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Proceedings of the Recovery Potential Assessment of Redside Dace (*Clinostomus elongatus*) in Canada

February 21-22, 2018
Burlington, ON

Chairperson: Lynn Bouvier
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Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings may include research recommendations, uncertainties, and the rationale for decisions made during the meeting. Proceedings may also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. As such, interpretations and opinions presented in this report individually may be factually incorrect or misleading, but are included to record as faithfully as possible what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available in the timeframe of the meeting. In the rare case when there are formal dissenting views, these are also archived as Annexes to the Proceedings.

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SUMMARY

A regional science peer-review meeting was held on 21-22 February 2018 in Burlington, Ontario. The purpose of the meeting was to assess the recovery potential of Redside Dace (*Clinostomus elongatus*) in Canada to provide advice that may be used for the development of a recovery strategy and action plan, and to support decision making with regards to the issuance of permits or agreements. Participants included DFO Science and Species at Risk programs, the Ontario Ministry of Natural Resources and Forestry (MNRF) and several conservation authorities.

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designated the Redside Dace as Special Concern in 1987. A reassessment by the committee in 2007 uplisted the species to Endangered. Redside Dace is found only in Ontario with the majority of the remaining populations found within the Lake Ontario drainage. Remaining populations have experienced dramatic reductions in range and abundance due to ongoing threats.

Proceedings report summarizes the relevant discussions from the meeting and presents recommended revisions to be made to the associated research document. The Proceedings, Science Advisory Report and Research Document resulting from this science advisory meeting are published on the DFO Canadian Science Advisory Secretariat (CSAS) website.

INTRODUCTION

In April 1987, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) recommended that Redside Dace be designated as Special Concern and this status was re-assessed as Endangered in April 2007. The species was assessed because it is especially sensitive to stream alterations that interfere with flow regimes and lead to increased siltation and water temperatures. Redside Dace is currently assessed as Endangered under Ontario's Endangered Species Act (2007). A Recovery Potential Assessment (RPA) process has been developed by Fisheries and Oceans Canada (DFO) to provide information and scientific advice needed to fulfill SARA requirements including the development of recovery strategies and authorizations to carry out activities that would otherwise violate SARA (DFO 2007a). The purpose of the meeting, as described in the Terms of Reference (Appendix 1), was to assess the recovery potential of Redside Dace. The RPA is a science-based peer review process that assesses the current status of the species by addressing 17 steps in the RPA framework outlined in the Summary section of the Revised Protocol for Conducting Recovery Potential Assessments (DFO 2007a, b). The current state of knowledge about Redside Dace habitat requirements, the scope for human-induced mortality, and scenarios for mitigation and alternatives to activities that negatively impact the species and its habitat, is included in the Science Advisory Report. A peer-review meeting was held from 21-22 February 2018 to discuss the Redside Dace RPA. Meeting participants included DFO (Central and Arctic Region), OMNR, serval Conservation authorities and academic experts (Appendix 2). The meeting followed the agenda outlined in Appendix 3.

DETAILED DISCUSSION

The meeting chair provided the participants with an introduction to the RPA process and explained the purpose of the meeting. This included information on where the RPA process fits with respect to the COSEWIC assessment and SARA listing process for Redside Dace. This included the intent of the meeting and how the products of the meeting might be used. Terms of Reference were outlined. Draft research documents were developed by DFO and MNRF and provided to participants in advance of the meeting. The draft research documents were the basis for discussion, and participants were encouraged to add to or change the material, as needed, to ensure that the best and most up-to-date information was included.

SPECIES DESCRIPTION

Presenter: Lynn Bouvier

This presentation included information on the description of Redside Dace, including morphological characteristics, coloration, lifespan, physiology and diet. One participant questioned the optimal growth temperature for the species as it contradicts what is in the draft recovery strategy for Redside Dace. Another participant responded that the optimal temperature was based on one study and they weren't actually targeting the thermal envelope for the species.

The distribution of Redside Dace in Canada was summarized and illustrated using maps. Several participants questioned the Wiltse Creek record for Redside Dace. This record was determined to be erroneous and will be deleted from the draft research document.

