Upper Peace Basin Arctic Grayling Recovery Guidance

Summary of the 2026 Arctic Grayling Synthesis Report

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1 Introduction

Arctic Grayling of the South Beringian lineage are not considered to be at risk of extinction (yellow listed by the BC Conservation Data Centre; BC CDC 2026) in their British Columbia range, but significant conservation concern remains for remnant populations in the flooded upper Peace Basin. The creation of Williston and Dinosaur Reservoirs resulted in the extirpation of an estimated 24 populations inhabiting the lower reaches of the Parsnip and Finlay rivers and upper reaches of the Peace River (Stamford et al. 2017). Surviving populations persist in larger tributaries to Williston Reservoir and the unflooded portions of the Parsnip and Finlay rivers, all of which now face additional threats from human land use and climate change. Because of this conservation concern and high human value, recovering Arctic Grayling populations is a priority for the Fish and Wildlife Compensation Program - Peace (FWCP). Despite this priority, few on-the-ground recovery actions have been proposed or implemented for the species largely due to uncertainty around which options would be responsible investments with low risk to existing populations (Legault 2025). To address this impasse, FWCP has produced an updated synthesis of Arctic Grayling research in the Williston Reservoir and Dinosaur Reservoir watersheds (Hagen et al. 2026), following 9 years of project implementation since the first Arctic Grayling synthesis report which was completed in 2017 (Stamford et al. 2017). This document summarizes the major findings of the Hagen et al. (2026) synthesis report. For detailed information necessary for implementing recovery actions, however, readers are referred to both the 2026 and 2017 synthesis reports.

The 2026 Arctic Grayling synthesis report poses three questions, answers to which are required to design and implement effective recovery actions for Arctic Grayling in the upper Peace Basin:

1. What is the conservation status of remaining populations of Arctic Grayling?
2. Where are critical habitats and what is their relative importance?
3. What are key factors limiting system capacity currently?

In the 2026 synthesis report, these questions are addressed through: 1) updated assessments of Arctic Grayling abundance, trend, distribution, and threats, which are rolled up to assess conservation status (urgency for recovery actions), 2) updated estimates of the distribution of critical habitats for Arctic Grayling in the upper Peace Basin, which identify where recovery actions must be located to be effective (where to work), and 3) a new analysis of limiting factors, which estimates what types of recovery actions are most likely to be effective for recovering Arctic Grayling in various sub-basins of the upper Peace Basin (what to do). Collectively, new study results since 2017 add to prior knowledge such that answers to questions about conservation urgency, where to work, and what to do are now tractable.

2 What is the Conservation Status of Remaining Populations (Urgency)?

In the 2026 synthesis report, Arctic Grayling conservation status, or population viability, was assessed using the 'Arctic Grayling Core Area Conservation Status' method (adapted from

Fredenberg et al. 2005), a rule- and point-based method similar to that applied in the 2017 synthesis report. Key indicators of conservation status are abundance (of mature individuals), trend, distribution, and threats. Monitoring data to assess conservation status has been a priority for FWCP since 2017. When new data were jointly analyzed in 2026 with prior information since the 1990s, estimates of conservation status and risk were possible for 5 of 8 extant core areas (putative metapopulations) in the upper Peace Basin (the Dinosaur Reservoir population is extirpated) (Table 1).

Table 1. Categorical estimates of conservation status indicators – distribution, abundance (population size), trend, and cumulative effects (threats) – rolled up as status rankings for Arctic Grayling core areas. Codes A-E correspond with Very High-Low levels of conservation concern. Cumulative effects codes are modal estimates of remaining system capacity among Arctic Grayling sub-basins in each core area (Section 4). See Hagen et al. (2026) for detailed methods.

