

Action Plan for the Cultus Pygmy Sculpin (*Cottus aleuticus*, Cultus Population) in Canada

Cultus Pygmy Sculpin



2017

Recommended citation:

Fisheries and Oceans Canada. 2017. Action Plan for the Cultus Pygmy Sculpin (*Cottus aleuticus*, Cultus Population) in Canada. *Species at Risk Act* Action Plan Series. Fisheries and Oceans Canada, Ottawa. v + 34pp.

For copies of the recovery strategy, or for additional information on species at risk, including COSEWIC Status Reports, residence descriptions, action plans, and other related recovery documents, please visit the Species at Risk Public Registry (www.sararegistry.gc.ca¹).

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Également disponible en français sous le titre
« Plan d'action pour le chabot pygmée du lac Cultus (*Cottus aleuticus*, population Cultus) au Canada »

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ISBN 978-0-660-06853-4

Catalogue no. CW69-21/26-2016E-PDF

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¹ www.registrelep.gc.ca/default_e.cfm

PREFACE

The federal, provincial, and territorial government signatories under the [Accord for the Protection of Species at Risk \(1996\)](#)² agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Under the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the federal competent ministers are responsible for the preparation of action plans for species listed as Extirpated, Endangered, and Threatened for which recovery has been deemed feasible. They are also required to report on progress five years after the publication of the final document on the Species at Risk Public Registry.

Under SARA, one or more action plan(s) provides the detailed recovery planning that supports the strategic direction set out in the recovery strategy for the species. The plan outlines what needs to be done to achieve the population and distribution objectives (previously referred to as recovery goals and objectives) identified in the recovery strategy, including the measures to be taken to address the threats and monitor the recovery of the species, as well as the proposed measures to protect critical habitat that has been identified for the species. The action plan also includes an evaluation of the socio-economic costs of the action plan and the benefits to be derived from its implementation. The action plan is considered one in a series of documents that are linked and should be taken into consideration together. Those being the COSEWIC status report, the recovery strategy, and one or more action plans.

The Minister of Fisheries and Oceans Canada is the competent minister under SARA for the Cultus Pygmy Sculpin and has prepared this action plan to implement the recovery strategy, as per section 47 of SARA. To the extent possible, it has been prepared in cooperation with the Province of British Columbia as per section 48(1) of SARA.

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions and actions set out in this action plan and will not be achieved by Fisheries and Oceans Canada or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this action plan for the benefit of the Cultus Pygmy Sculpin and Canadian society as a whole.

Implementation of this action plan is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

² www.ec.gc.ca/media_archive/press/2001/010919_b_e.htm

ACKNOWLEDGMENTS

This action plan was co-authored by Eric Chiang and Heather Stalberg (Fisheries and Oceans Canada; DFO). The initial action plan was drafted by Gerrit Velema. DFO wishes to acknowledge the contributions made by those that have supported the development of the action plan for Cultus Pygmy Sculpin. In March 2011 a workshop was held in Cultus Lake, British Columbia to gather input from participants for the action plan. Information on local activities and perspectives, the species' biology and current management was provided by: University of British Columbia's species expert; both provincial Ministry of Environment and Parks staff and; the Cultus Lake Aquatic Stewardship Strategy which is a network of people working towards a healthy Cultus Lake and includes local residents, volunteer scientists, representatives from non-Government Organizations, industry, First Nations, Regional and Municipal Government, provincial Parks and, DFO. During the drafting of the document, provincial Parks staff provided further assistance as did DFO's Cultus Lake Laboratory researchers. The assistance provided will be used to help guide the implementation of the actions identified in the plan wherever possible.

EXECUTIVE SUMMARY

Cultus Pygmy Sculpin (*Cottus aleuticus*, Cultus Population) is a small Canadian endemic freshwater fish found only in Cultus Lake and is listed as Threatened on Schedule 1 of SARA. Cultus Lake is located in the lower mainland region of southwestern British Columbia which is an area undergoing sustained and rapid urbanization. The Cultus Pygmy Sculpin shares many physical features of the Coastrange Sculpin (*Cottus aleuticus*) and of sculpins in general, but there are also important differences in morphology and ecology, most importantly small body size, retention of larval features, and a limnetic existence. Abundance of the Cultus Pygmy Sculpin is unknown with the 2007 *Recovery Strategy for Cultus Pygmy Sculpin (Cottus sp.) in Canada* noting there may be a slight downward trend in abundance based on limited incidental catch data from Sockeye Salmon trawls (National Recovery Team Cultus Pygmy Sculpin (NRTCPS) 2007). Cultus Lake is heavily used by recreationists and drains into the lower Fraser River area where many invasive species are well established. The species is vulnerable to habitat quality decline and invasive species establishing in the lake.

This action plan addresses the entire distribution of the Cultus Pygmy Sculpin in Canada. It identifies recovery measures to implement the broad approaches to recovery identified in the 2007 *Recovery Strategy for Cultus Pygmy Sculpin (Cottus sp.) in Canada* (NRTCPS 2007). These measures are intended to support progress towards the population and distribution objective that has been identified for the species in Section 7 of the Cultus Pygmy Sculpin recovery strategy (NRTCPS 2007), which is ensuring the long-term viability of the Cultus Pygmy Sculpin population in the wild. The geographic extent of the distribution objective is Cultus Lake.

A description of the residence for the Cultus Pygmy Sculpin is included in this document.

Critical habitat for the Cultus Pygmy Sculpin has been identified as the entire Cultus Lake, up to its wetted boundary, with the features being the benthic environment and the watercolumn, with associated attributes described to the extent possible. This is based on the best available information such as the recent Fisheries and Oceans Canada peer review advisory report which provided recommendations for the Cultus Pygmy Sculpin critical habitat. Under SARA, critical habitat must be legally protected from destruction within 180 days of being identified in a recovery strategy or action plan. For Cultus Pygmy Sculpin, it is anticipated that this will be accomplished through a SARA Ministerial Order made under subsections 58(4) and (5), which will prohibit the destruction of the identified critical habitat.

This action plan identifies recovery measures to be taken by Fisheries and Oceans Canada, in cooperation and consultation with other agencies, organizations and individuals as appropriate to support the recovery of Cultus Pygmy Sculpin. As all Canadians are invited to join in supporting and implementing this action plan for the benefit of the Cultus Pygmy Sculpin and Canadian society as a whole, the action plan also identifies measures that would contribute to the recovery of Cultus Pygmy Sculpin that could be voluntarily undertaken by other jurisdictions, groups and individuals interested in participating in the recovery of these species.

The recovery measures fall into four broad and complementary categories:

- Protection and management e.g. establish and support a recovery implementation group,
- Outreach and communication e.g. inform and educate stakeholders and the general public about the Cultus Pygmy Sculpin and the overall biodiversity value of Cultus Lake,
- Monitoring and assessment e.g. advance development and implementation of a long-term monitoring plan, and
- Research e.g. fill data gaps such as those pertaining to biology and habitat.

The protection and recovery of species at risk can result in both benefits and costs. The benefits of the recovery measures in this plan are unknown but likely positive. There are likely non-market benefits (i.e. existence, bequest and option)³ from recovery of the species itself. The recovery actions also likely provide broader ecosystem benefits which in turn provide non-market benefits. As well, the measures may result in recreational and amenity benefits for local residents and visitors to Cultus Lake. The costs of the short- and medium-term activities identified in this plan are likely to be low; however, there is a lack of certainty around the longer-term costs. In particular, the implementation stage of recovery measures could result in longer-term costs that cannot be known until the associated protocols and plans have been developed.

Implementation of this action plan is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

³ Existence means valuing its existence; bequest means valuing knowing it is there for future generations and option means valuing its potential use in the future.

