Arctic Grayling (*Thymallus arcticus*)
Conservation Status Rank Summary

February 14, 2024

For details on assessment and ranking methodology, see: *Conservation Status Assessment Definitions, Process, Rank Factors, and Calculation of State Ranks for Montana Species*

Rarity and Trends

Rank Factor	Date Assessed	Value	Score	Data Source	Comments
Rarity					
Range Extent	2024-02-14	Y: 9479.2 km²	3.140	MTNHP Range Maps	None
Area of Occupancy			-		Factor not used in ranking.
Number of Occurrences	2024-02-14	63	2.750	MTNHP Databases	None
Population Size			-		Factor not used in ranking.
# of Occurrences in Good Condition			-		Factor not used in ranking.
% of Area Occupied in Good Condition			-		Factor not used in ranking.
Environmental Specificity			-		Factor not used in ranking.
Rarity is calculated by averaging weighted factor scores: **((3.14 × 1) + (2.75 × 1)) / 2 = 2.95**					
Trends					
Short-term Trend	2024-02-14	-69.0%	[-0.310, -0.220]	Reinert et al. 2021;MAGWG 2022	Big Hole: Reinert et al. 2021 (2012-2021: 0.505 based on regression of Nb estimates) Centennial Valley: MAGWG 2022 (2013-2022: 0.07 based on Red Rock Creek abundance estimates) Ruby River: MAGWG 2022 (2010-2015: 0.29 based on change of Nb estimates) I then calculated the weighted average of all three population trends where the approx. occupied stream length for that population was the weight...very similar to unweighted average.
Long-term Trend	2024-02-14	-80.0%	[-0.400, -0.310]	Kaya 1992	Kaya (1992) estimated 1250 miles were historically occupied, I added the occupied stream lengths of the Big Hole, Centennial Valley, Ruby, and Gallatin populations (populations from MAGWG 2022): ~251 miles now occupied
Trends score is calculated by summing weighted short and long-term trend scores: **(([-0.31, -0.22] × 2) + ([-0.40, -0.31] × 1)) = [-1.02, -0.75]**					

Threats

Rank Factor	Date Assessed	Value	Score	Data Source	Comments
Threats					
Overall Threat Impact		Very high - high	[0.000, 1.830]		None
Intrinsic Vulnerability			-		Factor not used in ranking.
Threat score is calculated from Overall Threat Impact when available or Intrinsic Vulnerability if not: **([0.00, 1.83]) = [0.00, 1.83]**					

Individual Threats Data

Threat Category	Date Assessed	Impact Score	Scope	Severity	Immediacy	Comments
Invasive & Other Problematic Species, Genes & Diseases	2024-02-14	Medium - Low	Large	Moderate-Slight	High	Identified as threat by McCullough 2017 - Brown Trout present in all AGR range except Centennial Valley. Projected losses were estimated from appendix C in McCullough 2017
Climate Change & Severe Weather	2024-02-14	High	Pervasive	Serious	High	Habitat degradation from warming water temperatures
Other Threats	2024-02-14	Medium	Restricted	Extreme	High	Centennial Valley populations have largely declined due to slow eutrophication of Upper Red Rock Lake leading to low oxygen in winter (Davis et al. 2019) - plans to install aerators have been halted due to lawsuits. Given the steep decline of the CV population, estimate of near 0 suitable overwintering habitat in 2022/23 (Warren et al. 2023), it is likely this population will be extirpated without swift intervention.
Threat Tally: 0 - Very High, 1 - High, [1,2] - Medium, [0,1] - Low Overall Threat Impact* = Very high - high						

*See Conservation Status Assessment Definitions, Process, Rank Factors, and Calculation of State Ranks for Montana Species for calculation of Overall Threat Impact based on the number and impact of individual threats.

Conservation Status Rank Calculation

Raw score

Rarity: (2.95 × 70%) + Threats: ([0.00, 1.83] × 30%) + Trends: ([-1.02, -0.75]) = [1.04, 1.86]

Calculated Rank: S1S2

Accepted Rank	S1
Date Approved	Date Unknown
Approval Authority	Legacy Assessment: MTNHP Staff
Rank Justification	Species is declining and faces numerous threats likely to impact persistence and habitat suitability

Supplementary Information

Montana Natural Heritage Program. 2021. Conservation Status Assessment Definitions, Process, Rank Factors, and Calculation of State Ranks for Montana Species. 18 p.
https://mtnhp.mt.gov/docs/Montana_State_Rank_Criteria_20211201.pdf

Montana Field Guide Species Account:
https://fieldguide.mt.gov/speciesDetail.aspx?elcode=AFCHA07010

Predicted Suitable Habitat Model:
https://mtnhp.mt.gov/resources/models/?elcode=AFCHA07010

Information Needs

Information needs are assessed by considering the availability of factors used to assess species status as well as the quality of these assessments. Current information availability and quality to inform Conservation Status Rank for this species are highlighted.