Geographic information		Status and risk indicators				Scores					Risk assessment
ID	**Core area**	**Distribution**	**Population size**	**Trend**	**Cumulative Effects**	**Distribution**	**Population size**	**Trend**	**Cumulative Effects**	**Numeric score**	**C-rank for occurrence**
1	Parsnip	D	E	E	B/C	0	0.25	0.25	-0.38	3.13	C4-Low Risk
2	Nation	C	U	U	A/B	-0.25			-0.63	NA	CU-Unranked
3	Omineca	D	C/D	B	C/D	0	-0.13	-0.5	-0.13	2.25	C3-Potential Risk
4	Ingenika	C	D	D	D	-0.25	0	0	0	2.75	C3-Potential Risk
5	Lower Finlay	D	U	U	D	0			0	NA	CU-Unranked
6	Upper Finlay	D	U	U	D	0			0	NA	CU-Unranked
7	Williston	C	B	U	A/B	-0.25	-0.5	0	-0.63	1.63	C2-At Risk
8	Upper Peace	B	A	C	A	-0.5	-0.75	-0.25	-0.75	0.75	C1-High Risk

The Parsnip core area was ranked C4-Risk because of high abundance, increasing trend, and widespread distribution, which mitigated elevated cumulative effects (threats) (Table 1). The Omineca core area was ranked C3-Potential Risk, due mainly to evidence of a rapidly declining trend and elevated cumulative effects. The relatively pristine Ingenika core area had low cumulative effects, but was ranked C3-Potential Risk because of small population size and limited distribution. The Williston core area, which comprises flooded portions of the Finlay and Parsnip River valleys, was ranked C2-At Risk because of drastic reductions of population size and distribution (many local extirpations), combined with high cumulative effects which are dominated by the flooding of critical, large mainstem river habitats. The Upper Peace core area was ranked C1-High Risk for similar reasons, exacerbated by the facts that Arctic Grayling distribution and abundance are so low that extirpation may have occurred or is imminent. The three remaining core areas Nation, Lower Finlay, and Upper Finlay were not ranked (CU-Unranked) because of the lack of population data indicating abundance and trend, which is an important information gap limiting conservation planning. Nonetheless, high conservation urgency is indicated for the Nation core area because of high to very high cumulative effects.

3 Where are Critical Habitats and What is their Importance (Where to Work)?

Work by FWCP since the 1990s (reviewed in Stamford et al. 2017), combined with new study methods such as environmental DNA (e.g., Stamford et al 2022), reconnaissance snorkeling surveys (e.g., Hagen and Stamford 2023), and telemetry (Martins et al. 2022; Bottoms et al. 2023), has done much to improve understanding of the distribution of critical habitats for multiple life stages. The 2026 synthesis report features an updated review of these data. A total of 85 stream segments were delineated providing critical habitats for at least one Arctic Grayling life stage (fry, juvenile, subadult/adult rearing, overwintering) across seven core areas of the Williston Reservoir watershed. Core area-specific maps of these segments are presented in the 2026 synthesis report along with a detailed appendix table containing descriptions and key references for each segment. Most importantly, these segments identify targets for potential recovery actions including habitat conservation, restoration, and enhancements. Geospatial data for stream segments are available on BC's Ecological Reports Catalogue, associated with the 2026 synthesis report (Hagen et al. 2026). The GIS spatial files provided the basis for defining spatial units for the analysis of limiting factors (Section 4).

4 What are Key Factors Limiting System Capacity Currently (What to Do)?

Knowledge of limiting factors affecting growth and survival of Arctic Grayling identifies what kinds of recovery actions are necessary. Because uncertainty around limiting factors is a cause for low investment in recovery actions in the upper Peace Basin (Legault 2025), the 2026 synthesis report features an analysis of six priority limiting factors using the newly-available *Cumulative Effects Modelling for Prioritizing Recovery Actions* (CEMPRA; Bayly et al. 2024) framework. The framework makes use of explicit hypotheses (stressor-response curves) about how varying magnitudes of stressors (threats and natural limiting factors) affect the productive capacity of the environment (system capacity), factored together with stressor magnitude data. Outcomes, expressed in terms of remaining system capacity as a percentage, can be used to specify limiting factors as targets for recovery action. To estimate cumulative effects across all stressors, outcomes are multiplied together. The six priority limiting factors, for which stressor-response curves could be delineated and stressor magnitude data compiled, were: 1) peak flow, 2) sediment and surface erosion, 3) fragmentation – culverts, 4) stream temperature – juveniles, 5) stream temperature – adults, and 6) angling mortality. Prioritization and derivation of stressor-response curves are presented in a detailed, technical appendix of the 2026 synthesis report.

