Ontario Species at Risk Evaluation Report for Deepwater Sculpin (*Myoxocephalus thompsonii*)

Great Lakes – Upper St. Lawrence populations
Southern Hudson Bay – James Bay populations
Saskatchewan – Nelson River populations

Committee on the Status of Species at Risk in Ontario (COSSARO)

Great Lakes – Upper St. Lawrence populations
Assessed by COSSARO as Not at Risk

Southern Hudson Bay – James Bay populations
Assessed by COSSARO as Data Deficient

Saskatchewan – Nelson River populations
Assessed by COSSARO as Not at Risk

November 2017

Final

Chabot de profondeur (*Myoxocephalus thompsonii*)

Le chabot de profondeur est un poisson des grandes profondeurs présent dans les lacs profonds, froids et bien oxygénés. C'est une proie importante pour diverses espèces de poissons (dont plusieurs sont des cibles de choix pour la pêche sportive et commerciale). Le chabot de profondeur se nourrit principalement des petits crustacés *Diporeia* et *Mysis,* bien qu'il mange aussi des larves de chironomes (moucherons). On recense six unités désignables au Canada, dont trois en Ontario (Grands Lacs et haut Saint-Laurent, Sud de la baie d'Hudson et baie James, et rivière Saskatchewan et fleuve Nelson). Les populations de chabot de profondeur sont séparées les unes des autres et souvent recensées dans des lacs isolés et froids, ce qui rend leur dispersion naturelle peu probable. Néanmoins, il a été envisagé d'utiliser la dérive des larves comme mécanisme de rétablissement de la population du lac Ontario. Le chabot de profondeur est sensible aux espèces envahissantes, à l'eutrophisation (pollution), aux changements de température de l'eau et aux changements dans le réseau alimentaire. Les menaces varient d'une unité désignable à l'autre, mais en règle générale, la situation des populations ontariennes de chabot de profondeur est stable, en hausse (sans doute grâce à l'évolution des méthodes de recherche) ou inconnue. La population du lac Ontario, que l'on croyait disparue, a connu un rétablissement important. Celle du lac Huron a reculé, mais c'est peut-être parce qu'elle occupe un habitat plus profond à cause de l'invasion des moules de la famille des *Dreissenidae.*

Le chabot de profondeur des Grands Lacs et du haut Saint-Laurent est considéré comme une espèce non en péril en Ontario, puisqu'il ne remplit aucun critère de désignation.

Le chabot de profondeur du Sud de la baie d'Hudson et de la baie James appartient à la catégorie « données insuffisantes », car on ne connaît ni le nombre d'endroits où il se trouve, ni sa zone d'occurrence, ni son indice de zone d'occupation, ni les menaces qui peuvent exister dans ces régions éloignées.

Le chabot de profondeur de la rivière Saskatchewan et du fleuve Nelson est considéré comme une espèce non en péril puisqu'il a une grande zone d'occurrence et un indice de zone d'occupation élevé, qu'il est présent à de nombreux endroits et que les menaces recensées sont limitées.

*Cette publication hautement spécialisée «*COSSARO Candidate Species at Risk Evaluation for Deepwater Sculpin*» n'est disponible qu'en anglais conformément au Règlement 671/92, selon lequel il n'est pas obligatoire de la traduire en vertu de la Loi sur les services en français*. *Pour obtenir des renseignements en français, veuillez communiquer avec le CDSEPO au COSSAROSecretariat@ontario.ca.*

Executive summary

Deepwater Sculpin (*Myoxocephalus thompsonii*) are bottom-dwelling fish found in deep, cold, well-oxygenated lakes and are an important prey item for a variety of other fishes (some important sport and commercial species). Deepwater Sculpin feeds mainly on the tiny crustaceans *Diporeia* and *Mysis*, although they also feed on chironomid (midges) larvae. Deepwater Sculpin form six Designatable Units in Canada, three of which are in Ontario (Great Lakes – Upper St. Lawrence DU; Southern Hudson Bay – James Bay DU; Saskatchewan – Nelson River DU). Deepwater Sculpin have a disjunct distribution with many populations found in isolated, coldwater lakes, and thus they are unlikely to disperse naturally. However, larval drift has been proposed as the mechanism for the re-establishment of the Lake Ontario population. Deepwater Sculpin are sensitive to invasive species impacts, eutrophication (pollution), water temperature changes, and food web shifts. The specific threats vary among the Designatable Units; however, in general, Ontario's Deepwater Sculpin populations are mostly stable, increasing (likely due to changes in search methods) or unknown. The Lake Ontario population was thought to be extirpated, yet has recovered to high numbers. The Lake Huron population has declined, but this observation may be a result of utilizing deeper habitat in response to dreissenid mussel invasion.

The Great Lakes – Upper St. Lawrence populations of Deepwater Sculpin are classified as Not at Risk in Ontario based on not meeting any criteria for listing.

The Southern Hudson Bay – James Bay populations of Deepwater Sculpin are classified as Data Deficient based on a lack of information on numbers of location, EOO, IAO and possible threats in these remote areas.

