BC Stronghold Assessment Report

Will Atlas, Jon Hart, Greg Knox, Matt Sloat

Introduction

Wild Salmon Center's (WSC) works around the North Pacific Rim to conserve and manage wild salmon strongholds, watersheds with large, biodiverse populations of Pacific salmonids (*Oncorhynhus sp.*), intact naturally functioning habitats, and minimal influence from hatchery enhancement (Rahr et al. 2025). Strongholds within the WSC network have previously been selected using a variety of methods, supporting or leading processes with stakeholders and rightsholders, management agencies, and local salmon science experts, all aimed at identifying the best remaining watersheds within their respective ecoregions and working with local partners to protect and restore them for future generations (e.g. WSC 2012).

Across the fourteen major NE Pacific strongholds currently identified in the WSC stronghold network we work with local partners including Indigenous Nations, local non-profits, and research collaborators to provide sustained support for stewardship of wild salmon and their ecosystems. We provide science support, project and financial management, and policy advocacy, all to empower local conservation leaders to manage and preserve wild salmon and the social and ecological values they sustain.

British Columbia (BC) is home to more than 9,000 individual populations of wild salmon, supporting vitality and continuity for cultures and ecosystems that revolve around their annual cycles of abundance. Beginning in 2015 WSC established a BC Program, and our work has grown steadily there in the ensuing years, with funding, scientific collaboration and strategic support flowing to the local and Indigenous organizations stewarding and rebuilding wild salmon populations in strongholds across the province. In 2025, we hired Greg Knox to lead this growing program, and to establish Wild Salmon Centre – Canada, an independent non-profit organization established in Canada to expand our ability to support ongoing and new conservation initiatives in BC.

The current BC stronghold network includes five major watersheds or watershed groups, across diverse ecoregions spanning the full latitudinal extent of the province. The Harrison, Inner Central Coast, Skeena, Nass, and Taku Rivers support some of the largest and most biodiverse salmon populations in Canada. Freshwater habitat in these strongholds remains largely intact or functioning, and local and Indigenous partners are there leading stewardship efforts, managing fisheries, and protecting watersheds from major industrial threats.

To guide strategic planning for these efforts, there was a need to develop a repeatable methodology for stronghold identification. This assessment evaluated existing information on habitat threats, abundance and biodiversity using open access data provided by the Pacific

Salmon Foundation's Salmon Explorer, reports and data from management agencies, and open-access research publications. Using data from 120 unique spawning populations, we assessed 10 candidate strongholds. These include watersheds and regions already in the stronghold network, as well as new areas such as the Stikine and Kitimat Fjords, and the Thompson, Chilcotin, and Quesnel rivers in the upper Fraser River watershed above Hells Gate Canyon—an important salmon ecoregion in BC that is not yet represented in the WSC stronghold network. These insights provide increased visibility into areas where WSC Canada can work to foster conservation outcomes protecting wild salmon ecosystems alongside local partners and highlight the global importance of BC watersheds for the future of wild salmon and the social-ecological systems they have sustained for millennia.

Methods

Habitat Analysis

Information on habitat conditions and stressors was downloaded from the Pacific Salmon Explorer (PSE), providing a comprehensive assessment of the distribution and magnitude of human and natural disturbances in candidate strongholds across British Columbia. These data were available for all spawning populations represented in our analysis (n=120), and for tributaries and mainstem spawning areas comprising the entirety of the accessible salmon habitat in each candidate stronghold. Habitat pressures quantified in the PSE datasets include anthropogenic stressors such as road development and urbanization, mining, and forestry, among others. They also include natural stressors, such as short-term forest cover loss due to fire or beetle kill. Detailed methods underpinning these anthropogenic and natural threat scores are provided by Connors et al. (2024). Anthropogenic and total habitat stressor scores produced by the PSF analysis range from 1 under pristine watershed conditions, and 3 in the case of watersheds with severely impacted habitat. We focused our assessment on anthropogenic habitat pressures, since ecological responses to natural disturbance can be difficult to predict, and they represent an important driver of salmon and watershed evolution and resilience (Waples et al. 2009).

Spawner abundance data

Fish abundance data was gathered from for 120 unique spawning populations, spanning all 10 candidate strongholds: the Taku, Stikine, Nass, Skeena, Kitimat Fjords, Inner Central Coast, Harrison, Thompson, Chilcotin, and Quesnel watersheds, spanning three major salmon ecoregions the Fraser, North and Central Coast, and Northern Transboundary. Data was aggregated from the Pacific Salmon Explorer, and PSC Chinook Technical Committee data reports and web applications. Our analysis focused on spawner escapement since it is more widely estimated than total run size. Abundance data was not available for all species in all locations, and accordingly our analysis focused on Chinook, coho, and sockeye which were more commonly monitored and comparable across candidate strongholds.

In addition to location specific spawner abundance, we gathered data on aggregate watershed-level abundance for regions where these data were available, including Skeena, Nass, Taku, and Stikine. These data were drawn from PSC CTC and Northern Boundary Technical Committee, and Northern Transboundary Technical Committee documents and data sources.

Biodiversity analysis

We used biodiversity and life-history data from Pinsky et al. (2009) to compare species composition and life-history diversity for each of the 120 documented spawning locations. Each species by run-timing combination was counted for each spawning location, and the total and average species-run-timing diversity was estimated for all locations within each of the 10 candidate strongholds, producing a biodiversity value for each location. These biodiversity values were then summed across each watershed and divided by the number of spawning locations to produce both total and average biodiversity scores. Our team made minor modifications to the Pinsky data, based on either the known presence or extirpation (no spawners observed >1 generation) of species or life-histories in a location. Examples include the addition of winter-, summer- or fall-run steelhead in some tributaries in the Northern Transboundary and Inner Central Coast, and the loss of Chinook salmon from some rivers in the Kitimat Fjords candidate stronghold. Biodiversity scores were standardized across each ecoregion to account for natural biogeographic constraints that limit the distribution of some species and life-histories (e.g. Hells Gate canyon). The highest average stronghold-level biodiversity score within each region was then used as a scalar to estimate the relative score between 0 and 1 of the remaining candidate strongholds within that ecoregion.