Outputs of the cumulative effects modelling were computed for two spatial scales: 1) Arctic Grayling sub-basins, as defined by the critical habitats spatial layer (Figure 1), and 2) 1:20,000 Watershed Assessment Units (WAUs; BC Watershed Atlas) which correspond roughly to 3rd order watersheds (Figure 2).

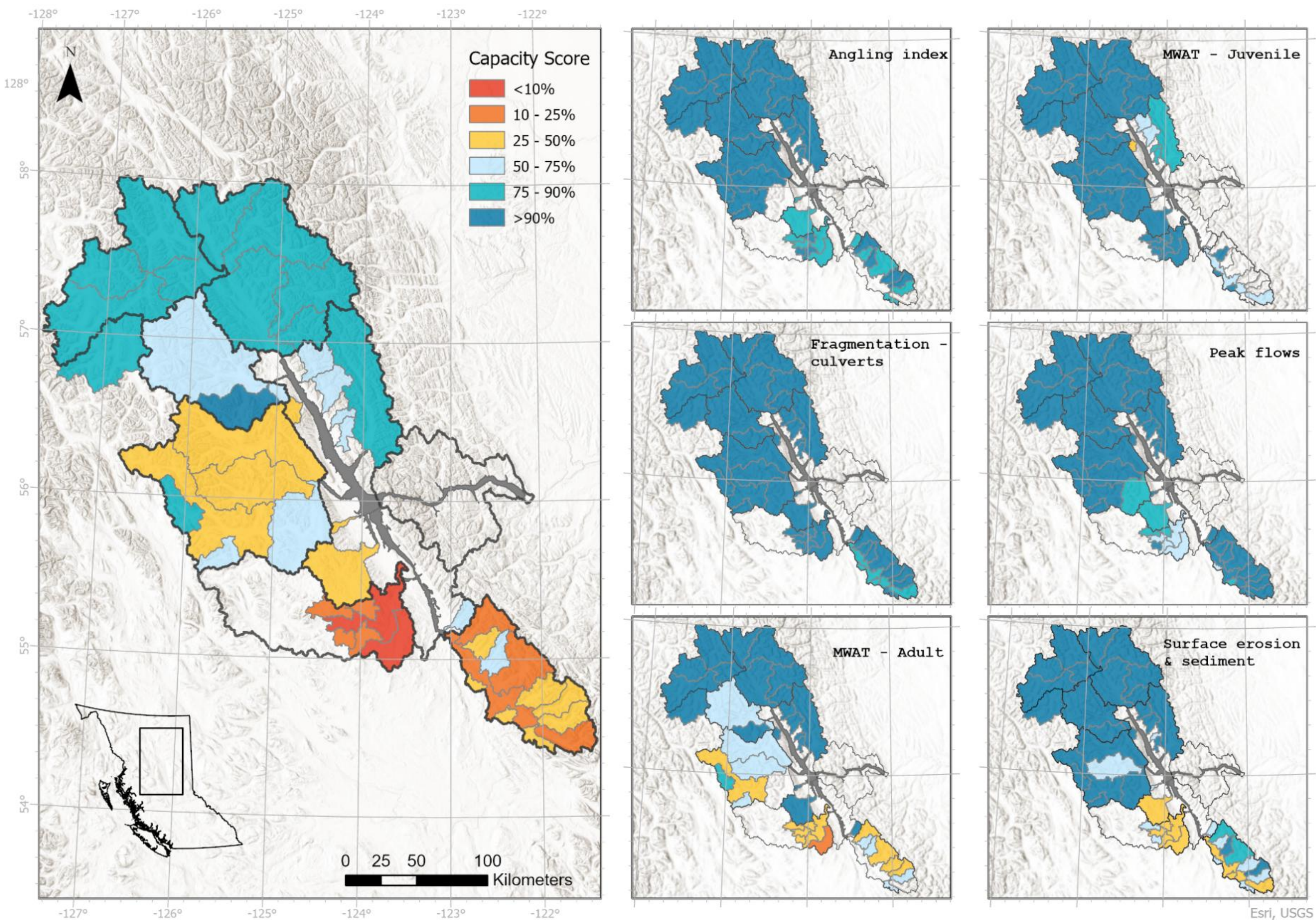

Figure 1. CEMPRA model outputs at the sub-basin scale. System capacity is shown in the left panel and the response scores of the individual stressor layers are shown on the right. Sub-basins with no system capacity scores are included within an Arctic Grayling core area but do not have any known critical habitats. The acronym MWAT refers to the maximum weekly average temperature. Prioritization of stressors and stressor-response curve development are detailed in Appendix B of Hagen et al. (2026).