The Saskatchewan – Nelson River populations of Deepwater Sculpin are classified as Not at Risk based on large EOO, IAO and number of locations, coupled with limited identified threats in this area.

1. Eligibility for Ontario status assessment

1.1. Eligibility conditions

1.1.1. Taxonomic distinctness

The Deepwater Sculpin is taxonomically distinct from congeners based on mitochondrial DNA sequence data (Kontula & Vainola 2003) as well as diagnostic morphological characters (COSEWIC 2017).

1.1.2. Designatable units

Canadian Deepwater Sculpin are divided into six Designatable Units, of which three occur in Ontario: Great Lakes – Upper St. Lawrence; Southern Hudson Bay – James Bay; Saskatchewan – Nelson River.

1.1.3. Native status

Deepwater Sculpin have been known in Ontario since 1851 (Lake Ontario; COSEWIC 2006), although many of the populations have been discovered since 2006 due to more targeted sampling efforts in the Great Lakes and inland lakes (COSEWIC 2017).

1.1.4. Occurrence

Deepwater Sculpin are routinely captured in Ontario.

1.2. Eligibility results

Deepwater Sculpin (*Myoxocephalus thompsonii*) is eligible for status assessment in Ontario.

2. Background information

2.1. Current designations

- GRANK: G5 (NatureServe 2017)
- NRANK Canada: N5
- COSEWIC: DU1: Special Concern; DU2: Data Deficient; DU3: Not at Risk (April 2017)
- SARA: Special Concern (Schedule 1)
- ESA 2007: NAR (April 2006)
- SRANK: SNR

2.2. Distribution in Ontario

Deepwater Sculpin occurs in Lakes Ontario, Huron and Superior as well as at least 41 inland lakes in Ontario (COSEWIC 2017). Deepwater Sculpin larvae have been captured in Lake Erie, but they are believed to be vagrants resulting from drift transport from Lake Huron (COSEWIC 2017). Historically, the standard sampling methods used in Ontario for benthic fishes was not efficient for capturing Deepwater Sculpins due to using overly large mesh gill nets and/or sampling at shallow depths. Recent changes in sampling protocols to target deep water benthic fishes (specifically Deepwater Sculpins, among others), as well as implementation of Ontario's Broadscale Monitoring Program have dramatically expanded the number of Deepwater Sculpin locations in Ontario (COSEWIC 2017). Populations of Deepwater Sculpin in Ontario fall into three Designatable Units (DUs) which vary substantially in the number of locations.

Great Lakes – Upper St. Lawrence populations

This DU includes three Great Lakes (Ontario, Huron and Superior) and 6 inland lakes (Fig. 1). The Lake Ontario population was believed to be extirpated, but that population is growing rapidly (COSEWIC 2017). As more targeted sampling is done, more upland lakes in this DU may be identified.

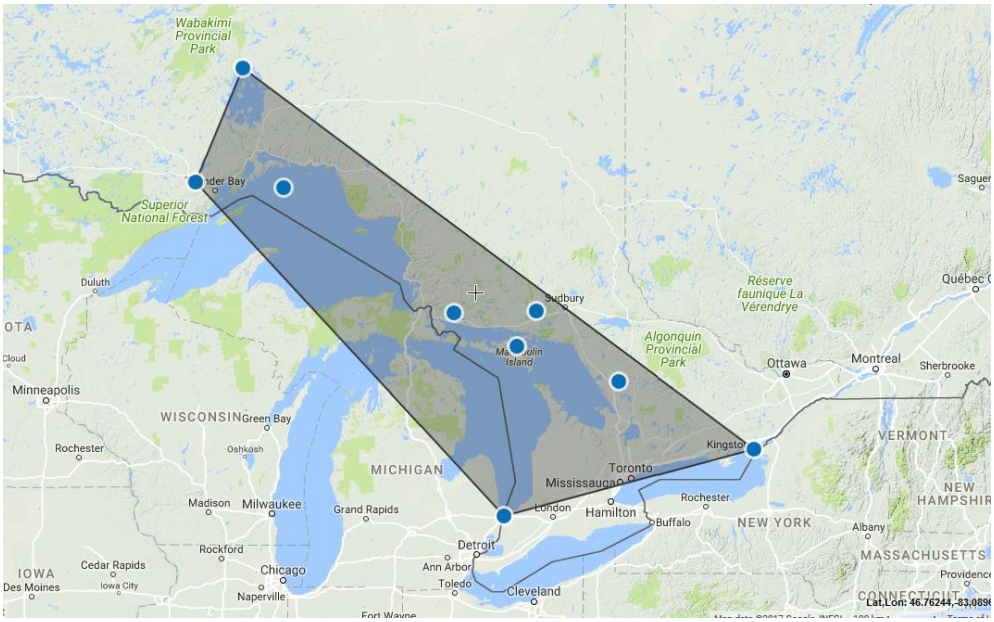

Figure 1. Ontario Deepwater Sculpin distribution within the Great Lakes – Upper St. Lawrence DU showing estimated extent of occurrence (EOO). Created for this report using GeoCAT [website accessed Oct. 23, 2017].

