COSEWIC
Status Appraisal Summary

on the

Brook Floater
Alasmidonta varicosa
Jipu'ji'jey N'kata'law

in Canada

SPECIAL CONCERN
2022

COSEWIC
Committee on the Status
of Endangered Wildlife
in Canada

COSEPAC
Comité sur la situation
des espèces en péril
au Canada

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COSEWIC
Assessment Summary

Assessment Summary – December 2022

Common name
Brook Floater, Jipu'ji'jey N'kata'law

Scientific name
Alasmidonta varicosa

Status
Special Concern

Reason for designation
This medium-sized freshwater mussel is confined to 13 widely scattered watersheds in Nova Scotia and New Brunswick. This mussel is never abundant in waterbodies where it is found. With additional search effort, the species has been found in new tributaries/lakes but was not confirmed in two previously identified watersheds. Domestic and urban wastewater and agricultural and forestry effluents pose the greatest current threat to this species. Additional threats include habitat degradation, residential development, predation, and invasive species, including Zebra Mussel, which is now confirmed in the St. John River watershed and is expected to spread into adjacent systems where Brook Floater occurs. Special Concern status is retained for this species as it may become threatened if factors suspected of negatively influencing its persistence are neither reversed nor managed with demonstrable effectiveness.

Occurrence
Nova Scotia, New Brunswick

Status history
Designated Special Concern in April 2009. Status re-examined and confirmed in December 2022.

COSEWIC
Status Appraisal Summary

Brook Floater
Alasmidonta varicosa
Jipu'ji'jey N'kata'law

Range of occurrence in Canada (province/territory/ocean): Nova Scotia, New Brunswick

SAS 6
Wildlife species:

Change in eligibility, taxonomy or designatable units:	yes ☐ no ☒

Explanation:
No changes since the previous assessment.

Range:

SAS 7	Change in Extent of Occurrence (EOO):	yes ☒ no ☐ unk ☐
SAS 8	Change in Index of Area of Occupancy (IAO):	yes ☒ no ☐ unk ☐
SAS 9	Change in number of known or inferred current locations[1]:	yes ☒ no ☐ unk ☐
SAS 10	Significant new survey information	yes ☒ no ☐

Explanation:
The Brook Floater's distribution in Canada is limited to 13 watersheds in Nova Scotia and New Brunswick (Table 1, Figure 1). In New Brunswick, the presence of the Brook Floater has been confirmed in the St. Croix River, Kouchibouguacis River, Bouctouche River, Miramichi River and Petitcodiac Composite watersheds (Baisley and Bredin 2009; Baisley 2010; Elward 2015; Cormier and Elward 2016; Anqotum Resource Management 2018; The Friends of the Kouchibouguacis 2018; Anqotum Resource Management 2019; Ward 2019; Biodrawversity 2020; Elward 2020). The species' presence was identified in three new tributaries/lakes (Barnaby River, Taxis River, and Miramichi Lake) in the Miramichi River watershed, which were not recorded in the previous status report (Anqotum Resource Management 2019).

According to the 2009 COSEWIC status report, the Shediac River was classified as having the largest population of Brook Floaters in New Brunswick. However, following the reported presence of Brook Floaters in the Shediac Bay watershed (including Shediac River, Weisner Brook, Calhoun Brook and Scoudouc River) in 2005, a six-year study (2014–2019) was conducted to confirm the species' presence there. After significant effort, no evidence of the Brook Floater was found (Audet and Caissie 2006; Hébert 2016; Hébert and Leblanc 2018). As such, it was concluded that the specimens found in the 2005 surveys were most likely misidentified, suggesting that populations of the Brook Floater were not accurately identified during those initial surveys (Hébert and Donelle 2020). Therefore, data from the Shediac Bay watershed were excluded from this report. In addition, surveys for the Brook Floater have not occurred since 2009 in Meadow Brook (Bouctouche), Johnson Brook (Bouctouche), Luke Brook (Bouctouche), North Branch Bouctouche River, and South Branch Bouctouche River (Elward 2020). These sites have been included in this report as it is believed that the Brook Floater is still present at these sites.

[1] Use the IUCN definition of "location"

Environmental DNA (eDNA) has emerged as a powerful tool in detecting the presence of species in aquatic systems and has been applied to detecting species at risk including freshwater mussels (Currier *et al*. 2018; Preece *et al*. 2021; Schmidt *et al*. 2021). LeBlanc *et al*. 2021 developed eDNA primers and demonstrated their ability to detect the Brook Floater. Using this system, LeBlanc *et al.* (2021) detected Brook Floater DNA at 16 sites in New Brunswick. The amount of DNA measured was always below the theoretical limit of detection for their assay and as a result LeBlanc *et al.* (2021) classified these results as suspected or inconclusive. The low amount of DNA recovered in their samples is consistent with the fact that the Brook Floater is often present at low densities and abundances. This species can be challenging for consistent eDNA detection, particularly when environmental samples are taken at some distance from the source mussels. Despite these limitations, these results can provide informative data and can direct future surveys that may detect previously unknown subpopulations. Cases where positive detection was obtained with eDNA but visual confirmation was lacking were not included in the EOO and IAO, due to concern over the potential issue of false positives (Currier *et al*. 2018).