APPLICATION OF ENVIRONMENTAL DNA (E-DNA) SAMPLING TO MONITOR REDSIDE DACE POPULATIONS IN GTA STREAMS

Presenter: Scott Reid

The presenter summarized his findings on the use of eDNA as a monitoring tool for Redside Dace populations in the GTA. The author explained the methodology around eDNA sampling in small streams that was used in his study. A question from a participants centered around detection probability estimates and if they were biased towards false negatives or false positives. The presenter calculated the detection probabilities based on the patterns of detection history at a site. Another participant remarked that false negatives are very low in these studies. The presenter is confident that false negatives are truly false negatives but suggested that we collect more data before we confirm extirpation from a river. The presenter was asked how many fish are needed in any given area for there to be a detection. The presenter stated that the exact number of fish is not known but we do know what factors affect detection such as distance, source biomass, flow, temperature and shedding rate of DNA. The purpose of this presentation was to support the RPA with respect to the use of eDNA as a monitoring tool. The research document itself was not peer reviewed at this meeting.

CURRENT STATUS AND POPULATION ASSESSMENT

Presenter: Andrew Drake

The presentation on population status included relative abundance and population trajectory for all Redside Dace populations, as well as the certainty associated with for each population. A participant noted that the lone Niagara River record for Redside Dace was from an island within the Welland Canal at Lock 7. This stream no longer exists. Another participant noted that there is a 1960s record for Wedgewood Creek in Oakville that should be included. Also, another participant was skeptical about two records in Bowmanville and Graham Creek. These will be investigated.

A participant noted that Rowshyra Castaneda's work at Two Tree River suggest that the population trajectory for that river should be considered stable and not increasing. The population trajectory for both Fourteen Mile Creek and Sixteen Mile Creek should also be considered to be decreasing according to another participant. According to one participant, Duffins Creek abundance should be changed from Low to Medium based on his field observations.

HABITAT REQUIREMENTS; FUNCTIONS, FEATURES AND ATTRIBUTES TABLE

Presenter: Andrew Drake

The presentation included a description of Redside Dace's habitat requirements for four life stages: spawn to hatch, young of year, juvenile, and adult. Key habitat variables and their functions for each stage were listed. This included the importance of pool and riffle habitat along with the meander belt and overhanging riparian vegetation

A participant asked do we know if the use of other species nests by Redside Dace was facultative or not. It was concluded that we don't know but when we have seen Redside Dace spawn, it's always in the presence of Creek Chub or Common Shiner. It is unknown if they would spawn in the absence of these species. One participant has footage of spawning and they seem to prefer Creek chub nests to Common Shiner. Water temperature and flow cues are important factors affecting the onset of spawning, according to one participant. Riffle substrate particle size of less than 7 cm was identified as important habitat characteristic in a report by John Parrish. This report will be shared with the authors.

There were very few records given for young of the year habitat. This data is available and will be given to the authors for incorporation into the research document. Young of the year seem to be found with adults, according to one participant. But he rarely catches young of the year when electrofishing. This could mean that they are not as affected by electric current or that they spend time in other habitats. One participant noted that wording in the habitat section is important since it will be used to define critical habitat for the species in the federal recovery strategy. The participant suggested that the description of riparian vegetation has omitted a treed canopy. Therefore, this could get omitted from critical habitat despite the use of such habitats by Redside Dace in certain areas

TIMELAPSE IMAGERY OF GTA OVER LAST 30 YEARS AND MAPPING OF REDSIDE DACE WATERSHEDS

Presenter: Mark Heaton

The presenter used Google timelapse satellite imagery of the Greater Toronto Area to illustrate how the landscape has changed in the last 30 years. The imagery showed rapid urbanization of the watersheds containing Redside Dace. This was an informal presentation used to demonstrate how Redside Dace watersheds have physical changed over the last three decades. These images demonstrated how pervasive urbanization is in the GTA and reinforced the importance of this threat in negatively affecting populations. This presentation was for information purposes only and was not peer reviewed.

URBANIZATION, LONG-TERM STREAM FLOW CONDITIONS, AND REDSIDE DACE STATUS IN GREATER TORONTO AREA STREAMS

Presenter: Scott Reid

This study was presented to support the discussion on threats to Redside Dace. The presenter summarized the results of his study that analyzed a long term hydrometric dataset to characterize stream flow trends in the Greater Toronto Area. Flow trends were compared among streams that had either declining/extirpated Redside Dace populations to those that had stable populations. The research demonstrates that increasing impervious landcover results in higher frequencies of high flow events as well as greater flow variability. This research was not peer reviewed at this meeting.