Southern Hudson Bay – James Bay populations

This DU includes Deepwater Sculpin found in 3 inland lakes (Fig. 2); however it is highly likely that more (possibly many more) populations exist that have not been sampled in this remote area.

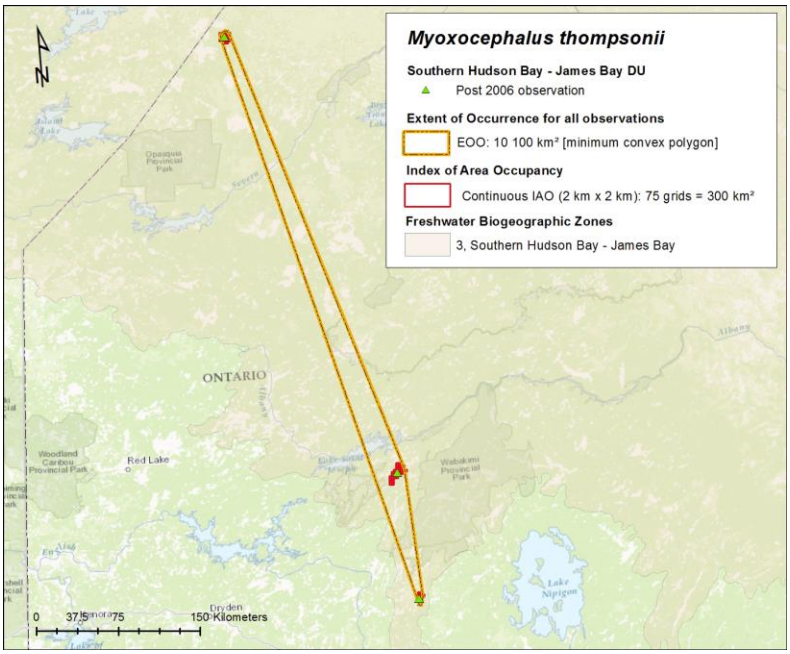

Figure 2. Ontario Deepwater Sculpin distribution within the Southern Hudson Bay – James Bay DU showing estimated extent of occurrence (EOO). Used with permission from COSEWIC (2017).

Saskatchewan – Nelson River populations

This DU includes Deepwater Sculpin found in 32 inland lakes (Fig. 3); however, most of those locations were discovered since 2006 due to more targeted sampling. It is likely that additional locations exist.

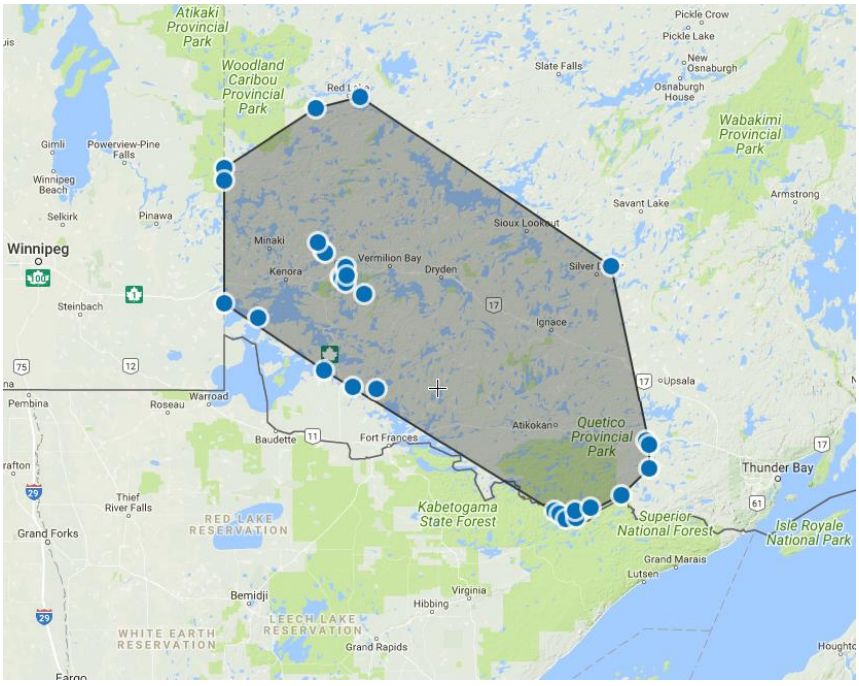

Figure 3. Ontario Deepwater Sculpin distribution within the Saskatchewan – Nelson River DU showing estimated extent of occurrence (EOO). Created for this report using GeoCAT [website accessed Oct. 23, 2017].

2.3. Distribution and status outside Ontario

Deepwater Sculpin are a deep, cold lake species and their distribution is almost entirely within Canada, reflecting the historic glacial lake extent (COSEWIC 2017). In Canada, they exhibit a disjunct distribution that includes southwestern Quebec, Ontario, Manitoba, Saskatchewan and the Northwest Territories, with one isolated population in southern Alberta (Fig. 4). Generally, Deepwater Sculpin populations are either stable or increasing, although some are known to be in decline (e.g., Quebec) and many have unknown status. Outside of Canada, Deepwater Sculpin are found in Indiana (S1S2), Michigan (S5), Minnesota (SNR), New York (S1), Pennsylvania (SX) and Wisconsin (S5), although targeted sampling might expand their US distribution.

