AMIP Early Warning Triggers – Updated Spawn Year 2024 Baseline Abundance Thresholds for Upper Columbia River, Middle Columbia River and Snake River Stocks

Technical Memorandum

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Date	01 October, 2025
Subject	AMIP Early Warning Triggers – Updated Spawn Year 2024 Baseline Abundance Thresholds for Upper Columbia River, Middle Columbia River and Snake River Stocks

The Yakama Nation and Nez Perce Tribe are federally recognized tribes with reserved treaty-rights to take fish at all usual and accustomed areas. The right to harvest fish includes the responsibility to protect, manage, and enhance treaty fishery resources. As anadromous fish mangers, we conduct and contribute to fish population status monitoring. This memorandum updates the Adaptive Management Implementation Plan (AMIP) trigger analysis through spawn year 2024 for natural-origin adult anadromous fish returning to the Upper Columbia, Middle Columbia, and Snake River basins. The analysis was last completed and presented to the Regional Implementation and Oversight Group (RIOG) on February 4th, 2020, by Josie Thompson and Ritchie Graves of National Marine Fisheries Service (NMFS). Their 2020 analysis found recent returns for Upper Columbia spring Chinook, Upper Columbia steelhead, and Snake River steelhead below AMIP abundance and trend thresholds in some years.

The updated analysis completed below evaluates adult returns through spawn year 2024 for Upper Columbia spring (sp) Chinook, Upper Columbia Steelhead, Middle Columbia Steelhead (Yakima River), Snake River fall Chinook, Snake River spring/summer (sp/su) Chinook, and Snake River steelhead stocks. The updated analysis uses the best available abundance series as agreed upon by local and regional fisheries managers and described below. The methods used to recalculate AMIP abundance and trend triggers follows the original approach outlined in Appendix 4 of the 2009 AMIP document[1] and in the 2018 Federal Columbia River AMIP indicator

[1] Adaptive Management Implementation Plan, Appendix 4. Development Concepts for the Significant Decline

and trigger update document.[2]

Background

To address uncertainty and concerns with the 2008 Federal Columbia River Power System Biological Opinion (2008 BiOp), the National Oceanic and Atmospheric Administration (NOAA) developed abundance indicators and triggers that would detect significant deviations from the biological expectations of the 2008 BiOp.[3]

> "Specifically, the scientists suggested that additional triggers be developed that would be sensitive to 1) unexpected declines in adult abundance and 2) environmental disasters or environmental degradation (either biological or environmental) in combination with preliminary abundance indicators. They further advised that these triggers should be based on simple metrics that are readily available."[4]

The Early Warning and Significant Decline triggers in the 2008 BiOp were intended to prompt Rapid Response Actions and to "alert and focus more attention on potentially vulnerable species."[5] Triggers are defined as:

- Early Warning Indicator. Reached if the 4-year average abundance of naturally produced adult fish falls within the lowest 20% of returns during the Base Period (i.e., 80% of prior 4-year averages were higher).
- Significant Decline Trigger: This trigger is reached if the 4-year average abundance of naturally produced adult fish falls into the lowest 10 percent of fish returns during the Base Period (i.e., if 90 percent of the prior 4-year averages were higher than this number).
- Abundance Trend Trigger: This trigger is reached if the 4-year average abundance of naturally produced adult fish falls into the lowest 50 percent of returns during the Base Period (i.e., if 50 percent of the prior 4-year averages were higher than this number); and the trend in abundance (defined as the slope of the last 5 years of annual abundance estimates) falls into the lowest 10 percent of abundance trends in the Base Period (i.e., if 90 percent of the prior 5-year trends or slopes were higher than this number). This trigger could prompt either an Early Warning Indicator or a Significant Decline Trigger.

Triggers and Early Warning Indicators. 2019.

[2] Federal Columbia River Power System Biological Opinion Adaptive Management Implementation Plan: Biological Indicator and Triggers Update, March 2018

[3] Adaptive Management Implementation Plan, Appendix 4. Development Concepts for the Significant Decline Triggers and Early Warning Indicators. 2019.

[4] Ibid.

[5] Ibid.

Abundance Datasets

We could not obtain the original abundance time series used in the AMIP analysis. Based on available documentation, those series appear to have been derived from Columbia River Technical Advisory Committee (TAC) run-reconstruction estimates for all evaluated stocks. In this update, we retained TAC estimates for select stocks; for the others, we used time series jointly endorsed by local and regional fisheries managers as the best available representations of escapement. The datasets used in the updated analysis are described below.

Upper Columbia Spring Chinook

Escapement at Rock Island Dam was taken from the 2025 Joint Columbia River Staff Report (Joint Coumbia River Management Staff, 2025, Table 7, p. 68). These data correspond to the series referenced in AMIP Appendix 4 and are believed to match the series NOAA used in its 2020 update.

Upper Columbia Steelhead

Escapement at Priest Rapids Dam (natural-origin) was provided by WDFW. Estimates for 1986–2009 derive from stock-assessment sampling; 2010–present use the Upper Columbia Patch Occupancy Model to estimate escapement to four populations (Wenatchee, Entiat, Methow, Okanogan) and exclude overshooters from downriver populations (Murdoch, See, and Truscott, 2022; Waterhouse et al., 2020). The exact time series used in the original AMIP analysis for UC steelhead is not documented.

Middle Columbia Steelhead

Per AMIP Appendix 4 (2009), Prosser Dam counts are used for the Yakima River MPG of Mid-Columbia River steelhead (natural-origin).

Snake River Stock Abundance

For Snake River fall Chinook, spring/summer Chinook, and steelhead, we used annual returns to Lower Granite Dam (LGR) from the Idaho Department of Fish and Game Master Dam Count compilation (Beeken et al., 2024). Fall Chinook estimates follow run reconstruction methods that combine LGR window counts with adult trap sampling (William Young et al., 2025). For natural-origin spring/summer Chinook and steelhead, adult abundance was derived from size-specific window counts prior to 1998; beginning in 1998, adult fractions from LGR trap samples were applied to window counts. Since 2022, IDFG's EASE model has first adjusted window counts using PIT-tag detections (to account for non-operation periods, fallback, and re-ascension) and then applied trap-based adult proportions to estimate total adult returns (Baum et al., 2023).

Summary and Results

Updated early warning abundance indicators and significant decline triggers are summarized as the 50%, 80%, and 90% exceedances thresholds in Table 1. Across the last decade (2015-2024), the six indicator stocks (60 stock-years) analyzed met AMIP abundance or trend based triggers during 15 return years (Figure 1). Upper Columbia River steelhead stocks reached the early warning indicators in 2017 and 2018. Upper Columbia sp Chinook fell below the early warning in 2019 and 2020. Middle Columbia steelhead have experienced abundance returns below the 80% early warning indicator for the last three return years (2022-2024). Snake River sp/su Chinook have been below the early warning indicator three times (2019-2021). And the Snake River steelhead stock has experienced the greatest number of years meeting the AMIP thresholds, with five years (2019-2023) below the early warning indicator and one year (2020) also falling below the significant decline trigger. Snake River fall Chinook did not meet any trigger during this period.