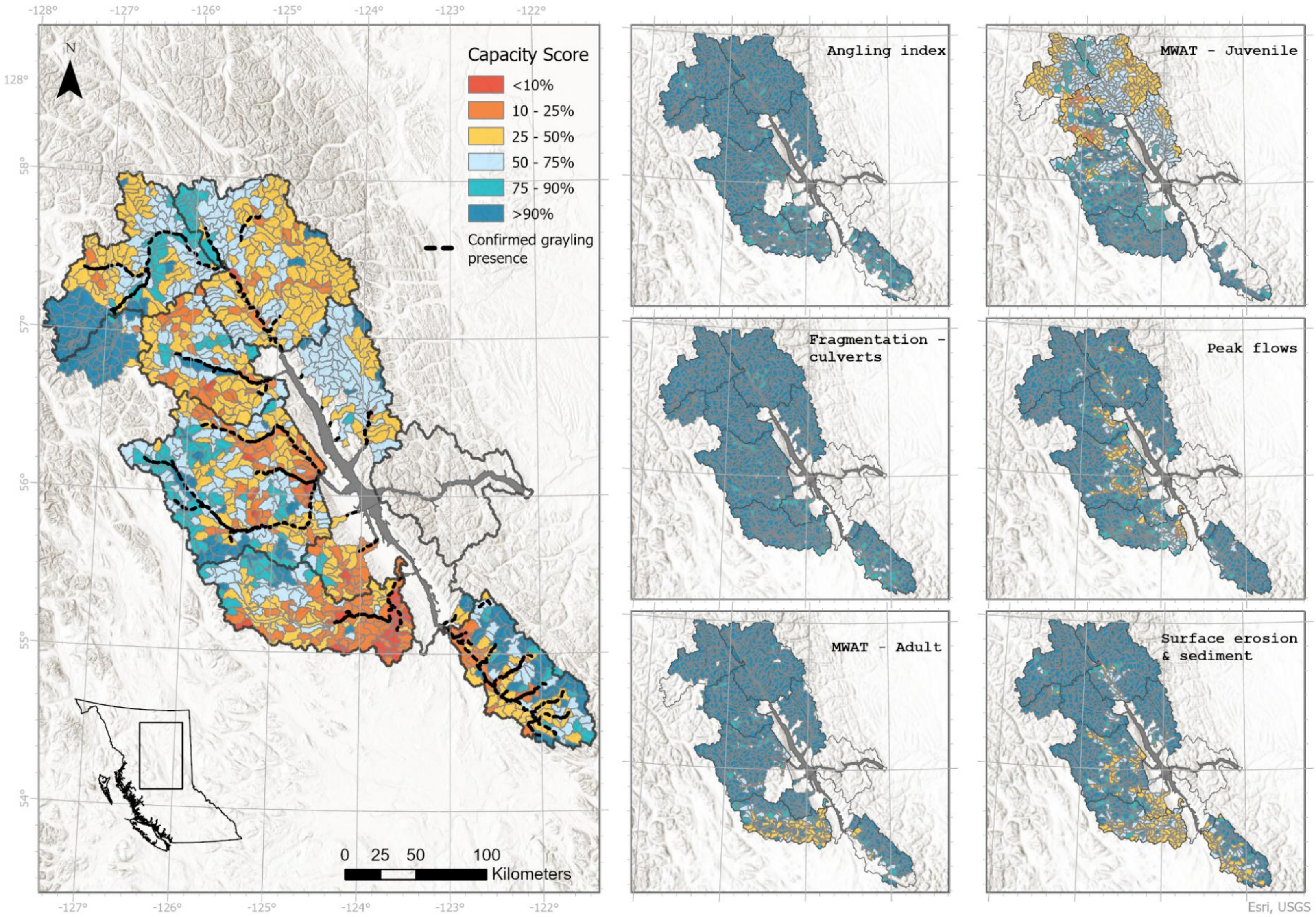

Figure 2. CEMPRA model outputs at the Watershed Assessment Unit (WAU) scale. System capacity is shown in the left panel and the response scores of the individual stressor layers are shown on the right. WAUs with no system capacity scores are included within an Arctic Grayling core area but are not within the watershed contributing area of any known critical habitat. The acronym MWAT refers to the maximum weekly average temperature. Prioritization of stressors and stressor-response curve development are detailed in Appendix B of Hagen et al. (2026).

Recovery actions can variously include conservation of habitat currently in good ecological condition, restoration of degraded habitats, and enhancements to boost population productivity. CEMPRA outcomes indicate candidate locations for habitat conservation (high system capacity scores) as well as for habitat restoration (high cumulative effects). Significant anthropogenic reductions to system capacity were indicated among sub-basins of the Parsnip, Nation, and Omineca core areas (Figure 1). In contrast, system capacity remains higher among sub-basins of the Ingenika, Lower Finlay, and Upper Finlay core areas. Flooding was not included as a stressor, but is known to have resulted in major effects on the Williston and Upper Peace core areas. Importantly, WAU-scale models depict much finer outputs and are therefore useful for more precisely locating targets for recovery actions (Figure 2), but may not accurately represent system capacity at the population scale.

Detailed tables of restoration priorities (low system capacity scores) and conservation priorities (high system capacity scores) are presented in the 2026 synthesis report. The CEMPRA rankings identify priority limiting factors and locations where they are expected to limit system capacity, but are not prescriptive about recovery actions. Next steps for practitioners will be to reference the priority stressors indicated by the model and to