Evaluating hatchery contributions

Hatchery contributions to spawner abundance were evaluated at the scale of the whole stronghold, given straying and connectivity linking hatchery and adjacent populations, and the role hatchery-produced fish can play in shaping fisheries and ecosystem dynamics. Full scores were given to species where hatchery contributions to total spawner abundance ranged from 0-20% for the entire stronghold, species with hatchery contributions > 20% were given a score of 0.5, and species with hatchery contributions >40% were given a score of zero. These hatchery contribution scores were then averaged across all the three focal species in our analysis to produce a single assessment score for each candidate stronghold.

Spawner Data Analysis

We estimated long-term trends in spawner escapement using hierarchical linear mixed-effects models fit separately for each species. The trend was estimated from the earliest year in the timeseries to 2024, the most recent year where data was reliably available for populations in the candidate strongholds. Escapement was log-transformed prior to analysis, and time was centered and scaled to improve interpretability and model convergence. Models included a fixed effect of year representing the coast-wide mean temporal trend for a given species, along with random intercepts and random slopes for year at both the stronghold and population levels. This structure allowed populations to share information within strongholds, and strongholds to share information across the species, while still permitting population-specific deviations in trend. Models were fit using restricted maximum likelihood (REML), producing partially pooled estimates that are robust to uneven time-series lengths and differences in monitoring history among populations. Resulting trend estimates represent long-term directional changes in escapement while accounting for hierarchical spatial structure and shared temporal dynamics (Equation 1).

Equation 1 –

lnSpawners ~ year + (1+ year | Stronghold) + (1 + year | population)

Two core metrics for stronghold assessment were derived from this analysis including: (1) Average stronghold-level trend in spawner abundance for each species, and (2) the proportion of populations within a stronghold region experiencing a declining trend. Stronghold-level abundance trends that were flat or increasing received full points for each of the three species, and these species-trend scores were averaged to produce a score for the stronghold trend metric. Declining trends were identified for populations where mean trend estimates fell below zero and more than 75% of the probability distribution for the trend parameter fell below zero. Individual population trend scores were then generated proportional to the number of populations with stable or increasing trends (e.g. 7 of 10 populations not declining = 0.7). We restricted this analysis to Chinook, coho, and sockeye, since they were present in all watersheds and had timeseries of escapement information for trend estimation, and therefore comparable across strongholds.

Visualization of population and stronghold trajectories

To visualize temporal patterns in spawner abundance, we generated stronghold-level plots for each species using the fitted hierarchical mixed-effects models. For each population, observed escapement time series were natural log-transformed using a ln(1 + x) transformation and then z-standardized within strongholds to place populations on a common relative scale while preserving temporal structure. Population trajectories were displayed as continuous lines, color-coded by population, to emphasize within-stronghold variability and synchrony through time.

Stronghold-level trends were derived from the conditional (random-effect) stronghold-specific intercepts and slopes estimated by the mixed-effects model, combining the global fixed effect of year with the stronghold-level random deviation. These conditional stronghold trends represent partially pooled estimates that borrow strength across populations and strongholds. Approximate 95% confidence intervals for the stronghold trends were calculated by combining fixed-effect uncertainty with the conditional variance of the stronghold random effects and were displayed as grey shaded ribbons. Together, these visualizations highlight population-level variability while providing a stabilized representation of long-term stronghold-scale trajectories.

Aggregate habitat, biodiversity, hatchery contribution and abundance trend scores

These 5 assessment metrics were applied to each of the 10 candidate strongholds to produce a score ranging from zero to 5, with higher values representing more intact habitats, rich biodiversity, and healthy populations. (Table S1).

Results

Habitat pressures

Overall, habitat pressures on BC salmon watersheds exhibited a notable north to south gradient. Watersheds with the lowest habitat pressures were the Taku and Stikine watersheds in the Northern Transboundary region (<1.15), placing them within the low cumulative thread category in the PSE habitat assessment framework. Among the 10 candidate strongholds we assessed, those with the highest cumulative threat scores were the Thompson (2.38, moderate/high threat), Quesnel (2.10, moderate) and the Chilcotin (1.95, moderate), all in the Interior Fraser. However, anthropogenic impacts are not distributed equally across the province, and an assessment of only anthropogenic threats revealed lower levels of habitat pressure for the Inner Central Coast (1.23, low) and Chilcotin (1.74, low-moderate) watersheds, where recent forest fire and beetle kill contributed to higher cumulative threats, despite relatively low anthropogenic threats (Figure 1).

Habitat conditions within individual spawning locations revealed key insight into the distribution of anthropogenic impacts within candidate strongholds. In watersheds and regions with higher anthropogenic habitat pressures, many of the areas of high impact often overlapped with productive salmon spawning habitats. For example, Weaver Creek (3.0, high) and the lower Harrison River, and the Babine River (2.18, moderate) in the Skeena, contribute more than half of total salmon production within their respective strongholds but had the highest level of anthropogenic threats. Major salmon producing areas within the Thompson River also had higher anthropogenic threat levels than higher elevation tributaries with fewer anthropogenic impacts but lower salmon abundance and biodiversity (Figure 2).

Biodiversity assessment

The Skeena River and Kitimat and Northern Fjords candidate strongholds had the highest richness of salmon biodiversity in our assessment, with 133 and 125 unique species by run-timing combinations across 20 spawning locations in each. The Taku, Skeena, and Nass Rivers had the highest average diversity, with an average of 6.7 species-timings across 10 Taku River spawning locations, and an average of 6.65 in 20 Skeena locations. Watersheds in the interior Fraser had lower species-timing diversity. The Quenel River had only 17 unique species and run timings, across 5 spawning locations, for an average of 3.4 per watershed. The Thompson River had the highest number of spawning locations in our dataset (25) but relatively low average diversity in each location (3.88). The Chilcotin River had the highest average diversity within the ecoregion (5.2), due to the presence of both spring and summer Chinook, and summer steelhead in all locations (Figure 3; Table 1).

