zibethicus*), Raccoon (*Procyon lotor*), Mink (*Mustela vison*) and a variety of fish species, and their shells can provide habitat for other small organisms. Due to the sensitivity of freshwater mussels to environmental conditions they are considered good indicators of ecosystem health.

Freshwater mussels are largely sedentary organisms with a limited ability to disperse and relocate from substandard conditions, leaving them particularly vulnerable to habitat disruptions and predation. Their reliance on host fishes for persistence and dispersal means they are also impacted by threats to the host species.

The main cause of the decline in lake-dwelling populations of freshwater mussel (including in these three species) is the presence of the invasive dreissenid mussels (e.g. Zebra Mussels [*Dreissena polymorpha*] and Quagga Mussels [*Dreissena bugensis*]). Dreissenid mussels attach themselves to the shells of native mussels and inhibit feeding, respiration, movement and reproduction. Other invasive species that have been implicated in the decline of freshwater mussel populations are the Round Goby (*Neogobius melanostomus*) and Common Carp (*Cyprinus carpio*). Round Goby has been observed to consume juvenile mussels, and may also act as a sink for glochidia, meaning the glochidia become attached to the fishes' gills but do not successfully metamorphose into juveniles. Further, host fish species may be impacted by Round Goby through competition for resources and predation during early life stages. The Common Carp feeds on benthic organisms and is thought to be capable of consuming mussels. Its feeding behaviour can also negatively impact habitat by disturbing the sediment and reducing water quality. Common Carp may be of particular concern in the Thames River, the lower Grand River, Jordan Harbour, and Hamilton Harbour and surroundings where it is prolific.

Another threat to river-dwelling populations of these species is poor water quality from pollution and siltation. The two major contributors to these problems are extensive agriculture and urbanization. Southern Ontario is largely comprised of agricultural land, and historic poor agricultural practices have resulted in large inputs of sediment and excess nutrients to watercourses. High rates of sediment loading are thought to impact mussel feeding, respiration, and reproduction by clogging siphons (tube-like structures used to take in and expel water) and gill structures (organs which extract food particles and dissolved oxygen from the water), and reducing the likelihood of interactions with host fishes due to decreased visibility. Nutrient loading can lead to increased algal growth and a subsequent reduction of oxygen in the water column, affecting mussels directly and indirectly through impacts to the fish community. With that said, updated environmental protections may mitigate these effects moving forward. Urbanization can introduce contaminants such as heavy metals, pesticides, pharmaceuticals and road

salt into watercourses through runoff and wastewater effluents. It is thought that freshwater mussels are more sensitive to water and sediment contamination than the animals they co-exist with, though species-specific tolerances are unknown and require further investigation.

Additional threats to Fawnsfoot, Threehorn Wartyback and Lilliput include habitat loss or modification (e.g. damming, dredging and in-stream construction), changes in the availability of host fishes, recreational activities and climate change.

Fawnsfoot, Threehorn Wartyback and Lilliput are rare in Ontario, and population demographics and threats are not well understood. This lack of information presents a challenge for developing specific population and distribution targets. Research and monitoring are required to gain a better understanding of species-specific life history characteristics, demographic traits, and thresholds of tolerance in order to implement effective strategies to protect known populations and their habitat, and to refine recovery efforts and objectives. Accordingly, the government supports investigating the necessity and feasibility of population augmentation where the species are known to occur.

Government's Recovery Goal

The government's goal for the recovery of Fawnsfoot, Threehorn Wartyback and Lilliput is to maintain or restore self-sustaining populations where the species occur, where feasible and appropriate. The government supports investigating the necessity and feasibility of augmenting existing populations.

Actions

Protecting and recovering species at risk is a shared responsibility. No single agency or organization has the knowledge, authority or financial resources to protect and recover all of Ontario's species at risk. Successful recovery requires inter-governmental co-operation and the involvement of many individuals, organizations and communities. In developing the government response statement, the government considered what actions are feasible for the government to lead directly and what actions are feasible for the government to support its conservation partners to undertake.