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1. RECOVERY ACTION

1.1 Context and Scope of the Action Plan

Cultus Pygmy Sculpin (*Cottus aleuticus*, Cultus Population) is a small Canadian endemic freshwater fish found only in Cultus Lake, located in the lower mainland region of southwestern British Columbia which is an area undergoing sustained and rapid urbanization (Committee on the Status of Endangered Species in Canada (COSEWIC) 2010)⁴. Cultus Pygmy Sculpin is listed as Threatened on Schedule 1 of the *Species at Risk Act* (SARA). Figure 1 depicts the distribution of the species. The Cultus Pygmy Sculpin shares many physical features of the Coastrange Sculpin (*Cottus aleuticus*) and of sculpins in general, but there are also important differences in morphology and ecology, most importantly small body size, retention of larval features, and a limnetic existence (National Recovery Team Cultus Pygmy Sculpin (NRTCPS) 2007). Abundance is unknown, though based on limited incidental catch data from Sockeye Salmon trawls there may be a slight downward trend in abundance (NRTCPS 2007). Cultus Lake is heavily used by recreationists and drains into the lower Fraser River area where many invasive species are well established (COSEWIC 2010). The species is vulnerable to habitat quality decline and invasive species establishing in the lake (COSEWIC 2010). For more information on Cultus Pygmy Sculpin and the threats to the species, refer to the *Recovery Strategy for Cultus Pygmy Sculpin (Cottus sp.) in Canada* (NRTCPS 2007).

The action plan addresses the entire distribution of the Cultus Pygmy Sculpin in Canada. The residence of the species is described. It also identifies critical habitat necessary for the species survival and recovery as well as recovery measures to implement the broad approaches to recovery identified in the *Recovery Strategy for Cultus Pygmy Sculpin (Cottus sp.) in Canada* (NRTCPS 2007). These measures are intended to support progress towards the population and distribution objective that has been identified for the species in Section 7 of the recovery strategy, which is ensuring the long-term viability of the Cultus Pygmy Sculpin population in the wild. To clarify, the geographic extent of the distribution objective is Cultus Lake.

⁴ The general appearance of the Cultus Pygmy Sculpin is very similar to that of the Coastrange Sculpin. In Schedule 1 of SARA, this species is officially listed as “Coastrange Sculpin – Cultus Population”. In this document, the common name “Cultus Pygmy Sculpin” is used throughout, to maintain consistency with the Recovery Strategy (NRTCPS 2007).

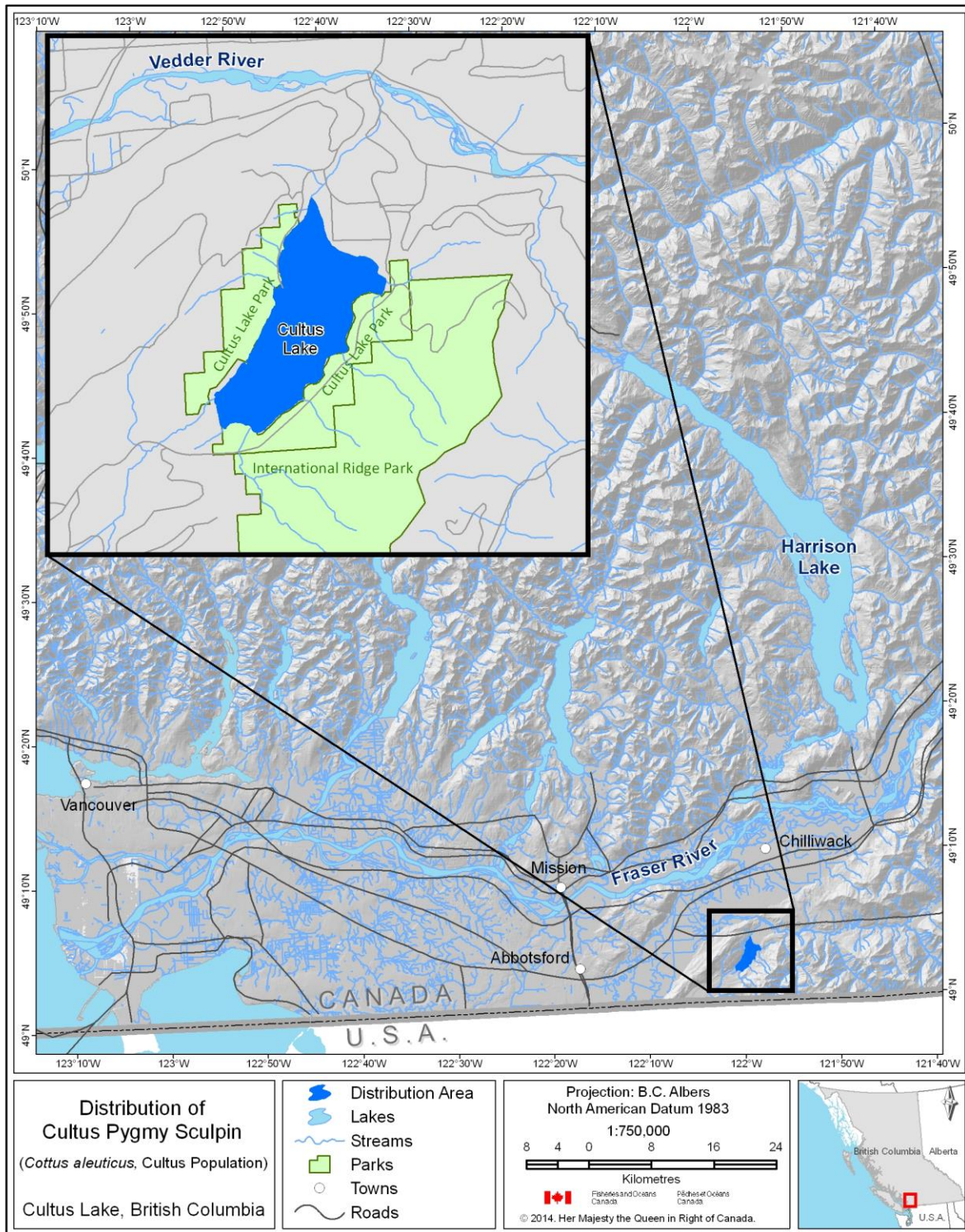


Figure 1. Distribution of Cultus Pygmy Sculpin.

1.2 Residence of the Cultus Pygmy Sculpin

SARA defines a residence as “*a dwelling place, such as a den, nest or other similar area or place, that is occupied or habitually occupied by one or more individuals during all or part of their life cycles, including breeding, rearing, staging, wintering, feeding or hibernating*”.

Based on frequency of observations of gravid (carrying eggs) females, Ricker (1960) suggests that most Cultus Pygmy Sculpin begin to breed in their third year, with spawning beginning in late May or early June, peaking in late June through July, and tapering until early September. Spawning behaviour and habitats are not known (Ricker 1960). It is difficult to determine these as the Cultus Pygmy Sculpin reside in the deep parts of Cultus Lake.

It is generally assumed that Cultus Pygmy Sculpin reproduce in a manner similar to *C. aleuticus*, which lay egg masses under stones that are then guarded by males (NRTCPS 2007). This is supported by McPhail (2007), which states that *C. aleuticus* spawning behaviour has been observed in a laboratory, and is similar to that described for the Mottled Sculpin (*C. bairdii*). Savage (1963) summarized reported observations from the wild, where *C. bairdii* spawning occurred under rocks and in various other crevices with the eggs deposited on the roof of the nest to which they adhered. The females left the nest soon after spawning; the male remained with the eggs and were said to guard them until they had hatched and had left the nest (Savage 1963). In addition to guarding the nest, Goto (1982) also included fanning of the eggs by the males as a common reproductive behaviour of *Cottids*, with the fanning becoming more frequent as the eggs developed. The purpose of this fanning isn't described, though it likely enhances oxygenation of the eggs, flushes away metabolic waste, and maintains the eggs free of any material that might inhibit water flow around the eggs.

A nest of Cultus Pygmy Sculpin is considered a residence given Cultus Pygmy spawning behaviour is similar to *C. bairdii* and *Cottids* generally where: there is a discrete dwelling place that has structural form and function similar to a den or nest; there is an investment in the modification of the dwelling place via removing material that might inhibit flow around the eggs; the dwelling place has the functional capacity to support successful spawning and hatching; and the dwelling-place is occupied during the life-stages of adult, egg and juvenile hatch. The nest is considered a residence during the time that it is occupied by the male through the spawning period, while the eggs are incubating and while the hatched juveniles occupy the nest.