Table 1: *AMIP trigger thresholds derived from 1980–2007 escapement estimates of natural-origin adults at Lower Granite Dam, compiled by the Idaho Department of Fish and Game. Thresholds include abundance-based triggers (50%, 80%, and 90% exceedance values of 4-year moving average abundance) and slope-based triggers (90% exceedance values of 5-year moving window slopes of natural-log–transformed escapement).*

Stock	50% Exceedance	80% Exceedance	90% Exceedance	Slope 90% Exceedance
Snake River Fall Chinook	512	318	257	-0.209
Snake River Sp/su Chinook	9514	6628	4317	-0.348
Snake River Steelhead	20350	12193	8755	-0.215
Mid-Columbia Steelhead	1625	1096	799	-0.308
Upper-Columbia Sp Chinook	2317	1126	473	-0.376
Upper-Columbia Steelhead	2435	1046	894	-0.224

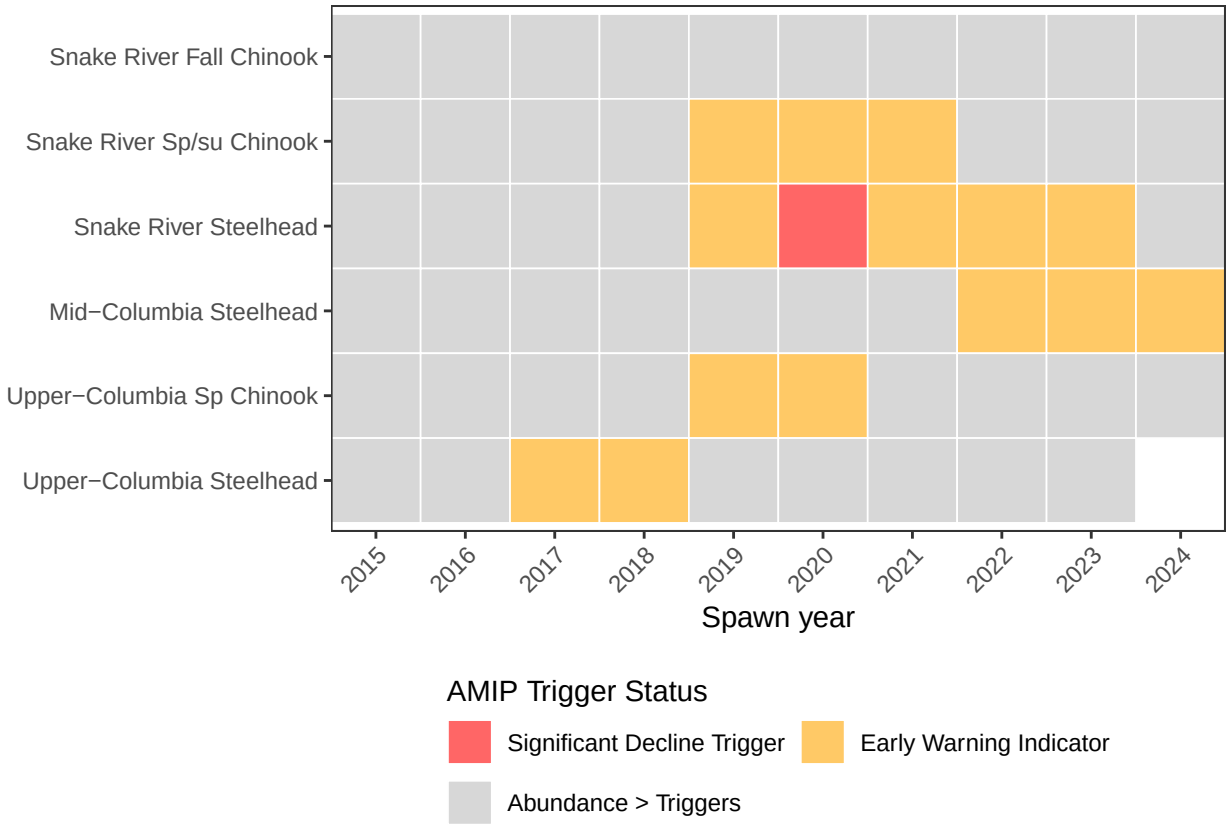

Figure 1: *Abundance returns for six upper Columbia, middle Columbia, and Snake River stocks have fallen below AMIP early warning indicator and significant decline triggers on 15 occassions in the last decade (2015-2024).*

Supplemental Information

Supporting figures for this summary are provided below. Figures 2, 3, and 4, show the baseline empirical cumulative distribution functions (ECDFs) with the AMIP exceedance thresholds overlaid (i.e., the trigger levels summararized in Table 1). Figures 5, 6, and 7 plot the exceedance (1 - ECDF) for each stock's four-year average abundance and five-year trend during the 2015-2024 period. The full abundance time series are shown in Figures 8, 9, 10, 11, 12, and 13, and the corresponding trends (the five-year slope of the log-transformed abundance) appear in Figures 14, 15, and 16.

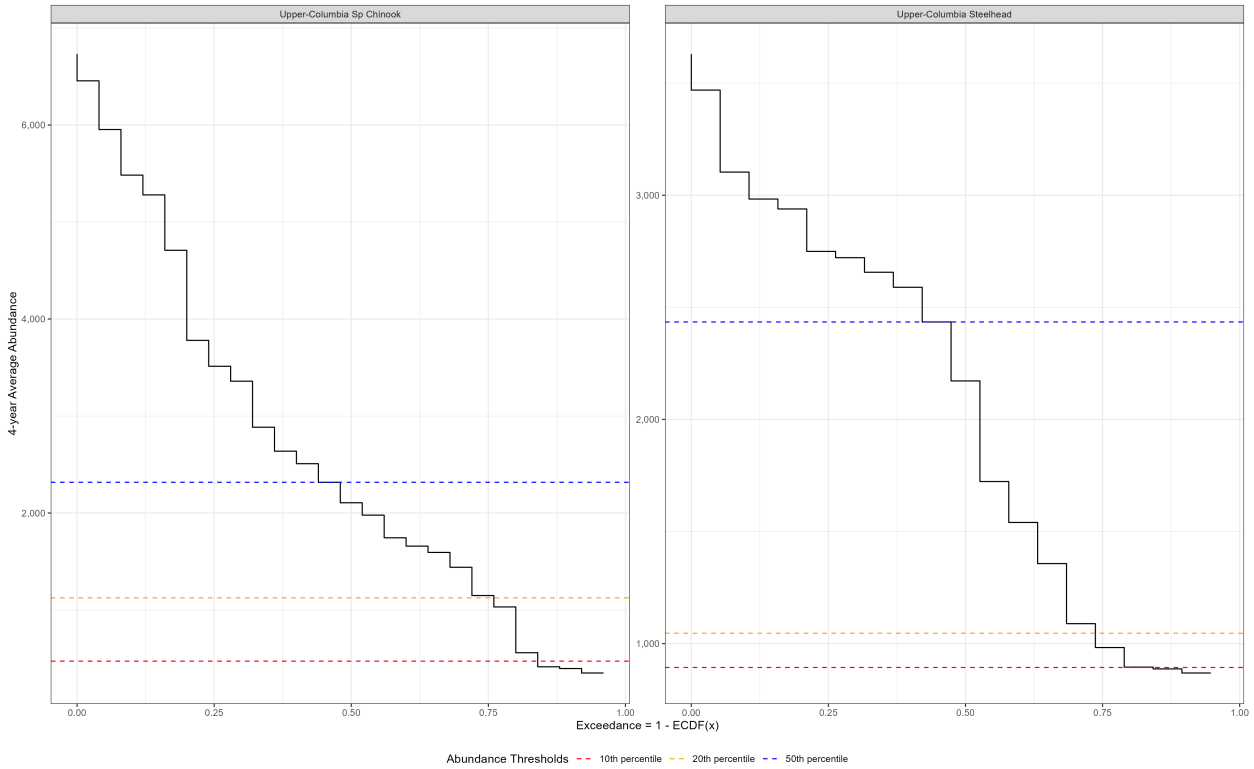

Figure 2: *Exceedance curves plotted as 1 - ECDF (empirical cumulative distribution function) of the 4-year moving averages of natural-origin adult spring Chinook and steelhead returning to the upper Columbia from 1980-2007.Abundance-based triggers (50%, 80%, and 90% exceedance values) are shown as horizontal lines.*