Abundance trend assessment

Trends in abundance for whole strongholds and individual populations varied by species and geography. Overall, aggregate Chinook salmon spawner abundance showed a declining trend across 9 of the 10 candidate strongholds, with the only exception being for the Inner Central Coast stronghold. Sockeye salmon escapement trends were declining for four candidate strongholds, including the Thompson River, Inner Central Coast, Kitimat and Fjords, and Stikine River. Coho showed relative resilience, with recent increases in escapement for Interior Fraser coho populations returning to watersheds above Hells Gate canyon. Only the Stikine River had a significant declining trend in coho escapement and in other candidate strongholds coho escapement appeared to be stable across the timeseries we evaluated (Table 2).

Individual population trends also highlighted differences in the status of salmon populations within each candidate stronghold, and which populations have shown relative resilience across the timeseries. Within the Fraser River ecoregion, 21 of 34 Chinook salmon populations met the criteria for declining escapement. Among Interior Fraser watersheds, these declines were concentrated among stream-rearing spring and summer Chinook populations, while summer-run ocean type populations spawning in the Adams River, Little River, Shuswap River, and South Thompson River all exhibiting increasing trends in abundance (Figures 4 – 8; Table 3). North Coast Chinook escapement trends also showed widespread declines in abundance in recent decades with 15 of 24 populations meeting the criteria for declining escapement abundance. Notable exceptions included the Atnarko River, Wahoo River in the Kitimat Fjords candidate stronghold, Damdochax River in the Nass stronghold, and the Morice River in the Skeena stronghold, all of which had trend estimates indicative of stable escapements (Figures 9 – 13; Table 3). In the Northern Transboundary ecoregion, 6 of 8 Chinook populations met the criteria for declining spawner escapements, including both populations with reliable timeseries of escapement within the Stikine candidate stronghold. Two populations in the Taku had positive trends in escapement: Dudidontu and Testa (Figures 14 – 16; Table 3).

Population trends for sockeye salmon were more mixed, with evidence of resilience in each of the ecoregions we assessed. In the Fraser ecoregion, 8 of 23 populations met criteria for a declining trend in escapement. These declines were particularly concentrated among late-run populations in the Thompson watershed, which have formerly been among the largest spawning populations in the Fraser, but have experienced marked declines over recent generations (Figures 28 - 32; Table 4). In the North Coast ecoregion 11 of 38 sockeye populations we assessed met criteria for declining spawner escapements. Central Coast (2 of 4) and Kitimat Fjords (3 of 5) candidate strongholds had the highest proportion of populations with declining escapement trends. In the Nass, only the Kwinageese population showed evidence of a declining trend, likely due to a major rockslide that impeded sockeye migration for several years beginning in 2011. In the Skeena, declining trends were evident for 5 of 23 populations, three of which are wild populations in the enhanced Babine Lake ecosystem (Figures 33 – 37; Table 4). In the Transboundary ecoregion, populations in the Stikine and Taku Rivers exhibited distinctly different trends in spawner abundance. In the Stikine 5 of 6 populations had declining escapement trends, with only the enhanced Tahltan River showing evidence of modest increases in escapement. In the Taku 3 of 4 populations assessed showed stable or increasing abundance, with a decline observed in Kuthai sockeye escapements (Figures 38 – 40, Table 4).

Spawner escapement trends for coho salmon showed relative resilience across candidate strongholds and ecoregions, with a notable exception of the Stikine River, where all 6 populations with spawner timeseries met criteria for declining escapement (Figures 26 & 27; Table 5). In the Fraser ecoregion many coho populations had increasing escapement across the timeseries we evaluated. Only 2 of 17 populations in the Fraser watershed had declining trends, including the Horsefly River in the Quesnel, and the Salmon River in the Thompson watershed. Although coho escapement data was notably absent in the Harrison watershed (Figures 17 – 20; Table 5). North Coast coho spawner escapements were also largely stable or increasing (21 of 23), with declines observed in the Dala and Quaal populations within the Kitimat Fjords candidate stronghold (Figures 21 - 25; Table 5). Trends for individual spawning populations in the Taku River could not be assessed, since only aggregate watershed-level abundance is estimated there, however the aggregate escapement of Taku River coho salmon increased modestly across the timeseries (Figure 26; Table 5).

Stronghold scores

Scores for anthropogenic habitat pressures, salmon biodiversity, hatchery influence, and spawner abundance trends were aggregated for each of the 10 candidate strongholds in BC (Table 6). Overall, the five watersheds or regions currently within the WSC stronghold network scored higher (mean = 4.03) than those currently outside the network (3.37). Based on these stronghold metrics, the Skeena River was rated as the most at-risk among the current BC strongholds, with an aggregate score of 3.784. These results stemmed from higher-than-average anthropogenic habitat pressures, declining stronghold-level trends for Chinook escapement, and high enhanced contributions to total sockeye abundance. Among the populations not currently in the WSC stronghold network, the Chilcotin watershed received the highest aggregate score (3.99), with the highest biodiversity in the Interior Fraser watersheds we assessed, stable or increasing trends at the stronghold level for two species (coho and sockeye), and low hatchery contributions across all species assessed.

Discussion

Overall, our analysis reveals important differences in habitat conditions, biodiversity, hatchery contributions, and population trends among major salmon bearing watersheds. This assessment approach provides a rigorous and repeatable methodology for assessing candidate strongholds in British Columbia. However, the feasibility of applying this framework in other jurisdictions will depend on the availability of habitat and salmon population data, which is unavailable for major portions of the North Pacific range of anadromous salmon.

Habitat risks were generally higher in southern portions of British Columbia, in or near areas of high human population density. Candidate strongholds in the Fraser watershed had some of the highest anthropogenic habitat pressures in our assessment, with notably lower habitat pressures impacts in the Harrison and Chilcotin. The Skeena River also had relatively high anthropogenic habitat impacts, with stressors being particularly acute in the Babine watershed, home to the greatest abundance of salmon in the entire Skeena watershed. Habitat risks were considerably lower in Northern Transboundary watersheds, which have low human population density and are largely roadless.