1.3 Critical Habitat

SARA stipulates that an action plan must include:

“an identification of the species’ critical habitat, to the extent possible, based on the best available information and consistent with the recovery strategy, and examples of activities that are likely to result in its destruction;” [ss.49(1)(a)]

Critical habitat is defined in SARA as:

“...the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species’ critical habitat in a recovery strategy or in an action plan for the species.” [s. 2(1)]

Also, SARA defines habitat for aquatic species at risk as:

“... spawning grounds and nursery, rearing, food supply, migration and any other areas on which aquatic species depend directly or indirectly in order to carry out their life processes, or areas where aquatic species formerly occurred and have the potential to be reintroduced.” [s. 2(1)]

Critical habitat for Cultus Pygmy Sculpin has been identified to the fullest extent possible using best available information, and is presently deemed sufficient to allow the species to carry out its life functions and meet the population and distribution objective which is to ensure long-term viability of the Cultus Pygmy Sculpin population in the wild. The critical habitat is described in terms of its extent and supporting biophysical features, functions and attributes. A further refinement of the biophysical features and attributes would further enable effective protection of the habitat and its functions that are essential for the species survival or recovery.

1.3.1 Information and methods used to identify critical habitat

The critical habitat for Cultus Pygmy Sculpin is based on *Recommendations for Cultus Pygmy Sculpin Critical Habitat* (Fisheries and Oceans Canada (DFO) 2012) and *Identification of critical habitat for Coastrange Sculpin (Cultus Population)* (Cottus aleuticus) (Chiang et al. 2015). These reports are informed by the outcomes of the related peer review process undertaken through DFO's Canadian Science Advisory Secretariat, and are available to the public.

1.3.2 Identification of critical habitat: geographic extent

The distribution of the Cultus Pygmy Sculpin is restricted to Cultus Lake in south-western British Columbia. Located approximately 10 km south of the City of Chilliwack, in the eastern Fraser Valley, Cultus Lake is a small lake with a surface area of 6.3 km² (Shortreed 2007). The lake has a littoral zone area of approximately 0.9 km², a mean depth of 31 m, and a maximum depth of 44 m (Shortreed 2007).

There is no evidence that the range of Cultus Pygmy Sculpin exceeds the wetted boundaries of Cultus Lake. In contrast to Coastrange Sculpin typical behaviour which is to migrate into streams to mature (Ricker 1960, Scott and Crossman 1973), the Cultus Pygmy Sculpin completes its entire life cycle in the deep offshore waters of Cultus Lake (Ricker 1960). Cultus Pygmy Sculpin were not found during extensive trapping for Sockeye Salmon (*Onchorhynchus nerka*) juveniles in the Cultus Lake outlet stream nor in shoreline seines (Ricker 1960). Further, for the past 30 years, DFO has conducted mid-water trawl surveys on approximately 30 B.C. lakes containing anadromous Sockeye Salmon. The majority of the lakes contain no sculpins, but for those that do, the sculpins have been generally identified to be too large to be pygmy forms of Coastrange Sculpin (COSEWIC 2010; Woodruff 2010). And lastly, while there is also an example of the rare pygmy pelagic form of the Coastrange Sculpin in Lake Washington, Washington State, the divergence found in recent genetic analysis between it and the Cultus Lake Pygmy Sculpin shows they likely have a different origin (Woodruff 2010).

Though the Cultus Pygmy Sculpin has not yet been found in the shallower littoral areas of the lake, the functioning of the pelagic zone and benthic environment is connected with littoral zone

processes, thus it was considered inseparable in determining the geographic extent of the critical habitat. Consequently, the whole of Cultus Lake up to its wetted boundary is identified as the geographic extent of the critical habitat for Cultus Pygmy Sculpin. The wetted boundary is to be interpreted on the ground as the natural boundary as defined in the British Columbia *Land Act*⁵ which is typically the surveyed property boundary. This encompasses the entire area occupied by the species. The critical habitat is depicted in Figure 2 and also includes a table of coordinates with the most northerly, easterly, southerly and westerly extent of the critical habitat provided.

⁵ The [British Columbia Land Act](#) defines natural boundary as “*the visible high water mark of any lake, stream, or other body of water where the presence and action of the water are so common and usual and so long continued in all ordinary years as to mark upon the soil of the bed of the lake, river, stream or other body of water a character distinct from that of the banks, both in vegetation and in the nature of the soil itself*” [s.1]

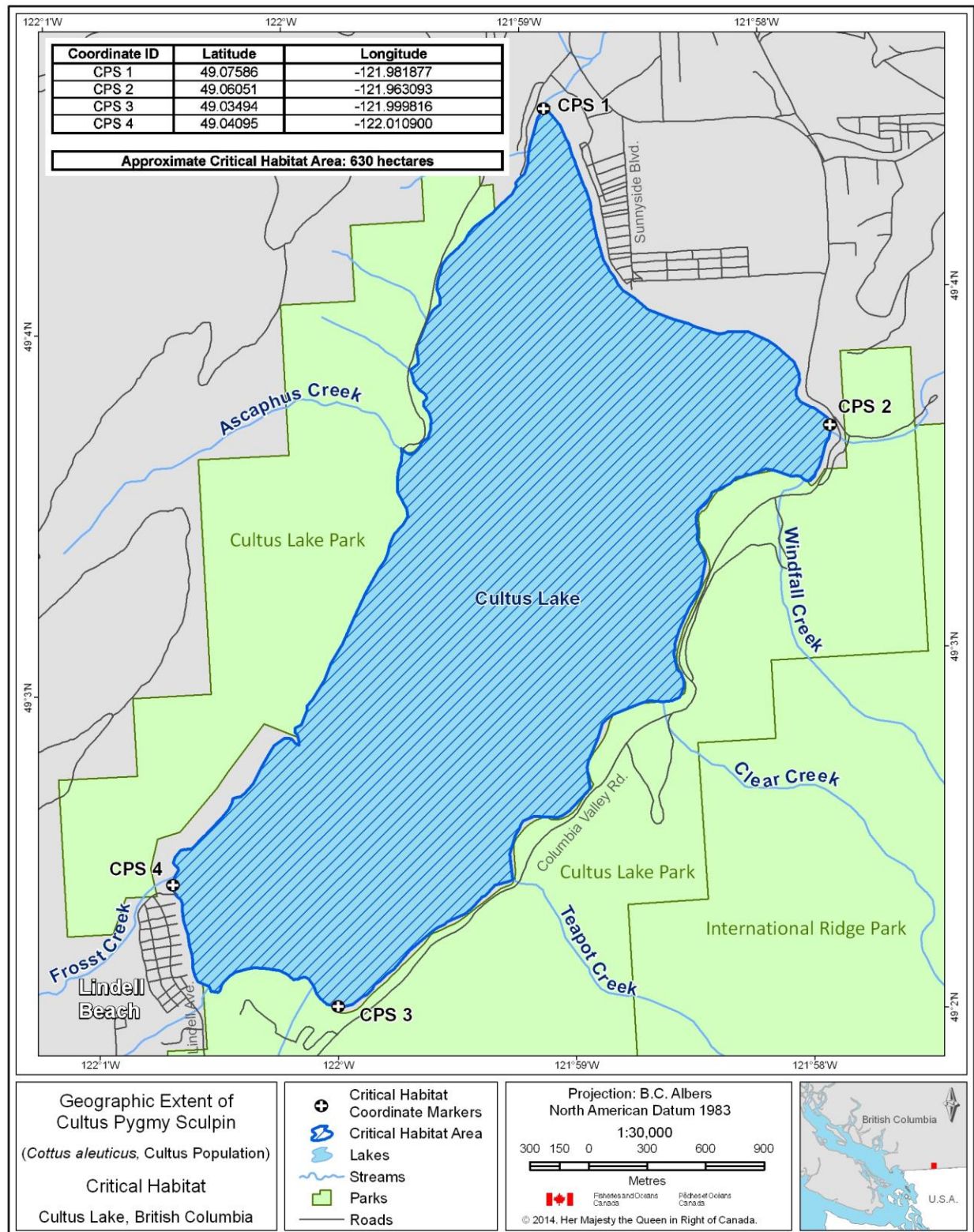


Figure 2: Geographic extent of critical habitat for Cultus Pygmy Sculpin.

1.3.3 Identification of critical habitat: biophysical functions, features, and attributes

The functions, features and attributes of the critical habitat within the geographic extent of the critical habitat are summarized in Table 1 below and followed with a description.