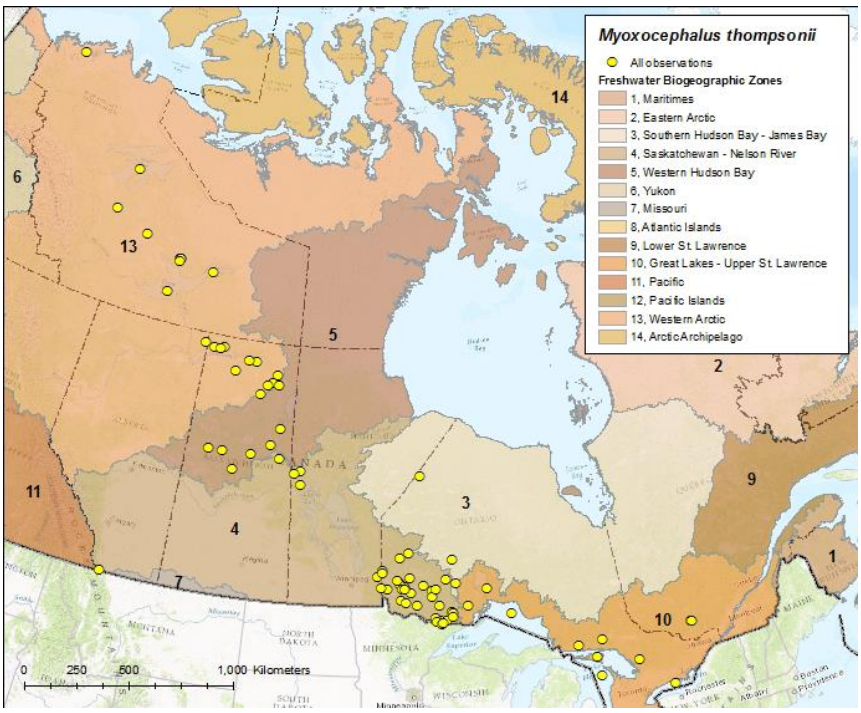

Figure 4: Canadian Deepwater Sculpin distribution (from COSEWIC 2017).

2.4. Ontario conservation responsibility

While the exact proportion of the global Deepwater Sculpin distribution within Ontario is not known, very large populations exist in the Great Lakes (Superior, Huron and Ontario). Most of the species' range is in Canada and the majority of the Canadian locations occur in Ontario (44 of 83). Across all DUs, Ontario likely constitutes in excess of 40% of the global range of Deepwater Sculpin.

The Ontario portion of Great Lakes – Upper St. Lawrence populations DU comprises > 40% of the global distribution of this DU (based on EOO).

The Ontario portion of the Southern Hudson Bay – James Bay populations DU comprises 100% of the known global distribution of this DU.

The Ontario portion of the Saskatchewan – Nelson River populations DU comprises >30% of the global distribution of this DU (based on EOO).

2.5. Direct threats

Great Lakes – Upper St. Lawrence populations

The overall threat category based on the Threat Calculator was High-medium, with "Natural System Modifications" (Quagga Mussel invasion forcing Deepwater Sculpin into deeper habitats) ranking highest (high-medium) and "Pollution" (eutrophication in inland lakes) ranking second (medium). All other threats were low, negligible or unknown. The dreissenid mussel (especially the Quagga Mussel, *Dreissena bugensis*) invasion of the Great Lakes coincided with a lower benthic catch of the Deepwater Sculpin in Lakes Superior, Huron and Michigan, leading to speculation that the mussel competed with the Deepwater Sculpin for food. Deeper trawls appear to indicate that the sculpin have shifted their distribution into deeper waters, perhaps following their preferred prey. Eutrophication is primarily a threat in the inland lakes, as cottage development, agriculture and industrial non-point sources are resulting in eutrophication in some areas.

Southern Hudson Bay – James Bay populations

The Threats Calculator identified no threats – all were either negligible or unknown due to the isolated and remote location of the lakes in thus DU.

Saskatchewan – Nelson River populations

The Threats Calculator indicated an overall threat level of "low"; "Pollution" (eutrophication) was identified as a low threat in this DU, however cottage development and ranching, farming and forestry may add to eutrophication in the future. "Energy production and mining" threats were low, although hard-rock mining has the potential to impact Deepwater Sculpin habitat.

2.6. Specialized life history or habitat use characteristics

Deepwater Sculpin require deep, cold and oxygenated water, suggesting that eutrophication and climate change will impact the species disproportionately.

3. Ontario status assessment

3.1. Application of endangered/threatened status in Ontario

3.1.1. Criterion A – Decline in total number of mature individuals

Great Lakes – Upper St. Lawrence populations
Insufficient information. Numbers of mature individuals are not known and no clear indication of decline.

