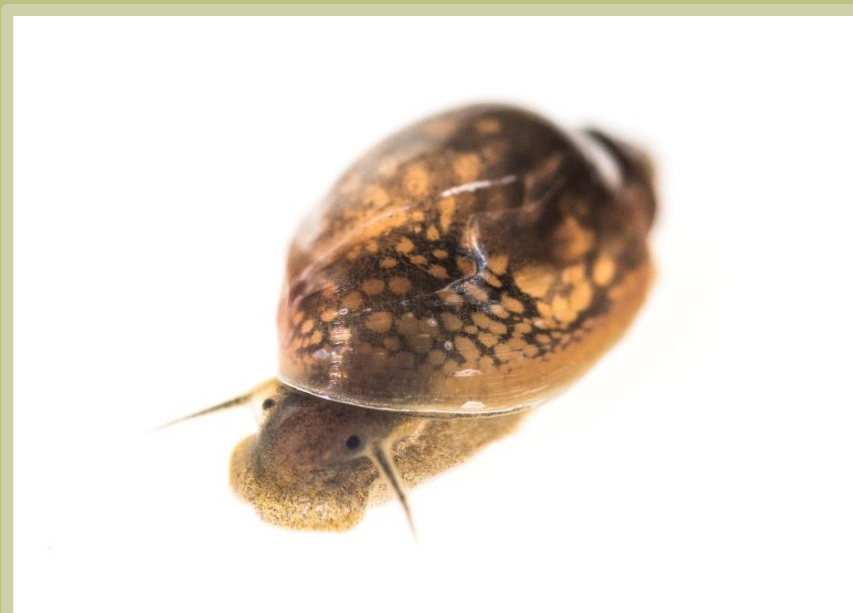


Report on the Progress of Recovery Strategy Implementation for the Hotwater Physa (*Physella wrighti*) in Canada for the Period 2016 to 2021

Hotwater Physa



2022

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Preface

The federal, provincial, and territorial government signatories under the [Accord for the Protection of Species at Risk \(1996\)](#) agreed to establish complementary legislation and programs that provide for the protection of species at risk throughout Canada. Under section 46 of the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the competent minister is responsible for reporting on the implementation of the recovery strategy for a species at risk, and on the progress towards meeting its objectives within five years of the date when the final recovery strategy was placed on the Species at Risk Public Registry, and in every subsequent five-year period until its objectives have been achieved or the species' recovery is no longer feasible.

Reporting on the progress of recovery strategy implementation requires reporting on the collective efforts of the competent minister(s), provincial and territorial governments, and all other parties involved in conducting activities that contribute to the species' recovery. Recovery strategies identify broad strategies and approaches that will provide the best chance of recovering the species at risk. Some of the identified broad strategies and approaches are sequential to the progress or completion of others and not all may be undertaken or show significant progress during the timeframe of a report on the progress of recovery strategy implementation (progress report).

The Minister of Fisheries and Oceans is the competent minister under SARA for the Hotwater Physa and has prepared this progress report.

As stated in the preamble to SARA, success in the protection and recovery of species at risk depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in the recovery strategy and will not be achieved by Fisheries and Oceans Canada or any other jurisdiction alone. The cost of recovering and conserving species at risk is shared amongst different constituencies. All Canadians are invited to join in supporting and implementing the recovery strategy for the Hotwater Physa for the benefit of the species and Canadian society as a whole.

Acknowledgments

This progress report was prepared by Marlena McCabe (Fisheries and Oceans Canada; DFO) with inputs from Manon Morrissette (DFO), Ahdia Hassan (DFO) and Erin Gertzen (DFO). To the extent possible, this progress report has been prepared with inputs from: Jennifer Heron, Greg Wilson, Adrian Batho, Nicole Tattam, and Andrea Somerville from the Province of British Columbia's Ministry of Environment and Climate Change Strategy; Erika Helmond and Kerri Finlay from the University of Regina; Henry Choong, Kim Gough, and Heidi Gartner from the Royal BC Museum; and Cory Sheffield from the Royal Saskatchewan Museum. DFO would also like to express its appreciations to all individuals and organizations who have contributed to the recovery of the Hotwater Physa.