Salmon run timing and species diversity largely reflected biogeographic drivers including migration distances for adults returning to their natal spawning areas, migration barriers that limit the distribution of some species (e.g. chum salmon & winter steelhead above Hells Gate), and North to South clines in the diversity of run timing (e.g. Chinook and steelhead) and even-odd year cycles for pink salmon in different areas of their range. In general, a pattern of declining biodiversity in upper reaches of watersheds was observed in the Fraser and Skeena Rivers and is consistent with observations of salmon biodiversity in other watersheds (Waples et al. 2001). In a handful of other instances, individual populations appear to have been extirpated during the period of record in our analysis. Some smaller Chinook salmon populations in the Kitimat & Fjords candidate stronghold had zero observations of spawners for >1 generation (six years). These data suggest that some of these populations may have been extirpated, and species and run timing data used for biodiversity assessments was updated from Pinsky et al. (2009).

Despite their relatively intact habitats, watersheds in the North Coast and Northern Transboundary regions were not immune to declining wild salmon populations. For example, population trends for all species in the Stikine River showed clear evidence of declines. Likewise, Chinook salmon have declined across most northern candidate strongholds, with a few rare exceptions, including the Atnarko River which receives large contributions (>50% in some years) of hatchery-origin spawners. Recent rebuilding of coho salmon in the Interior Fraser river were reflected in both stronghold-level and individual population trend scores, and overall coho salmon spawner escapements appeared to be the most stable among all species we evaluated. Sockeye populations showed mixed trends, depending on their history of exploitation, habitat conditions, and local survival trends. Notable sockeye salmon declines occurred across both the Fraser and North Coast region in the last several decades (e.g. Peterman and Dorner 2012; Connors et al. 2019; Price et al. 2021), but recent returns have provided reason for optimism in many watersheds and these recent increases in abundance were reflected in trend estimates. Chum, pink and steelhead trends were not assessed due to a lack of available spawner abundance data, and limited distribution of chum salmon within the candidate stronghold watersheds. However, chum salmon have been declining across much of Northern BC (e.g. Atlas et al. 2022). Data availability for steelhead trout populations limits insight into abundance trends, but for populations with available data recent assessments provide strong evidence of a sustained province-wide decline in abundance (PSF SWP 2024).

Timeseries of spawner escapement are an imperfect measure of wild salmon productivity and abundance, since escapement reflects both total abundance of salmon in a given return year after fisheries harvest, and management actions often reduce harvest rates or amounts during periods of lower total returns. Overall, harvest rates in BC commercial fisheries declined considerably across the years in our analysis, leading to higher escapements even at lower total run sizes (e.g. Walters et al. 2019). Total run size is a more direct measure of the productivity and health of a salmon population, but incomplete fishery and escapement monitoring, and differences in the scale of available total run size reconstructions (e.g. often for management units that aggregate multiple populations) precluded consistent application of our trend estimate methodology to total run size data.

Importantly, our assessment of abundance trends did not include metrics related to historical abundance, and some populations with more recent increases in abundance may be depressed well below their pre-industrial levels (e.g. Ricker 1947; Price et al. 2021). We also did not use spawner-recruit models to estimate population benchmarks, another common practice in status assessments (e.g. Holt and Bradford 2011; Connors et al. 2024). Nonetheless, for the sake of comparison across candidate stronghold geographies, our methods capture relevant trends in total and population-level abundance, providing insights into areas of resilience and risk for trends in spawner abundance.

In general, hatchery production is lower in many BC watersheds than in neighboring states, including Washington and SE Alaska, where production hatcheries are a primary source of harvest opportunities. However, among the 10 candidate strongholds in our analysis, there are places and species where current levels of hatchery enhancement pose significant risk to wild salmon biodiversity and resilience. In the Inner Central Cost stronghold region, hatchery Chinook production in the Atnarko River contributes >50% of total spawner abundance in some years. Likewise in the Skeena watershed, enhanced Babine Lake sockeye salmon make up an overwhelming majority of sockeye abundance in the stronghold in most years (Price et al. 2021). In the Taku and Stikine Rivers, sockeye enhancement efforts have been codified in the Pacific Salmon Treaty, and allocations to Canadian fisheries are dependent upon hatchery production for allocation under bilateral catch sharing agreements (TBTC 2025).

The Chilcotin watershed represents one unique and timely opportunity to expand the WSC stronghold network in BC. The Chilcotin scored highest on average biodiversity, trends in abundance, and habitat conditions among all interior Fraser watersheds we evaluated. The WSC Stronghold Strategy seeks to identify and protect at least one major watershed within each salmon ecoregion in BC, and the Interior Fraser has previously been unrepresented within our network. The Chilcotin is home to several unique spring and summer Chinook populations, and multiple sockeye populations including the Chilko Lake population, among the largest and most stable sockeye populations in the Fraser. Across the three major interior Fraser watersheds in our analysis, the Chlicotin scored highest in each stronghold metric. Research has documented uniquely high thermal tolerance among Chilko sockeye, with metabolic and swimming performance exceeding that of other Fraser sockeye populations at warmer temperatures now common in the lower and mid-Fraser mainstem (Eliason et al. 2011).

With strong local partnership and leadership towards the long-term health of habitats and salmon populations guided by the Tsilhqot'in National Government, WSC is working with a willing and capable partner towards advancing the long-term protection of the Chilcotin watershed and its uniquely important salmon populations. Other candidate stronghold watersheds, while undeniably important for the overall abundance and biodiversity of salmon in British Columbia, are not currently viable candidates for stronghold protections largely due anthropogenic habitat pressures. For example, the Thompson River is a massive watershed, home to an immense array of habitats and salmonid biodiversity, including the largest individual spawning populations of Chinook salmon in the province, sockeye populations that are major drivers of Fraser River salmon fisheries, and key populations in the ongoing story of recovery for interior Fraser coho salmon.

Our assessment of candidate wild salmon Strongholds in British Columbia spanned ten diverse watersheds or watershed groups, and 3 major salmon ecoregions. We conclude that current WSC strongholds do represent the most intact wild salmon watersheds and populations in British Columbia. We also identify the Chilcotin River as watershed with habitat, biodiversity, and population characteristics warranting recommendation for inclusion in the WSC BC stronghold network. In general, WSC's existing network of strongholds appears to include many of the most intact salmon watersheds, across metrics related to habitat condition, biodiversity, and spawner escapement trends. These insights can inform strategic planning for WSC, and our partners to identify areas for improvement, key emerging risks, assessment of conservation opportunities and outcomes, and ultimately effective and durable conservation of wild salmon habitats and biodiversity in BC.