THREAT STATUS

Presenter: Andrew Drake

The presentation on threat status overviewed the likelihood and impact of threats, as well as the causal certainty associated with the threat impact. It was established that threat likelihood of occurrence (LO) would be categorized as “known” (K), “likely” (L), “unlikely” (UL), “remote” (R) or “unknown” (U); threat impact level (LI) would be categorized as “extreme” (E), “high” (H), “medium” (M), “low” (L), or “unknown” (U). The causal certainty (C) associated with threat level of impact would be categorized as “very high” (1), “high” (2), “medium” (3), “low” (4), or “very low” (5). The threat status was presented for each Redside Dace watershed

Pringle Creek:

One participant would like to share his edits to Pringle Creek Threat status after the meeting. Another participant suggested that the LI for Pringle be increased since this is a heavily urbanized watershed where Redside Dace have been extirpated. It was also noted that the

IUCN has an impact analysis methodology that could be used to analyze climate change as a threat.

Lynde Creek:

There was much discussion around invasive species as a threat to Redside Dace in this watershed. One participant asked if non-native salmonids are invasive. The consensus was that they are invasive and the LO should be changed to reflect this. A participant suggested that we rely on our fish community data rather than expert opinion in order to rate invasive species as a threat. However, it was pointed out that geographic overlap between Redside Dace and salmonids does not clearly indicate the impact they may have on the species. Another participant suggested that we rank invasives depending on the invasive species present in the system but another participant stated that this would trivialize the other threats.

Carruthers Creek:

Threats to the Carruthers Creek population of Redside dace were discussed. It was noted that this creek doesn't have Rainbow Trout nor Brown Trout that could threaten the species. This led to a more general discussion on human intrusion as a threat. Elements of highway/bridge repair could be considered under the threat category Human Intrusion since there may be instances were fish removal is warranted.

Duffins Creek:

It was noted that the possibility of a future airport development would threaten this population of Redside Dace and should be included in the threats section.

A participant stated that the likelihood of pollution for these heavily urbanized watersheds is a certainty. What isn't certain is the impact it will have on the fish. This will be taken into consideration since the threat certainty rating deals directly with the impact (LI).

Petticoat Creek:

The discussion around this creek centred around the impacts of climate change to Redside Dace populations. These impacts may be negative or positive but it was suggested that Redside Dace would need to have the ability to move in response to these future changes. It was agreed to keep the LO as Known and the LI as unknown

Highland Creek:

Agriculture was deemed less of a threat to the creek's population as there is very little agriculture in the watershed.

For residential and commercial development causal certainty should be higher according participants.

Natural system modification is an important threat for Highland Creek Redside Dace. It was decided that this threat's LI should be extreme.

Rouge River:

Agriculture was determined to be an important threat for this river as there have been major spills that have resulted in large fish kills. The LI for agriculture was determined to be M.

Barriers and channelization on this river are significant and therefore the LI should be high with a causal certainty of 3, according to a participant.

Don River:

Agriculture was discussed as a potential threat to Redside Dace for this river. It was concluded that there is very little agriculture left in the surrounding watershed and therefore the LI should be low.

Natural system modification is a significant threat for the species, according to several participants and should have its LO changed to K and its LI changed to H.

Baitfish harvesting was determined to be the same as for Lynde Creek and Duffins Creek, with no baitfish harvested in the last 5 years. Therefore, it was agreed to keep the Biological Resource Use threat LO as UL and the LI as L.

Humber River:

A participant noted that there have been significant natural system modification on this river similar to the Rouge River and the Don River. The river has been heavily modified by dams and weirs and should have a LO of K and a LI of H. There was some discussion around the LI for Residential/Commercial Development, with one participant arguing that the LI should be dropped from E to B. However, another participant explained that forecasting to 2031, there will be major residential developments around the east and west branches of the Humber River therefore the group decided to leave this threat's LI as E.

Mimico Creek:

Due to very little agriculture in this watershed, it was decided as a group to change the LO to R. According to one participant, this river has been heavily modified similarly to the Don River, therefore the threat of Natural Systems Modifications should have a LO of K, and a LI of H.

One participant challenged the idea of giving a threat rating to a river where Redside Dace have been extirpated. The presenter explained that we need to have this information in the event that re-introductions of Redside Dace occur in the future.