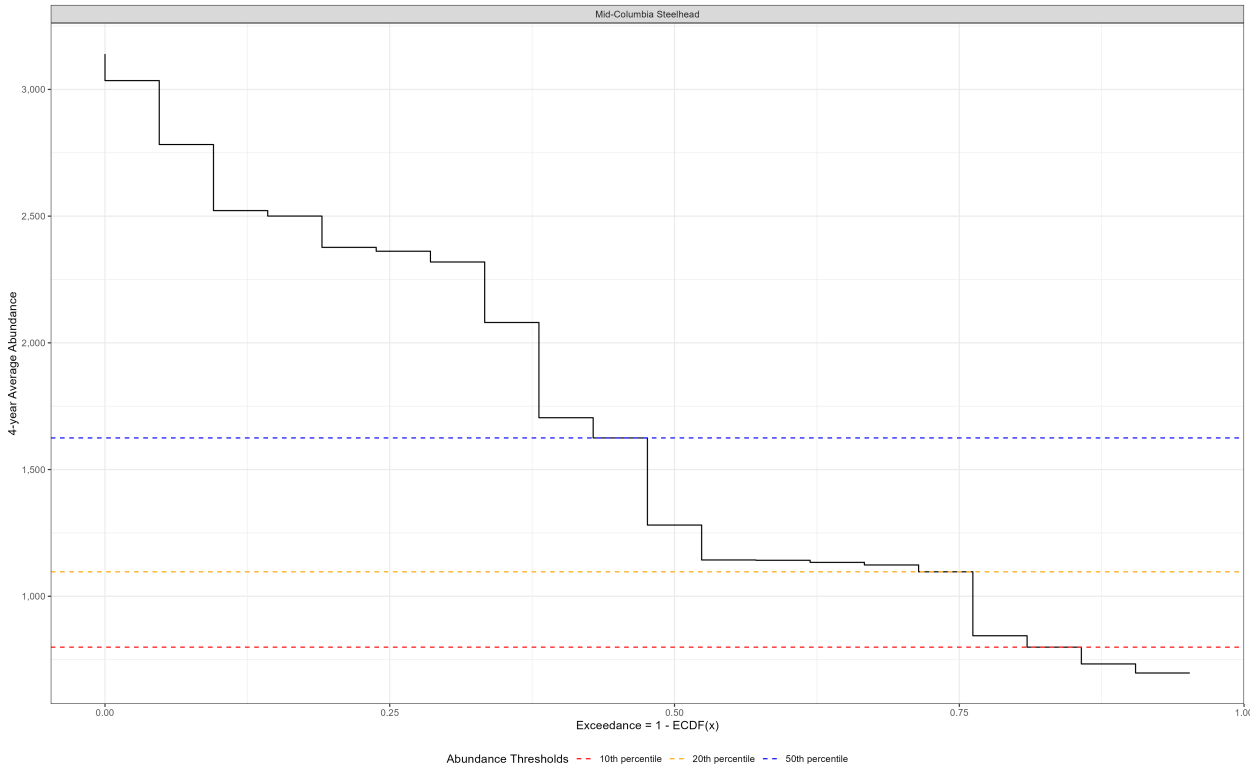

Figure 3: *Exceedance curves plotted as 1 - ECDF (empirical cumulative distribution function) of the 4-year moving averages of natural-origin adult steelhead returning to the middle Columbia (Yakima River) from 1980-2007.Abundance-based triggers (50%, 80%, and 90% exceedance values) are shown as horizontal lines.*

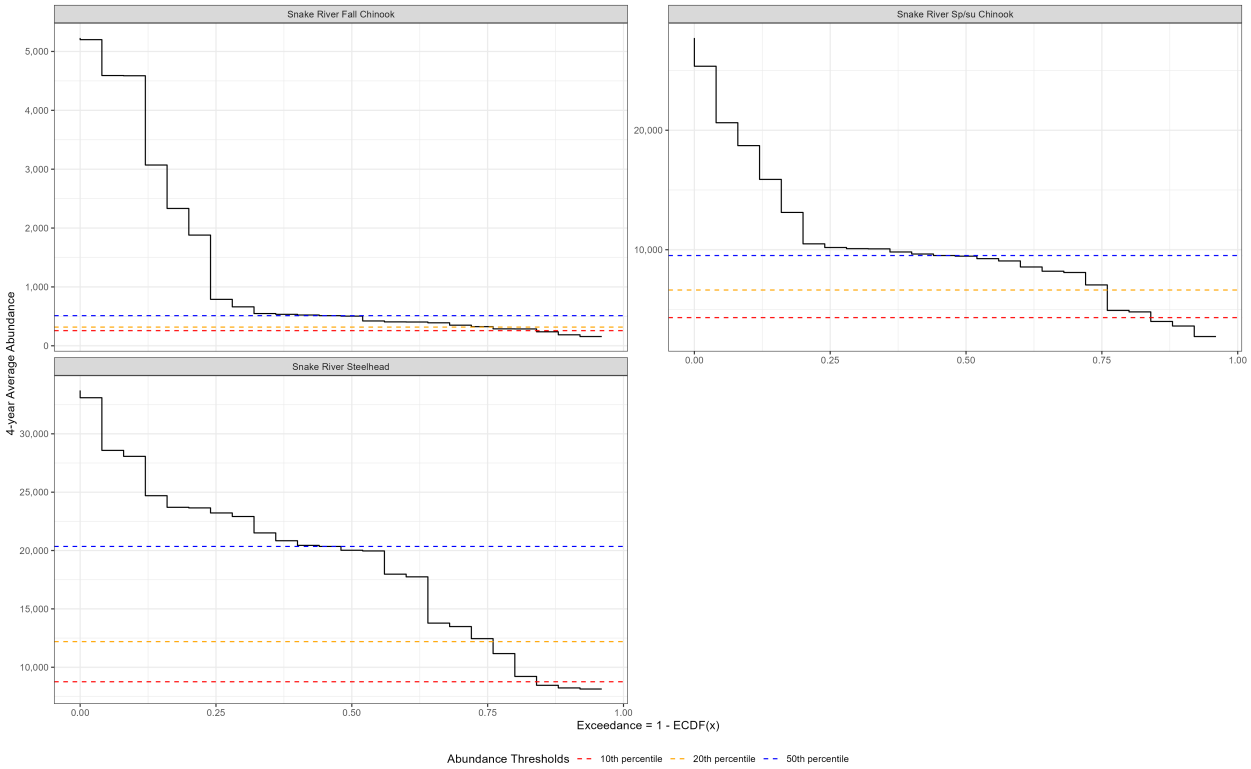

Figure 4: *Exceedance curves plotted as 1 - ECDF (empirical cumulative distribution function) of the 4-year moving averages of natural-origin adult abundance passing Lower Granite Dam from 1980-2007.Abundance-based triggers (50%, 80%, and 90% exceedance values) are shown as horizontal lines.*

