



ALLOWABLE HARM STATEMENTS FOR CORDILLERAN SUCKER AND UNARMoured STICKLEBACK

CONTEXT

Once the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses an aquatic species as Threatened, Endangered or Extirpated, Fisheries and Oceans Canada (DFO) undertakes a number of actions required under the *Species at Risk Act* (SARA), many of which require additional scientific information on the current status of the wildlife species, threats to its survival and recovery, and the potential for recovery. Development of this scientific advice has typically been achieved through a Recovery Potential Assessment (RPA).

Cordilleran Sucker (*Pantosteus bondi*) was designated Threatened in 2022 by COSEWIC due to its limited distribution and continued decline in habitat quality. Unarmoured Threespine Stickleback (*Gasterosteus aculeatus*) was designated Endangered in 2023 due to limited distribution, and increased risk of extinction due to observed population declines, threats from invasive species, and continued decline in habitat quality.

In support of listing recommendations by the Minister, DFO Science has been asked to undertake a modified RPA to provide advice in support of both scientific and socio-economic aspects of the listing decision, the development of a recovery strategy and action plan, decision making with regards to the issuance of permits or agreements, and/or the formulation of exemptions and related conditions, as per sections 73, 74, 75, 77, 78 and 83(4) of SARA. The advice in the RPA may also be used to prepare for the reporting requirements of SARA s.55.

The standard terms of reference for RPAs include multiple elements that encompass biology, abundance, distribution, life history parameters, habitat and resident requirements, threats and other constraints to survival and recovery, scenarios for recovery, mitigation of threats, and alternatives to activities. For Cordilleran Sucker and Unarmoured Threespine Stickleback, which have significant data limitations, the best available information is provided in recent COSEWIC assessments. Consequently, this modified terms of reference only evaluates the effect of human-induced harm on survival and recovery.

The specific objectives of this review are to provide up-to-date information, and associated uncertainties, for the following RPA Element for Cordilleran Sucker and Unarmoured Threespine Stickleback:

1. Evaluate the effect of human-induced harm (including habitat destruction) on survival or recovery.

This Science Response Report results from the regional peer review of October 28, 2025, on Allowable Harm Assessment of Cordilleran Sucker & Unarmoured Stickleback.

BACKGROUND

For Cordilleran Sucker (*Pantosteus bondi*) and Unarmoured Threespine Stickleback (*Gasterosteus aculeatus*), we present a brief summary of relevant, available biological

information that may help evaluate the effect of human-induced harm on survival or recovery, in addition to the context for evaluating harm.

Summary on Allowable Harm/ Effect of Human-induced Harm

Under section 73 of *Species at Risk Act* (SARA) the Minister of Fisheries and Oceans may issue a permit authorizing a person to affect a listed aquatic species, any part of its critical habitat, or the residence of its individuals only if the Minister is of the opinion that, among satisfying other conditions, the activity will not jeopardize the survival or recovery of the species. In order to fulfill this specific condition, DFO must evaluate the scope for allowable harm, i.e., human-induced harm that will not jeopardize the survival or recovery of an aquatic species (DFO 2022).

DFO (2014) defines *harm* as “the adverse result of an activity where single or multiple events reduce the fitness (e.g., survival, reproduction, growth, movement) of individuals”. While often equated with mortality, this definition also encompasses sublethal effects and effects of habitat destruction, where data permit.

The intent is to provide a comprehensive continuum of how harm may affect survival or time to recovery, enabling informed risk tolerance decisions when reviewing section 73 permit applications. However, across taxa, a wide range of data availability and analytical methods exist, resulting in varying approaches to evaluating harm (Drake et al. 2022). Drake et al. (2022) and DFO (2022) proposed a jeopardy assessment framework which considers:

1. harm to individuals,
2. harm to habitat, and
3. how harm is connected to vital rates (mortality, fecundity, growth, migration) and influences population growth.

This framework offers a flexible, consistent approach, even with limited data. However, it still requires some understanding of population state, vital rates, habitat state, and estimated changes in these parameters.