Executive summary

The Hotwater Physa (*Physella wrighti*) was listed as endangered under the *Species at Risk Act* (SARA) in 2003. The [Recovery Strategy for the Hotwater Physa \(*Physella wrighti*\) in Canada](#) was finalized and published on the Species at Risk Public Registry in 2007 (Heron 2007) and an [Action Plan for the Hotwater Physa \(*Physella wrighti*\) in Canada](#) was published in 2018 (DFO 2018) which identified critical habitat for the species. The [Report on the Progress of Recovery Strategy Implementation for the Hotwater Physa \(*Physella wrighti*\) in Canada for the Period 2007 – 2015](#) (DFO 2016) documents the 2007 to 2015 progress toward recovery implementation for the Hotwater Physa.

The main threats identified for the Hotwater Physa include: change to the flow regime as a result of human activities, introduction of deleterious substances, physical habitat destruction or alteration, introduced species, and collecting.

The recovery goal for the Hotwater Physa is to maintain and protect the population(s) of the species within its natural geographic range and within its current variation of abundance at the Liard River Hotsprings complex.

The “Report on the Progress of Recovery Strategy Implementation for the Hotwater Physa in Canada for the period 2016 to 2021” (progress report) reports on the progress made by Fisheries and Oceans Canada (DFO) and its partners towards implementing the recovery strategy from 2016 to 2021. During this time period, notable achievements have been made, including:

- Population surveys completed at Liard River Hotsprings Provincial Park suggest that habitat conditions and population abundance of Hotwater Physa remain stable
- Data on habitat composition, water quality, temperature, and flow research has enhanced an understanding of seasonal conditions required to sustain the population of the Hotwater Physa
- Critical Habitat was identified in the 2018 action plan and subsequently protected through a SARA critical habitat order in 2019
- New signage has been installed to increase park users’ awareness of the Hotwater Physa and the actions that park users can take to minimize threats to the snail and its habitat

DFO remains committed to the recovery of the Hotwater Physa. The progress made to date has built a strong foundation for continued research and management of this species over the next reporting period, and would not have been achieved without the contributions from partners like the British Columbia (BC) Ministry of Environment and Climate Change Strategy, including BC Parks. DFO looks forward to continuing these successful collaborations and welcomes the participation of additional partners.

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1 Introduction

The “Report on the Progress of Recovery Strategy Implementation for the Hotwater Physa in Canada for the Period 2016 to 2021” (progress report) outlines the progress made towards meeting the objectives listed in the Recovery Strategy for the Hotwater Physa (*Physella wrighti*) in Canada (recovery strategy; [Heron 2007](#)) during the indicated time period and should be considered part of a series of documents for this species that are linked and should be taken into consideration together; including the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) status reports (Lee and Ackerman 1998; [COSEWIC 2008](#)), the science advisory report from the recovery potential assessment (RPA) ([DFO 2010](#)), the recovery strategy ([Heron 2007](#)), the action plan for the Hotwater Physa (*Physella wrighti*) in Canada ([DFO 2018](#)) and the Report on the Progress of Recovery Strategy Implementation for the Hotwater Physa (*Physella wrighti*) in Canada for the Period 2007 to 2015 (2007 to 2015 progress report; [DFO 2016](#)). This progress report serves as the second progress report for the Hotwater Physa recovery strategy.

Section 2 of this progress report provides references to or reproduces key information on the threats to the species, recovery goal and recovery objectives for achieving its recovery, and performance measures to assess the progress of recovery. For more details, readers should refer back to the recovery strategy and the 2007 to 2015 progress report. Progress in carrying out broad strategies and specific activities identified in the recovery strategy, to support achieving the recovery goal and recovery objectives, is reported in Section 3.1. Section 3.2 reports on the progress of meeting the performance measures and other commitments identified in the recovery strategy. Section 4 summarizes the progress toward achieving the recovery goal and objectives.

2 Background

2.1 COSEWIC assessment summary and threats to the species and its critical habitat

Hotwater Physa (*Physella wrighti*) was included on the List as endangered when the *Species at Risk Act* (SARA) came into force in 2003. Its classification and inclusion on the list was based on the information provided in the 1998 COSEWIC Status Report (Lee and Ackerman 1998) and led to the development and publication of the “Recovery Strategy for the Hotwater Physa (*Physella wrighti*) in Canada in 2007” (Heron 2007).