Etobicoke Creek:

During the review of Etobicoke Creek, a participant noted that there is a small amount of agriculture in this watershed therefore the LO should be K but the LI is unknown. Similarly, it was decided by the group to update climate change as a threat for all watersheds.

Clarkson Creek:

Upon evaluation of the threats to this river, it was noted by a participant that agriculture is nonexistent for this watershed. Therefore, agriculture's LO should be R and the LI should be U.

Credit River:

During the discussion of the Credit River, a participant said that residential/commercial development should have an LI of H and a causal certainty of 2. They also stated that invasive species should have an LI of M and natural system modification should have an LO of R.

Morrison Creek:

Threats to Morrison Creek were discussed and one participant provided some edits to threat category ratings. It was decided that the LO for natural system modification and pollution is K, and that there were no known invasive species. Furthermore, agriculture likely has a LO of K and a LI of M.

Sixteen Mile Creek:

A discussion of this river led to changes in the agriculture, natural system modifications, and invasives threat categories. It was decided that agriculture should have a LO of K and a LI of M while the LO for natural system modifications was changed to K and the LI to H. The LO for invasives was changed to K.

Fourteen Mile Creek:

A group evaluation of threats to this river led to updates for several threat categories. Pollution was deemed to have an LI of H since one participant noted that there are more storm water ponds coming online and these have created pollution for the species. It was noted that there is a small amount of agriculture therefore, the LO was changed to R. A participant suggested that the LI for natural system modifications be changed to an H and that invasives are known in this system.

Bronte Creek:

Threats to this watershed were evaluated and one participant noted that water taking is over-allocated and therefore a significant threat to Redside Dace. Thus, the LI for natural system modification was designated as H. This participant noted that Northern Pike are in the system but are located below the escarpment.

Spencer Creek:

A participant recalled an event from twenty years ago when he saw a bait fisherman on this river with Redside Dace in his catch. There was some discussion around the significance of this one event. Another participant stated that bait fishermen are not forth coming with data so it's hard to know the significance of baitfishing on species at risk such as Redside Dace. It was decided as a group to keep the LI for biological resource use as an L but to increase C to a 3.

Niagara Peninsula:

A participant provided a field sheet for this record that was from an island in the Welland Canal in Lock 7. This island no longer has any hydrology, therefore this population no longer exists.

Holland River:

Threats to the Holland River watershed were discussed and one participant felt that agriculture should have an LO of K. Natural system modifications are known and likely have a LI of M. The participant also stated that invasives are in this system but are likely having an LI of L.

Irvine Creek/Gully Creek/Saugeen River:

During the discussion on these three rivers, it was concluded that agriculture should have an LI of H for both Irvine and Saugeen. A participant stated that Natural system modifications are known for the Saugeen and for Irvine therefore the LI should be H. Agricultural drain maintenance is an issue for these two rivers according to several participants. Little was known was Gully Creek nor South Gully Creek with respect to threats.

Two Tree River:

The group reviewed this river system and one participant stated that the watershed is almost entirely agricultural but the impact of this threat is hard to identify since the species is still there

in good numbers. The group decided that the LO for agriculture is a K and the corresponding LI should be a M.

Due to the challenges of completing the threat tables for each population within a two day time window, the group decided that the authors would contact experts (Conservation Authorities etc.) for each population following the meeting. That way, the threat tables will be have the most through and up to date information possible.

REVIEW OF PROJECTS AND ACTIVITIES IN REDSIDE DACE HABITAT

Presenter: Dave Balint

The review of projects and activities summarized all works, projects and activities that took place in Redside Dace habitat from 2013-2017. This includes areas where Redside Dace have been located but not necessarily areas upstream of those locations. Participants discussed whether these numbers were likely to increase, decrease, or remain the same in the future. One participant noted that residential development will be expanding into Seaton (Pickering), Oakville and Milton in the very near future. A result of residential expansion is an increase in permit applications to the Ministry of Transportation (MTO). It was stated that the MTO wants to remove 1/3 of riparian vegetation where projects are occurring even if they are located in Redside dace habitat.