References

Atlas, W.I., K.L. Wilson, C.K. Whitney, J.E. Moody, C.N. Service, M. Reid, and M.R. Sloat. 2022. Quantifying regional patterns of collapse in British Columbia central coast chum salmon (*Oncorhynchus keta*) populations since 1960. *Canadian Journal of Fisheries and Aquatic Sciences* 79: 2072-2086. http://dx.doi.org/10.1139/cjfas-2022-0013

Connors, K., Jones, E., Peacock, S., and Belton, K. 2024. State of Salmon 2024 Report. Pacific Salmon Foundation, Vancouver, BC, Canada. Available from: https://doi.org/10.60740/3867-G827

Eliason, E. J., Clark, T. D., Hague, M. J., Hanson, L. M., Gallagher, Z. S., Jeffries, K. M., ... & Farrell, A. P. (2011). Differences in thermal tolerance among sockeye salmon populations. *Science*, *332*(6025), 109-112.

Holt, C.A., and M.J. Bradford. 2011. Evaluating benchmarks of population status for Pacific salmon. North American Journal of Fisheries Management 31: 363-378. https://doi.org/10.1080/02755947.2011.578525

Pinsky, M. L., Springmeyer, D. B., Goslin, M. N., & Augerot, X. (2009). Range-wide selection of catchments for Pacific salmon conservation. *Conservation Biology*, *23*(3), 680-691.

Price, M. H., Moore, J. W., Connors, B. M., Wilson, K. L., & Reynolds, J. D. (2021). Portfolio simplification arising from a century of change in salmon population diversity and artificial production. *Journal of Applied Ecology*, *58*(7), 1477-1486.

[PSF SWP] Pacific Salmon Foundation Salmon Watershed Program. 2024. The status of steelhead populations in BC: 2024 snapshot report. *Pacific Salmon Foundation, BC, Canada.* Available online https://salmonwatersheds.ca/document/lib_598

Rahr III, G. R., Sloat, M. R., Atlas, W. I., & Hart, J. L. (2025). Strongholds for Pacific salmon: A proactive conservation strategy for ecosystem health, food security, biodiversity, and climate resilience. *Fisheries*, vuaf011.

Ricker, W. E. (1947). Hell's Gate and the sockeye. *The Journal of Wildlife Management*, *11*(1), 10-20.

[TBTB] Transboundary Technical Committee. 2025. Final estimates of transboundary river salmon production, harvest and escapement and a review of join enhancement activities in 2023. Pacific Salmon Commission Transboundary Technical Committee Report TCTR(25)-04. Vancouver, BC. https://www.psc.org/reports/tctr-25-04

Walters, C., English, K., Korman, J., & Hilborn, R. (2019). The managed decline of British Columbia's commercial salmon fishery. *Marine Policy*, *101*, 25-32.

Waples, RS, RG Gustafson, LA Weitkamp, JM Myers, OW Johnson, PJ Busby, GJ Bryant, FW Waknitz, K Neely, D Teel, WS Grant, GA Winans, S Phelps, A Marshall, and BM Baker. 2001. Characterizing diversity in salmon from the Pacific Northwest. *Journal of Fish Biology* 59 (Supplement A): 1-41. doi:10.1006/jfbi.2001.1764

[WSC] Wild Salmon Center. 2012. The California salmon stronghold initiative. California Department of Fish & Game.

Figures

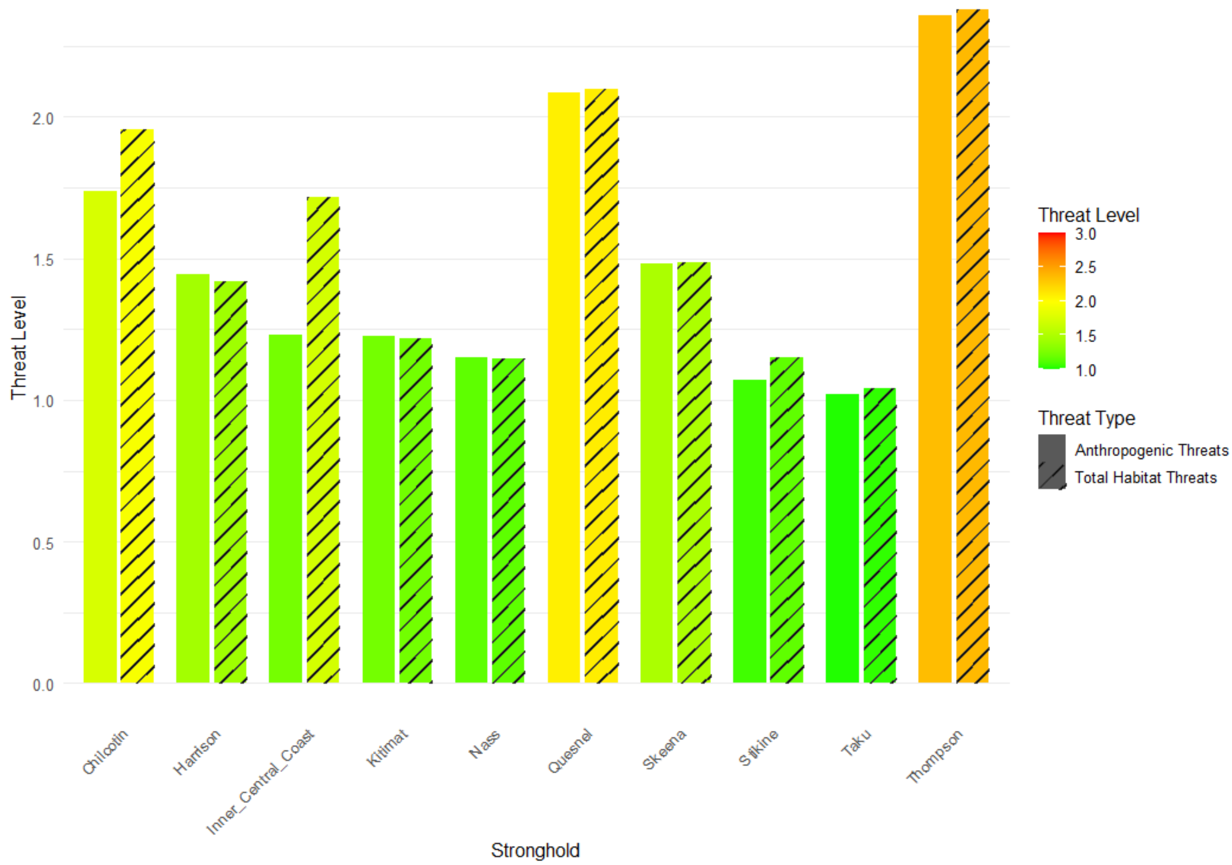

Figure 1: Anthropogenic and total habitat pressures, estimated by the PSF Salmon Habitat Explorer, for 10 stronghold watersheds/regions in BC.