In 2008, COSEWIC re-examined and confirmed the status of the Hotwater Physa as endangered ([COSEWIC 2008](#)).

Assessment summary - April 2008**Common name**

Hotwater Physa

Scientific name*Physella wrighti***Status**

Endangered

Reason for designation

This small snail is an endemic species living only within the hotsprings complex located in Liard River Hotsprings Provincial Park in British Columbia. The population is small, numbering fewer than 10,000 individuals and occupies an extremely restricted habitat around the margins of two pools and an outlet stream. Population size is believed to fluctuate by at least an order of magnitude in this short-lived snail (~1 year lifespan). The species is a habitat specialist requiring geothermally regulated water and substrates near the water/air interface in areas of no current. The hotsprings complex has been in use by humans for over 200 years. The species has survived structural modification and maintenance of the pools, the introduction of foreign substances such as soaps and shampoos and trampling. However a single event such as abrupt changes in water flow, chemical contamination or introduction of exotic species, could significantly affect persistence of this snail.

Occurrence

British Columbia

Status history

Designated endangered in April 1998. Status re-examined and confirmed in May 2000 and April 2008. Last assessment based on an update status report.

Section 1.5 of the recovery strategy identifies the threats to the recovery of the Hotwater Physa. These threats include: change to the flow regime as a result of human activities; introduction of deleterious substances; physical habitat destruction or alteration; introduced species; and collecting.

Critical habitat for the Hotwater Physa was identified, to the extent possible, in section 2.1.3 of the action plan ([DFO 2018](#)). The action plan also provides examples of activities that are likely to result in destruction of critical habitat (that is, threats to critical habitat). The list of activities provided in table 4 of the action plan is neither exhaustive nor exclusive, and their inclusion has been guided by the relevant threats to habitat described in the recovery strategy. For more details on the activities likely to result in the destruction of critical habitat, refer to the action plan.

2.2 Recovery

This section summarizes the information found in the recovery strategy (DFO 2007) on the recovery goal and recovery objectives that are necessary for the recovery of the Hotwater

Physa and on performance measures that provide a way to define and measure progress toward achieving the recovery goal and recovery objectives.

Section 2 of the recovery strategy identified the following recovery goal necessary for the recovery of the species.

The recovery goal for Hotwater Physa is to maintain and protect the population(s) of Hotwater Physa within its natural geographic range and within its current variation of abundance at the Liard River hot springs complex.

Section 2 of the recovery strategy also identified the following recovery objectives necessary for the recovery of the species.

The short term objectives¹ used to monitor recovery of the Hotwater Physa are to:

1. observe that the species current distribution within the Alpha [Pool]² and Beta [Complex] and streams is maintained, and to refine the understanding of the current distribution to better quantify this objective by 2011
2. observe that the species' current relative abundance is maintained, and to develop methodology that increases survey precision by 2011

Section 2.6 of the recovery strategy includes the following performance measures³ to define and measure progress toward achieving the recovery goal and objectives:

- Was Hotwater Physa's current distribution within the Alpha [Pool] and Beta [Complex] and outlet streams maintained through 2011? Is there a better understanding towards quantifying this objective by 2011?
- Was Hotwater Physa's current relative abundance maintained through 2011? Was a methodology developed to increase survey precision by 2011?
- Was population monitoring carried out? Was a standardized protocol for population monitoring and habitat assessment developed?
- Was the Liard River Hotsprings Park Master Plan reviewed? Were additional options to protect habitat within the park considered?
- Has the understanding of threats to Hotwater Physa been improved? How?
- Were any genetic studies undertaken and, if so, did the distinct species status of Hotwater Physa change? In what way? Does this knowledge assist the recovery plans for Hotwater Physa? Was there a decline in the population that requires new research studies to be identified? What studies are needed or were carried out?
- Did awareness of the Hotwater Physa and their habitat improve protection?

3 Progress towards recovery

The recovery strategy divides the recovery effort into five broad strategies: monitoring, protection, threats monitoring, knowledge gaps, and park education.

¹ Recovery objectives are time bound in the recovery strategy but still apply beyond 2011.