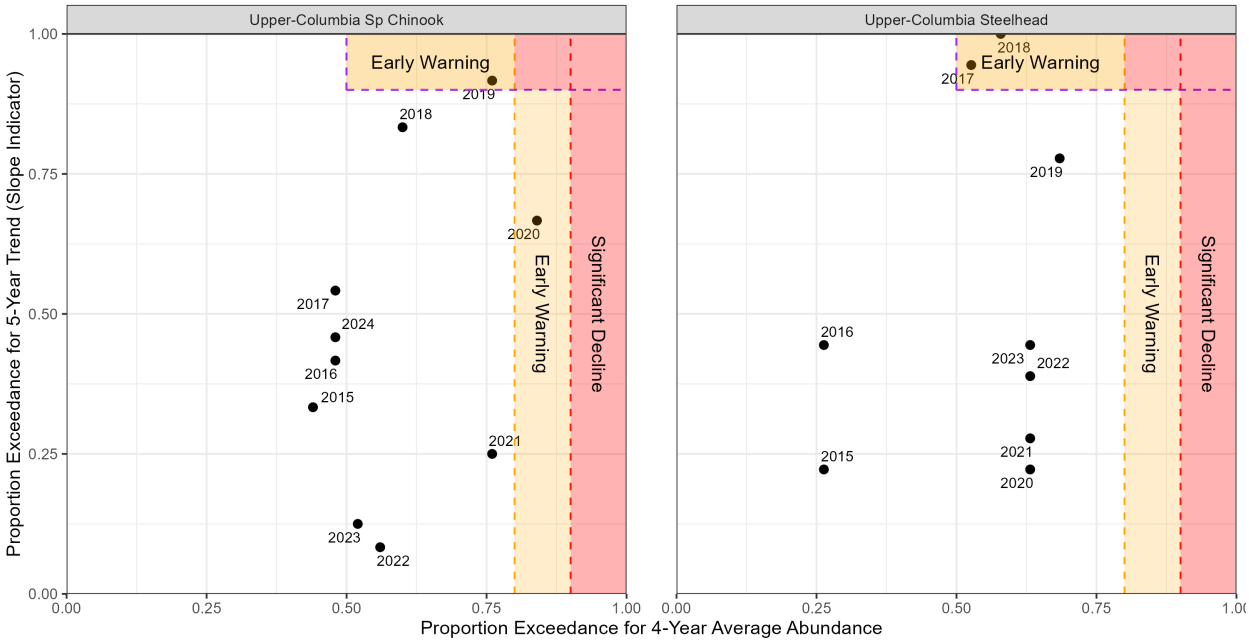

Figure 5: *Scatterplot of natural-origin adult upper Columbia spring Chinook and steelhead returns from 2015 to the present, positioned within the percentile space defined by 4-year moving average abundance (x-axis) and 5-year moving window slopes (y-axis). Shaded regions denote AMIP trigger thresholds.*

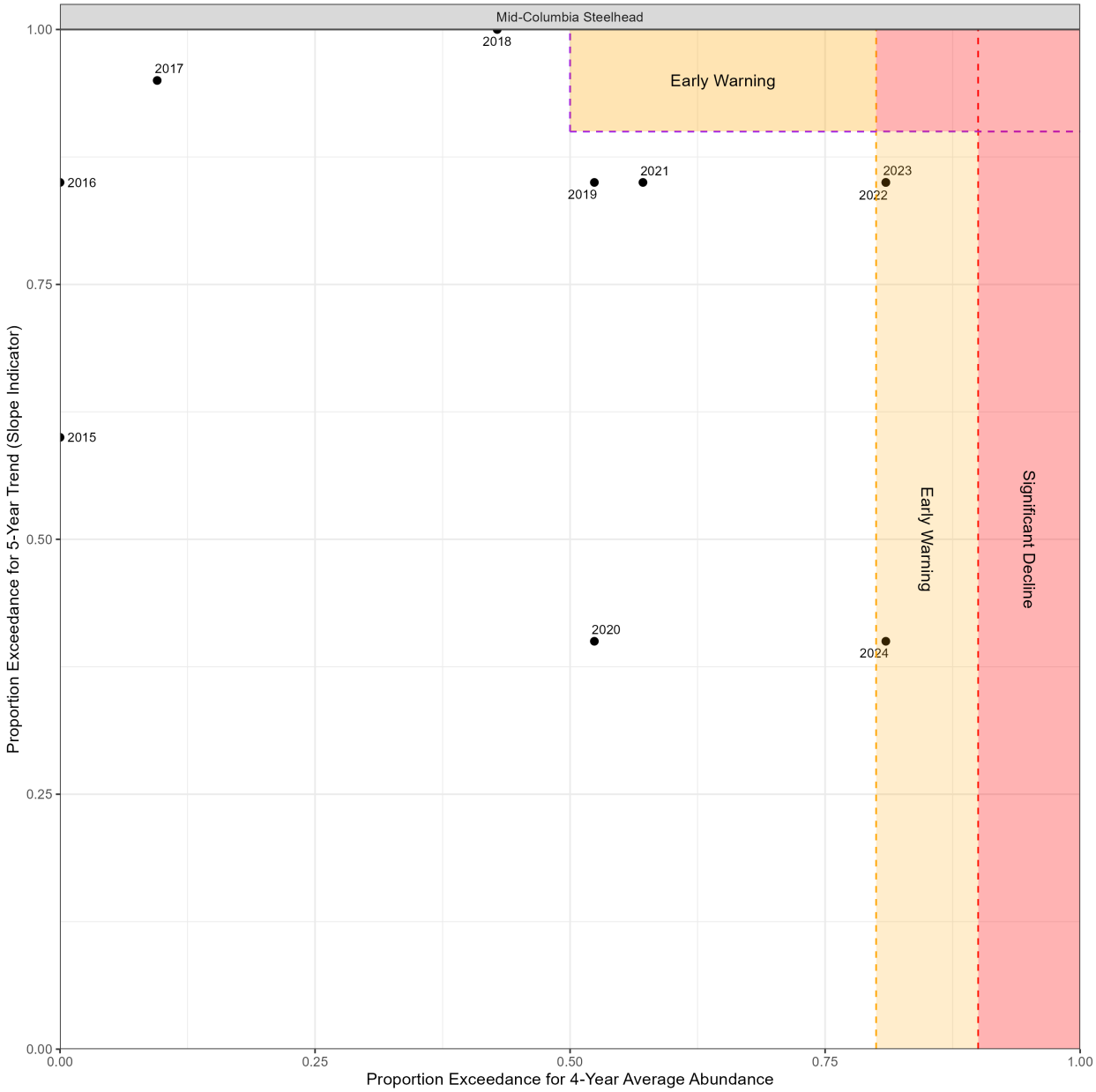

Figure 6: *Scatterplot of natural-origin adult middle Columbia steelhead (Yakima River) returns from 2015 to the present, positioned within the percentile space defined by 4-year moving average abundance (x-axis) and 5-year moving window slopes (y-axis). Shaded regions denote AMIP trigger thresholds.*