The purpose of a Recovery Potential Assessment is to provide the best available information on the current status and scientific information of the wildlife species, including: biology, abundance, distribution, life history parameters or vital rates (e.g., total mortality, natural mortality, fecundity, age and size structure, growth, age/size at maturity, generation time, and recruitment), recent population trends, habitat requirements, carrying capacity, threats to survival or recovery, candidate abundance and distribution targets, population trajectories, and probability recovery targets can be achieved. Much of this information is required to evaluate human-induced harm. In cases where empirical data are lacking, qualitative approaches for allowable harm have been employed until additional information can be obtained (Drake et al. 2022). However, the utility of qualitative approaches remains uncertain, as they have not been fully evaluated and may not entirely fulfill the intended objectives of harm assessment.

Species Summary – Cordilleran Sucker

The Cordilleran Sucker, formerly known as the Mountain Sucker (*Catostomus platyrhynchus*), was reassessed in December 2022 as Threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), due to limited distribution and continued decline in habitat quality (COSEWIC 2022).

Detailed descriptions of Cordilleran Sucker are provided in McPhail (2007) and COSEWIC (2022). This small freshwater fish, typically less than 230 mm, inhabits the Columbia River drainage in Washington, Oregon, Nevada, Idaho in the United States, and the Columbia River drainage and Fraser River drainage in British Columbia, Canada (McPhail 2007, COSEWIC 2022). In British Columbia it occupies diverse lotic habitats, ranging from small streams to large rivers, including the Similkameen, North Thompson and lower Fraser rivers. These habitats vary significantly in annual discharge, flow rate, turbidity, temperature and productivity (McPhail 2007, COSEWIC 2022).

Limited survey effort, particularly in the last 20 years, contribute to an incomplete understanding of its current distribution. In British Columbia, data for Cordilleran Sucker are primarily restricted to presence or absence (McPhail 2007, COSEWIC 2022). No data exist to inform population size, trends, density, or carrying capacity within any part of its Canadian range (McPhail 2007, COSEWIC 2022).

Relatively little is also known about the life history parameters, habitat requirements, or movement of Cordilleran Sucker (Campbell 1992, McPhail 2007, COSEWIC 2022). Similar to other fishes, fecundity is related to length and age with larger older females bearing more eggs (Wydoski and Wydoski 2002, Boguski and Watkinson 2013). Maturity is typically reached at four years for males and five years for females in British Columbia, though age and size of maturity vary across its North American range (Wydoski and Wydoski 2002, Boguski and Watkinson 2013, COSEWIC 2022). Spawning timing is also influenced by latitude and altitude (Wydoski and Wydoski 2002, DFO 2013, COSEWIC 2022). In Lost Creek, Utah, spawning occurs from late May to late June, peaking in early June at water temperatures of 9–11°C, primarily in riffles 11–30 cm deep with velocities of 6–20 cm/s (Wydoski and Wydoski 2002). Eggs are adhesive and demersal, scattered over substrates (McPhail 2007, DFO 2013). Cordilleran Sucker can spawn across multiple years, enhancing reproductive success if conditions are unfavorable in a given year. In British Columbia spawning is documented in the main stem of the lower Fraser River in June, but details on spawning timing and habitat across its range remain unclear (McPhail 2007).

Due to its limited, and patchy distribution in British Columbia, the Cordilleran Sucker faces varied and cumulative threats across its range, including habitat loss and degradation, pollution, climate change, dams and water use, and invasive species (see COSEWIC 2022). No data are available to quantify the impacts of these threats on the species or their effects on vital rates. For a detailed threat assessment, including impacts informed by subjective expert opinions, refer to COSEWIC (2022).

Species Summary – Unarmoured Threespine Stickleback

The Unarmoured Threespine Stickleback was reassessed by COSEWIC as Endangered in December 2023, due to limited distribution, and continued decline in both habitat quality and the number of mature individuals (COSEWIC 2023).

Detailed descriptions of Unarmoured Threespine Stickleback are provided in McPhail (2007) and COSEWIC (2023). In general, Threespine Stickleback are small-bodied fish typically 40–60 mm, characterized by two or three dorsal spines and bony plates. They have a broad distribution across the Northern Hemisphere in both marine and freshwater habitats, exhibiting remarkable morphological adaptations and genetic distinctiveness (COSEWIC 2023). Their traits make them valuable for studying evolutionary processes, speciation, and eco-evolutionary dynamics (COSEWIC 2023).