Government-led Actions

To help protect and recover Fawnsfoot, Threehorn Wartyback and Lilliput, the government will directly undertake the following actions:

- Continue to protect Fawnsfoot, Threehorn Wartyback and Lilliput and their habitat through the ESA.
- Undertake communications and outreach to increase public awareness of species at risk in Ontario.
- Educate other agencies and authorities involved in planning and environmental assessment processes on the protection requirements under the ESA.
- Encourage the submission of Fawnsfoot, Threehorn Wartyback and Lilliput data to Ontario's central repository through the NHIC (Rare species of Ontario) project in iNaturalist or directly through the Natural Heritage Information Centre.
- Continue to support conservation, agency, municipal and industry partners, and Indigenous communities and organizations to undertake activities to protect and recover Fawnsfoot, Threehorn Wartyback and Lilliput. Support will be provided where appropriate through funding, agreements, permits and/or advisory services.
- Continue to implement Ontario's *Invasive Species Act* to control the spread of invasive species (i.e. dreissenid mussels) that threaten Fawnsfoot, Threehorn Wartyback and Lilliput and their habitat by requiring all boaters in Ontario to clean and drain watercraft and watercraft equipment when transporting them overland.
- Continue to implement the Aquatic Invasive Species Regulations made under the *Fisheries Act* to control the spread of invasive species that threaten Fawnsfoot, Threehorn Wartyback and Lilliput and their habitat by prohibiting the transportation, possession, and release of live Round Goby in Ontario.
- Continue to implement the *Ontario Invasive Species Strategic Plan* (2012) to address the invasive species (e.g. dreissenid mussels, Round Goby, Common Carp) that threaten Fawnsfoot, Threehorn Wartyback and Lilliput and their habitat.

- Conduct a review of progress toward the protection and recovery of Fawnsfoot, Threehorn Wartyback and Lilliput within five years of the publication of this document.

Government-supported Actions

The government endorses the following actions as being necessary for the protection and recovery of Fawnsfoot, Threehorn Wartyback and Lilliput. Actions identified as "high" may be given priority consideration for funding under the Species at Risk Stewardship Program. Where reasonable, the government will also consider the priority assigned to these actions when reviewing and issuing authorizations under the ESA. Other organizations are encouraged to consider these priorities when developing projects or mitigation plans related to species at risk.

Focus Area:	**Research and Monitoring**
Objective:	Improve understanding of Fawnsfoot, Threehorn Wartyback and Lilliput biology, habitat requirements, population trends, threats to the species, and necessity and feasibility of population management actions (i.e. augmentation).

In order to ensure that recovery efforts for Fawnsfoot, Threehorn Wartyback and Lilliput are effective, it is necessary to gain a more thorough understanding of the factors influencing the species in Ontario. There are knowledge gaps relating to species-specific life history, juvenile habitat requirements, host fish species and their distribution and abundance, and population structure and trends. Filling these knowledge gaps will provide information to determine the feasibility of maintaining or restoring self-sustaining populations at the local scale and will help determine where recovery efforts are best focused.

Actions:

1. **(High)** Develop and implement a standardized monitoring program using a network of permanent monitoring stations to track changes in the distribution and abundance of each species and their host fishes (once they have been confirmed), habitat use and condition, and the presence of invasive species such as dreissenid mussels, Round Goby and Common Carp.
2. **(High)** Continue studies to identify host fishes for each species.

3. **(High)** Conduct intensive surveys for Lilliput to determine the distribution and abundance of extant populations with emphasis on newly discovered locations (e.g. Pelee Island and the Canard River).
4. **(High)** Evaluate threats to each species and their habitats at all life stages. Actions may include:
    i. determining sensitivities to environmental contaminants, including those found in the sediment (may involve the use of captive-bred specimens)
    ii. determining thresholds of tolerance to habitat modifications (e.g. altered water flow)
    iii. investigating the potential impacts of invasive species on host fish abundance
5. Conduct surveys within historical distributions where suitable habitat exists (including the presence of host fishes) and in other targeted areas where there is reason to believe each species may be present to detect or confirm whether populations exist.
6. Determine life history characteristics (e.g. age at maturation, longevity) and demographic traits of Fawnsfoot, Threehorn Wartyback and Lilliput populations to inform population models and recovery efforts.
7. Investigate the necessity and feasibility of augmenting existing populations of the species. Actions may include:
    i. assessing whether current threats can be sufficiently mitigated or reversed to support the survival of introduced individuals
    ii. undertaking population viability analysis for extant populations
    iii. assessing the genetic structure and diversity of Fawnsfoot, Threehorn Wartyback and Lilliput populations where they occur to determine genetic substructure and inform potential future translocation efforts
    iv. evaluating the feasibility of captive rearing and release, or the transfer of specimens from a wild donor population
    v. identifying locations that will support the successful translocation of wild individuals or the release of captive-reared mussels

8. Based on the outcome of Action 7, develop genetically sound propagation guidelines if augmentation is deemed necessary and feasible.

Focus Area:	**Management and Threat Mitigation**
Objective:	Maintain or improve the quality of Fawnsfoot, Threehorn Wartyback and Lilliput habitat in Ontario through the mitigation of threats.