MITIGATION OF THREATS AND ALTERNATIVES TO ACTIVITIES

Presenter: Andrew Drake

Standard methods of mitigation were reviewed, and possible alternatives and new methods were discussed. During the discussion of mitigation options, a participant pointed to the Guidance for Development Activities in Redside Dace Protected Habitat (OMNR 2016) as a resource. In fact, it was pointed out that this is where the majority of BMPs in the RPA were taken from. No other feasible mitigations were suggested during the discussion. Other mitigations that were suggested were the education of anglers on the ramifications of using live bait as well as the use of non-lethal sampling methods such as underwater cameras and eDNA.

SOURCES OF UNCERTAINTY

Presenter: Andrew Drake

The presentation addressed sources of uncertainty related to distribution, abundance, life history and threats. This included gaps in our understanding of movement patterns, genetic diversity and the key factors associated with urban development and agricultural activities that cause declines. One participant stated that there is a lot of uncertainty with the effectiveness of our BMPs. This uncertainty needs to be addressed along with our uncertainty of the effectiveness of new technologies that have the potential of mitigating threats such as new storm water filtration systems.

RECOVERY POTENTIAL MODELLING FOR REDSIDE DACE

Presenter: Adam van der Lee

The presentation on recovery potential modeling addressed life cycle and parameter estimates, model sensitivity, recovery targets, recovery effort, and risk of extirpation, as well as uncertainties and science advice on allowable harm. The discussion of recovery targets included recovery target approaches, minimum viable population (MVP) criteria, the selection process for MVP criteria, the effect of catastrophes, extinction thresholds, and habitat targets.

The discussion initially focused on the population growth rate parameter (lambda) where one participant asked about growth rates and carrying capacity. The presenter stated that lambda isn't always constant and that carrying capacity wasn't factored into the model. This led to a brief discussion of assumptions in the model. The presenter said that all assumptions are included in the research document.

Extinction rates used in the model were deemed to be conservative by one participant. The presenter was asked how much the MVP would be reduced by if less conservative values were used. The presenter stated that this relationship can be inferred from meta population graphs in the research document. Catastrophic events are built into the model and it was asked if these values have ever been ground-truthed. The answer was no, but that this would be a useful exercise in the future.

There was interest from the group about applying this model to different populations in order to prioritize conservation efforts. The presenter stated that this isn't how the model works. However, it was noted by a coauthor that you could use the MVP curves to estimate the probability of extinction for a particular area. This estimate, however, would be area specific and would not include the current model assumptions. This type of analysis was used before to estimate the time to extinction for a population.

This research paper was accepted with only minor editing revisions for publication on the CSAS website.

INVERTEBRATE PREY AVAILABILITY, HABITAT CONDITION AND REDSIDE DACE STATUS IN GREATER TORONTO AREA STREAMS

Presenter: Scott Reid

This research document looked at invertebrate prey availability in different habitat conditions. The authors' objective was to determine if habitat condition and prey availability corresponded to Redside Dace population status. The research looked at riparian vegetation, instream habitat, and terrestrial and aquatic invertebrate abundance and diversity for GTA populations that were stable, declining and extirpated.

A participant asked about the statistical difference found in invertebrate biomass between extirpated and stable sites. Although there were differences, the presenter said the trends were weak likely due to low statistical power. One suggested change to the methodology was to sample at night, however this presents some logistical challenges in the GTA.

This paper was accepted with only minor editorial changes.

SEASONAL MOVEMENT OF REDSIDE DACE (CLINOSTOMUS ELONGATUS) IN RELATION TO ABIOTIC AND BIOTIC FACTORS

Presenter: Andrew Drake

This presenter summarized research on Redside Dace movements in relation to habitat variables such as stream flow, depth and width as well as biotic factors such as species-level CUE of the fish assemblage. The results of this study showed that distance, CUE of Creek Chub, Common Shiner and White Sucker, stream volume, stream depth and stream width were important predictors of moving to a reach. However, much of the variation around Redside Dace movement were unexplained by the models presented indicating that future work is needed.

Questions from participants initially focused on the role of predators such as Brown Trout when it comes to influencing Redside Dace movements. The presenter stated that according to their data, Redside Dace were not avoiding Brown Trout but that this could be a result of sample size

since predators due influence movements of fish in general. In response to this comment, another participant suggested that sample size could be increased by pooling data from both Leslie Tributary and Berczy Creek. The presenter stated that it was conceptually more straightforward to separate these two groups.