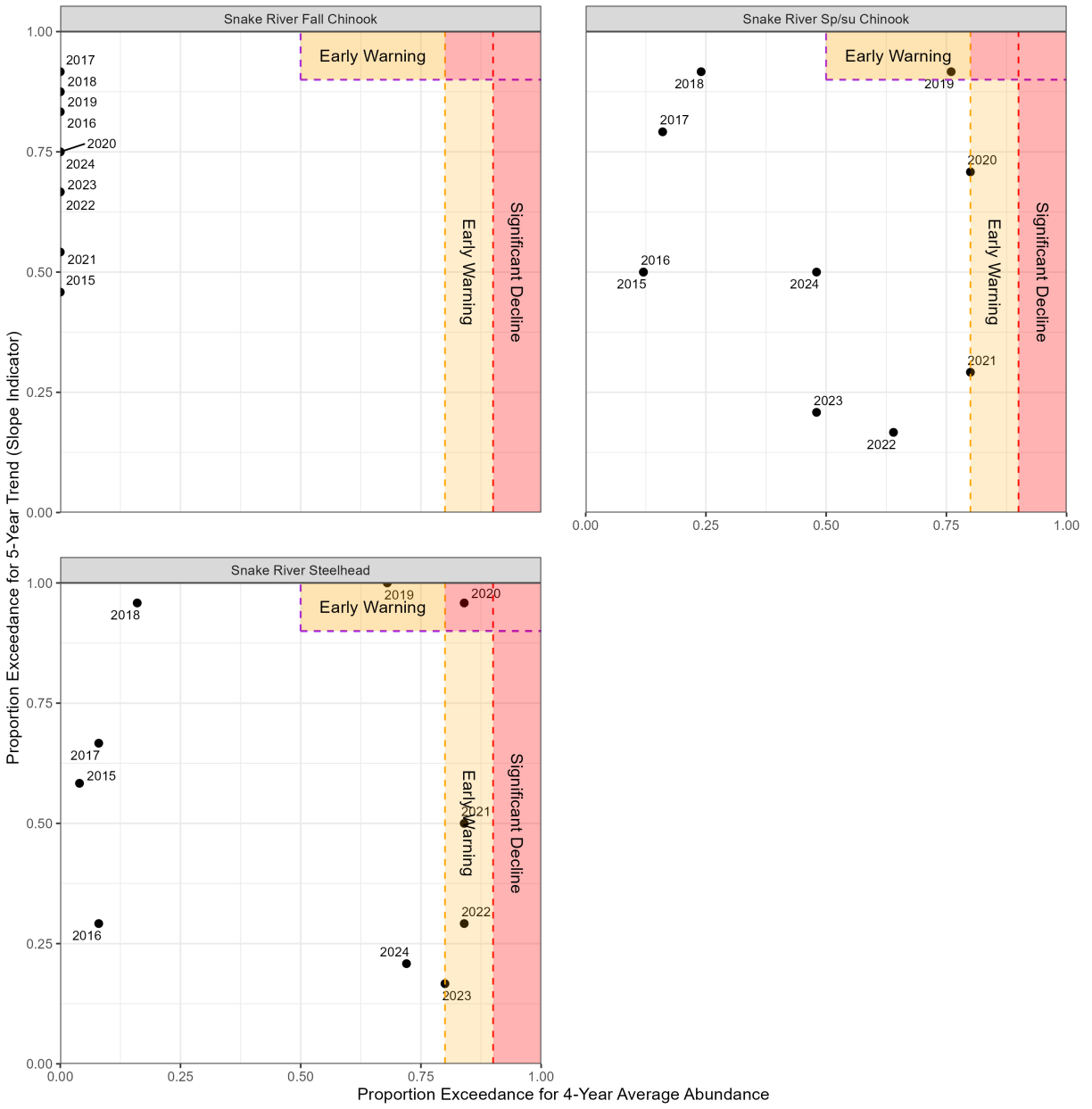

Figure 7: *Scatterplot of natural-origin adult Snake River fall Chinook, sp/sm Chinook, and steelhead returns from 2015 to the present, positioned within the percentile space defined by 4-year moving average abundance (x-axis) and 5-year moving window slopes (y-axis). Shaded regions denote AMIP trigger thresholds.*

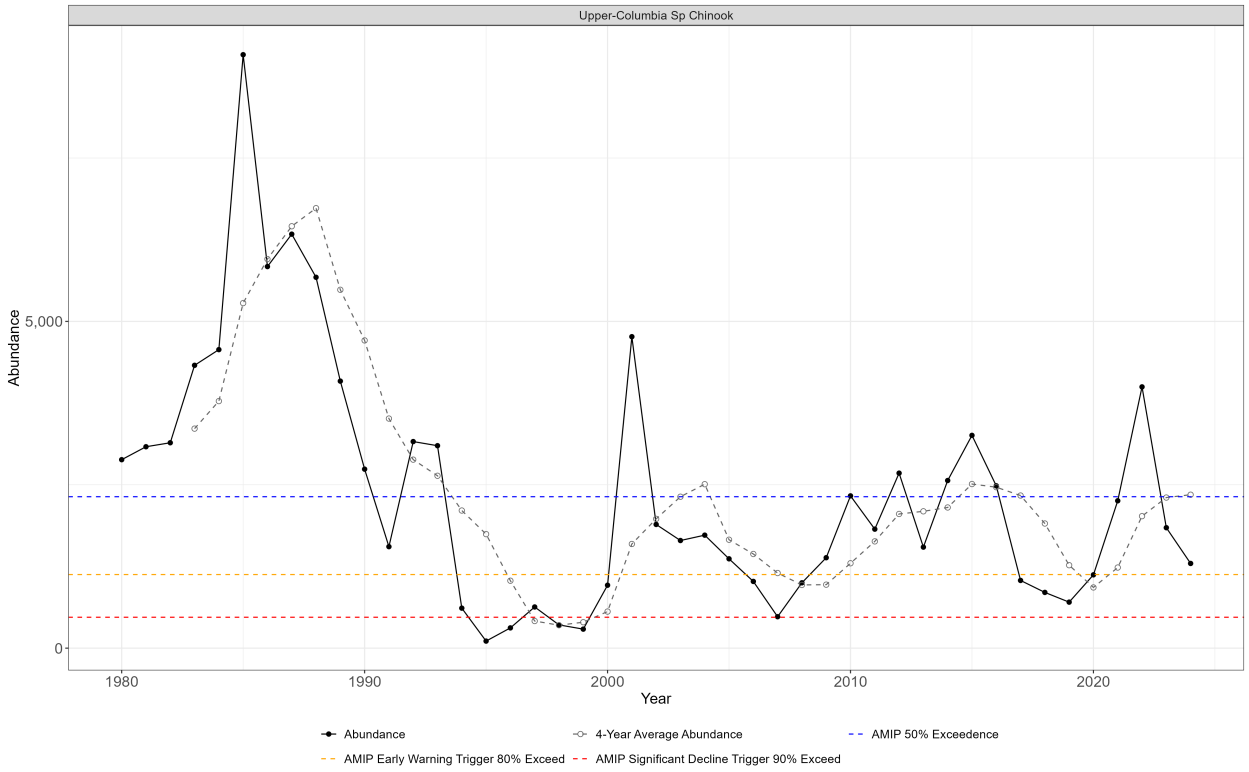

Figure 8: *Natural-origin adult upper Columbia spring Chinook escapement to Rock Island Dam, showing 4-year moving averages with AMIP trigger thresholds overlaid.*

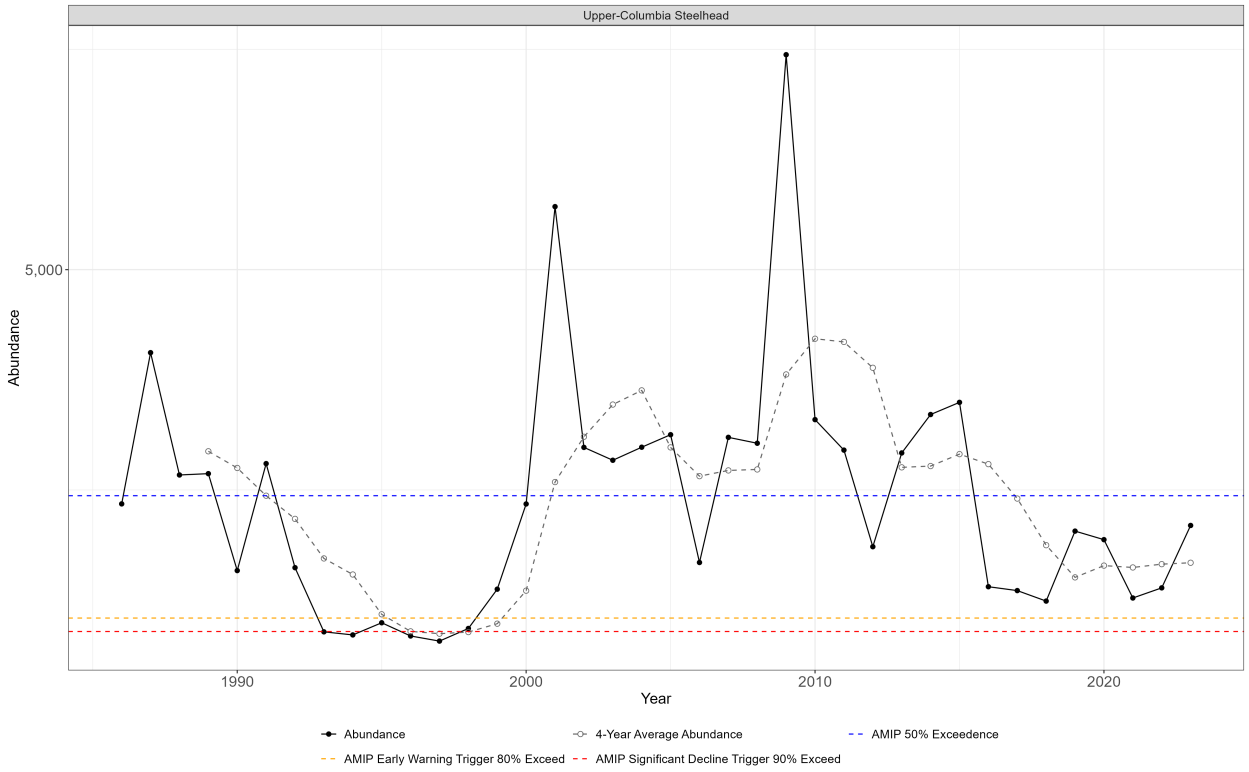

Figure 9: *Natural-origin adult upper Columbia steelhead escapement to Priest Rapids Dam, showing 4-year moving averages with AMIP trigger thresholds overlaid.*