Southern Hudson Bay – James Bay populations
Insufficient information. Numbers of mature individuals are not known and no clear indication of decline.

Saskatchewan – Nelson River populations
Insufficient information. Numbers of mature individuals are not known and no clear indication of decline.

3.1.2. Criterion B – Small distribution range and decline or fluctuation

Great Lakes – Upper St. Lawrence populations
Does not apply. EOO > 20,000 km^2 and IAO > 2,000 km^2.

Southern Hudson Bay – James Bay populations
Insufficient information. While EOO < 20,000 km^2 and IAO < 500 km^2, the number of locations (3) is likely a gross underestimate and population/habitat decline/fragmentation is unknown.

Saskatchewan – Nelson River populations
Does not apply. EOO > 20,000 km^2 and IAO > 500 km^2, and the number of locations is > 10 (32).

3.1.3. Criterion C – Small and declining number of mature individuals

Great Lakes – Upper St. Lawrence populations
Insufficient information. Numbers of mature individuals is not known and no clear indication of decline.

Southern Hudson Bay – James Bay populations
Insufficient information. Numbers of mature individuals is not known and no clear indication of decline.

Saskatchewan – Nelson River populations
Insufficient information. Numbers of mature individuals is not known and no clear indication of decline.

3.1.4. Criterion D – Very small or restricted total population

Great Lakes – Upper St. Lawrence populations
Does not apply. Numbers of mature individuals is not known but numbers likely to be well over 1000.

Southern Hudson Bay – James Bay populations
Does not apply. Numbers of mature individuals is not known but numbers likely to be well over 1000.

Saskatchewan – Nelson River populations
Does not apply. Numbers of mature individuals is not known but numbers likely to be well over 1000.

3.1.5. Criterion E – Quantitative analysis

Great Lakes – Upper St. Lawrence populations
Does not apply. No quantitative analysis done.

Southern Hudson Bay – James Bay populations
Does not apply. No quantitative analysis done.

Saskatchewan – Nelson River populations
Does not apply. No quantitative analysis done.

3.2. Application of Special Concern in Ontario

Great Lakes – Upper St. Lawrence populations
Does not apply. While there is evidence for high-medium threats, the Lake Ontario population has increased dramatically in numbers (formerly thought to be extirpated) and many inland subpopulations have been discovered since 2006. Declines have been observed in Lake Huron, but may be a result of a shift to deeper water habitats due to Quagga Mussel invasion. Inland lake populations in this DU may be most at risk from eutrophication and climate change.

Southern Hudson Bay – James Bay populations
Does not apply. While this DU has very few locations, it is a remote area and has not been sampled extensively. Very little is known about the extent of Deepwater Sculpin in this DU.

Saskatchewan – Nelson River populations
Does not apply. This DU is characterized by many independent populations (minimum 32) in isolated lakes in the western part of Ontario. Few threats were identified and no evidence for population decline exists.

3.3. Status category modifiers

3.3.1. Ontario's conservation responsibility

Ontario does contain a substantial portion of the global distribution of the Deepwater Sculpin (estimated to be >40% overall). However the Ontario populations are generally stable or increasing, and new Ontario populations are being discovered with targeted sampling.

3.3.2. Rescue effect

Great Lakes – Upper St. Lawrence populations
Does not apply. While larval drift may allow rescue effects with the Great Lakes, inland lakes are not connected.

Southern Hudson Bay – James Bay populations
Does not apply. There are no suitable habitat corridors for dispersal from other areas.

Saskatchewan – Nelson River populations
Does not apply. There are no suitable habitat corridors for dispersal from other areas.

3.4. Other status categories

3.4.1. Data deficient

Great Lakes – Upper St. Lawrence populations
Does not apply.

Southern Hudson Bay – James Bay populations
Data deficient. This DU is defined by three widely separated northern Ontario lake subpopulations; however more subpopulations are likely. No data exists on range, population size or likely threats for these locations and hence they cannot be assessed due to data deficiency.

Saskatchewan – Nelson River populations
Does not apply.

3.4.2. Extinct or extirpated

Does not apply.

3.4.3. Not at risk

Great Lakes – Upper St. Lawrence populations
Meets not at risk due to stable or increasing population sizes, coupled with new populations being found.

Southern Hudson Bay – James Bay populations
Does not apply due to lack of data.

Saskatchewan – Nelson River populations
Meets not at risk due to stable or increasing population sizes, coupled with new populations being found.

4. Summary of Ontario status

Great Lakes – Upper St. Lawrence populations
Deepwater Sculpin (Great Lakes – Upper St. Lawrence populations) is classified as Not at Risk in Ontario based on not meeting any criteria for listing. This differs from the COSEWIC status of Special Concern on the basis that the Ontario range of the Deepwater Sculpin is dominated by the Great Lakes populations which are not subject to one of the major threats (eutrophication) and one large population (Lake Ontario) has experienced a dramatic recovery. Additionally, new inland lake populations have been documented recently, with the expectation of more such discoveries, given the number of deep, cold lakes north of Lakes Superior and Huron. Also, the COSEWIC listing reflected the loss (extirpation?) of one Quebec population, which is not relevant for this listing.