The Unarmoured Threespine Stickleback is distinctive for its reduced bony plates and protective spines compared to other sticklebacks (COSEWIC 2023). It is restricted to three small, shallow, acidic lakes on Graham Island in Haida Gwaii, British Columbia: Serendipity Lake (0.02 km²), Rouge Lake (0.02 km²), and Boulton Lake (0.18 km²). These lakes lack predatory fishes, which likely drove the evolutionary loss of armour (Spoljaric and Reimchen 2007, COSEWIC 2023). It remains unknown if Unarmoured Threespine Stickleback occur in additional lakes on Haida Gwaii (COSEWIC 2023).

Little is known about the specific biology of Unarmoured Threespine Stickleback, but it is presumed to be similar to that of other freshwater Threespine Stickleback (COSEWIC 2023). Threespine Stickleback are typically short-lived, reaching maturity at approximately 12 or 24 months and have a lifespan of 2–3 years. Males construct nests for spawning and guard them until fry are about a week old. Males may mate with multiple females or nest more than once in a season. Females often complete multiple breeding cycles per season (COSEWIC 2023). Unarmoured Threespine Stickleback on Haida Gwaii differ from other Threespine Stickleback by reaching reproductive maturity later and producing larger but fewer eggs (Oravec and Reimchen 2013, COSEWIC 2023).

Specific habitat requirements for Unarmoured Threespine Stickleback are poorly understood, but are thought to align with those of other Threespine Stickleback, including sustained habitat integrity, suitable areas for nesting and juvenile rearing, and the absence of invasive species, the most likely imminent threat to these populations (COSEWIC 2023).

No reliable, or recent, data exist on population size, trends, density, productivity or carrying capacity within any of the three lakes that contain Unarmoured Threespine Stickleback (COSEWIC 2023). Estimates from the 1970s and early 1980s, 350,000 for Boulton Lake, 17,500 for Rouge Lake, and 22,000 for Serendipity Lake (Reimchen 1984), were based on unspecified methods and considered unreliable (COSEWIC 2023). COSEWIC (2023) suggested that adult populations likely exceed 10,000 per lake, though this estimate lacks supporting rational, data on productivity to account for varying lake sizes, or consideration of reported declines.

Although unquantified, notable population declines have occurred. In 2017 Unarmoured Threespine Stickleback were presumed extirpated from Rouge Lake after it temporarily dried up, but individuals were found in the lake in 2019, likely managing to persist in small pools adjacent to the lake until water levels stabilized (COSEWIC 2023). In Boulton Lake, a decline followed the 2009 introduction of Northern Red-legged Frog (*Rana aurora*), though by 2017 tadpole-to-stickleback ratios decreased, coinciding with morphological shifts towards more developed defensive structures (COSEWIC 2023). Additional evidence of declines includes very low heterozygosity in Unarmoured Threespine Stickleback, indicating past bottlenecks and reduced genetic diversity (Jones et al. 2012, COSEWIC 2023).

Aside from these limited observations, no recent surveys have confirmed current population levels or generated reliable data to estimate population size or trends in any lake inhabited by Unarmoured Threespine Stickleback.

ANALYSIS AND RESPONSE

Evaluating the effect of human-induced harm on survival or recovery is highly complex and species-specific. For Cordilleran Sucker and Unarmoured Threespine Stickleback, there are no data to undertake this assessment, including population sizes, trends, vital rates, habitat conditions, or carrying capacity etc., nor the degree to which identified threats are quantitatively impacting individuals. This precludes any quantitative assessment or the application of the

jeopardy assessment framework (Drake et al. 2022, DFO 2022) for these species. Consequently, qualitative approaches, despite their inherent limitations and uncertainties, are necessary until sufficient, rigorous data become available.

Allowable Harm – Cordilleran Sucker

In the absence of data on current population sizes, trends, or vital rates, quantifying the effect of human-induced harm on survival or recovery is not feasible. Nonetheless, a precautionary approach should minimize human-induced harm, across life stages to avoid jeopardizing the survival or recovery of Cordilleran Sucker. Activities that mitigate existing threats, enhance current conditions or generate relevant biological data are recommended, as they can contribute positively to the species' long-term conservation.