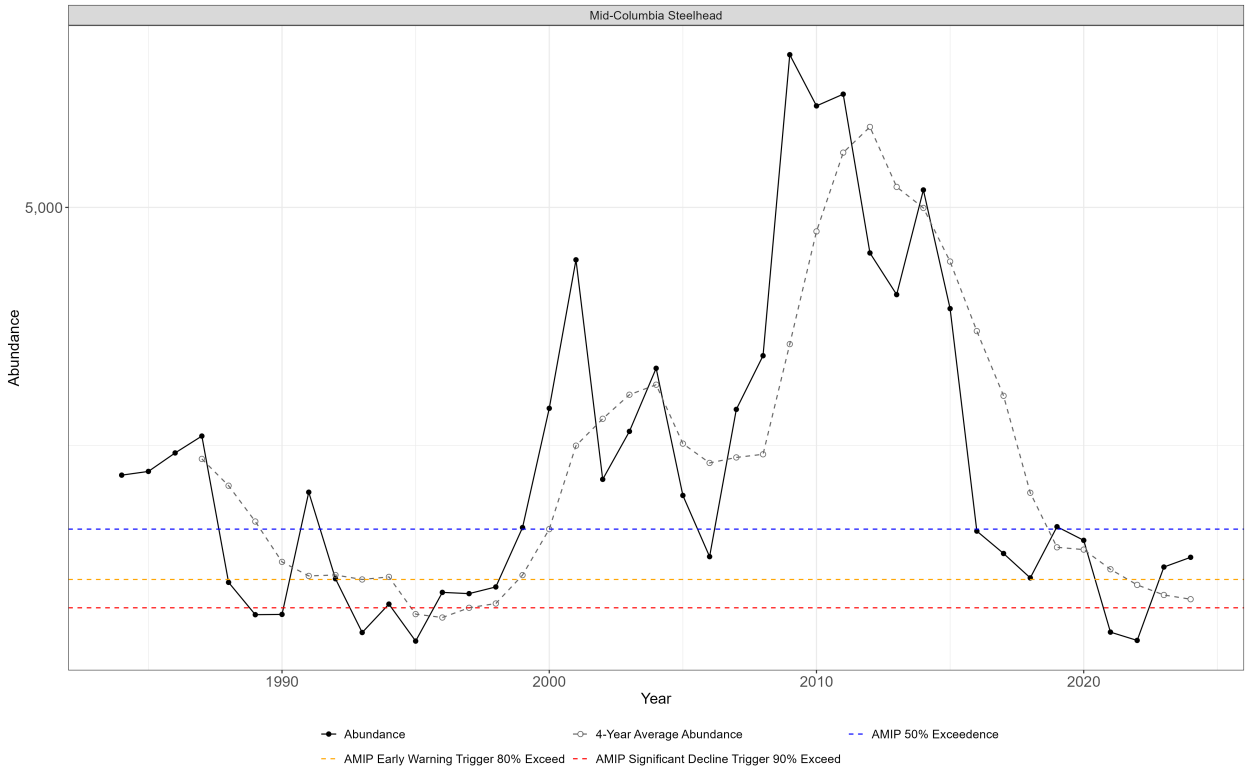

Figure 10: *Natural-origin adult middle Columbia steelhead escapement (Yakima River), showing 4-year moving averages with AMIP trigger thresholds overlaid.*

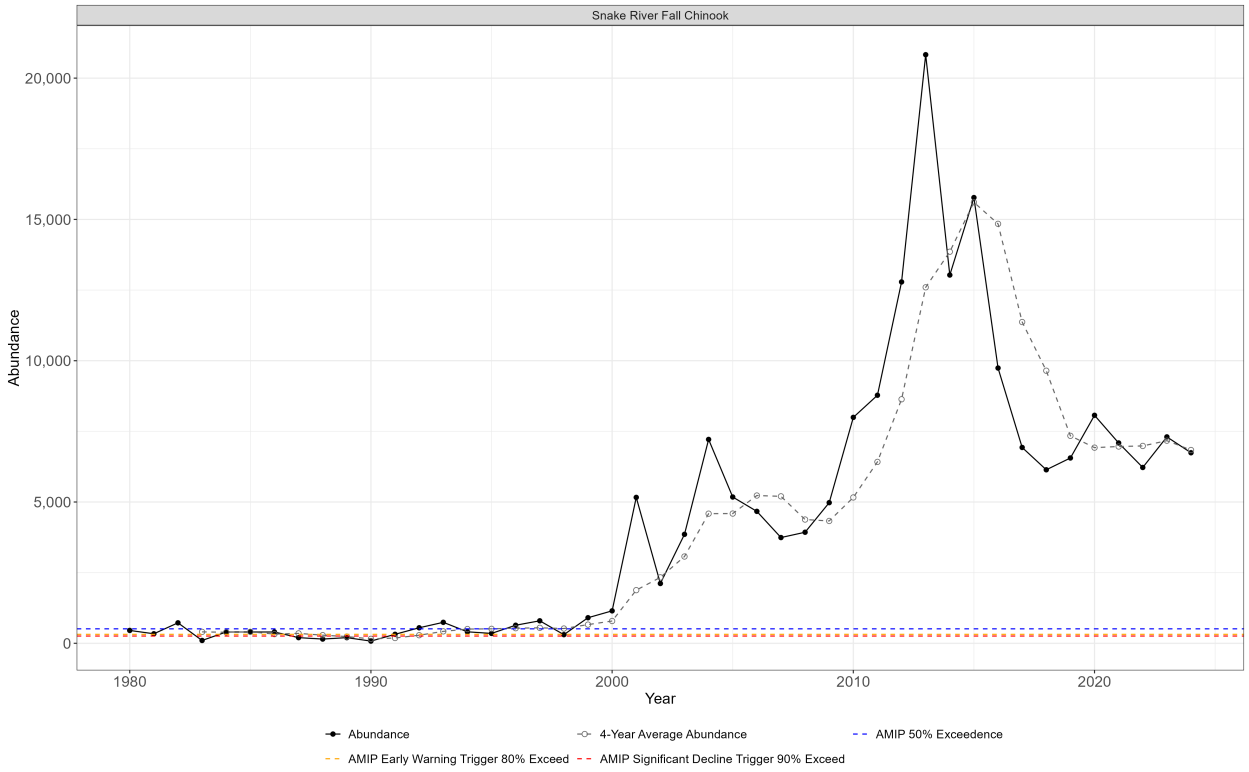

Figure 11: *Natural-origin adult fall Chinook escapement to Lower Granite Dam, showing 4-year moving averages with AMIP trigger thresholds overlaid.*