In Nova Scotia, the presence of the Brook Floater was confirmed in the Stewiacke/Shubenacadie (Gays River), Wallace River, St. Mary's River (Eden Lake and St. Mary's River), Annapolis River, and Salmon River watersheds (Marshall and Pulsifer 2010; MacDonald 2020) (Figure 5). Since the last assessment in 2009, the species' presence was identified in three new tributaries (Nine Mile River, East Branch St. Mary's River and North Branch St. Mary's River) in the Shubenacadie/Stewiacke and St. Mary's watersheds (MacDonald 2020; Marshall and Pulsifer 2010) (Table 1). In addition, the Brook Floater, historically known to occur in the Stewiacke River, was rediscovered in 2017 and live specimens were confirmed in 2018 and 2019 (Reader and Lachance 2017; D'Souza and Ransome 2018; Ransome and MacDonald 2019). Surveys for the Brook Floater were not undertaken in Mattatall Lake, Lochaber Lake, LaHave River, and Bordens Lake (Marshall and Pulsifer 2010). Nonetheless, these sites have been included in this report as it is believed that the Brook Floater is still present there.

The estimated extent of occurrence (EOO) in 2009 was 76,856 km² (COSEWIC 2009) and the newly calculated EOO (1985–2020) is 74,104 km² based on the minimum convex polygon of extant sites. The new EOO calculation did not include data from 1975–1985 and there is the potential that some data points could be missing from the 2009 status report because of inaccessibility, which might have resulted in the calculated decrease in the EOO. The comparison of Figure 5 from the previous assessment (COSEWIC 2009) with Figure 1 from this assessment suggests that new occurrences in the Southwest Miramichi should result in a slight increase in the EOO since the previous assessment. The calculated decrease in the EOO since the previous assessment appears to be an artifact, perhaps due to differences in how the EOO was calculated. It is important to note that the EOO (1985–2020) only includes geographical areas within Canada. Because the St. Croix River occurrence data straddles the US (Maine) and Canadian borders (New Brunswick), it is reasonable to assume that the Brook Floater could move back and forth across both geographic borders over the course of generations, which would slightly change the value of the EOO. Since the last COSEWIC status report, seven new tributaries with the presence of live Brook Floater specimens were identified, including the historical population in the Stewiacke River.

The Index Area of Occupancy (IAO) in 2009 was calculated at 707 km² (COSEWIC 2009), while the current IAO is 1,290 km² based on a 2 km by 2 km grid in continuous stretches of rivers/lakes. The increase is due to the increased search effort, resulting in occurrences in seven new tributaries being discovered; the increased number of occurrences in rivers with known populations; and the fact that, in 2009, the IAO was calculated as discrete IAO whereas now it is calculated as continuous IAO. For comparison, the current discrete IAO is 310 km². However, 11 of the 15 tributaries (the four tributaries in the Shediac watershed were excluded) where the Brook Floater's presence has not been confirmed or assessed since 2009 were included in the Brook Floater extant map, EOO calculations, and IAO calculations, as it was assumed that additional search effort would be needed to draw concrete conclusions about the Brook Floater's presence and/or absence.

Locations are identified based on plausible threats. Because the major threats are related to effluent runoff, these effects would not be expressed simultaneously across the species' entire range, but would be more localized, such as at the watershed level or at the tributary level. This would provide a number of locations ranging from 13 (watershed) to 31 (tributary/lake).

Population Information:

SAS 11	Change in number of mature individuals:	yes ☐ no ☐ unk ☒
SAS 12	Change in population trend:	yes ☐ no ☐ unk ☒
SAS 13	Change in severity of population fragmentation:	yes ☐ no ☐ unk ☒
SAS 14	Change in trend in area and/or quality of habitat:	yes ☐ no ☐ unk ☒
SAS 15	Significant new survey information	yes ☒ no ☐

Explanation:
While there appear to be changes in the number of individuals at specific locations in New Brunswick and Nova Scotia, the total number of mature individuals of the Brook Floater since the last report is unknown. In addition, the percentage of the total area of occupancy with small, unviable habitat patches is unknown. Some habitat patches are very distant from each other and might be considered fragmented but, due to the limited data, it is unknown if the population is fragmented. There is also scientific uncertainty about the minimum number of mature individuals needed to constitute a viable population or subpopulation of the Brook Floater (COSEWIC 2009).

There may be long-term changes in the quality and extent of habitat, but due to the lack of repeated standardized sampling, it is not possible to estimate a population trend or to determine if there are extreme fluctuations in the number of mature individuals.

The newly identified occurrences of the Brook Floater in the Miramichi (Barnaby River, Taxis River and Miramichi Lake), Shubenacadie/Stewiacke (Stewiacke River and Nine Mile River) and St. Mary's (East Branch St. Mary's River and North Branch St. Mary's River) watersheds is significant new information as it increases the IAO. This increase is most likely due to the increased search effort rather than an increase in species abundance or a change in the trend in area of habitat.

SAS 16
Threats:

Change in nature and/or severity of threats:	yes ☒ no ☐ unk ☐

Explanation:
A Threats Calculator (Appendix 1) was completed. The 2018 Management Plan for Brook Floater also included a threat assessment table based on the 2009 COSEWIC report and new data from the Science Branch of Fisheries and Oceans Canada (DFO) (Fisheries and Oceans Canada 2016). There were some differences in the threats identified in the 2009 COSEWIC report (COSEWIC 2009) and those recognized during the Threats Calculator call (Appendix 1). Briefly, in 2009, residential development was considered to be a potential threat of uncertain harm, consistent with not being a threat as assessed in the Threats Calculator. Water level fluctuations were considered to be an imminent threat to subpopulations in the 2009 report but considered to be a negligible threat in the Threats Calculator. Muskrat predation, considered an imminent threat in 2009, was not identified as a threat to the species during the Threats Calculator meeting. At the time of the Threats Calculator meeting, the invasive Zebra Mussel (*Dreissena polymorpha*) and Quagga Mussel (*Dreissena rostriformis bugensis*) were not yet present in New Brunswick or Nova Scotia. As a consequence, these invasives were considered unlikely to pose a threat in the next 10 years, according to the Threats Calculator group (Appendix 1). Information came to light in October 2022 that Zebra Mussels have been confirmed in Lake Temiscouata, which empties into the St. John River via the Madawaska River. The Brook Floater has not been recently recorded in either the Madawaska or the Saint John Rivers (see COSEWIC 2009, Figures 4 and 5), and there is no voucher for the single specimen recorded from the Aroostook in 1960. Other than that single record, despite a great deal of search effort, the Brook Floater has not been recorded in the Saint John watershed. As a result, the presence of Zebra Mussels in the Saint John watershed is not an immediate threat to the Brook Floater. The likelihood of Zebra Mussels getting into watersheds where the Brook Floater occurs is likely a question of not if, but when. Fishing tournament anglers who use boats with live wells are the major concern for the spread of Zebra Mussels. It has been reported

that these anglers sometimes move between drainages in a single weekend (i.e. St. Croix, Magaguadavic, upper Saint John River, lower Saint John River, etc.), and this would facilitate the spread of these invasive species (Mary Sabine pers. comm. 2022). If not managed effectively, the threat from Zebra Mussels could be devastating to the Brook Floater and other unionid mussels.

Another threat brought to attention during the review that was not considered in the Threats Calculator meeting or in 2009 (COSEWIC 2009) was the potential use of rotenone to control the invasive Smallmouth Bass (*Micropterus dolomieu*) (DFO 2019). Hart *et al*. (2001) have shown that rotenone does not have any apparent effects on several species of freshwater mussels. Rotenone could affect potential hosts of the Brook Floater; fish species that have been identified as successful hosts of Brook Floater glochidia are present in Miramichi Lake, including the Yellow Perch (*Perca flavescens*), Brown Bullhead (*Ameiurus nebulosus*), Golden Shiner (*Notemigonus crysoleucas*), Common Shiner (*Luxilus cornutus*), and White Sucker (*Catostomus commersonii*) (Wicklow *et al*. 2017).

However, according to DFO (2019), the native fish population is expected to be re-established through the natural recolonization of the affected area. Presumably, this would happen in a time frame that would permit the resumption of successful Brook Floater spawning using the host fish. However, should rotenone treatment proceed, there will undoubtedly be an impact on Brook Floater reproduction in the shorter term.

Habitat degradation from a variety of sources was identified as an imminent threat in 2009, particularly to the riparian zone. These sources include damage due to water crossings (including from recreational ATV use), and degraded road crossings and culverts, as well as effluent from urban, residential, agricultural and forestry activities. Recreational activities were not considered to be threats in the Threats Calculator. Effluent from Domestic and Urban Waste Water (9.1) and Agricultural and Forestry Effluents (9.3) were identified as the threats in the Threats Calculator (Appendix 1) with impacts of Low and Medium-Low respectively. Domestic and urban wastewater is well established as a threat to freshwater mussels (e.g. Gagné *et al*. 2011; Falfushynska *et al*. 2014; Gillis *et al*. 2014) due to a wide variety of toxicants including ammonia, metals, and estrogenic compounds. Similarly, agricultural and forestry effluents have been demonstrated to be harmful to freshwater mussels (e.g. Bringolf *et al*. 2007; Gascho Landis *et al*. 2016; Moore and Bringolf 2018).

While the nature of the threats to the species seems to be consistent since COSEWIC (2009), there was no formal Threats Calculator in 2009 and this, combined with the lack of data and standardized threat assessments, makes comparisons between, and changes in, the severity of threats difficult to assess. The threats identified currently were also threats in 2009 (COSEWIC 2009).

The Threats Calculator resulted in a Medium-Low impact which translates to a 1–30% projected decline. After discussion among the Threats Calculator teleconference attendees, it was agreed that a 1–10% decline was more plausible than the upper range. The Threats Calculator focused mainly on threats to the St. Mary's River and Petitcodiac Composite watersheds, as it was estimated that approximately 80% of the entire Canadian population resides in these two watersheds. It is important to note that this population distribution estimate has a high degree of uncertainty due to the lack of information on population size and the lack of quantitative data for assessing population and habitat degradation trends in each of the watersheds. If future population surveys reveal a different trend in species distribution, the Threats Calculator should be redone to give more weight to the other watersheds.

SAS 17
Protection:

Change in effective protection:	yes ☒ no ☐ unk ☐
Explanation: COSEWIC assessed the Brook Floater as Special Concern (COSEWIC 2009), and the species was added to Schedule 1 of the *Species At Risk Act* in 2013, resulting in the creation of a management plan for the Brook Floater in 2016 (Fisheries and Oceans Canada 2016).	

In 2013, the New Brunswick Department of Natural Resources (NBDNR) listed the Brook Floater as a species of Special Concern under the province's *Species at Risk Act* (New Brunswick Department of Natural Resources 2012). In Nova Scotia, the Brook Floater has been designated Threatened since 2013 under the *Endangered Species Act* (Nova Scotia Department of Natural Resources 2021).

The conservation status ranks for the Brook Floater are: N3 (Canada), and S3 (Vulnerable) for both New Brunswick and Nova Scotia (Atlantic Canada Conservation Data Centre 2022).