Table 1: Summary of critical habitat biophysical functions, features, and attributes of the Cultus Pygmy Sculpin.

| Function | Feature(s) | Attribute(s) |
|----------|---------------------|---|
| Spawning | Benthic environment | Benthic substrate size – Coarse substrates such as cobble or gravel Adequate oxic benthic conditions |
| Rearing | Benthic environment | Benthic substrate size – Coarse substrates such as cobble or gravel Adequate oxic benthic conditions Adequate prey availability e.g. chironomids and harpacticoid copepods |
| | Water column | Lake water quality that maintains the functional lake ecosystem characteristics necessary for the persistence of Cultus Pygmy Sculpin Sufficient water clarity to retain the deep euphotic zone of Cultus Lake Adequate prey availability e.g. <i>Daphnia</i> and other zooplankton |
| Feeding | Benthic environment | Adequate prey availability e.g. chironomids and harpacticoid copepods |
| | Water column | Lake water quality that maintains the functional lake ecosystem characteristics necessary for the persistence of Cultus Pygmy Sculpin Sufficient water clarity to retain the deep euphotic zone of Cultus Lake Adequate prey availability e.g. <i>Daphnia</i> and other zooplankton |

| | | |
|-----------------|---------------------|---------|
| Predator Refuge | Benthic environment | Unknown |
| | Water column | Unknown |

Critical Habitat Feature – Benthic Environment

Similar to all sculpins, the Cultus Pygmy Sculpin does not possess a swim bladder, and is thus negatively buoyant (Scott and Crossman 1973; McPhail 2007). The benthic environment of Cultus Lake is likely the primary habitat for the Cultus Pygmy Sculpin and supports life functions such as spawning, rearing and feeding (Ricker 1960; Woodruff 2010). The associated critical habitat attributes are described below.

Critical habitat attribute - Benthic substrate size

The exact type of substrate preferred by Cultus Pygmy Sculpin is unknown. Based on the following it can be reasonably inferred that Cultus Pygmy Sculpin likely favour coarse substrates for spawning and rearing purposes: stream-based Coastrange Sculpin tend to spawn on gravel substrate within riffles, and are often found on coarse gravel and cobble substrates (Ricker 1960; McPhail 2007; Tabor et al., 2007); the lacustrine Bear Lake Sculpin (*C. extensus*) use rocky, cobble or boulder substrate (Ruzycki et al., 1998); and both juvenile and adult Cultus Pygmy Sculpin have been captured in association with coarse benthic substrates during the breeding season from mid-May to late October (Woodruff 2010).

Recent numerous recreational dive observations have found Cultus Pygmy Sculpin on a deep detrital silt layer with openings; cobble-gravel slopes where it was too steep to retain an overlaying detrital layer and; on silt covered debris such as boat wreckage (Carlisle pers. comm. 2012).

Critical habitat attribute – Adequate oxic benthic conditions

No specific information exists on the oxygen requirements of *Cottid* species, however, they usually are found in habitat with higher dissolved oxygen concentrations. Coastrange Sculpins (non Cultus populations) inhabit fast waters, especially riffles and glides (McPhail 2007) and oxygen content in those waters are generally higher than found in stagnant pools. British Columbia water quality guideline sets the minimum instantaneous oxygen level in the water column for aquatic life at 5 mg/L (B.C. Ministry of Environment 1997). In the absence of specific data for the Cultus Pygmy Sculpin, it is likely that this value is indicative of the minimum requirement for the species as well. More importantly, the optimum oxygen level for the species may be higher.

Critical habitat attribute – Adequate prey availability

Ricker (1960) found chironomid larvae and *Ostracods*, which are associated with the lake bottom, in Cultus Pygmy Sculpin stomachs. Similarly, (Pon pers. comm. 2012) found harpacticoid copepods, which are associated with the lake bottom, in Cultus Pygmy Sculpin stomachs. These invertebrates can exist in a wide range of substrates and oxic conditions so no thresholds have been associated with this attribute.

The bed of Cultus Lake may also function as a predator refuge for the Cultus Pygmy Sculpin. The aforementioned recent recreational dive observations found the Cultus Pygmy Sculpin typically moved short distances along the bottom away from the diver disturbance before

swimming up into the watercolumn, whereupon it then settled on the bottom nearby soon afterwards (Carlisle pers. comm. 2012). Perhaps where more complex substrates are present, these also provide interstices for Cultus Pygmy Sculpin to hide. It is interesting to note that Bull Trout ⁶ (*Salvelinus confluentus*), which are native to Cultus Lake, prey on Cultus Pygmy Sculpin, with 100 Cultus Pygmy Sculpin found in one Bull Trout stomach (Ricker 1960). Bull Trout can feed off the bottom and in the watercolumn so perhaps both the lake bottom and watercolumn play a role as refugia depending on the predatory species, though no specific data is available to define related attributes (see discussion below regarding predator refuge in the water column).

Critical Habitat Feature – Water Column

The water column of Cultus Lake is identified as a critical habitat feature for the Cultus Pygmy Sculpin. It likely provides rearing, feeding and predator refuge functions for the species. The associated critical habitat attributes are described below.

Critical habitat attribute – Lake water quality that maintains the functional lake ecosystem necessary for the persistence of Cultus Pygmy Sculpin

Cultus Lake is a relatively productive lake-system (oligo-mesotrophic), with an unusually high proportion of the zooplankton *Daphnia* present year round (Shortreed 2007). This abundance of *Daphnia* is attributed as a factor for the Cultus Pygmy Sculpin's behavioural difference with the Coastrange Sculpin, i.e. its pelagic existence, as it preys on *Daphnia* (Ricker 1960). Lake Washington, where another pelagic Coastrange Sculpin is found, is also a productive (mesotrophic) lake system (Woodruff 2010).

In the context of prey supply, the water quality of the Cultus Lake ecosystem becomes integral in supporting a healthy population of Cultus Pygmy Sculpin. Although the exact ranges of water chemistry parameters are not known, the average levels, as reported by Shortreed (2007), provide a good present-day baseline. Examples include:

- dissolved oxygen (DO) concentration- 9.9 mg DO/L surface average and 8.9 mg DO/L hypolimnion,
- secchi depth (a measurement of water clarity)- 9.2 – 10.6m,
- euphotic zone depth (the depth to which photosynthesis occurs)- average 15.8m,
- total dissolved solids- 101 - 106 mg/L, and
- nitrates- 39-45 µg N/L May-October growing season average for euphotic zone.

Note that these values should not be interpreted as critical thresholds and deviations from them would not necessarily indicate a threat to the Cultus Pygmy Sculpin. However, deviations from the present day baseline may indicate deterioration of the lake environment as well as of the quality of the species' critical habitat.

Shortreed (2007) compared lake water chemistry with historical data and presents convincing evidence that increases in lake nutrient levels from anthropogenic sources have likely contributed

⁶ Ricker's 1960 work identified these fish as Dolly Varden, however subsequent taxonomic work by Haas and McPhail (1991) clarified Dolly Varden and Bull Trout as two distinct char species. Woodruff (2010) confirmed the only char species in the Cultus Lake watershed is Bull Trout.

to the higher productivity levels. The anthropogenic sources of nutrient input into the lake include septic tank run-off and agricultural activities. However, as the history of Lake Washington has shown, increasing amounts of anthropogenic nutrients can result in eutrophication and a phytoplankton community dominated by inedible cyanobacteria (Edmondson 1994; Arhonditsis et al., 2003). This increase in productivity causes a decrease in water quality (Arhonditsis et al. 2003) and a decline in fish diversity (Lopez-Rojas and Bonilla-Rivero 2000). A similar process in Cultus Lake could very likely threaten the persistence of Cultus Pygmy Sculpin.