Future considerations were provided by participants. This included monitoring the movements of other species such as Creek Chub etc. These species were treated as stationary in this study. Other suggestions included repeating this study again to see if land-use changes would influence movement or stationarity. The presenter said this would be a good idea and hypothesized that land-use changes may cause fish to move frequently to find optimal habitat. On the other hand, he suggested that fish may move less because of flow impediments.

One concern posed by a participant was the low recapture rate in this study. This suggests that Redside Dace may in fact move more than we think since individuals may have move further than the sample sites. The presenter stated that they tried to address this by sampling further away but conceded that had sampling sites been even further away they may have had different results.

This research document was accepted for publication with only minor revisions.

REDSIDE DACE MONITORING PROGRAM

Presenter: Mark Heaton

This presentation was largely a sidebar conversation about the future of Redside Dace monitoring being proposed by the Ontario Ministry of Resources and Forestry in order to minimize the potential negative impacts of scientific sampling on Redside dace populations. There had been concern among many participants that new potential rules regarding Redside Dace sampling as part of OMNR's permitting process would hamper the ability of biologists in the GTA to monitor and better understand Redside Dace populations. Given that almost all of the province's Redside Dace experts were present at this RPA meeting, it was decided that an overview of the proposed monitoring program would help alleviate any concerns among the group.

The presenter outlined a monitoring plan for intensive Redside Dace monitoring in occupied reaches. These reaches would be split into remnant reaches (where two or less Redside Dace have been caught in the last 20 years) and stronghold reaches (where greater than two Redside Dace have been caught in the last 20 years). Remnant reaches would be sampled once every 3 years and stronghold reaches would be sampled once every 6 years. There would be no frequency limitations on the use of low-risk monitoring methods such as underwater video and/or eDNA. This sampling scheme would help alleviate any unnecessary mortality caused by frequent sampling.

Concerns were raised by multiple participants about the ability of the new proposed sampling framework to meet the needs of COSWEIC reassessment 5-10 years down the road. The presenter stated that this concern was not taken into consideration when developing the framework. Others argued that mortality due to current sampling would be a small fraction of the mortality that occurs due to spills etc.

Participants voiced their concerns regarding the ability of the proposed sampling program to meet its own objectives particularly with respect to the proposed sampling frequencies. One participant in particular noted that proposed sampling program would be inadequate in order to measure the variation around abundance indexes. The presenter noted that the current sampling that is conducted in the GTA is mostly presence/absence data and insufficient to estimate population abundance.

The presenter noted that within the Aurora district, there are five Conservation Authorities that each have varying sampling frequencies with respect to Redside Dace monitoring. These range from once every year to once every to 3 years. According to the presenter, MNRF would like all of these CAs to have the same sampling schedule. The presenter than reached out to the Conservation Authorities about how they both can work together to monitor for Redside Dace. The presenter committed to having a formal meeting between MNRF, DFO and Conservation Authorities in the very near future to decide how to move forward with the current proposed monitoring program.

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DFO. 2007b. Documenting habitat use of species at risk and quantifying habitat quality. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2007/038.

APPENDIX 1. TERMS OF REFERENCE

Recovery Potential Assessment – Redside Dace (*Clinostomus elongatus*)

Regional Peer Review Meeting – Central and Arctic Region

February 21-22, 2018
Burlington, ON

Chairperson: Lynn Bouvier

Context

After the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses an aquatic species as Threatened, Endangered or Extirpated, Fisheries and Oceans Canada (DFO) undertakes a number of actions required to support implementation of the Species at Risk Act (SARA). Many of these actions require scientific information on the current status of the wildlife species, threats to its survival and recovery, and the feasibility of recovery. Formulation of this scientific advice has typically been developed through a Recovery Potential Assessment (RPA) that is conducted shortly after the COSEWIC assessment. This timing allows for consideration of peer-reviewed scientific analyses into SARA processes including recovery planning.

In support of listing recommendations for Redside Dace by the Minister, DFO Science has been asked to undertake an RPA, based on the national RPA Guidance. The advice in the RPA may be used to inform both scientific and socio-economic aspects of the listing decision, development of a recovery strategy and action plan, and to support decision making with regards to the issuance of permits or agreements, and the formulation of exemptions and related conditions, as per sections 73, 74, 75, 77, 78 and 83(4) of SARA. The advice in the RPA may also be used to prepare for the reporting requirements of SARA s.55. The advice generated via this process will update and/or consolidate any existing advice regarding the Redside Dace.