SAS 18
Rescue Effect:

Change in evidence of rescue effect:	yes ☐ no ☒

Explanation:
There is no change in the evidence regarding rescue effect. With the exception of the subpopulation in the St. Croix River, rescue from US populations remains unlikely. Brook Floater populations in the US are still unhealthy and in decline (Fisheries and Oceans Canada 2016). The species is ranked as critically imperiled or imperiled (S1 or S2) in 11 of the 17 states in which it occurs, and the Brook Floater might have become extirpated (SH or SX) in two other states in the US (NatureServe 2020). Approximately 40–50% of the historically known populations in the US are designated as extirpated (COSEWIC 2009; U.S. Fish and Wildlife Service 2018). The Brook Floater is designated Threatened in Maine (Wicklow *et al*. 2017, 2018; U.S. Fish and Wildlife Service 2018).

Canada and the US share a small Brook Floater population in the St. Croix River, which forms the Canada–US border (Biodrawversity 2020). This population is one of the healthiest in the US, which suggests that rescue effects might come from Canada rather than vice versa. The 2009 COSEWIC report on the Brook Floater considers Canada to represent an important global stronghold for the species (COSEWIC 2009).

The migration of the Brook Floater between different watersheds in Canada and the US is considered theoretically possible but unlikely, because the host fish would have to move through brackish or salt water to reach other watersheds, thus entering a different stage of its life cycle. Glochidia, the parasitic larvae of the Brook Floater, are intolerant of salt water and unlikely to survive during host migration (Whitford 2012). However, the glochidia may survive if they are very well buried in the host fish's tissues and the exposure time to salt water is short (COSEWIC 2009). It is unknown whether a rescue effect like that described above has ever happened between nearby watersheds.

SAS 19
Quantitative Analysis:

Change in estimated probability of extirpation:	yes ☐ no ☐ unk ☒

Details:
No data available to estimate the probability of extinction.

Summary and Additional Considerations [e.g. recovery efforts; summarize exactly what has changed since the previous assessment]

The Canadian population of the Brook Floater remains one designatable unit and its range is limited to 13 watersheds in New Brunswick and Nova Scotia. Seven newly recorded rivers/tributaries have been identified as containing the Brook Floater, three in the Miramichi watershed (Barnaby River, Taxis River and Miramichi Lake), two in the Shubenacadie/Stewiacke watershed (Stewiacke River and Nine Mile River) and two in the St. Mary's watershed (East Branch St. Mary's River and North Branch St. Mary's River). In addition, 15 rivers/tributaries could not be assessed or confirmed to contain the Brook Floater since the last status report. Four of these rivers/tributaries, located in the Shediac Bay watershed, were not carried over from the previous

status report due to unsuccessful attempts over the past six years to confirm the species' presence there and the surveyors' hypothesis that the species was previously misidentified. The EOO has declined from 76,856 km^2 to 74,104 km^2 since the last status report, with the IAO increasing from 707 km^2 to 1,290 km^2. This increase is likely the result of the increased search effort rather than an increase in species abundance.

The main threats to the Brook Floater remain pollution from agricultural and forestry practices, and domestic and urban wastewater. The Threats Calculator produced an overall Medium-Low impact, which translates to a 1–30% projected decline, which was considered to be high, and a decline of 1–10% was deemed more likely.

The management plan for the Brook Floater was completed in 2016 (Fisheries and Oceans Canada 2016) and included four broad strategies to aid in the recovery of the species. Much of the data that exists and that was used for this report is derived from the identification and/or confirmation of new and existing Brook Floater locations. This is important information as it gives a better understanding of the distribution of the Brook Floater in Canada.

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List of Individuals and Organizations Consulted in the Compilation of the Dataset for Mapping Freshwater Mussel Sampling Sites and the Locations of Brook Floater Occurrences in New Brunswick and Nova Scotia:

- Atlantic Canada Conservation Data Centre. Freshwater mussel database. 2019. [Accessed November 2020]. Data received from I. Theriault and D. Pirie-Hay
- Fisheries and Oceans Canada, Species at Risk Program, Gulf Region. Brook Floater Locations Dataset. [Accessed November 2020]. Data received from I. Theriault and D. Pirie-Hay

Writers of Status Appraisal Summary:

- Alana Ransome (co-writer) and Marie Lachance (co-writer)
- The Confederacy of Mainland Mi'kmaq-i'kmaw Conservation Group, Millbrook, Nova Scotia

TECHNICAL SUMMARY

Brook Floater

Alasmidonte renflée

Alasmidonta varicosa

Jipu'ji'jey N'kata'law

Range of occurrence in Canada (province/territory/ocean): Nova Scotia, New Brunswick

Demographic Information

Generation time (usually average age of parents in the population; indicate if another method of estimating generation time indicated in the IUCN guidelines (2011) is being used)	10 years (estimated)
Is there an [observed, inferred, or projected] continuing decline in number of mature individuals?	Unknown
Estimated percent of continuing decline in total number of mature individuals within [5 years or 2 generations, whichever is longer up to a maximum of 100 years]	Unknown
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over the last [10 years, or 3 generations, whichever is longer up to a maximum of 100 years].	Unknown
[Projected or suspected] percent [reduction or increase] in total number of mature individuals over the next [10 years, or 3 generations, whichever is longer up to a maximum of 100 years].	Unknown
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over any period [10 years, or 3 generations, whichever is longer up to a maximum of 100 years], including both the past and the future.	Unknown
Are the causes of the decline a. clearly reversible and b. understood and c. ceased?	a. No b. Somewhat c. No
Are there extreme fluctuations in number of mature individuals?	Unknown