Critical habitat attribute – *Sufficient water clarity to retain the deep euphotic zone of Cultus Lake*
Cultus Lake has relatively clear water, with average secchi depths ranging from 9.2 -10.6 m and a euphotic zone average depth of 15.8 m (Shortreed 2007). Both *C. aleuticus* and *C. hubbsi* have been observed to use vision to cue in on food in a tank (Taylor pers. comm. 2012). If Cultus Pygmy Sculpin is dependent on a visual cue to forage, one of the advantages of the high lake water clarity is likely allowing the Cultus Pygmy Sculpin to find their preferred prey items *Daphnia* (Taylor pers. comm. 2011). Furthermore, there is a strong positive association with water clarity and *Daphnia* abundance (Edmondson and Litt 1982). The depth of the euphotic zone provides a source of energy for primary production in the deeper water; which in turn attracts zooplankton grazers, which are then available to fish as prey in the deeper, cooler waters of the lake (Shortreed 2007). This is especially important to Cultus Pygmy Sculpin as they are mainly distributed in deeper waters. Given our lack of understanding on the strength of association between the euphotic zone depth and Cultus Pygmy Sculpin production, neither 15.8 m nor a range around that average depth can be specified to bound this attribute. However, deviations from this present day average may indicate deterioration of the lake environment as well as of the quality of the species' critical habitat.

Critical habitat attribute – *Adequate prey availability*

Hydroacoustic and mid-water trawl surveys conducted to enumerate juvenile sockeye salmon in Cultus Lake have demonstrated that adult Cultus Pygmy Sculpin migrate into surface waters at night (COSEWIC 2010). It is proposed that they are following the zooplankton *Daphnia* on which they feed (Woodruff 2010). The stomachs of 16 large Cultus Pygmy Sculpins were examined in 1934, with *Daphnia* found to be the main food item by volume (Ricker 1960). In decreasing representation by volume, the remaining food items were found to be chironomid midges (17 larvae and 1 pupae), *Epischura* (zooplankton), *Ostracoda*, *Bosmina* (zooplankton) and *Cyclops* (zooplankton), with one specimen having eaten a smaller *C. aleuticus* (Ricker 1960).

The water column of Cultus Lake also likely functions as a predator refuge for the Cultus Pygmy Sculpin. The Prickly Sculpin (*C. asper*) inhabits the benthic habitat of the lake (Shortreed 2007; Woodruff 2010) and has been observed to prey upon Cultus Pygmy Sculpin individuals (Woodruff pers. comm. 2010). Woodruff's (2010) behavioural study showed that Cultus Pygmy Sculpin individuals remained in the water column in the presence of Prickly Sculpin, in spite of their negative buoyancy. This interaction may have caused Cultus Pygmy Sculpin to seek the water column as a refuge from this predator but no specific data is available to define related attributes. Water clarity may play a role.

1.3.4 Examples of activities likely to result in destruction of critical habitat

Under SARA, critical habitat must be legally protected from destruction within 180 days of being identified in a recovery strategy or action plan. For Cultus Pygmy Sculpin, it is anticipated that this will be accomplished through a SARA Ministerial Order made under subsections 58(4) and (5), which will prohibit the destruction of the identified critical habitat. It is important to keep in mind that critical habitat can be destroyed from activities both within and outside of its geographic extent.

The activities likely to destroy critical habitat described in this section are neither exhaustive nor exclusive and have been guided by the threats in Section 3 of the Cultus Pygmy Sculpin recovery strategy (NRTCPS 2007). The absence of a specific human activity neither precludes nor fetters the department's ability to regulate it pursuant to SARA. Furthermore, the inclusion of an activity does not result in its automatic prohibition since it is the destruction of critical habitat that is prohibited. Every activity should be assessed on a case-by-case basis and site-specific mitigation applied where it is reliable and available. In every case, where information is available, thresholds and limits are associated with attributes to better inform management and regulatory decision-making. However, in many cases the knowledge of a species and its critical habitat may be lacking, and in particular specific information associated with the species or habitat thresholds of tolerance to disturbance from human activities is lacking, and would be beneficial to acquire.

Table 2 contains examples of activities that are likely to destroy the critical habitat of Cultus Pygmy Sculpin.

Table 2: Examples of activities likely to result in the destruction of the critical habitat of the Cultus Pygmy Sculpin.

| Activity | Effect Pathway | Function Affected | Feature(s) Affected | Attribute Affected |
|---|---|--|---|---|
| Non-Point Source Nutrient Input: Excessive nutrient input to Cultus Lake through groundwater and/or surface flows as a result of non-point sources such as residential seepage. | Eutrophication causing algal blooms in the lake which lead to: -reduced light penetration and water clarity, -oxygen depletion, -changes in water chemistry and -increased sedimentation rates of dead algae. These changes can then result in: -an altered food web structure for Cultus Pygmy Sculpin by changing the plankton composition, -making it more difficult to find prey items in murky water, -decreasing oxygen levels on the lake floor due to decomposition of the settled algae and decreasing the benthic invertebrate production, -changing the lakebed composition | Spawning Rearing Feeding | Water Column Benthic environment | Lake water quality that maintains the functional lake ecosystem characteristics necessary for the persistence of Cultus Pygmy Sculpin Sufficient water clarity to retain the deep euphotic zone of Cultus Lake Benthic substrate size – Coarse substrates such as cobble or gravel Adequate prey |

| Activity | Effect Pathway | Function Affected | Feature(s) Affected | Attribute Affected |
|--|--|---|---|--|
| | from coarse substrates to greater fines reducing functionality for spawning and rearing and -the possible shallowing of the summer euphotic zone to within the warm epilimnion changing foraging efficiency as the Cultus Pygmy Sculpin would need to swim higher into the warmer water column to access prey thus expending more energy. | | | availability Adequate oxic benthic conditions |
| Point Source Nutrient Input: Excessive nutrient input to Cultus Lake through groundwater and/or surface flows, as a result of over-application of fertilizers in agricultural lands, golf courses, and residential lawns in the watershed. | Eutrophication causing algal blooms in the lake which lead to: -reduced light penetration and water clarity, -oxygen depletion, -changes in water chemistry and -increased sedimentation rates of dead algae. These changes can then result in: -an altered food web structure for Cultus Pygmy Sculpin by changing the plankton composition, -making it more difficult to find prey items in murky water, -decreasing oxygen levels on the lake floor due to decomposition of the settled algae and decreasing benthic invertebrate production, -changing the lakebed composition from coarse substrates to greater fines reducing functionality for spawning and rearing and -the possible shallowing of the summer euphotic zone to within the warm epilimnion changing foraging efficiency as the Cultus Pygmy Sculpin would need to swim higher into the warmer water column to access prey thus expending more energy. | Spawning Rearing Feeding | Water Column Benthic environment | Lake water quality that maintains the functional lake ecosystem characteristics necessary for the persistence of Cultus Pygmy Sculpin Sufficient water clarity to retain the deep euphotic zone of Cultus Lake Benthic substrate size – Coarse substrates such as cobble or gravel Adequate prey availability Adequate oxic benthic conditions |
| Invasive Species: Introduction of aquatic invasive species through deliberate or inadvertent human actions. | Can dramatically modify the lake ecosystem which may cause any or all of the following effects: -changes in the lake nutrient cycling, -modification of predator-prey relationships, -changes to the zooplankton community composition and -changes to lake water quality. | Rearing Feeding Predator refuge | Water Column Benthic environment | Lake water quality that maintains the functional lake ecosystem characteristics necessary for the persistence of Cultus Pygmy Sculpin Sufficient water |

| Activity | Effect Pathway | Function Affected | Feature(s) Affected | Attribute Affected |
|-----------------|-----------------------|--------------------------|----------------------------|---|
| | | | | clarity to retain the deep euphotic zone of Cultus Lake Adequate prey availability |

1.4 Proposed Measures to Protect Critical Habitat

Under SARA, critical habitat must be legally protected from destruction within 180 days of being identified in a recovery strategy or action plan. For Cultus Pygmy Sculpin, it is anticipated that this will be accomplished through a SARA Ministerial Order made under subsections 58(4) and (5), which will prohibit the destruction of the identified critical habitat.

In addition to the prohibition, various other mechanisms will aid in the protection of critical habitat. For example, legislation such as the provincial *Parks Act* is considered beneficial to critical habitat protection given the current understanding of the nature and extent of the identified threats to the species.

1.5 Measures to be Taken and Implementation Schedule

Success in the recovery of this species is dependent on the actions of many different jurisdictions; it requires the commitment and cooperation of the constituencies that will be involved in implementing the directions and actions set out in this action plan.