Southern Hudson Bay – James Bay populations
Deepwater Sculpin (Southern Hudson Bay – James Bay populations) is classified as Data Deficient based on a lack of information on numbers of locations, EOO, IAO and possible threats in these remote areas.

Saskatchewan – Nelson River populations
Deepwater Sculpin (Saskatchewan – Nelson River populations) is classified as Not at Risk based on large EOO, IAO and number of locations, coupled with limited identified threats in this area.

5. Information sources

COSEWIC 2006. COSEWIC assessment and update status report on the deepwater sculpin *Myoxocephalus thompsonii* (Western and Great Lakes-Western St. Lawrence populations) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 39 pp. (Species at Risk Status Reports)

COSEWIC. 2017. COSEWIC assessment and status report on the Deepwater Sculpin Myoxocephalus thompsonii, Great Lakes-Upper St. Lawrence populations, Southern Hudson Bay-James Bay populations, Saskatchewan-Nelson River populations, Waterton Lake population, Western Hudson Bay populations and Western Arctic populations in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xxxvii + 61 pp. (Species at Risk Public Registry)

Kontula, T. and R. Vainola. 2003. Relationships of Palearctic and Nearctic ‘glacial relict’ *Myoxocephalus* sculpins from mitochondrial DNA data. Mol. Ecol. 12: 3179-3184.

Appendix 1: Technical summary for Ontario

Species: Deepwater Sculpin (*Myoxocephalus thompsonii*) Great Lakes – Upper St. Lawrence populations

Demographic information

Demographic attribute	Value
Generation time.	4-5 years
Is there an observed, inferred, or projected continuing decline in number of mature individuals? *Lake Ontario population size increases, new populations identified (may not be genuine). Decline observed in Lake Huron (may not be genuine).*	No
Estimated percent of continuing decline in total number of mature individuals within 5 years or 2 generations.	Does not Apply
Observed, estimated, inferred, or suspected percent reduction or increase in total number of mature individuals over the last 10 years or 3 generations.	Unknown
Projected or suspected percent reduction or increase in total number of mature individuals over the next 10 years or 3 generations. *Estimated population rate of increase is 29% per year in Lake Ontario.*	Unknown
Observed, estimated, inferred, or suspected percent reduction or increase in total number of mature individuals over any 10 years, or 3 generations, over a time period including both the past and the future.	Unknown
Are the causes of the decline (a) clearly reversible, and (b) understood, and (c) ceased?	a. Unknown b. Unknown c. Unknown
Are there extreme fluctuations in number of mature individuals?	Unknown/No

Extent and occupancy information in Ontario

Extent and occupancy attributes	Value
Estimated extent of occurrence (EOO). *Calculated using all known Ontario reports within DU1 and GeoCat (Oct 2017).*	310,000 km^2
Index of area of occupancy (IAO). *COSEWIC (2017) less two Quebec populations.*	> 2,000 km^2
Is the total population severely fragmented?	a. No b. No

Extent and occupancy attributes	Value
i.e., is >50% of its total area of occupancy is 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?	
Number of locations. *Main Threats include whole-lake processes, so number of lakes is appropriate for location estimates. Note, there are likely more undiscovered lake populations.*	At least 9.
Number of NHIC Element Occurrences	12
Is there an observed, inferred, or projected continuing decline in extent of occurrence? *Increasing – not genuine; increase due to improved sampling methods and spatial coverage.*	No
Is there an observed, inferred, or projected continuing decline in index of area of occupancy? *Increasing – not genuine.*	No
Is there an observed, inferred, or projected continuing decline in number of populations? *Increasing – not genuine; increase due to improved sampling methods and spatial coverage.*	No
Is there an observed, inferred, or projected continuing decline in number of locations? *Increasing – not genuine; increase due to improved sampling methods and spatial coverage.*	No
Is there an observed, inferred, or projected continuing decline in [area, extent and/or quality] of habitat? *The Great Lakes – Upper St. Lawrence DU locations experience known multiple stressors that are known to affect Deepwater Sculpins (e.g. eutrophication, invasive species such as Quagga mussels) which are inferred to affect habitat.*	Likely
Are there extreme fluctuations in number of populations?	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 sub-population or total population (if known)

Sub-population (or total population)	Number of mature individuals
Lake Superior, Lake Huron,	Unknown

Lake Ontario, High Lake, Fairbank Lake, Dog Lake, Lake Matinenda, Lake Manitou Lake Nipigon.	

Quantitative analysis (population viability analysis conducted)

Probability of extinction in the wild is unknown.

Threats

A Threats Calculator was performed (2016). The overall threat category was High-medium, with “Natural System Modifications” (Quagga mussel invasion forcing Deepwater Sculpin into deeper habitats) ranking highest (High-medium) and “Pollution” (eutrophication in inland lakes) ranking second (Medium). All other threats were low, negligible or unknown.