Extent and Occupancy Information

Estimated extent of occurrence (EOO)	74,104 km²
Index of area of occupancy (IAO) (Always report 2x2 grid value).	1290 km²
Is the population "severely fragmented" i.e., is >50% of its total area of occupancy in habitat patches that are (a) smaller than would be required to support a viable population, and (b) separated from other habitat patches by a distance larger than the species can be expected to disperse?	a. Unknown (size of viable population is unknown) b. Unknown

Number of “locations”* (use plausible range to reflect uncertainty if appropriate)	13 watersheds (31 tributaries/lakes): Miramichi River; Petitcodiac Composite; Kouchibouguacis River; Bouctouche River; Magaguadavic River; St. Croix River; St. Mary's River; Stewiacke/Shubenacadie Watershed; Salmon River; Wallace River; Annapolis River; River John; LaHave River
Is there an [observed, inferred, or projected] decline in extent of occurrence?	Yes, small observed decline as calculated. However, this is likely an artifact due to differences in how EOO was calculated. Comparisons of the maps in the previous report and this report suggest there may be a slight increase in EOO that is not captured in the calculated EOO.
Is there an [observed, inferred, or projected] decline in index of area of occupancy?	No
Is there an [observed, inferred, or projected] decline in number of subpopulations?	Unknown
Is there an [observed, inferred, or projected] decline in number of “locations”*?	No
Is there an [observed, inferred, or projected] decline in [area, extent and/or quality] of habitat?	Yes, observed, inferred, and projected for some sites
Are there extreme fluctuations in number of subpopulations?	No
Are there extreme fluctuations in number of “locations”*?	No
Are there extreme fluctuations in extent of occurrence?	No
Are there extreme fluctuations in index of area of occupancy?	No

Number of Mature Individuals (in each subpopulation)

Subpopulations (give plausible ranges)	N Mature Individuals
Southwest Miramichi River (Miramichi River Watershed)	Unknown
Taxis River (Miramichi River Watershed)	Unknown
Barnaby River (Miramichi River Watershed)	Unknown
Miramichi Lake (Miramichi River Watershed)	Unknown
Little River (Petitcodiac Composite)	Unknown
Petitcodiac River (Petitcodiac Composite)	Unknown

* See Definitions and Abbreviations on COSEWIC website for more information on this term.

North River (Petitcodiac Composite)	Unknown
Ruisseau à la Truite (Kouchibouguacis River)	Unknown
Kouchibouguacis River	Unknown
South Branch Bouctouche (Bouctouche River)	Unknown
Luke Brook (Bouctouche River)	Unknown
Meadow Brook (Bouctouche River)	Unknown
Johnson Brook (Bouctouche River)	Unknown
Bouctouche River	Unknown
North Branch Bouctouche (Bouctouche River)	Unknown
Magaguadavic River	Unknown
St. Croix River	Unknown
North Branch St. Mary's River	Unknown
East Branch St. Mary's River	Unknown
Lochaber Lake (St. Mary's River)	Unknown
St. Mary's River	Unknown
Eden Lake (St. Mary's River)	Unknown
Gays River (Shubenacadie/Stewiacke river watershed)	Unknown
Stewiacke River	Unknown
Nine Mile River (Shubenacadie/Stewiacke river watershed)	Unknown
Salmon River	Unknown
Bordens Lake (Salmon River)	Unknown
Wallace River	Unknown
Annapolis River	Unknown
Mattatall Lake (River John)	Unknown
LaHave River	Unknown
Total	Unknown

Quantitative Analysis

Is the probability of extinction in the wild at least [20% within 20 years or 5 generations whichever is longer up to a maximum of 100 years, or 10% within 100 years]?	Unknown

Threats (direct, from highest impact to least, as per IUCN Threats Calculator)

Was a threats calculator completed for this species?

Yes, 21 October 2021. Overall threat impact calculated as medium to low. After discussion among threats calculator teleconference attendees, it was agreed that a range of 1-10% decline (Low) was more plausible than the upper range.

i. 9.1 Domestic & urban wastewater: Low
ii. 9.3 Agricultural and forestry effluent: Medium-Low

What additional limiting factors are relevant?

The Brook Floater relies on different species of host fishes to complete its reproduction cycle. The specific species of host fishes in Canada are still unknown. At least 12 different fish species have been identified as suitable hosts with Longnose Dace (*Rhinichthys cataractae*), Margined Madtom (*Noturus insignis*), White Sucker, and Slimy Sculpin (*Cottus cognatus*) being the most suitable based on glochidial transformation (Wicklow *et al*. 2017). Any threats to the host fishes will likely have a negative impact on the mussel.

Rescue Effect (immigration from outside Canada)

Status of outside population(s) most likely to provide immigrants to Canada.	Declining
Is immigration known or possible?	Unknown, unlikely
Would immigrants be adapted to survive in Canada?	Yes
Is there sufficient habitat for immigrants in Canada?	Yes
Are conditions deteriorating in Canada?[+]	Possibly
Are conditions for the source (i.e., outside) population deteriorating? [+]	Yes
Is the Canadian population considered to be a sink? [+]	No
Is rescue from outside populations likely?	Unlikely

Data Sensitive Species

Is this a data sensitive species?	No

Status History:

COSEWIC Status History:
Designated Special Concern in April 2009. Status re-examined and confirmed in December 2022.

[+] See Table 3 (Guidelines for modifying status assessment based on rescue effect).