Objectives

To provide up-to-date information, and associated uncertainties, to address the following elements:

Biology, Abundance, Distribution and Life History Parameters

Element 1: Summarize the biology of Redside Dace.

Element 2: Evaluate the recent species trajectory for abundance, distribution and number of populations.

Element 3: Estimate the current or recent life-history parameters for Redside Dace.

Habitat and Residence Requirements

Element 4: Describe the habitat properties that Redside Dace needs for successful completion of all life-history stages. Describe the function(s), feature(s), and attribute(s) of the habitat, and quantify by how much the biological function(s) that specific habitat feature(s) provides varies with the state or amount of habitat, including carrying capacity limits, if any.

Element 5: Provide information on the spatial extent of the areas in Redside Dace's distribution that are likely to have these habitat properties.

Element 6: Quantify the presence and extent of spatial configuration constraints, if any, such as connectivity, barriers to access, etc.

Element 7: Evaluate to what extent the concept of residence applies to the species, and if so, describe the species' residence.

Threats and Limiting Factors to the Survival and Recovery of Redside Dace

Element 8: Assess and prioritize the threats to the survival and recovery of the Redside Dace.

Element 9: Identify the activities most likely to threaten (i.e., damage or destroy) the habitat properties identified in elements 4-5 and provide information on the extent and consequences of these activities.

Element 10: Assess any natural factors that will limit the survival and recovery of the Redside Dace.

Element 11: Discuss the potential ecological impacts of the threats identified in element 8 to the target species and other co-occurring species. List the possible benefits and disadvantages to the target species and other co-occurring species that may occur if the threats are abated. Identify existing monitoring efforts for the target species and other co-occurring species associated with each of the threats, and identify any knowledge gaps.

Recovery Targets

Element 12: Propose candidate abundance and distribution target(s) for recovery.

Element 13: Project expected population trajectories over a scientifically reasonable time frame (minimum of 10 years), and trajectories over time to the potential recovery target(s), given current Redside Dace population dynamics parameters.

Element 14: Provide advice on the degree to which supply of suitable habitat meets the demands of the species both at present and when the species reaches the potential recovery target(s) identified in element 12.

Element 15: Assess the probability that the potential recovery target(s) can be achieved under current rates of population dynamics parameters, and how that probability would vary with different mortality (especially lower) and productivity (especially higher) parameters.

Scenarios for Mitigation of Threats and Alternatives to Activities

Element 16: Develop an inventory of feasible mitigation measures and reasonable alternatives to the activities that are threats to the species and its habitat (as identified in elements 8 and 10).

Element 17: Develop an inventory of activities that could increase the productivity or survivorship parameters (as identified in elements 3 and 15).

Element 18: If current habitat supply may be insufficient to achieve recovery targets (see element 14), provide advice on the feasibility of restoring the habitat to higher values. Advice must be provided in the context of all available options for achieving abundance and distribution targets.

Element 19: Estimate the reduction in mortality rate expected by each of the mitigation measures or alternatives in element 16 and the increase in productivity or survivorship associated with each measure in element 17.

Element 20: Project expected population trajectory (and uncertainties) over a scientifically reasonable time frame and to the time of reaching recovery targets, given mortality rates and productivities associated with the specific measures identified for exploration in element 19. Include those that provide as high a probability of survivorship and recovery as possible for biologically realistic parameter values.

Element 21: Recommend parameter values for population productivity and starting mortality rates and, where necessary, specialized features of population models that would be required to allow exploration of additional scenarios as part of the assessment of economic, social, and cultural impacts in support of the listing process.

Allowable Harm Assessment

Element 22: Evaluate maximum human-induced mortality and habitat destruction that the species can sustain without jeopardizing its survival or recovery.

Expected Publications

- Science Advisory Report
- Proceedings
- Research Document(s)

Expected Participation

- Fisheries and Oceans Canada (DFO) (Science sector, Species at Risk Program and Fisheries Protection Program)
- Ontario Ministry of Natural Resources and Forestry
- Academia
- Conservation Authorities
- Other invited experts

References

- COSEWIC. 2007. COSEWIC assessment and update status report on the redside dace, *Clinostomus elongates* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 59 pp.