Fawnsfoot, Threehorn Wartyback and Lilliput occur in southern Ontario, where pollution and habitat loss present ongoing threats to the species. The removal of riparian areas, unrestricted livestock access to rivers, improper use of fertilizers and pesticides, and tile drainage practices contribute to increased levels of sediment and nutrients in the watershed. A collaborative approach to implementing best management practices on a broad scale will help to improve water quality conditions for both mussels and their fish hosts.

Actions:

9. **(High)** Encourage development and use of Environmental Farm Plans and Nutrient Management Plans to incorporate best management practices (BMPs) for rural streams and drains. These BMPs should include restoring a healthy riparian zone, reducing access by livestock, establishing manure-storage and runoff collection systems, encouraging conservation tillage and improving faulty septic systems.
10. Work with existing ecosystem recovery efforts, such as the Sydenham River Action Plan, the Thames River Ecosystem Recovery Strategy, the Essex-Erie Region Ecosystem-based Recovery Strategy and the Grand River Fish Species at Risk Recovery Strategy, to implement recovery actions on a watershed basis.
11. If determined necessary and feasible, implement, monitor and adapt augmentation actions for local populations with a focus on those at a higher risk of extirpation.

Focus Area:	**Awareness**
Objective:	Increase public awareness and promote the protection and stewardship of Fawnsfoot, Threehorn Wartyback and Lilliput in Ontario.

Freshwater mussels play an integral role in the health of aquatic ecosystems and their continued presence is of great benefit to all Ontarians. Fawnsfoot, Threehorn Wartyback and Lilliput habitat is bordered by public, private and commercial lands including agricultural fields, livestock farms, residential properties and Indigenous lands.

Due to the nature of aquatic systems, the species are also impacted by activities occurring upstream of occupied habitat. Therefore, promoting public awareness is a key factor in supporting the effective protection and recovery of the species and their habitat in Ontario.

Actions:

12. **(High)** Develop materials and programs to increase public awareness of these mussels and their host fishes (once confirmed), the threats facing them, and stewardship options.
13. Promote and enhance expertise in freshwater mussel identification and biology, ecology, and conservation.
14. Undertake work consistent with existing provincial programs (e.g. Ontario's Invading Species Awareness Program) to promote public education and awareness of invasive species and their impacts in Ontario and implement actions to prevent, respond to, and manage the spread of invasive species.

Implementing Actions

Financial support for the implementation of actions may be available through the Species at Risk Stewardship Program. Conservation partners are encouraged to discuss project proposals related to the actions in this response statement with Ministry of the Environment, Conservation and Parks staff. The Ontario government can also provide guidance about the requirements of the ESA, whether an authorization or regulatory exemption may be required for the project and, if so, the authorization types and/or conditional exemptions for which the activity may be eligible. Implementation of the actions may be subject to changing priorities across the multitude of species at risk, available resources and the capacity of partners to undertake recovery activities. Where appropriate, the implementation of actions for multiple species will be co-ordinated across government response statements.

Performance Measures

Progress towards achieving the government's goal for the recovery of Fawnsfoot and Threehorn Wartyback will be measured against the following performance measures:

- By 2028, the continued presence of Fawnsfoot and Threehorn Wartyback is confirmed within their known distribution.

- By 2028, reproduction of Fawnsfoot and Threehorn Wartyback is confirmed at known sites.

Progress towards achieving the government's goal for the recovery of Lilliput will be measured against the following performance measures:

- By 2028, the continued presence of Lilliput is confirmed within its known distribution.
- By 2030, the status of Lilliput is confirmed at extant locations.
- By 2030, the population trajectory of Lilliput is determined at extant locations.

Reviewing Progress

The ESA requires the Ontario government to conduct a review of progress towards protecting and recovering a species no later than the time specified in the species' government response statement, which has been identified as 5 years. The review will help identify if adjustments are needed to achieve the protection and recovery of Fawnsfoot, Threehorn Wartyback and Lilliput.

Acknowledgement

We would like to thank all those who participated in the development of the Recovery Strategies and Government Response Statement for the Fawnsfoot (*Truncilla donaciformis*), Threehorn Wartyback (*Obliquaria reflexa*) and Lilliput (*Toxolasma parvum*) in Ontario for their dedication to protecting and recovering species at risk.

For Additional Information:

Visit the species at risk website at ontario.ca/speciesatrisk
Contact the Ministry of the Environment, Conservation and Parks
1-800-565-4923
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www.ontario.ca/environment