Status and Reasons for Designation:

Status:	**Alpha-numeric codes:**
Special Concern	Not applicable

Reasons for designation:
This medium-sized freshwater mussel is confined to 13 widely scattered watersheds in Nova Scotia and New Brunswick. This mussel is never abundant in waterbodies where it is found. With additional search effort, the species has been found in new tributaries/lakes but was not confirmed in two previously identified watersheds. Domestic and urban wastewater and agricultural and forestry effluents pose the greatest current threat to this species. Additional threats include habitat degradation, residential development, predation, and invasive species, including Zebra Mussel, which is now confirmed in the St. John River watershed and is expected to spread into adjacent systems where Brook Floater occurs. Special Concern status is retained for this species as it may become threatened if factors suspected of negatively influencing its persistence are neither reversed nor managed with demonstrable effectiveness.

Applicability of Criteria

Criterion A (Decline in Total Number of Mature Individuals): Not applicable. Insufficient data to reliably infer, project, or suspect population trends.
Criterion B (Small Distribution Range and Decline or Fluctuation): Not applicable. The species is near to qualifying for Threatened because IAO (1,290 km²) is below the threshold for Threatened and there is a projected decline in habitat quality, but the population is not severely fragmented and occurs at >10 locations.
Criterion C (Small and Declining Number of Mature Individuals): Not applicable. Insufficient data to determine number of mature individuals and/or continuing decline.
Criterion D (Very Small or Restricted Population): Not applicable. Number of mature individuals and vulnerability to rapid and substantial population decline are unknown.
Criterion E (Quantitative Analysis): Not applicable. Analysis not conducted.

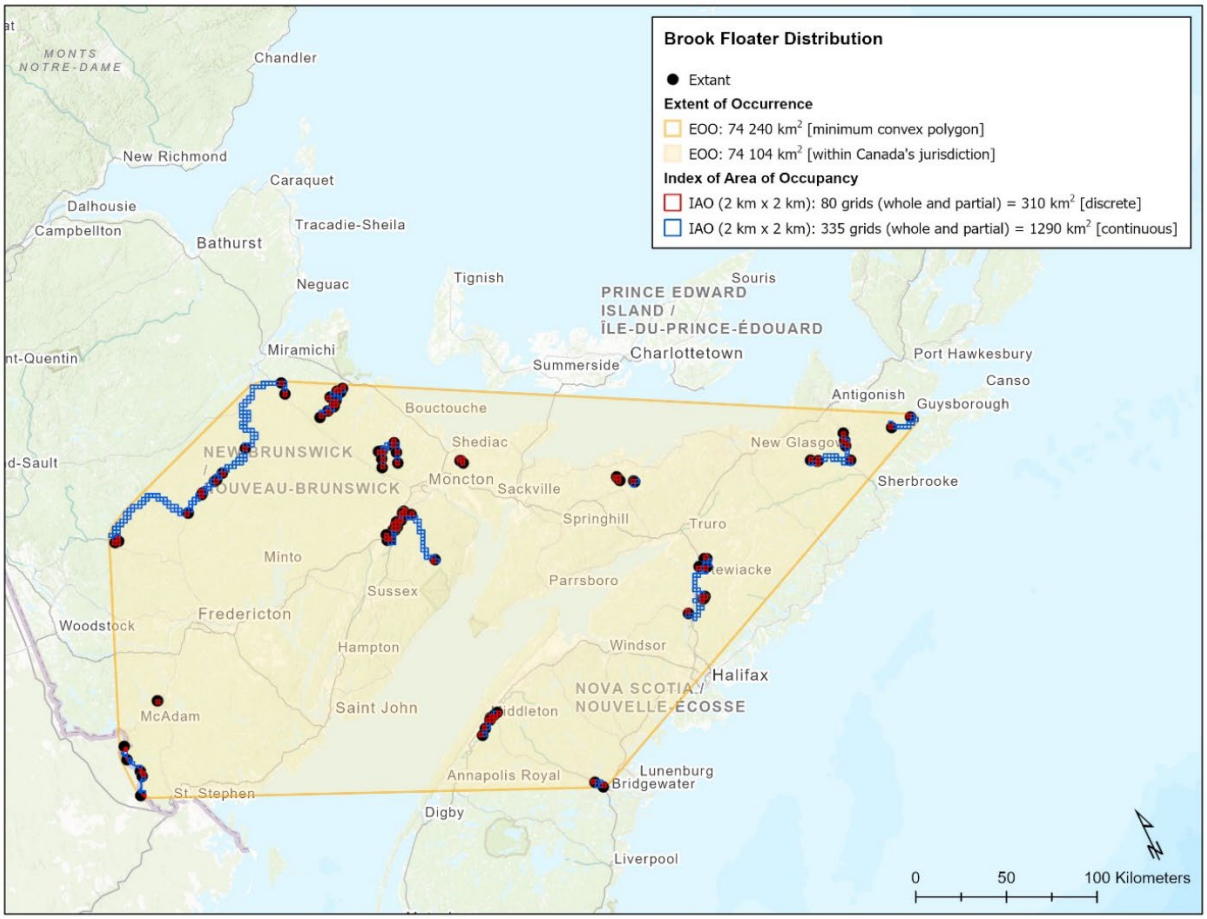

Figure 1. Historical and current (combined) extent of occurrence and index of area of occupancy of the Brook Floater, *Alasmidonta varicosa*, in Canada. Andrew Van Wychen (Confederacy of Mainland Mi'kmaq) provided the map and calculations.

Table 1. List of all the tributaries/lakes and their associated watersheds where the Brook Bloater has been found since 1985. The symbol * indicates new locations where live Brook Floater specimens have been found since 2009. It is important to note that the Shediac Bay watershed and Scoudouc River sites have been excluded from the table and the report due to possible errors in species identification. The Stewiacke River was a historical location with a new Brook Floater population rediscovered after 2009.