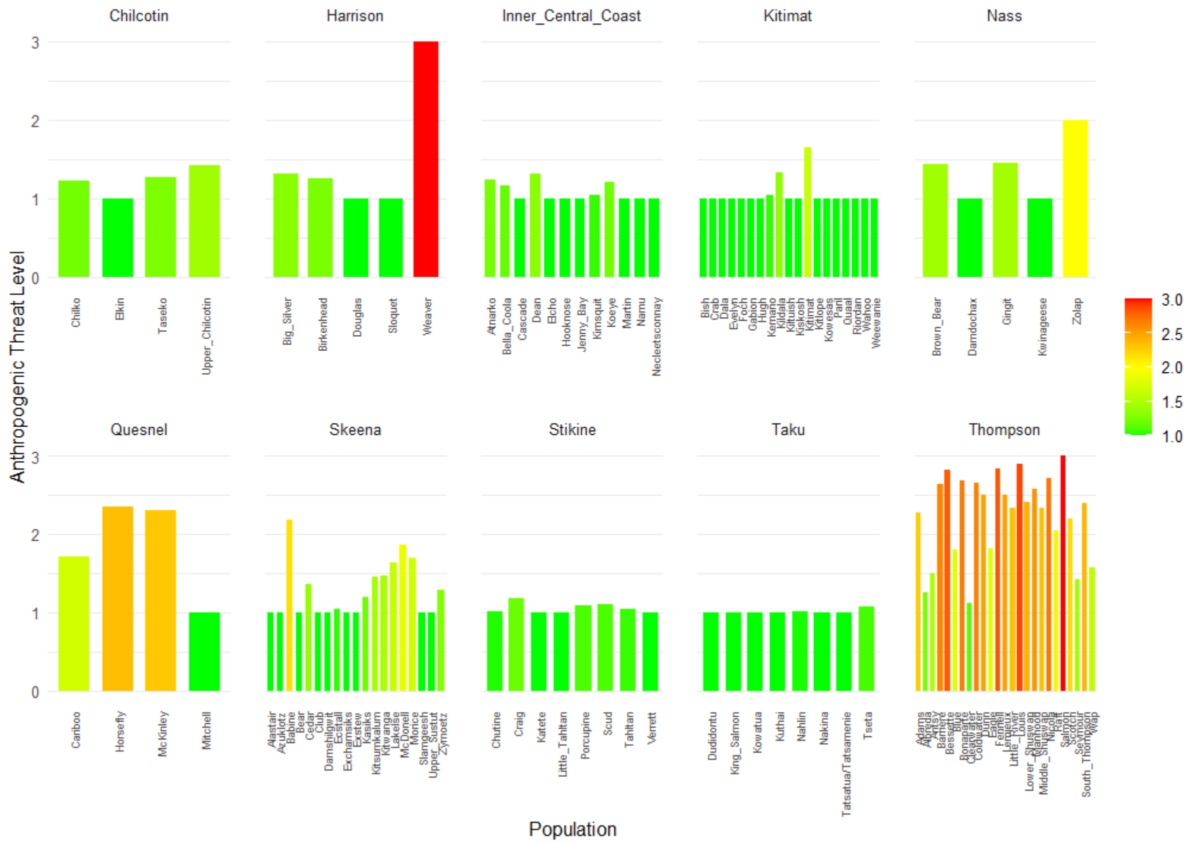

Figure 2: Anthropogenic pressures for all 120 spawning populations we evaluated in BC. Panels are for each of the 10 candidate strongholds.