APPENDIX 2. LIST OF PARTICIPANTS

Name	Organization/Affiliation
Lynn Bouvier (Chair)	DFO - Science
Kari Jean	Ausable Bayfield Conservation Authority
Ian Kelsey	Central Lake Ontario Conservation Authority
Jon Clayton	Credit Valley Conservation Authority
Amanda Conway	DFO – Fisheries Protection Program
Bill Glass	DFO – Fisheries Protection Program
Karla Zubrycki	DFO – Policy
Adam van der lee	DFO – Science
Andrew Drake	DFO – Science
Dave Andrews	DFO – Science
Dominque Lebrun	DFO – Science
Marten Koops	DFO – Science
Elliot Quider (Rapporteur)	DFO – Science
Kristin Thiessen (Rapporteur)	DFO – Science
Amy Boyko	DFO – Species at Risk
Dave Balint	DFO – Species at Risk
Shawn Staton	DFO – Species at Risk
Andrew Dunn	Halton Region Conservation Authority
Chris Wilson	Ontario Ministry of Natural Resources and Forestry
Emily Funnel	Ontario Ministry of Natural Resources and Forestry
Jeff Anderson	Ontario Ministry of Natural Resources and Forestry
Maria Vavro	Ontario Ministry of Natural Resources and Forestry
Mark Heaton	Ontario Ministry of Natural Resources and Forestry
Nick Jones	Ontario Ministry of Natural Resources and Forestry
Scott Gibson	Ontario Ministry of Natural Resources and Forestry
Scott Reid	Ontario Ministry of Natural Resources and Forestry
Doug Forder	Ontario Streams
Dave Lawrie	Toronto and Region Conservation Authority
Jan Moryk	Toronto and Region Conservation Authority
Rick Portiss	Toronto and Region Conservation Authority
Mark Poesch	University of Alberta
Nicholas Mandrak	University of Toronto, Scarborough
Trevor Pritcher	University of Windsor

APPENDIX 3. MEETING AGENDA

Recovery Potential Assessment – Redside Dace

Regional Peer Review Meeting – Central and Arctic Region
Holiday Inn Burlington Hotel, 3063 S Service Rd, Burlington, ON
Harvester North Room

February 21-22, 2018
Chairperson: Lynn Bouvier

Day 1 - Wednesday, February 21

9:00 a.m.	Welcome and Introductions (Chair)
9:30 a.m.	Purpose of the Meeting (Chair)
9:45 a.m.	Species Description (A. Drake)
10:00 a.m.	Application of eDNA sampling to monitor Redside Dace Populations in GTA streams (S. Reid)
10:10 a.m.	Current Status and Population Assessment (A Drake)
10:30 a.m.	BREAK
10:45 a.m.	Habitat Requirements, Functions, Features and Attributes Table (A. Drake)
11:00 a.m.	Timelapse imagery of GTA over last 30 years and mapping of Redside Dace Watersheds (J. Andersen/M. Heaton)
11:20 a.m.	Urbanization, long-term stream flow conditions, and Redside Dace status in GTA streams (S. Reid)
11:30 a.m.	Threat Status (A. Drake)
12:00 p.m.	LUNCH
1:00 p.m.	Threat Status continued
1:45 p.m.	Review of Projects and Activities in Redside Dace Habitat (D. Balint)
2:15 p.m.	Mitigation of Threats and Alternatives to Activities (A. Drake)
3:00 p.m.	BREAK
3:15 p.m.	Mitigation of Threats and Alternatives to Activities continued
3:45 p.m.	Sources of uncertainty (A. Drake)
4:30 p.m.	End of Day

Day 2 - Thursday, February 22

9:00 a.m.	Recovery Potential Modelling (A. van der Lee)
10:30 a.m.	BREAK
10:45 a.m.	Invertebrate prey availability, habitat condition and Redside Dace status in Greater Toronto Area streams (S. Reid)

11:20 a.m.	Seasonal Movement of Redside Dace (Clinostomus elongatus) in Relation to Abiotic and Biotic Factors (A. Drake)
12:00 p.m.	LUNCH
1:00 p.m.	Redside Dace Monitoring Program (M. Heaton)
2:30 p.m.	BREAK
2:45 p.m.	Review Terms of Reference (Chair)
4:30 p.m.	Meeting Adjourned