The purpose of this action plan is to outline what needs to be done to achieve the population and distribution objectives for the Cultus Pygmy Sculpin to guide not only activities to be undertaken by Fisheries and Oceans Canada, but those for which other jurisdictions, organizations and individuals have a role to play. Fisheries and Oceans Canada strongly encourages all Canadians to participate in the conservation of this species through undertaking priority recovery measures outlined in this action plan. In addition, where appropriate, Fisheries and Oceans Canada seeks to engage with organizations or individuals and enter into a Conservation Agreement under section 11 of SARA to implement the relevant conservation measures.

Table 3 identifies measures to be led by Fisheries and Oceans Canada, in cooperation and consultation with other agencies, organizations and individuals as appropriate, to support the recovery of Cultus Pygmy Sculpin.

As all Canadians are invited to join in supporting and implementing this action plan for the benefit of the Cultus Pygmy Sculpin and Canadian society as a whole, Table 4 identifies measures that would support the recovery of the species that could, or are, being undertaken voluntarily by other jurisdictions, groups and individuals interested in participating in the recovery of this species.

Broad approaches for recovery and threats to the species were first identified in the Cultus Pygmy Sculpin recovery strategy (NRTCPS 2007). Specific actions under these broad approaches were subsequently discussed and updated based on more recent information gained at an action plan workshop held in March 2011. Workshop participants included: University of British Columbia's species expert; both provincial Ministry of Environment and Parks staff and the Cultus Lake Aquatic Stewardship Strategy (CLASS) which includes local residents, volunteer scientists, representatives from non-Government Organizations, industry, First Nations, Regional and Municipal Government, provincial Parks and, Fisheries and Oceans Canada. Species taxonomy and critical habitat identification actions suggested in the recovery

strategy have already been completed so are no longer included in implementation tables 3 and 4 below.

Implementation of this action plan is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

Table 3: Implementation Schedule – Measures to be Taken by Fisheries and Oceans Canada (DFO)

| # | Recovery Measures | Priority ⁷ | Description | Threats Addressed | Timeline |
|----------------------------------|---|-----------------------|---|---|----------|
| Protection and Management | | | | | |
| 1 | Support a Recovery Implementation Group or alternative working group for Cultus Pygmy Sculpin. | H | Support a group that advances the population and distribution objective for the Cultus Pygmy Sculpin for example by providing the group with information on SARA, the species and review of SARA related funding applications such as the Habitat Stewardship Program and Aboriginal Funds for Species at Risk Program. | <ul style="list-style-type: none"> • Invasive Species • Water Quality • Land Use | On-going |
| Monitoring and Assessment | | | | | |
| 2 | Prioritize and advance development and implementation of a long-term monitoring plan to assess population response to management activities and | H | <p>A long-term monitoring plan to be developed in 2017-18 (e.g. scope, metrics, return-rate) to measure progress for survival or recovery of the species and to determine aspects to implement in both the short- and long-term. Information gained from implementation will help determine if setting a quantitative population recovery target is possible.</p> <p>The monitoring program should be sufficiently robust to provide a clear indication of the progress achieved towards the recovery goal of the Cultus Pygmy Sculpin - “... to secure the long-term viability of the population in the wild.”</p> | <ul style="list-style-type: none"> • Invasive Species • Water Quality • Land Use | On-going |

⁷ “Priority” reflects the degree to which the action contributes directly to the recovery of the species or is an essential precursor to an action that contributes to the recovery of the species. High (H), Medium (M), Low (L)

| # | Recovery Measures | Priority ⁷ | Description | Threats Addressed | Timeline |
|-----------------|---|-----------------------|---|---|----------|
| | threats. | | <p>DFO will collaborate with relevant stakeholders and agencies in the implementation of the monitoring plan.</p> <p>Monitoring efforts may include:</p> <ol style="list-style-type: none"> 1. Population abundance and trends of Cultus Pygmy Sculpin. 2. Population abundance and trends of Cultus Pygmy Sculpin prey species. 3. Population trends and distribution of the lake aquatic communities (ecological dynamics) and opportunistic collection of ecosystem benefit information. 4. Water quality such as nutrient level, contaminants and physical parameters like oxygen level and temperature.⁸ 5. Land/water use pattern and trends. | | |
| Research | | | | | |
| 3 | Prioritize and advance research to address information gaps on biology. | H | Research on life history needs such as habitat use patterns (e.g. spawning, overwintering and larval stage habitats), size-at-age and natural mortality rate. | <ul style="list-style-type: none"> • Invasive Species • Water Quality • Land Use | On-going |

⁸ Water quality and quantity monitoring efforts should likely focus on Spring Creek, creeks on the Vedder Mountain side of Cultus Lake, Frosst Creek, and shorelines.

| # | Recovery Measures | Priority ⁷ | Description | Threats Addressed | Timeline |
|---|---|-----------------------|---|---|--|
| 4 | Advance research to address information gaps on nutrient loading. | H | Support investigations into nutrient loading in Cultus Lake. | <ul style="list-style-type: none"> • Invasive Species • Water Quality • Land Use | On-going |
| 5 | Develop and implement protocols for scientific investigations. | L | Development of scientific protocols for capture and handling methods. | None – This action supports future scientific research efforts. | On-going; finalize 2017–18, implement 2018- and beyond |

Table 4: Recovery measures that could be taken voluntarily by other agencies, organizations and individuals who wish to contribute to the recovery of Cultus Pygmy Sculpin

| # | Recovery Measures | Priority | Description | Threats Addressed |
|----------------------------------|--|----------|---|---|
| Protection and Management | | | | |
| 1 | Establish and support a Recovery Implementation Group or alternative working group for Cultus Pygmy Sculpin. | H | <i>On-going-</i> CLASS, established in 2007, has recently added to its portfolio the implementation of recovery measures necessary for the survival or recovery of Cultus Pygmy Sculpin. | <ul style="list-style-type: none"> • Invasive Species • Water Quality • Land Use |
| 2 | Develop and implement an AIS Total Prevention Plan with direct links to stewardship groups and local stakeholders. | H | <p><i>New-</i> The AIS Total Prevention Plan will outline activities that need to be undertaken to prevent aquatic invasive species from entering and becoming established in Cultus Lake. The plan may include one or more of the following elements:</p> <ol style="list-style-type: none"> 1. Vectors and pathways approach: To proactively block vectors and pathways of AIS, on a priority basis rather than focus on individual species or pathogens. 2. Enhanced knowledge: To gather increased knowledge about AIS in order to prevent their arrival to Cultus Lake. 3. Early Detection and Rapid Response: A system of monitoring and communications to ensure early detection as well as a rapid response in the event AIS are detected. Efforts should be informed by the <i>Aquatic Invasive Species Regulations</i> under the | <ul style="list-style-type: none"> • Invasive Species • Water Quality |

| # | Recovery Measures | Priority | Description | Threats Addressed |
|---|--|----------|---|---|
| | | | <p>federal <i>Fisheries Act</i>, existing provincial procedures for rapid response to invasive species introductions, and the Invasive Species Council of BC.</p> <p>4. Education: To highlight and communicate AIS prevention via outreach initiatives (e.g. public signage at boat launches).</p> | |
| 3 | Develop and implement an integrated land and water use plan that strives to conserve Cultus Lake, as well as satisfy user needs. | H | <p><i>New</i>- A variety of land and water uses exist in the Cultus Lake watershed, from agricultural and residential, to resource extraction and the intense recreational use from over one million visitors every year. These are covered by a variety of planning processes which should be coordinated and/or integrated as appropriate:</p> <ol style="list-style-type: none"> 1. Include consideration of Cultus Lake watershed and Cultus Pygmy Sculpin conservation into the Official Community Plan process for the Electoral Area H of Fraser Valley Regional District to ensure further land development plans in the Columbia Valley protect the integrity of Cultus Lake from cumulative impacts. 2. Investigate and establish appropriate water quality objectives for Cultus Lake, taking into account the needs of Cultus Pygmy Sculpin protection and conservation, as well as other user needs. 3. <i>Ongoing</i> - Assess the need to incorporate Cultus Lake watershed and Cultus Pygmy Sculpin conservation considerations into Cultus Lake Park Board's future strategic planning and refine as necessary. | <ul style="list-style-type: none"> •Water Quality •Land Use |