² Initial wording from the recovery strategy refers to Alpha and Beta pools and streams. Updated wording here reflects that this objective is referring to Alpha Pool (a public use pool at Liard River Hotsprings Provincial Park) and Beta Complex (or the complex connected to this area but closed to public use).

³ Some performance measures are time bound in the recovery strategy but still apply beyond 2011.

Progress in carrying out these broad strategies is reported in section 3.1. Section 3.2 reports on the progress made toward meeting the performance measures and other commitments identified in the recovery strategy.

3.1 Activities supporting recovery

Table 1 provides information on the implementation of broad strategies and their associated specific activities (identified in the recovery strategy). A number of recovery activities were implemented prior to 2016 and have been documented in the “Report on the Progress of Recovery Strategy Implementation for the Hotwater Physa (*Physella wrighti*) in Canada for the Period 2007 to 2015”.

Table 1. Details of specific activities supporting the recovery of the Hotwater Physa from 2016 to 2021. When more than one participant is associated with a recovery activity, they are listed in alphabetical order and the lead is bolded.

#	Broad strategy	Specific activities	Descriptions and results	Participants
1	Monitoring	Establish a standardized protocol for population monitoring, habitat occupancy and distribution surveys. Protocol should include habitat where the snail is not known to occur.	No standardized protocol has been developed during this reporting period. The 2011 monitoring protocols (Lauzier et al. 2011) have been informally amended to reduce impacts to Hotwater Physa habitat by sampling along the banks for snails (Heron. pers. comm. 2020). Field studies were conducted between 2016 to 2018 and helped to increase precision for distribution and habitat characterization surveys (including in habitat where the snail is not known to occur), to better assist with field data collection for Hotwater Physa (Heron pers. comm. 2021).	Province of British Columbia's (BC) Ministry of Environment and Climate Change Strategy, which includes BC Parks (BC ENV), Fisheries and Oceans Canada (DFO)

#	Broad strategy	Specific activities	Descriptions and results	Participants
2	Monitoring	Map the distribution and population information throughout the hotsprings complex.	Field studies conducted since 2016 have helped characterize distribution and population information for Hotwater Physa in Liard River Hot Springs Provincial Park (LRHSPP) and nearby springs⁴ including documentation of Hotwater Physa habitat (Heron and Wilson pers. comm. 2021). Mapping of the aquatic footprint of LRHSPP through analyses of high resolution aerial photographs was also conducted to provide more detailed data on the hotsprings complex (Wilson pers. comm. 2021). Initial data suggests that other suitable habitat to support Hotwater Physa is likely present throughout LRHSPP (Wilson pers. comm. 2021).	BC ENV , DFO
3	Protection	Update the Liard River Hotsprings Provincial Park Master Plan and include provisions for the construction of boardwalks, as necessary.	BC Parks is developing a park management plan for LRHSPP to replace the 1990 Master Plan (BC Parks 2020a). The intent of this updated plan is to better reflect management priorities for LRHSPP including the effective management of species at risk within the park (Somerville. pers. comm. 2020); an online public comment period to solicit input on the updated plan was held between May to September 2020 (BC Parks 2020a).	BC ENV
4	Protection	Develop a quick response plan for retrieving snails in the event of a natural catastrophic event.	A response plan to the potential threat posed by a natural catastrophic event has not been developed; however, captive breeding techniques have been studied and could prove effective to support an external breeding program to assist with a quick response plan for Hotwater Physa (Helmond, 2020).	BC ENV , DFO, Royal Saskatchewan Museum, University of Regina

⁴ Toad River Hot Springs and Deer River Hot Springs. Data was also gathered from Betta, Gamma, Delta, Epsilon pools, and connecting streams within Liard Hotsprings.