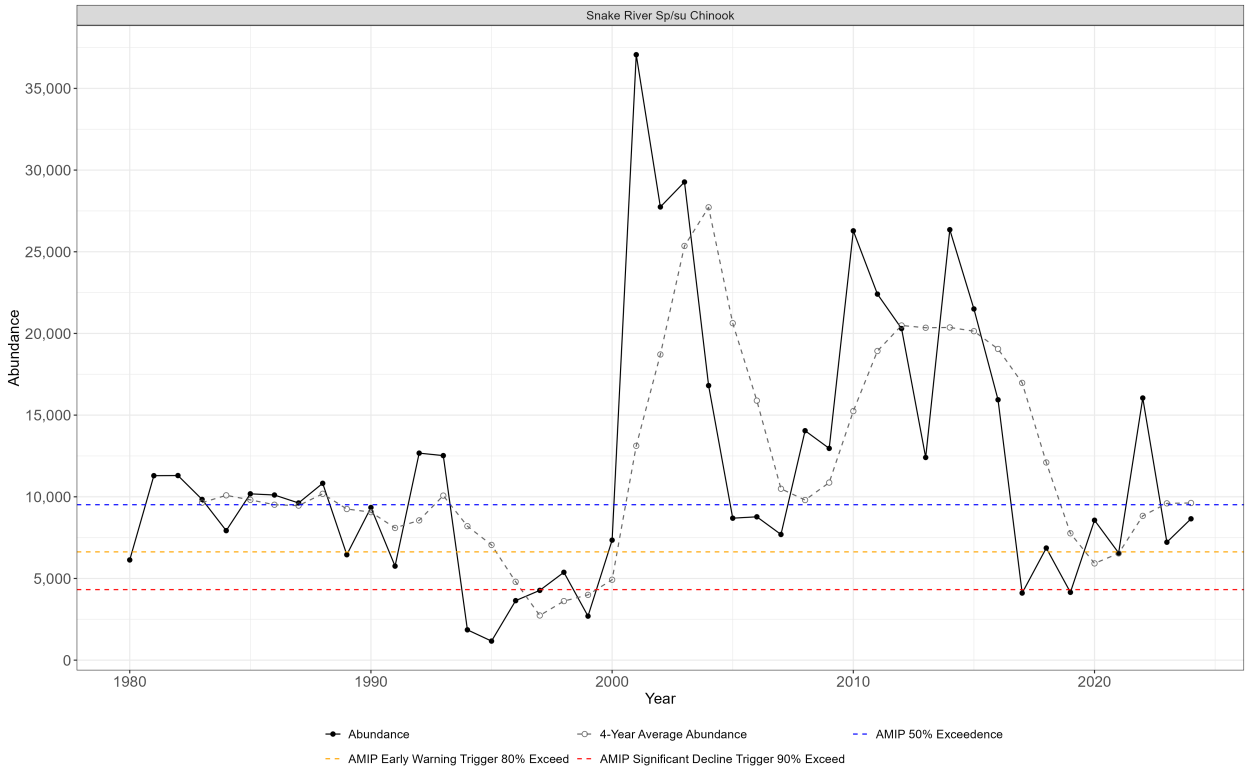

Figure 12: *Natural-origin adult spring-summer Chinook escapement to Lower Granite Dam, showing 4-year moving averages with AMIP trigger thresholds overlaid.*

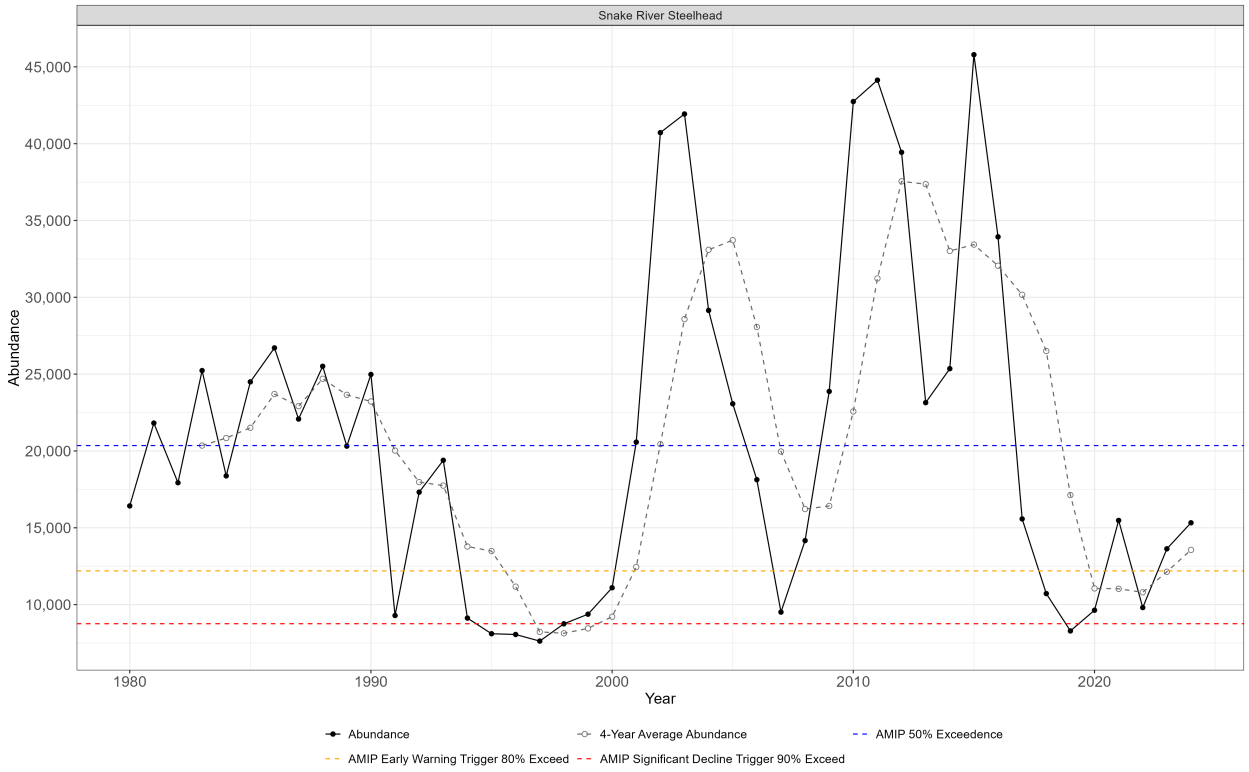

Figure 13: *Natural-origin adult steelhead escapement to Lower Granite Dam, showing 4-year moving averages with AMIP trigger thresholds overlaid.*