design an appropriate restoration plan(s). For example, if 'sedimentation and surface erosion' is indicated as a priority stressor for a given location, determining the appropriate restoration action will first require a site assessment of what is driving the GIS indicator (e.g., land use, post-fire erosion, unstable slopes, road crossings, etc.).

Other information presented in the 2026 synthesis report can also inform prioritization and recovery planning, notably:

1. the conservation status rankings indicating urgency,
2. the report tables providing descriptions of critical habitats and key references, and
3. a recommended strategy that prioritizes conservation of habitats in good ecological condition and restoration of degraded areas in unflooded core areas, over methods to recover populations threatened or lost because of flooded mainstem habitats in the Williston and Upper Peace core areas which will require further research.

5 Recommendations

1. Utilize CEMPRA results to focus restoration actions on watersheds with reduced system capacity for Arctic Grayling (e.g., Omineca, Nation, and Parsnip core areas).
2. Where possible, coordinate with ongoing restoration and enhancement actions and other initiatives (e.g., BC Hydro Water Use Plan; Forest Landscape Planning) under watershed-based recovery plans.
3. Include effectiveness monitoring in plans for recovery actions, which will improve effectiveness of future actions and help to close remaining data gaps on species and limiting factors.

4. Conduct population monitoring in the Nation, Lower Finlay and Upper Finlay core areas to identify conservation status and refine knowledge of critical habitats and population limitation.
5. Improve understanding about the importance of small streams to Arctic Grayling spawning and early life history.
6. Determine the feasibility and genetic implications of non-habitat-based restoration levers (i.e., translocation or remote site incubation).

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