#	Broad strategy	Specific activities	Descriptions and results	Participants
5	Protection	Record and assess the impact of physical changes to the habitat by humans (physical destruction of habitat, trampling, etc.).	Field studies conducted since 2016 have helped characterize Hotwater Physa habitat requirements and provide baseline information to assess potential impacts of physical habitat changes by humans: • Data on habitat composition, water quality, temperature and flow rate (collected since 2016) has enhanced an understanding of seasonal conditions required to sustain the population of Hotwater Physa • Captive rearing research on 300 snails collected and housed at the Royal Saskatchewan Museum helped increase understanding on how water temperature fluctuations affect life history parameters including relative activity and amount of egg laying (Helmond, 2020) To assess the impact of human use of the Alpha pool, population surveys for Hotwater Physa were completed by BC Parks in summer of 2020 to gather information on distribution of Hotwater Physa during park closure period⁵ (Tattam pers. comm. 2020). Minimal data was collected on physical habitat changes (Heron and Wilson pers. comm. 2021).	BC ENV, DFO, Royal Saskatchewan Museum
6	Protection	Apply to obtain a water license for conservation purposes on the hotsprings output.	This activity is no longer necessary as it has been determined that a water license is not needed for conservation purposes on the hotsprings output. LRHSPP regulates their water withdrawals as per the <i>Parks Act</i> . No running water is extracted for use from hot springs at LRHSPP (Batho. pers. comm. 2020).	BC ENV

⁵ LRHSPP hot pools were closed to the public to prevent the spread of COVID 19 from March 2020 to May 2021. Surveys done at this time observed a total of 695 Hotwater Physa within Alpha Pool.

#	Broad strategy	Specific activities	Descriptions and results	Participants
7	Protection	In the event an interest in oil and gas or geothermal exploration arises, develop and implement guidelines to mitigate the potential impacts to geothermal sources.	Guidelines to mitigate the potential impacts to geothermal sources have not been developed. Subsurface tenure requests for petroleum and natural gas rights will not be accepted in hotsprings' recharge zones and Hotwater Physa critical habitat (DFO 2016; GW Solutions 2010). LRHSPP has established a 10 kilometre 'referral buffer' around the park preventing industrial directional drilling of gas (both around the park, in recharge zones, and in critical habitat) (Batho. pers. comm. 2020).	BC Oil and Gas Commission, BC Ministry of Natural Gas Development, BC ENV , DFO
8	Protection	Develop a weir maintenance protocol for park staff.	No specific weir maintenance protocol is in place at LRHSPP (Tattam pers. comm. 2020); however, park staff monitor the weir and have taken action to maintain it's stability through: • Placing pea gravel at the downstream end to likely help slow bank erosion overtime (Tattam pers. comm. 2020; Heron pers. comm. 2021) • Using cement blocks around the weir to protect the weir structure while preventing flow changes that could negatively impact Hotwater Physa habitat (Tattam pers. comm. 2020)	BC ENV

#	Broad strategy	Specific activities	Descriptions and results	Participants
9	Protection	Evaluate necessity and means to restrict public access to critical habitat.	Access to Hotwater Phyllis habitat is restricted using regulations provided under the <i>Parks Act</i> and park public access, yearly maintenance, and management is regulated by BC ENV. Use of Alpha Pool is restricted, with no access to the remainder of the hotsprings and pools within the critical habitat. A 2019 critical habitat order under the <i>Species at Risk Act</i> (SARA) invokes the prohibition against destruction of any part of critical habitat. Any maintenance works within Hotwater Phyllis critical habitat requires permitting under SARA.	BC ENV, DFO

#	Broad strategy	Specific activities	Descriptions and results	Participants
10	Threats monitoring	Evaluate the effectiveness of measures used to prevent deleterious substances entering the hotsprings water (e.g., water sampling or monitoring of park users' habits).	Evaluation of effectiveness of measures used to prevent deleterious substances entering the hotsprings water has not been formally completed; however, water quality monitoring does take place at LRHSPP and provides baseline information to be able to assess the effectiveness of measures used to prevent deleterious substance introduction: - In September 2017, water samples were collected from sites⁶ across LRHSPP. Initial unpublished analyses suggested that there was very minimal concentrations of deleterious substances and it is unlikely that Hotwater Physa would be negatively affected given limited anthropogenic pressures and pool composition (Finlay. pers. comm. 2020; Heron and Wilson pers. comm. 2021) - BC ENV continues to periodically collect water samples for chemical analyses to better monitor the presence of deleterious substances entering the hotsprings (Heron and Wilson pers. comm. 2021; Finlay pers. comm. 2021) Park rangers regularly monitor park use both within high use areas (Alpha pool) and those closed to the public to prevent deleterious substance introduction. Informational signage is present within the park to encourage users to shower before entering the hot pools (Tattam pers. comm. 2020).	BC ENV, University of Regina, DFO
11	Threats monitoring	In the event the levels of deleterious substances are found to be a concern, evaluate the effect on the snail.	Refer to table 1, row 10	BC ENV, University of Regina

⁶ Epsilon Pool and its outlet, Beta Pool, Alpha Pool, and both upper/lower Alpha Stream.