| # | Recovery Measures | Priority | Description | Threats Addressed |
|-----------------------------------|--|----------|---|---|
| | | | <p>4. Assess the need to incorporate Cultus Lake watershed and Cultus Pygmy Sculpin conservation considerations into provincial management plans for the crown lands and the Cultus Lake Provincial Park and refine as necessary.</p> <p>5. Coordinate with other regional conservation initiatives such as South Coast Conservation Program.</p> | |
| Outreach and Communication | | | | |
| 4 | Inform and educate stakeholders and the general public about the Cultus Pygmy Sculpin and the overall biodiversity value of Cultus Lake. | M | <p><i>New and on-going-</i> Develop and implement projects to educate the public about the Cultus Pygmy Sculpin along with the biodiversity and conservation value of Cultus Lake.</p> <p>Some examples include:</p> <ol style="list-style-type: none"> 1. Distribute existing provincial and federal educational materials on the threat of invasive species to the recreational fishing and boating communities to prevent the transfer of invasive species. 2. <i>On-going-</i> Develop additional educational material (e.g. educational brochure, web-based material, social networking tools) to engage the public about the species, its biodiversity values, benefits to human health and communities, commercial and economic values, and threats. In particular, schools in the vicinity of Cultus Lake could be engaged. 3. <i>On-going</i> - Develop clever messaging using language catered to distinct audiences. (Example provided by the Action Plan | <ul style="list-style-type: none"> • Invasive Species • Water Quality • Land Use |

| # | Recovery Measures | Priority | Description | Threats Addressed |
|-----------------|---|----------|--|---|
| | | | <p>Community Workshop participants: “PS (Pygmy Sculpin) I love you”).</p> <p>4. Develop educational signage for placement at specific locations (e.g. road crossings, habitat enhancement project, etc.) to inform the public about the Cultus Lake environment.</p> <p>5. <i>On-going by CLASS</i>- Periodically engage with local media to bring about public awareness of Cultus Lake and its biodiversity.</p> <p>6. Encourage collaboration between private land owners and local governments to identify, promote and implement stewardship and best management practices for Cultus Lake.</p> | |
| Research | | | | |
| 5 | Advance research to address information gaps on nutrient loading. | H | <i>On-going</i> - Building on existing research, develop a lake-specific model of nutrient loading. | <ul style="list-style-type: none"> • Invasive Species • Water Quality • Land Use |
| 6 | Advance research to address information gaps on mortality. | H | <i>New</i> - Utilizing insight gained from population monitoring to bound potential impacts, investigate potential and real causes of mortality (e.g. temperature, contaminants, predation, siltation of incubation habitat, etc). | <ul style="list-style-type: none"> • Invasive Species • Water Quality |

| # | Recovery Measures | Priority | Description | Threats Addressed |
|---|--|----------|--|--|
| | | | | <ul style="list-style-type: none"> •Land Use |
| 7 | Advance research to address information gaps on population limiting factors. | H | <i>Ongoing-</i> Investigate limiting factors to population growth such as food availability. | <ul style="list-style-type: none"> •Invasive Species •Water Quality •Land Use |

2. EVALUATION OF SOCIO-ECONOMIC COSTS AND BENEFITS

SARA requires that an action plan include an evaluation of the socio-economic costs of the action plan and the benefits to be derived from its implementation (*SARA* 49(1)(e), 2003). This evaluation addresses only the incremental socio-economic costs of implementing this action plan from a national perspective as well as the social and environmental benefits that would occur if the action plan were implemented in its entirety, recognizing that not all aspects of its implementation are under the jurisdiction of the federal government. It does not address cumulative costs of species recovery in general nor does it attempt a cost-benefit analysis. Its intent is to inform the public and to guide decision making on implementation of the action plan by partners.

The protection and recovery of species at risk can result in both benefits and costs. The Act recognizes that “wildlife, in all its forms, has value in and of itself and is valued by Canadians for aesthetic, cultural, spiritual, recreational, educational, historical, economic, medical, ecological and scientific reasons” (*SARA*, S.C. 2003, c.29). Self-sustaining and healthy ecosystems with their various elements in place, including species at risk, contribute positively to the livelihoods and the quality of life of all Canadians. A review of the literature confirms that Canadians value the preservation and conservation of species in and of themselves. Actions taken to preserve a species, such as habitat protection and restoration, are also valued. In addition, the more an action contributes to the recovery of a species, the higher the value the public places on such actions (Loomis and White, 1996; DFO., 2008b). Furthermore, the conservation of species at risk is an important component of the Government of Canada’s commitment to conserving biological diversity under the *International Convention on Biological Diversity*. The Government of Canada has also made a commitment to protect and recover species at risk through the [Accord for the Protection of Species at Risk](http://www.ec.gc.ca/media_archive/press/2001/010919_b_e.htm).⁹

The following evaluation describes, to the extent possible, the benefits that may accrue, as well as the costs that governments, industry and/or Canadians may incur due to activities identified in this action plan. Both benefits and costs are identified from the time of listing, and encompass all actions. The overall impacts (costs and benefits) of this action plan cannot be determined with a high degree of certainty as several identified actions indicate implementation of plans (e.g. long-term monitoring plan) that have yet to be developed.

This evaluation does not address the socio-economic impacts of protecting critical habitat for Cultus Pygmy Sculpin. In cases where critical habitat has been identified in a recovery strategy or action plan for a species, DFO must ensure that this critical habitat is legally protected within 180 days of the final posting of the recovery strategy or action plan. If a *SARA* Ministerial Order is used for critical habitat protection, its development will follow a regulatory process in compliance with the Cabinet Directive on Regulatory Management and a detailed analysis of the

⁹ http://www.ec.gc.ca/media_archive/press/2001/010919_b_e.htm

incremental impacts will be carried out as part of the Regulatory Impact Analysis Statement (Government of Canada, 2012).

Recovery actions for Cultus Pygmy Sculpin began with the species' legal listing under SARA in 2003. DFO funded approximately \$20,000 in research projects to complete the species taxonomy and critical habitat identification which were actions identified in the Cultus Pygmy Sculpin recovery strategy (NRTCPS 2007). As well, individuals and organizations have provided in-kind support in terms of time and resources for meetings and activities associated with development of the recovery strategy and action plan, development of research proposals and grant applications, and activities relating to outreach and communication. Partners have included the staff from the University of British Columbia and the provincial Ministry of Environment, and CLASS which is a network that includes local residents, volunteer scientists, representatives from non-government organizations, industry, First Nations, regional and municipal government, provincial Parks and, DFO.

Benefits

The benefits of recovery measures to ensure the long-term viability of the Cultus Pygmy Sculpin population are unknown but likely positive. There are likely non-market benefits (i.e. existence, bequest and option)¹⁰ from recovery of the species itself. As well, the recovery actions also likely provide broader ecosystem benefits, which in turn provide non-market benefits. Recovery actions that address water quality and prevention of aquatic invasive species (AIS) in Cultus Lake may have a positive impact on Cultus Lake Sockeye Salmon, a species assessed as threatened by COSEWIC in 2003, as well as some of the numerous other fish species found in the lake (NRTCPS 2007).

In addition, recovery measures to maintain water quality and prevent AIS may preserve or increase recreational and amenity benefits for local residents and visitors to Cultus Lake. The two communities of Cultus Lake and Lindell Beach are located on the lake and are home to over 1,000 residents. As well, the lake is a popular recreational destination with over a million visitors, primarily Canadian residents, annually making extensive use of the lake for swimming, power boating, paddle boating, sailing and fishing (Robinson 2011).

Costs

The measures in this action plan focus on research on the species and threats, development of protocols and plans, engagement through support of an implementation working group and education. The cost of longer-term activities, in particular implementation of plans yet to be developed, cannot be assessed. However, there is more certainty around the cost of the measures

¹⁰ Existence means valuing its existence; bequest means valuing knowing it is there for future generations and option means valuing its potential use in the future.

identified as on-going, underway or near-term (next 1-2 years), with the overall cost of these activities likely to be low¹¹.

The short-term research activities (Table 3) are either underway or have been approved for funding from existing government sources, and in-kind and direct funds from partner sources have been identified. Combined, these are low cost activities. While the remaining research activities (Table 4) are also anticipated to be low cost, the timing and distribution of costs are unknown. The development of protocols and plans identified in both tables, as well as engagement activities, will be undertaken in the short- to medium-term and are generally low cost consisting of in-kind support for participation by government and partner staff and individuals. Education and engagement programs for other freshwater aquatic species have involved low direct costs for activities (i.e. development and dissemination of communications materials and/or in-kind staff support from partners). Future activities for Cultus Pygmy Sculpin are expected to be similar with costs likely to be low, although identification of future partners and distribution of costs are dependent on the set of activities adopted and voluntary participation.