Province	Watershed	Tributary/Lake
New Brunswick	Miramichi River	Southwest Miramichi River Taxis River* Barnaby River* Miramichi Lake*
	Petitcodiac Composite	Little River Petitcodiac River North River
	Kouchibouguacis River	Ruisseau à la Truite Kouchibouguacis River
	Bouctouche River	South Branch Bouctouche Luke Brook Johnson Brook Bouctouche River North Branch Bouctouche
	Magaguadavic River	Magaguadavic River
	St. Croix River	St. Croix River
Nova Scotia	St. Mary's River	North Branch St. Mary's River* East Branch St. Mary's River* Lochaber Lake St. Mary's River Eden Lake
	Stewiacke/Shubenacadie Watershed	Gays River Stewiacke River* Nine Mile River*
	Salmon River	Salmon River Bordens Lake
	Wallace River	Wallace River
	Annapolis River	Annapolis River
	River John	River John
	LaHave River	LaHave River

Appendix I. Threats Calculator for Brook Floater, *Alasmidonta varicosa.*

THREATS ASSESSMENT WORKSHEET				
Species or Ecosystem Scientific Name	Brook Floater (*Alasmidonta varicosa*)			
Element ID		**Elcode**		
Date (Ctrl + ";" for today's date):				
Assessor(s):	telecon 29 Oct 2021: Joe Carney (Co-chair), Andrew Hebda, Marie Lachance, Dwayne Lepitzki (facilitator), Bev McBride (Secretariat), Kelly McNichols-O'Rourke, Donald Pirie-Hay, Desiree Roberts, Mary Sabine, Kellie White, Claire Wilson, Daelyn Woolnough, Dave Zanatta			
References:	draft prepared by DL based on draft SAS and final 2018 mgmt plan available at: https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/plans/Mp-BrookFloater-v00-2018Mar-Eng.pdf			
Overall Threat Impact Calculation Help:		**Level 1 Threat Impact Counts**		
	Threat Impact		**high range**	**low range**
	A	Very High	0	0
	B	High	0	0
	C	Medium	1	0
	D	Low	0	1
Calculated Overall Threat Impact:			Medium	Low
Assigned Overall Threat Impact:			**CD = Medium - Low**	
Impact Adjustment Reasons:				
Overall Threat Comments			Generation time = 10 years, therefore time frame for severity and scope is 30 years into the future. Species is recorded in 13 watersheds (31 tributaries/lakes) in NB and NS. The number of mussels in each of the watersheds is unknown; population trend, unknown; final 2018 management plan includes threats but no threats assessment done. Overall water quality trends summarized, presence of threats with % Canadian population; threats by watershed also summarized in COSEWIC (2009) Tech. Summary. After discussion among threats calculator attendees, it was agreed that a range of 1–10% decline (Low) was more plausible than the upper range (Medium).	

Threat		**Impact (calculated)**		**Scope (next 10 Yrs)**	**Severity (10 Yrs or 3 Gen.)**	**Timing**	**Comments**
1	Residential & commercial development						
1.1	Housing & urban areas						Residential development (localized, moderate severity) medium concern in management plan but if this results in pollution, then it goes under 9.1. Increased residential development Lochaber, Eden, and Mattatall lakes (COSEWIC 2009). Not considered to be a threat. Removal of riparian goes under 7.3. Records for Lochaber and Mattatall not confirmed.
1.2	Commercial & industrial areas						
1.3	Tourism & recreation areas						No new/expansion of current marinas, beach resorts seem to be planned for the next 10 years.

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
2	Agriculture & aquaculture		Negligible	Negligible (<1%)	Slight (1-10%)	High (Continuing)	
2.1	Annual & perennial non-timber crops						
2.2	Wood & pulp plantations						
2.3	Livestock farming & ranching		Negligible	Negligible (<1%)	Negligible (<1%)	High (Continuing)	Uncontrolled river access by cattle in management plan (trampling); sedimentation and manure goes under 9.3.
2.4	Marine & freshwater aquaculture						
3	Energy production & mining						
3.1	Oil & gas drilling						Pipelines go under 4.2. Moratorium on fracking still in place.
3.2	Mining & quarrying						Pollution from mining under 9.2
3.3	Renewable energy						
4	Transportation & service corridors						
4.1	Roads & railroads						Discussion on whether there are new roads, culverts, bridges, etc. in areas of Brook Floater habitat. Insufficient information to score, but there is a decline in quality of culverts and crossings in New Brunswick. Might need to be updated in the future, but don't know at present. Current activities such as bridge repair, opening of causeway, etc. are outside of current habitat. However, might be a benefit; but might increase salinity (harm); might increase siltation rates (harm). When causeway was opened it was considered to be a positive effect but whether there are any lingering positive effects is uncertain.
4.2	Utility & service lines						No new pipelines proposed.
4.3	Shipping lanes						
4.4	Flight paths						
5	Biological resource use						
5.1	Hunting & collecting terrestrial animals						
5.2	Gathering terrestrial plants						
5.3	Logging & wood harvesting						Buffers for forestry seem sufficient and no removal of riparian or direct impact from felling into the water.
5.4	Fishing & harvesting aquatic resources						There is some very limited lethal research activity (DNA, vouchers, etc.) but it is very limited and of negligible impact.