#	Broad strategy	Specific activities	Descriptions and results	Participants
12	Threats monitoring	Monitor the introduction of natural sedimentation and changes to riparian structure into the hotsprings complex.	Monitoring the introduction of natural sedimentation does not take place; however, natural sedimentation is normally localized and unlikely to have an impact on the Hotwater Phrysa habitat (Heron and Wilson pers. comm. 2021). Clearing of riparian vegetation adjacent to boardwalks (to prevent human-wildlife altercations) is documented (e.g., depth of bank undercutting is measured) and may help inform and monitor impacts related to riparian structure changes (Heron pers. comm. 2021).	BC ENV, DFO
13	Threats monitoring	Document introduction of invasive species and if invasive species are introduced develop an invasive species management strategy.	There has been informal documentation of terrestrial invasive plants at LRHSPP (Batho pers. comm. 2020). Invasive species management objectives will likely be incorporated into the new management plan for LRHSPP (refer to table 1 row 3; Somerville. pers. comm. 2020). The BC Government has two regulatory documents⁷ which provide the provincial framework for invasive species management (BC Parks 2020b).	BC ENV, DFO
14	Threats monitoring	In the event that there is an interest in development (e.g. oil and gas exploration or hydroelectric), define the risks to the source water from the industrial activity outside of the park boundaries.	Refer to table 1 row 7.	BC Oil and Gas Commission, BC Ministry of Natural Gas Development, BC ENV

⁷ The [Invasive Species Strategy for British Columbia: 2018-2022](#) and the [BC Government Invasive Species Strategic Plan](#).

#	Broad strategy	Specific activities	Descriptions and results	Participants
15	Knowledge gaps	Undertake genetic studies to confirm that <i>P. wrighti</i> is a distinct species.	Initial data from DNA barcoding suggests that Hotwater Physa in LRHSPP are genetically similar to physids found in Deer River Hotsprings (Heron and Wilson pers. comm. 2021). Haplotype mapping and genetic barcoding is currently being used to gather data on whether the Hotwater Physa is a distinct species or its own distinct designatable unit⁸ (Sheffield. pers. comm. 2020; Heron pers. comm. 2020).	BC ENV, Royal Saskatchewan Museum
16	Knowledge gaps	In the event population surveys determine that there is a decline in the population, and the cause can not be identified, develop a research plan to identify the cause.	Population surveys completed at upper and lower Alpha Pools of LRHSPP during the park closure (May 2020 to May 2021) suggest that the population is not in decline (Heron pers. comm. 2021). In the event of a decline in populations, past and ongoing research would help to identify the cause (refer to table 1 rows 1 to 5, 10 to 12, and 15).	BC ENV, DFO
17	Park education	Develop a communications strategy, as necessary, to minimize impact from recreational users.	Educational signage for Hotwater Physa was designed and installed at LRHSPP (Tattam. pers. comm. 2020). A portable “mini-museum” for Hotwater Physa was designed and presented in 2017 at LRHSPP. It can be loaned out to help raise awareness for Hotwater Physa recovery (Gough. pers. comm. 2020). A community outreach presentation regarding the biology and conservation of Hotwater Physa was given in 2019, in Prince George, BC (Choong. pers. comm. 2020).	BC ENV, DFO, Royal BC Museum

⁸ Physids have been collected in various locations throughout British Columbia in other thermal and non-thermal areas for comparison to Hotwater Physa genetics (Heron pers. comm. 2021).