There is a lack of certainty around the longer-term actions identified in the action plan, which includes the implementation stage of activities. Implementation could result in longer-term costs; however, these cannot be known until the protocols and plans have been developed. The cost to implement long-term monitoring cannot be determined until the requirements of a protocol to assess the population response of Cultus Pygmy Sculpin have been determined; however, generally such protocols are designed with cost as a consideration. In the case of voluntary activities with an implementation stage (Table 4), a collaborative approach would allow for discussion of costs during the plan development stage. The timing and distribution of costs associated with the implementation stages of activities cannot be ascertained until the protocol and plans have been developed.

3. MEASURING PROGRESS

The performance indicators presented in the associated recovery strategy provide a way to define and measure progress toward achieving the population and distribution objective.

Reporting on *implementation* of the action plan, under s. 55 of SARA, will be done by assessing progress towards implementing the strategies outlined in the recovery strategy.

Reporting on the ecological and socio-economic impacts of the action plan, under s. 55 of SARA, will be done by assessing the results of monitoring the recovery of the species and its long term viability, and by assessing the implementation of the action plan. Where undertaken,

¹¹ The definition for the scale of costs is based on the [Treasury Board Secretariat Triage Statement \(2009\)](#). Dollar figures are: low (\$0-\$1 million per year), medium (\$1-\$10 million), and high (≥\$10 million) or equivalent present values.

results of recovery actions such as the following can facilitate reporting on ecological impacts:
Table 3, #s 2 (2, 3, 4, and 5), 3 and 4; and Table 4, #s 2, 3 and 5.

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APPENDIX A: EFFECTS ON THE ENVIRONMENT AND OTHER SPECIES

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the [Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals](#)¹². The purpose of an SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making and to evaluate whether the outcomes of a recovery planning document could affect any component of the environment or achievement of any of the [Federal Sustainable Development Strategy](#)'s (FSDS)¹³ goals and targets.

Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that implementation of action plans may inadvertently lead to environmental effects beyond the intended benefits. The planning process based on national guidelines directly incorporates consideration of all environmental effects, with a particular focus on possible impacts upon non-target species or habitats. The results of the SEA are incorporated directly into the action plan itself, and summarized below in this statement.

This action plan will benefit the environment by promoting the long-term viability of the Cultus Pygmy Sculpin population in the wild, thereby contributing to FSDS Goal 5 (Wildlife Conservation). The actions identified in this plan address threats such as invasive species, water quality degradation due to eutrophication from point and non-point source nutrient inputs, and land-use activities that may negatively affect water quality and littoral habitat, all of which typically negatively affects other aquatic species and amphibians. This contributes to Goal 3 (Water Quality) of the FSDS. By addressing these threats, these actions will provide benefits to any other such species that are present, thus contributing to FSDS Goal 6 (Ecosystem/Habitat Conservation and Protection). Fish species that co-occur with Cultus Pygmy Sculpin include Prickly Sculpin, Sockeye Salmon, Coho Salmon (*Onchorhynchus kisutch*), Cutthroat Trout (*O. clarkii clarkii*), Bull Trout (*Salvelinus confluentus*), Northern Pikeminnow (*Ptychocheilus oregonens*), and White Sturgeon (*Acipenser transmontanus*)¹⁴.

SARA listed species that also might benefit from these recovery actions are the Western Painted Turtle (*Chrysemys picta*), Pacific Water Shrew (*Sorex bendirii*), Pacific Giant Salamander (*Dicamptodon tenebrosus*), the Red-legged Frog (*Rana aurora*), Pacific Tailed Frog (*Ascaphus truei*), Western Toad (*Bufo boreas*), Mountain Beaver (*Aplodontia rufa*), Great Blue Heron (*Ardea herodias fannini*) and the Common Nighthawk (*Chordeiles minor*).

In the Cultus Pygmy Sculpin recovery strategy (NRTCPS 2007) it is captured that management of the Sockeye Salmon– Cultus Lake Population, assessed by COSEWIC as endangered, may

¹² <http://www.ceaa.gc.ca/default.asp?lang=En&n=B3186435-1>

¹³ www.ec.gc.ca/dd-sd/default.asp?lang=En&n=F93CD795-1

¹⁴ Different Fraser River populations of White Sturgeon have been assessed by COSEWIC as endangered and threatened; the origins of the White Sturgeon observed in Cultus Lake are uncertain.

have implications for Cultus Pygmy Sculpin and vice versa, as they have similar prey and share some predators. These species are both native to Cultus Lake and the efforts to maintain lake productivity for Cultus Pygmy Sculpin should also benefit the sockeye as the juveniles too are planktivores.

The contribution of the identified recovery actions will also contribute to overall ecosystem and watershed health, providing benefits to many species and ecological services to Canadians living in the area. Given the considerations outlined above, the benefits of this action plan to the environment and other species are expected to far outweigh any adverse effects that may occur.

APPENDIX B: RECORD OF COOPERATION AND CONSULTATION

The Cultus Pygmy Sculpin was listed as Threatened under SARA in June 2003. A recovery strategy for the species was finalized in February 2007. The Minister of Fisheries and Oceans Canada (DFO) is the competent minister under SARA for the Cultus Pygmy Sculpin and prepared the action plan to implement the recovery strategy, as per section 47 of SARA. To the extent possible, it has been prepared in cooperation with the Province of British Columbia as per section 48(1) of SARA. Processes for coordination and consultation between the federal and British Columbia governments on management and protection of species at risk are outlined in the Canada-B.C. Agreement on Species at Risk (Government of Canada, 2005). The draft document was also sent to the Parks Canada Agency and Environment and Climate Change Canada for review and comment.

In March 2011, a workshop was held in Cultus Lake, British Columbia to gather input from participants for the action plan. Information on local activities and perspectives, the species' biology and current management was provided by: University of British Columbia's species expert; both provincial Ministry of Environment and Parks staff and; the Cultus Lake Aquatic Stewardship Strategy which is a network of people working towards a healthy Cultus Lake and includes local residents, volunteer scientists, representatives from non-Government Organizations, industry, First Nations, Regional and Municipal Government, provincial Parks and, DFO.

Consultations on the draft action plan occurred between November 15 and December 17, 2012. Consultation activities included:

- on-line posting of the draft action plan, background information and a comment form,
- letters, e-mails and faxes with information on the draft action plan consultations and offering opportunities for bilateral meetings sent to 15 First Nation organizations,
- letters regarding the draft action plan consultations sent to approximately 150 private landowners,
- e-mails regarding the action plan consultations sent to approximately 150 stakeholders including agricultural associations, industry (agriculture, property development, and forestry), academia, environmental non-government organizations, community stewardship groups, and government representatives (municipal, regional, provincial and federal),
- a community open house in Cultus Lake where feedback forms were distributed,
- public notices of the community open house and action plan consultations posted throughout the community (e.g. golf-course, community halls, post office, resort residences, and Park Board Association Office), and
- social media tweets notifying of consultations with links to the on-line postings.

Approximately 15 people participated in the November 24, 2012 Cultus Lake community open house. Nine people, the Province of British Columbia and one local government submitted comments on elements of the draft action plan via e-mail, electronic submission of the guidebook and mail.

Open-house participants were predominantly positive towards the action plan, as were the majority of submitted comments, with the identified critical habitat and its protection, and recovery measures supported; a number of respondents expressed an interest in participating in recovery actions and emphasized the need for funding of recovery measures. The action plan was seen as a means to help address concerns regarding invasive species and water quality degradation of Cultus Lake by many. New observational information on habitat use and behaviour of the Cultus Pygmy Sculpin was gained through the consultation process. As part of one submission, clarity was sought on thresholds for activities likely to destroy critical habitat, information on the Department's future management and enforcement of such activities, and reassurances that no additional regulatory burden would result and no restrictions would be placed on use or enjoyment of Cultus Lake.

Additional stakeholder, Aboriginal, and public input was sought through the publication of the proposed document on the Species at Risk Public Registry for a 60-day public comment period.

All feedback received was considered in the finalization of the Action Plan.