Rescue effect

Rescue effect attribute	Value
Status of outside population(s) most likely to provide immigrants to Ontario	Quebec (S1S2) Manitoba (S2S3) Michigan (S5) New York (S1)
Is immigration of individuals and/or propagules between Ontario and outside populations known or possible?	Possibly; Deepwater Sculpin require deep cold water, hence dispersal from inland lakes is not possible. Some evidence exists for dispersal within and among Great Lakes.
Would immigrants be adapted to survive in Ontario?	Yes
Is there sufficient suitable habitat for immigrants in Ontario?	Yes
Are conditions deteriorating in Ontario?	Yes, in some locations
Is the species of conservation concern in bordering jurisdictions?	Yes
Is the Ontario population considered to be a sink?	No
Is rescue from outside populations likely?	Yes, except for inland locations

Sensitive species

Does not apply.

Species: Deepwater Sculpin (*Myoxocephalus thompsonii*) Southern Hudson Bay – James Bay populations

Demographic information

Demographic attribute	Value
Generation time.	4-5 years
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.	Unknown
Observed, estimated, inferred, or suspected percent reduction or increase in total number of mature individuals over the last 10 years or 3 generations.	Unknown
Projected or suspected percent reduction or increase in total number of mature individuals over the next 10 years or 3 generations.	Unknown
Observed, estimated, inferred, or suspected percent reduction or increase in total number of mature individuals over any 10 years, or 3 generations, over a time period including both the past and the future.	Unknown
Are the causes of the decline (a) clearly reversible, and (b) understood, and (c) ceased?	a. Unknown b. Unknown c. Unknown
Are there extreme fluctuations in number of mature individuals?	Unknown

Extent and occupancy information in Ontario

Extent and occupancy attributes	Value
Estimated extent of occurrence (EOO). *COSEWIC (2017). Likely higher due to low search effort.*	10,100 km^2
Index of area of occupancy (IAO). *COSEWIC (2017). Likely higher due to low search effort.*	300 km^2
Is the total population severely fragmented? i.e., is >50% of its total area of occupancy is in habitat patches that are: (a) smaller than would be required to support a viable population, and	a) No b) No

Extent and occupancy attributes	Value
(b) separated from other habitat patches by a distance larger than the species can be expected to disperse?	
Number of locations. *Main threats include whole-lake processes, so number of lakes is appropriate for location estimates. Note, there are likely many more undiscovered lake populations.*	At least 3.
Number of NHIC Element Occurrences	N/A
Is there an observed, inferred, or projected continuing decline in extent of occurrence?	Unknown
Is there an observed, inferred, or projected continuing decline in index of area of occupancy?	Unknown
Is there an observed, inferred, or projected continuing decline in number of populations?	Unknown
Is there an observed, inferred, or projected continuing decline in number of locations?	Unknown
Is there an observed, inferred, or projected continuing decline in [area, extent and/or quality] of habitat?	Unknown
Are there extreme fluctuations in number of populations?	Unknown
Are there extreme fluctuations in number of locations?	Unknown
Are there extreme fluctuations in extent of occurrence?	Unknown
Are there extreme fluctuations in index of area of occupancy?	Unknown

Number of mature individuals in each sub-population or total population (if known)

Sub-population (or total population)	Number of mature individuals
Echoing Lake Sparkling Lake McCrea Lake	Unknown

Quantitative analysis (population viability analysis conducted)

Probability of extinction in the wild is unknown.

Threats

A Threats Calculator was performed (2016). No Threats identified – all were either negligible or unknown.

Rescue effect

Rescue effect attribute	Value
Status of outside population(s) most likely to provide immigrants to Ontario	No potential source populations

Rescue effect attribute	Value
Is immigration of individuals and/or propagules between Ontario and outside populations known or possible?	No
Would immigrants be adapted to survive in Ontario?	Unknown
Is there sufficient suitable habitat for immigrants in Ontario?	Yes
Are conditions deteriorating in Ontario?	Unknown
Is the species of conservation concern in bordering jurisdictions?	Does not apply
Is the Ontario population considered to be a sink?	No
Is rescue from outside populations likely?	No

Sensitive species

Does not apply.

Species: Deepwater Sculpin (*Myoxocephalus thompsonii*) Saskatchewan – Nelson River populations

Demographic information

Demographic attribute	Value
Generation time. Based on average age of breeding adult: age at first breeding = X year; average life span = Y years.	4-5 years
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.	Unknown
Observed, estimated, inferred, or suspected percent reduction or increase in total number of mature individuals over the last 10 years or 3 generations.	Unknown
Projected or suspected percent reduction or increase in total number of mature individuals over the next 10 years or 3 generations.	Unknown
Observed, estimated, inferred, or suspected percent reduction or increase in total number of mature individuals over any 10 years, or 3 generations, over a time period including both the past and the future.	Unknown
Are the causes of the decline (a) clearly reversible, and (b) understood, and (c) ceased?	a. Unknown b. Unknown c. Unknown