3.2 Summary of progress towards recovery

3.2.1 Status of performance measures

Table 2 provides a summary of the progress made toward meeting the performance measures outlined in the recovery strategy. Some performance measures are time bound in the recovery strategy but still apply beyond 2011. Each measure has been assigned one of four statuses:

- 1) not met: the performance measure has not been met, and little to no progress has been made
- 2) partially met, underway: moderate to significant progress has been made toward meeting one or more elements of the performance measure, and further work is ongoing or planned
- 3) met: the performance measure has been met and no further action is required
- 4) met, ongoing: the performance measure has been met, but efforts will continue until such time the population is considered to be recovered

Table 2. Details of the progress made toward meeting the performance measures outlined in the recovery strategy.

Performance measures	Status	Details
Was Hotwater Physa's current distribution within the Alpha [Pool] and Beta [Complex] and outlet streams maintained through 2011? Is there a better understanding towards quantifying this objective by 2011?	Met, ongoing	The distribution of Hotwater Physa had been maintained within Alpha Pool, Beta Complex, and outlet streams (DFO, 2016; Heron and Wilson pers. comm. 2021). High resolution aerial photographs were taken flying over Liard River Hotsprings Provincial Park (LRHSP) in 2014; mapping of the aquatic footprint of the hot springs complexes was completed and spatial data of the complexes was collected (Heron. pers. comm. 2020). This data could help inform Hotwater Physa distribution within Alpha pool, Beta complex, and outlet streams.
Was Hotwater Physa's current relative abundance maintained through 2011? Was a methodology developed to increase survey precision by 2011?	Met, ongoing	Population surveys completed between 2016 and 2019 continue to suggest that the relative abundance of Hotwater Physa has remained stable (Heron and Wilson pers. comm. 2021) Methodology continues to be updated to increase survey precision since the development of standardized monitoring and habitat assessment protocols by Lauzier et al. (2011) (Heron. pers. comm. 2020). Further efforts are required to obtain quantitative Hotwater Physa population abundance and distribution data.

Performance measures	Status	Details
Was population monitoring carried out? Was a standardized protocol for population monitoring and habitat assessment developed?	Partially met, underway	Population monitoring was conducted on 4 occasions by the Province of British Columbia's (BC) Ministry of Environment and Climate Change Strategy (BC ENV) between 2016 and 2019. A standardized protocol continues to be refined to minimize habitat disturbance by sampling for snails while the surveyor remains on the land and surveys from the side of the creek (Heron. pers. comm. 2020).
Was the Liard River Hotsprings Park Master Plan reviewed? Were additional options to protect habitat within the park considered?	Partially met, underway	BC Parks is developing a park management plan for LRHSPP to replace the 1990 Master Plan (BC Parks 2020a). The intent of this updated plan is to better reflect management priorities for LRHSPP including the effective management of species at risk within the park (Somerville. pers. comm. 2020). An online public comment period to solicit input on the updated plan was held between May to September 2020 (BC Parks 2020a). Other measures to protect habitat are referenced in Table 1 rows 3, 10, 11, and 17. Legal protection of Hotwater Physa critical habitat was established in 2019 through a SARA critical habitat order made under subsections 58(4) and (5), which invoked the prohibition in subsection 58(1) against the destruction of any part of the identified critical habitat.
Has the understanding of threats to Hotwater Physa been improved? How?	Met, ongoing	Research and monitoring conducted between 2016 and 2020 on genetics, water chemistry, microhabitat characterization, and flow contributed to an increased understanding of threats to Hotwater Physa (Heron and Wilson pers. comm. 2021). Initial qualitative water quality data from LRHSPP suggests that the introduction of deleterious substances is currently not a significant threat to Hotwater Physa (Heron and Wilson pers. comm. 2021). Future mitigation measures could be installed at LRHSPP (e.g. shower facilities) to ensure water quality is maintained throughout Hotwater Physa habitat.
Were any genetic studies undertaken and, if so, did the distinct species status of Hotwater Physa change? In what way? Does this knowledge assist the recovery plans for Hotwater Physa? Was there a decline in the population that requires new research studies to be identified?	Met	Genetic studies have been undertaken during this reporting period. Initial results from genetic analyses in 2020 suggest that populations of hot water snails outside LRHSPP are similar to the Hotwater Physa (Heron pers. comm. 2020). Further studies were carried out through a collaboration between BC ENV and the Royal Saskatchewan Museum using genetic barcoding and haplotype mapping to compare taxonomy of hot water snails from a range of waterbodies across western Canada. Preliminary results show snails in at least five separate springs in BC have slightly different barcodes and may represent five different designatable units of the snail (Heron pers. comm. 2020). These results will not likely assist in the development of recovery plans for the Hotwater Physa. No declines in abundance (over the last 5 years) have been observed, and therefore has not triggered new research studies on this topic.