Rank Factor	Assessment Category	Value	Criteria
General Status	Status Quality	Adequate	Calculated rank has low uncertainty and is represented by a single rank (e.g. S3); accepted rank may be adjusted to a range rank (e.g. S2S3)
		Poor	Rank assessed as SU or calculated rank has notable uncertainty and corresponds to a range rank with 2 or more values (e.g. S2?, S1S3, or S4S5)
Rarity	Range Quality	Adequate	Range polygon adequately represents area of probable occupancy and does not include substantial unoccupied areas; range may be adequately defined and still include areas of unsuitable habitat (e.g. mountain ranges for plains species)
		Marginal	Range polygon defined, but may include or exclude notable areas where the species may or may not occur on the landscape
		Poor	Range polygon not defined
	Habitat Quality	Adequate	Species-habitat relationship is well-defined (e.g. relevant literature or robust habitat model available)
		Marginal	Understanding of species-habitat relationship is adequate among some but not all habitats (e.g. literature covers similar habitats outside of Montana or habitat model performance is only somewhat adequate)
		Poor	Species-habitat relationship is not well understood
Threats	Threat Quality	Adequate	Threat Impact is a single value (including "Unthreatened")
		Marginal	Threat Impact assessed at more than one value (e.g. "High - Medium")
		Poor	Threat Impact is Unknown but Intrinsic Vulnerability is assessed
		Unknown	Threat Impact is Unknown and Intrinsic Vulnerability is not assessed
Trends	Recency	Current	Short-term Trend assessment date less than 10 years old
		Out of Date but Adequate	Short-term Trend assessment date is more than 10 years old or Unknown, but species is Unthreatened
		Out of Date	Short-term Trend assessment date more than 10 years old
		Not Available	Short-term Trend data are not available
	Trend Quality	Sufficient	Short-term Trend assessed at a single value or multiple values with a minimum trend greater than -10% (stable or increasing)
		Unknown but Sufficient	Short-term Trend is Unknown, but species is Unthreatened
		Poor	Short-term Trend is less than -10% (in decline) with two or more values selected
		Unknown	Short-term Trend is Unknown

Summary of Information Availability

Information to assess status is available

Summary of Information Needs

No further information is needed

Additional Threat Details

The table below contains the complete threats assessment for this species. While the Conservation Status Rank Calculation is based on cumulative, broadly categorized (Level 1) threats data, threats are assessed and tracked for more specifically categorized (Level 2) threats when available.

Threat Category	Date Assessed	Assessed By	Data Source	Scope	Severity	Imme-diacy	Comments
Agriculture & Aquaculture - 2.3 - Livestock Farming & Ranching	2024-02-14	Niall Clancy	Montana Arctic Grayling Working Group 2022	Large	Unknown	High	Habitat degradation through dewatering
Biological Resource Use - 5.4 - Fishing & Harvesting Aquatic Resources	2024-02-14	Niall Clancy	Montana Arctic Grayling Working Group 2022	Large	Unknown	High	Identified as threat in MAGWG 2022- I considered entire native range except Centennial Valley where there are fishing closures to prevent catch during spawning of adfluvial population. Unknown catch rates or mortality.
Invasive & Other Problematic Species, Genes & Diseases - 8.1 - Invasive Non-Native/Alien Species/Diseases	2024-02-14	Niall Clancy	McCullou gh 2017	Large	Moderate-Slight	High	Identified as threat by McCullough 2017 - Brown Trout present in all AGR range except Centennial Valley. Projected losses were estimated from appendix C in McCullough 2017
Climate Change & Severe Weather - 11.1 - Habitat Shifting & Alteration	2024-02-14	Niall Clancy	Clancy et al. in review	Pervasive	Serious	High	Habitat degradation from warming water temperatures
Other Threats - 12.1 - Other Threat	2024-02-14	Niall Clancy	Davis et al. 2019	Restricted	Extreme	High	Centennial Valley populations have largely declined due to slow eutrophication of Upper Red Rock Lake leading to low oxygen in winter (Davis et al. 2019) - plans to install aerators have been halted due to lawsuits. Given the steep decline of the CV population, estimate of near 0 suitable overwintering habitat in 2022/23 (Warren et al. 2023), it is likely this population will be extirpated without swift intervention.