Demographic attribute	Value
Are there extreme fluctuations in number of mature individuals?	Unknown

Extent and occupancy information in Ontario

Extent and occupancy attributes	Value
Estimated extent of occurrence (EOO). *Calculated using all known Ontario reports within DU1 and GeoCat (Oct 2017).*	61,800 km^2
Index of area of occupancy (IAO). *COSEWIC (2017) based on grids over entire lake area for 32 known lakes. Note: IAO is likely higher due to low search effort.*	> 2,000 km^2
Is the total population severely fragmented? i.e., is >50% of its total area of occupancy is 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) No b) No
Number of locations. *Main threats include whole-lake processes, so number of lakes is appropriate for location estimates. Note, there are likely many more undiscovered lake populations.*	At least 32
Number of NHIC Element Occurrences	9
Is there an observed, inferred, or projected continuing decline in extent of occurrence? *Increased substantially over past 10 years, not genuine; increase due to improved sampling methods and spatial coverage.*	No
Is there an observed, inferred, or projected continuing decline in index of area of occupancy? *Increased substantially over past 10 years, not genuine; increase due to improved sampling methods and spatial coverage.*	No
Is there an observed, inferred, or projected continuing decline in number of populations? *Increased substantially over past 10 years, not genuine; increase due to improved sampling methods and spatial coverage.*	No
Is there an observed, inferred, or projected continuing decline in number of locations? *Increased substantially over past 10 years, not genuine; increase due to improved sampling methods and spatial coverage.*	No

Extent and occupancy attributes	Value
Is there an observed, inferred, or projected continuing decline in [area, extent and/or quality] of habitat?	Unknown
Are there extreme fluctuations in number of populations?	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 sub-population or total population (if known)

Sub-population (or total population)	Number of mature individuals
Raven Lake Sturgeon Lake Lake 259 (ELA) Teggau Lake (ELA) Lake 310 (ELA) High Lake William Lake Horseshoe Lake Dicker Lake Passover Lake Burton Lake Trout Lake Eagle Lake Burchell Lake Saganaga Lake Squeers Lake Huston Lake Cliff Lake Angnes Lake Kakagi Lake Otukamamoan Lake Pipestone Lake Poohbah Lake Sarah Lake Sawbill Lake Sheridan Lake This Man Lake Sparkling Lake Titmarsh Lake Victoria Lake Mameigwess Lake Red Lake Sandybeach Lake	Unknown

Indian Lake	

Quantitative analysis (population viability analysis conducted)

Probability of extinction in the wild is unknown.

Threats

A Threats Calculator was performed (2016). Overall Threat identified as low; “Pollution” (eutrophication) was identified as low, however cottage development and ranching, farming and forestry may add to eutrophication. “Energy production and mining” was low, although hard-rock mining has the potential to impact habitat.

Rescue effect

Rescue effect attribute	Value
Status of outside population(s) most likely to provide immigrants to Ontario	Manitoba (S2S3)
Is immigration of individuals and/or propagules between Ontario and outside populations known or possible?	No, natural immigration among inland lakes is not possible
Would immigrants be adapted to survive in Ontario?	Yes
Is there sufficient suitable habitat for immigrants in Ontario?	Yes
Are conditions deteriorating in Ontario?	Unknown
Is the species of conservation concern in bordering jurisdictions?	Yes
Is the Ontario population considered to be a sink?	No
Is rescue from outside populations likely?	No

Sensitive species

Does not apply.

Appendix 2: Adjoining jurisdiction status rank and decline

Information regarding rank and decline for Deepwater Sculpin (*Myoxocephalus thompsonii*)

Jurisdiction	Subnational rank	Population trend	Sources
Ontario	S3?	See earlier text.	NatureServe 2017
Quebec	S1S2	Unknown	NatureServe 2017
Manitoba	S2S3	Unknown	NatureServe 2017
Michigan	S5	Unknown	NatureServe 2017
Minnesota	NNR	Unknown	NatureServe 2017
Nunavut	SU	Unknown	NatureServe 2017
New York	S1	Unknown	NatureServe 2017
Ohio	Not Present	N/A	NatureServe 2017
Pennsylvania	SX	Unknown	NatureServe 2017
Wisconsin	S5	Unknown	NatureServe 2017

Acronyms

COSEWIC: Committee on the Status of Endangered Wildlife in Canada
COSSARO: Committee on the Status of Species at Risk in Ontario
ESA: Endangered Species Act
EO: Element occurrence (as defined by NHIC)
EOO: extent of occurrence
GRANK: global conservation status assessments
IAO: index of area of occupancy
MNRF: Ministry of Natural Resources and Forestry
NHIC: Natural Heritage Information Centre
NNR: Unranked
NRANK: National conservation status assessment
SARA: Species at Risk Act
SNR: unranked
SRANK: subnational conservation status assessment
S1: Critically imperiled
S3: Vulnerable
S5: Secure
IUCN: International Union for Conservation of Nature and Natural Resources
CDSEPO: Le Comité de détermination du statut des espèces en péril en Ontario