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
6	Human intrusions & disturbance		Negligible	Small (1-10%)	Negligible (<1%)	High (Continuing)	
6.1	Recreational activities		Negligible	Small (1-10%)	Negligible (<1%)	High (Continuing)	Stream crossing by ATVs is considered to be a medium concern threat in management plan (localized, moderate severity). Discussion determined that while this does occur, it is mostly not in Brook Floater habitat and overall severity is negligible.
6.2	War, civil unrest & military exercises						
6.3	Work & other activities		Negligible	Small (1-10%)	Negligible (<1%)	High (Continuing)	eDNA is collected, but it is non-lethal, and in reality is water sampling. Swabs are primarily used for DNA collections and are non-lethal. There is handling and flushing of gravid females to get glochidia, but non-lethal. Visual surveys, tagging, all are non-lethal activities.
7	Natural system modifications		Unknown	Large (31-70%)	Unknown	High (Continuing)	
7.1	Fire & fire suppression						Water bucketing for fighting fires was discussed and the indication is that it does not happen in Brook Floater habitat.
7.2	Dams & water management/ use		Negligible	Restricted (11-30%)	Negligible (<1%)	High (Continuing)	Concern was raised regarding river drawdowns which would cause strandings. No new dams are planned in the next 10 years. Existing dams on the St. Croix (up to 100 years old) are well established and presumably the mussels have adapted. There was discussion on the effect of cold water release, but there was no sense of what, if any, effect this would have on the mussels. Operating plans on existing dams limit water fluctuations/releases/etc. Desire is to keep things consistent (e.g. St. Croix). This stability could be beneficial.
7.3	Other ecosystem modifications		Unknown	Large (31-70%)	Unknown	High (Continuing)	Lots of discussion on the threats due to introduced fish species such as Chain Pickerel and Smallmouth Bass. Introduced Chain Pickerel cause a decline in overall fish diversity which could compromise Brook Floater fish host(s) populations. The Smallmouth Bass has been introduced in the Miramichi River and is of great concern. The threat is to the fish host populations. The Chain Pickerel has been introduced into the Gays, Petitcodiac, and other rivers. As a cautionary example, Dwarf Wedgemussel disappeared when hosts were cut off, so the example exists of what happens when the fish hosts disappear.
8	Invasive & other problematic species & genes						

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
8.1	Invasive non-native/alien species/diseases						Dreissenids are not yet present, but could be devastating. Not expected in next 10 years, and not considered to be a big threat because the Brook Floater is higher in the watershed (upstream) of where dreissenids would be expected to occur. However, fishing tournaments (e.g Saint John River) have movement of boats from all over (St. Croix, Petitcodiac, Miramichi, elsewhere). There are only boat check/wash stations on day of tournament, but boats arrive before that and scout.
8.2	Problematic native species/diseases						Muskrat predation was discussed but no evidence of big middens in Nova Scotia, and where middens are observed there are few Brook Floaters present, so not considered to be a big threat.
8.3	Introduced genetic material						
8.4	Problematic species/diseases of unknown origin						
8.5	Viral/prion-induced diseases						
8.6	Diseases of unknown cause						
9	Pollution	CD	Medium - Low	Pervasive (71-100%)	Moderate - Slight (1-30%)	High (Continuing)	
9.1	Domestic & urban waste water	D	Low	Small (1-10%)	Moderate - Slight (1-30%)	High (Continuing)	Oil, salt, sediments from roads; treated and untreated sewage; pharmaceuticals from wastewater plants all contribute to this
9.2	Industrial & military effluents		Negligible	Negligible (<1%)	Extreme (71-100%)	High - Low	Effluent from a lead-zinc mine on the Gays River considered to be a low concern threat with negligible impact.
9.3	Agricultural & forestry effluents	CD	Medium - Low	Pervasive (71-100%)	Moderate - Slight (1-30%)	High (Continuing)	Highest concern threat in management plan (sedimentation, pesticides, nutrients; widespread, moderate severity); also impact host fish assemblages & ability of females to detect fish.
9.4	Garbage & solid waste						
9.5	Air-borne pollutants						
9.6	Excess energy						
10	Geological events						
10.1	Volcanoes						
10.2	Earthquakes/tsunamis						
10.3	Avalanches/landslides						
11	Climate change & severe weather		Unknown	Pervasive (71-100%)	Unknown	High (Continuing)	

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
11.1	Habitat shifting & alteration						
11.2	Droughts		Unknown	Pervasive (71-100%)	Unknown	High (Continuing)	Could result in not enough water for mussel or host fish, but unknown severity.
11.3	Temperature extremes		Unknown	Pervasive (71-100%)	Unknown	High (Continuing)	Could result in temperatures that are too hot for mussel or host fish, but severity unknown.
11.4	Storms & flooding		Unknown	Pervasive (71-100%)	Unknown	High (Continuing)	Possibility for increased scouring? Unknown severity.
11.5	Other impacts						
Classification of Threats adopted from IUCN-CMP, Salafsky et al. (2008).							

COSEWIC HISTORY

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

COSEWIC MANDATE

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

COSEWIC MEMBERSHIP

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

DEFINITIONS
(2022)

Wildlife Species	A species, subspecies, variety, or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years.
Extinct (X)	A wildlife species that no longer exists.
Extirpated (XT)	A wildlife species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A wildlife species facing imminent extirpation or extinction.
Threatened (T)	A wildlife species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)**	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
Data Deficient (DD)***	A category that applies when the available information is insufficient (a) to resolve a species' eligibility for assessment or (b) to permit an assessment of the species' risk of extinction.

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

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

*** Formerly described as "Indeterminate" from 1994 to 1999 or "ISIBD" (insufficient scientific information on which to base a designation) prior to 1994. Definition of the (DD) category revised in 2006.

Environment and Climate Change Canada
Canadian Wildlife Service
Environnement et Changement climatique Canada
Service canadien de la faune
Canada

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