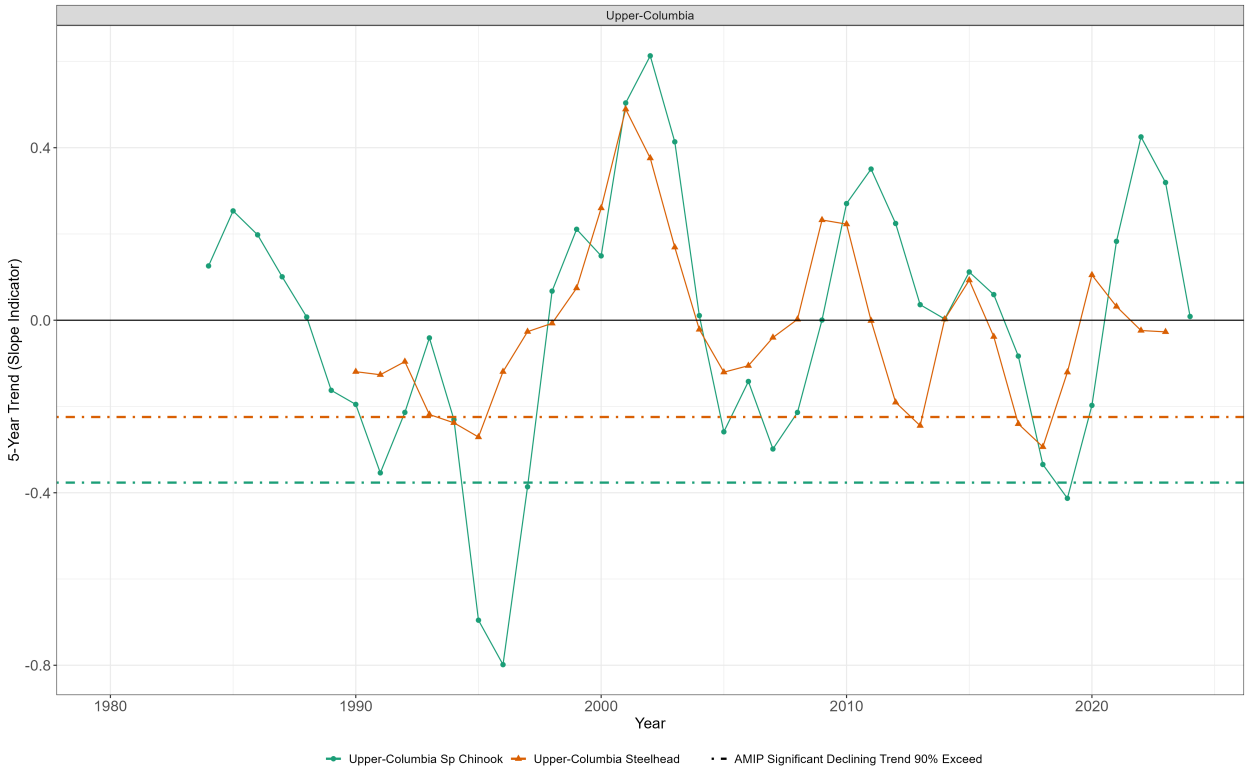

Figure 14: *Five-year moving window slopes of natural-origin adult escapement of Upper Columbia spring Chinook and steelhead, illustrating short-term trends in abundance. The 90% slope exceedance threshold is overlaid for each species.*

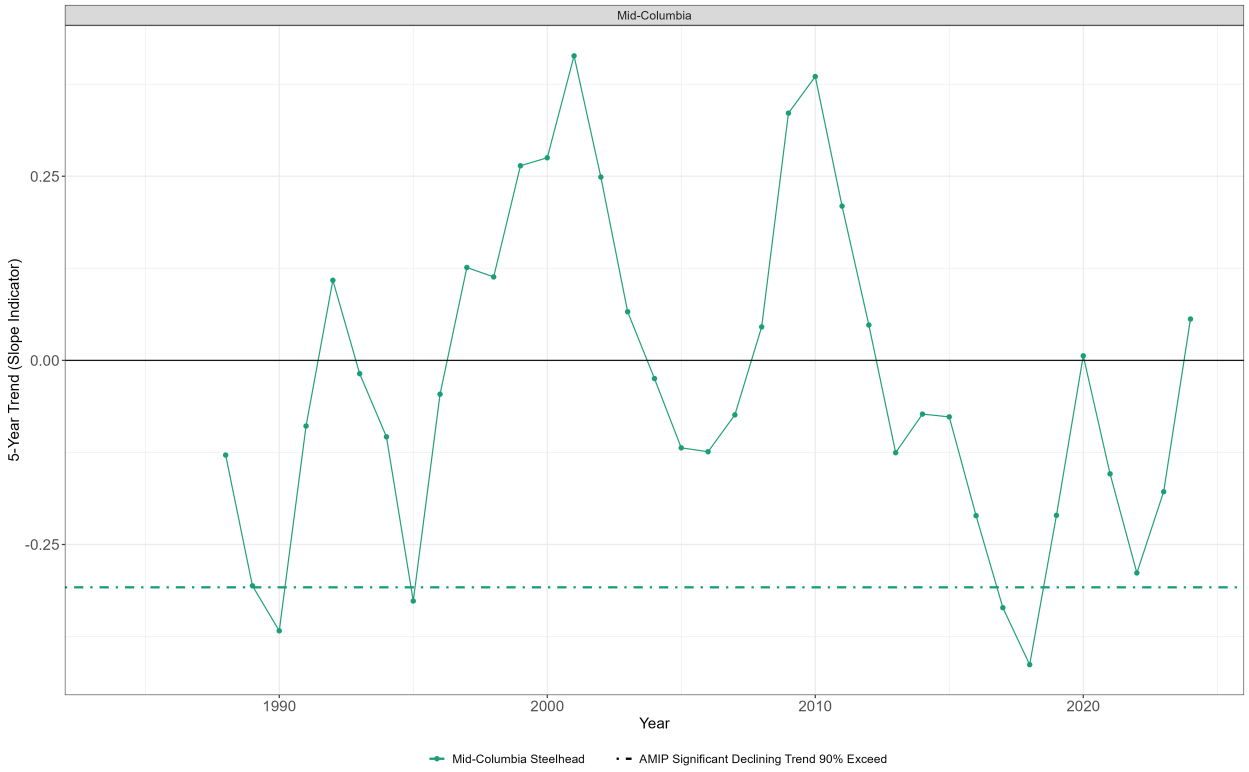

Figure 15: *Five-year moving window slopes of natural-origin adult escapement of middle Columbia steelhead (Yakima River), illustrating short-term trends in abundance. The 90% slope exceedance threshold is overlaid for each species.*

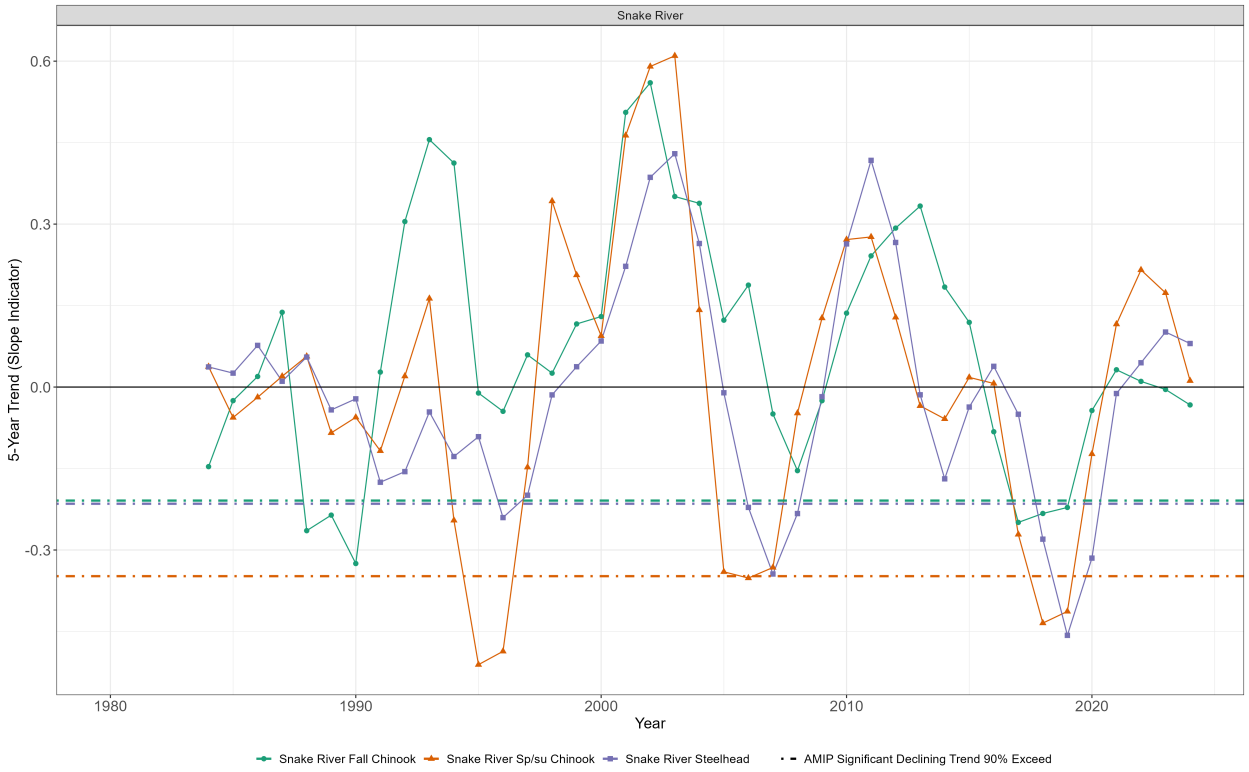

Figure 16: *Five-year moving window slopes of natural-origin adult escapement of Snake River fall Chinook, spring–summer Chinook, and steelhead to Lower Granite Dam, illustrating short-term trends in abundance. The 90% slope exceedance threshold is overlaid for each species.*

References

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