Allowable Harm – Unarmoured Threespine Stickleback

Low heterozygosity and past bottlenecks in the Unarmoured Threespine Stickleback may diminish the species' resilience to additional stressors, thereby heightening vulnerability to environmental changes, invasive species, and habitat alterations. Low genetic diversity limits adaptive potential, as it constrains the genetic variation available for responding to new challenges, potentially leading to inbreeding depression, reduced fitness, and decreased viability (Kardos et al. 2021, Turba et al. 2022, Vásquez et al. 2023). In unarmoured forms of Threespine Stickleback in Southern California, similar patterns of low heterozygosity are associated with more pronounced demographic declines and reduced resilience to climate-driven events or hydrological fluctuations (Turba et al. 2022). Furthermore, evidence indicates that small, isolated populations with low genetic variation face a higher extinction risk due to genetic factors compared to larger, more diverse populations (Kardos et al. 2021).

Although surviving past bottlenecks (e.g., events like the 2017 Rouge Lake drying event) demonstrates short-term tolerance to population-level impacts, this does not indicate inherent resilience. Instead, each successive bottleneck cumulatively erodes genetic diversity, thereby elevating long-term extinction risk over time rather than building adaptive capacity (Jones et al. 2012, Turba et al. 2022, Vásquez et al. 2023).

In the absence of data on current population sizes, trends, or vital rates, quantifying the effect of human-induced harm on survival or recovery is not feasible. Nonetheless, a precautionary approach should assume limited resilience in this population. Consequently, to support survival and recovery, introduced species and human-induced harm should be prevented to the extent possible, recognizing that activities which maintain habitat and ecosystem integrity or generate relevant biological data may contribute positively to the species' long-term conservation.

Sources of Uncertainty

Data gaps and limited availability are common for aquatic species at risk, presenting substantial obstacles to developing robust quantitative assessments. In the case of Cordilleran Sucker and Unarmoured Threespine Stickleback the extensive deficiencies in data hinders the provision of comprehensive science advice.

- Populations sizes and trends are unknown.
- Most of the life history parameters or vital rates (e.g., total mortality, natural mortality, fecundity) are unknown.
- Habitat requirements, carrying capacity, and the relationships between habitat alterations and vital rates are unknown.

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- Impact of threats including cumulative and sublethal impacts to survival or recovery remain poorly understood.
- Candidate abundance and distribution targets are unknown and need further exploration when data is available to address effect of human-induced harm to these populations in the context of survival and time required to achieve recovery.
- The utility of qualitative approaches remains uncertain, as they have not been fully evaluated and may not entirely fulfill the intended objectives of harm assessment.
- Specific to the Cordilleran Sucker, the scarcity of collections over recent decades raises concerns and introduces uncertainty regarding its current distribution and population status (COSEWIC 2022). Furthermore, recent evidence suggests collection records are even more limited due to misidentification of specimens within museum collections (Gilmore 2025 unpublished data).
- For Unarmoured Threespine Stickleback, uncertainties about current population size and resilience particularly in light of observed declines and introduction of invasive species, add further uncertainty regarding its extinction risk (COSEWIC 2023).

Recommendations

- Further work to address knowledge gaps and uncertainties is required to develop a better understanding of the biological and conservation needs of these species, and the effect of human activities.
- Until further data becomes available, a precautionary approach is recommended, while supporting activities which maintain habitat and ecosystem integrity that contribute to the species' long-term conservation. Permitting requirements could consider the inclusion of acquiring biological data to inform knowledge gaps.

CONCLUSIONS

Currently, insufficient data exist to quantitatively evaluate the effects of human-induced harm on the survival or recovery for Cordilleran Sucker and Unarmoured Threespine Stickleback. To address these knowledge gaps and uncertainties, further research and monitoring are essential to enhance understanding of the species' biological requirements, conservation needs, and responses to human activities. In the interim, reliance on qualitative assessments and precautionary strategies is required to safeguard these species' persistence and recovery under SARA.

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