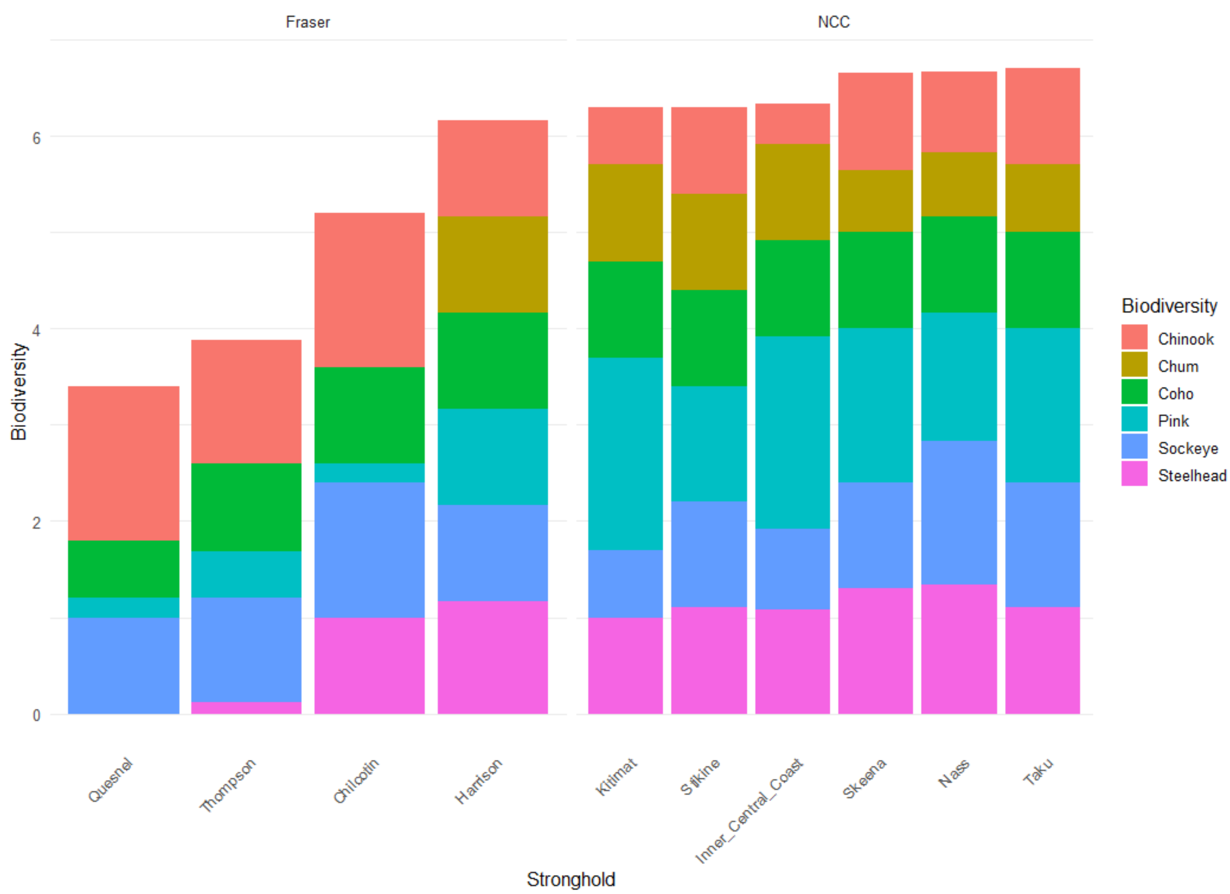

Figure 3: Stacked bar chart showing species-specific biodiversity scores for strongholds and candidate stronghold watersheds in British Columbia.

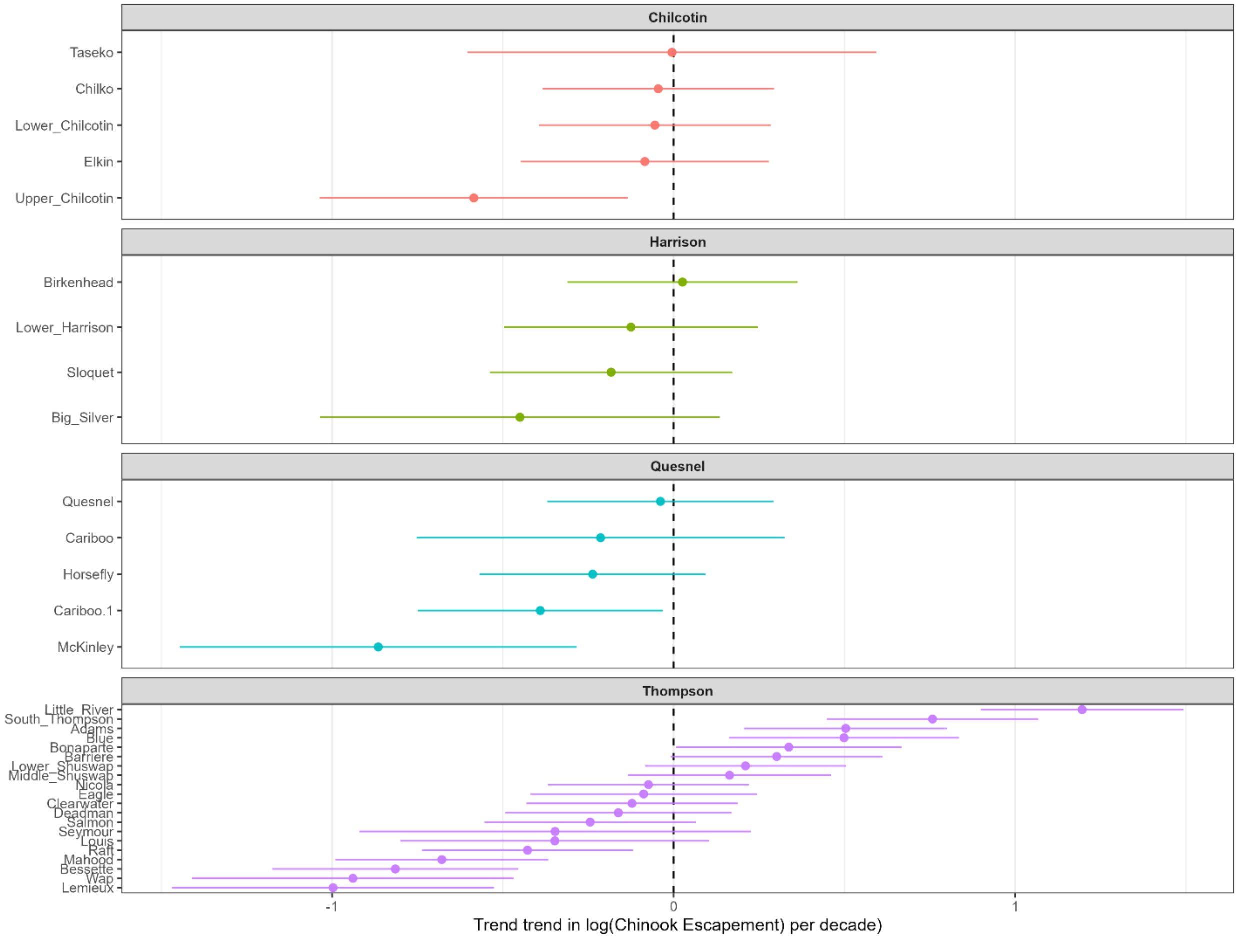

Figure 4: Individual population trends in Chinook salmon populations across the four stronghold watersheds (panels) Fraser River ecoregion. Mean estimates for decadal log trends in abundance are shown as points, and 95% confidence intervals are plotted as horizontal, colored whiskers. Dashed line indicates zero trend.