Performance measures	Status	Details
What studies are needed or were carried out?		
Did awareness of the Hotwater Physa and their habitat improve protection?	Met, ongoing	In addition to signage that was installed in 2014 at LRHSPP, BC ENV, in collaboration with DFO, developed signage for Hotwater Physa to help raise awareness among park users of the threat posed by deleterious substances (for example: bug spray or sunscreen). BC ENV is exploring the possibility of installing a shower facility offsite of LRHSPP which could further raise awareness for Hotwater Physa and protect their critical habitat by educating parks users about washing off and not using deleterious substances in the bathing pool. Awareness of Hotwater Physa likely improved following the Royal British Columbia Museum's mini-museum species at risk touring series in 2017 (Choong pers. comm. 2020).

3.2.2 Completion of action plan

The Action Plan for the Hotwater Physa (*Physella wrighti*) in Canada was published in 2018 ([DFO 2018](#)). It is a comprehensive document that outlines the measures that provide the best chance of meeting the recovery goals and recovery objectives for the species, including the measures to be taken to address threats and monitor the recovery of the species.

3.2.3 Critical habitat identification and protection

Critical habitat for the Hotwater Physa was identified to the extent possible, using the best available scientific information in section 2 of the action plan (DFO 2018). The schedule of studies to identify critical habitat, identified in the recovery strategy, has been reported out on in the 2007 to 2015 progress report (DFO 2016) and in table 1 of this progress report. As critical habitat was identified in the action plan, the schedule of studies is no longer active, and recovery measures to help further refine critical habitat are detailed in the action plan (DFO 2018). Protection of Hotwater Physa critical habitat was accomplished in 2019 through a SARA critical habitat order made under subsections 58(4) and (5), which invokes the prohibition in subsection 58(1) against the destruction of any part of the identified critical habitat ([SOR/2019-21](#)).

3.2.4 Recovery feasibility

Recovery was determined to be feasible for the Hotwater Physa within the recovery strategy (DFO 2007). On March 2, 2021, Environment and Climate Change Canada published the Policy on Survival and Recovery, which may lead to changes to recovery feasibility criteria (SARA Policies 2020). The recovery feasibility of the Hotwater Physa may be reassessed based the policy and updated in an amendment of the recovery strategy.

4 Concluding statement

Over the last five years, through the implementation of the broad strategies and associated specific activities identified in the recovery strategy, considerable progress has been made in ensuring the recovery of the Hotwater Physa.

Notable achievements have been made to support Hotwater Physa recovery efforts from 2016 to 2021:

- Population surveys completed at Liard River Hot Springs Park suggest that habitat conditions and population abundance of Hotwater Physa remain stable
- Data on habitat composition, water quality, temperature, and flow research has enhanced an understanding of seasonal conditions required to sustain the population of the Hotwater Physa
- Critical Habitat was identified in the 2018 action plan and subsequently protected through a SARA critical habitat order in 2019
- Initial results from captive rearing of Hotwater Physa help provide the baseline data needed to successfully support an external breeding program if a catastrophic event or detrimental environmental impact significantly alters populations
- New signage is being installed to increase park users' awareness of the Hotwater Physa and the actions that park users can take to minimize threats to the snail and its habitat

Some suggested next steps that could be used to maintain the achievements noted above include:

- Further research on the life cycle, thermal tolerances, and natural history of the Hotwater Physa through captive rearing studies
- Continuation of regular distribution and habitat monitoring surveys to ensure populations remain stable

DFO remains committed to recovering the Hotwater Physa. The work started and completed to date has built a strong foundation for continued recovery of this species over the next reporting period. Progress made to date would not have been achieved without the contribution from our partners including BC Parks, with the British Columbia Ministry of Environment & Climate Change Strategy and significant contributions from the University of Regina, Royal BC Museum, and Royal Saskatchewan Museum. DFO looks forward to continuing these successful collaborations and welcomes the participation of additional partners.

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