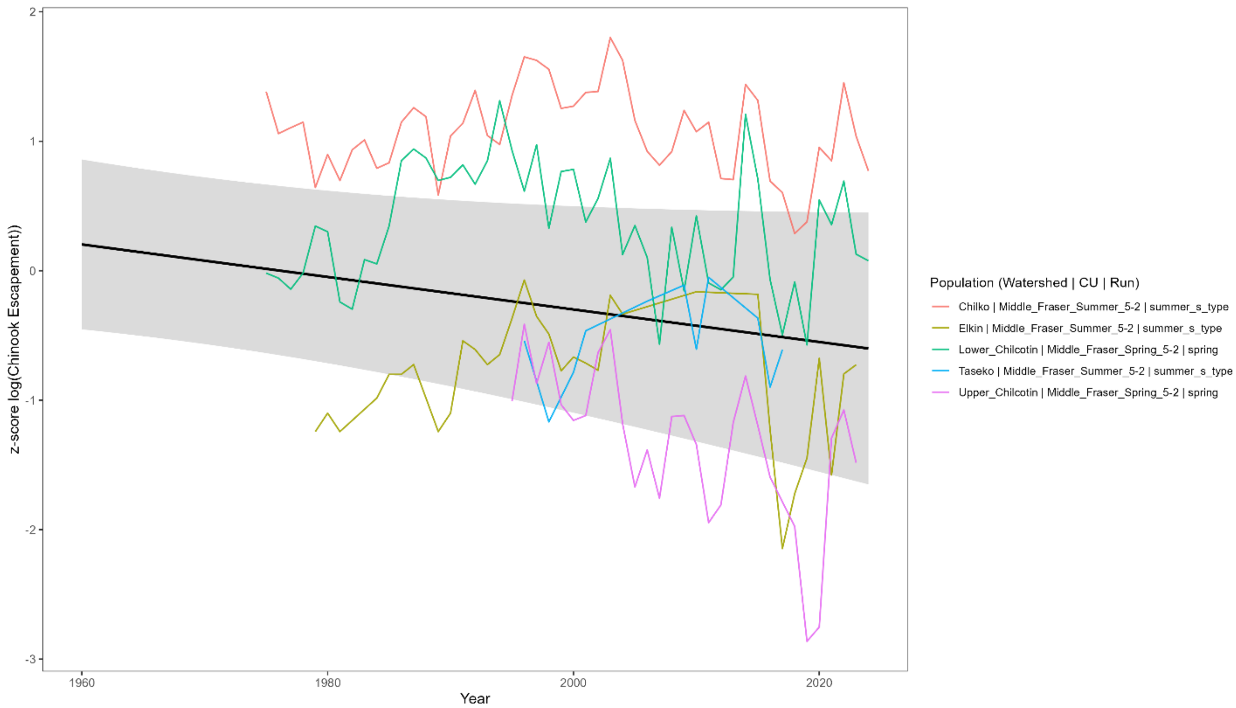

Figure 5: Timeseries of spawner escapement for Chinook salmon populations within the Chilcotin watershed. Colored lines are individual population timeseries, while the thick black line represents the mean estimated trend for Chinook salmon escapement in the Chilcotin watershed. Shaded grey areas represent the upper and lower 95% confidence intervals for the trend in Chinook salmon escapement.

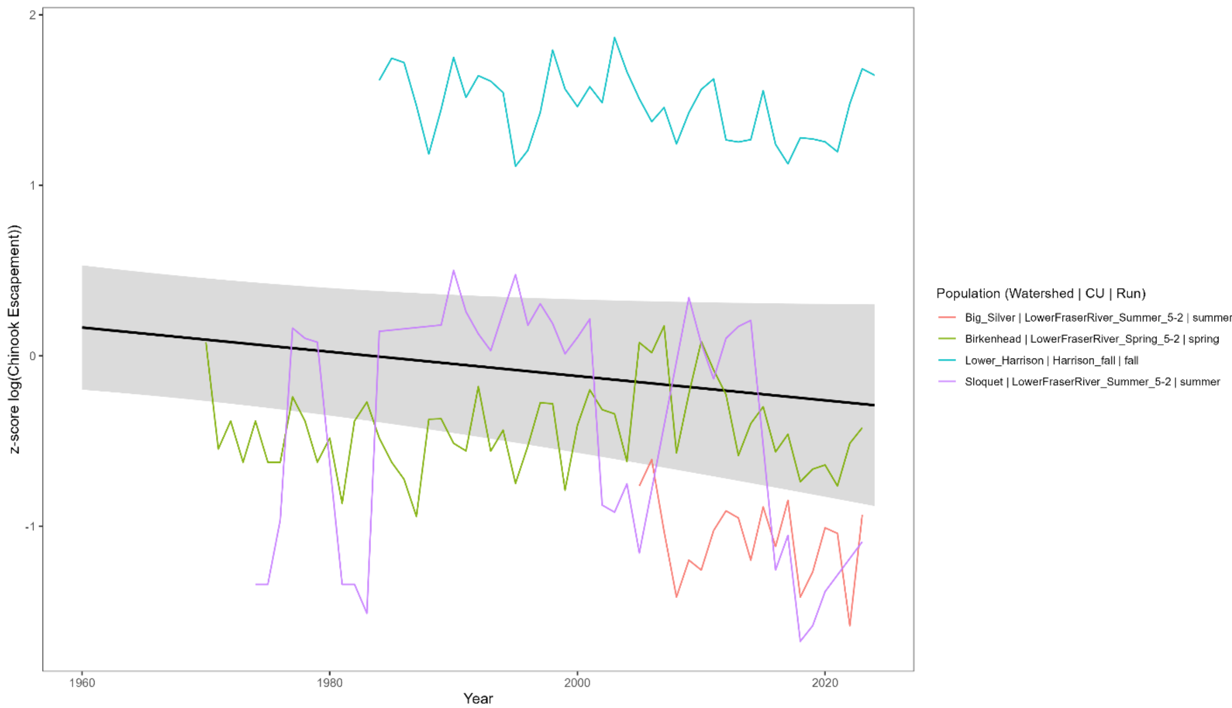

Figure 6: Timeseries of spawner escapement for Chinook salmon populations within the Harrison watershed. Colored lines are individual population timeseries, while the thick black line represents the mean estimated trend for Chinook salmon escapement in the Harrison watershed. Shaded grey areas represent the upper and lower 95% confidence intervals for the trend in Chinook salmon escapement.

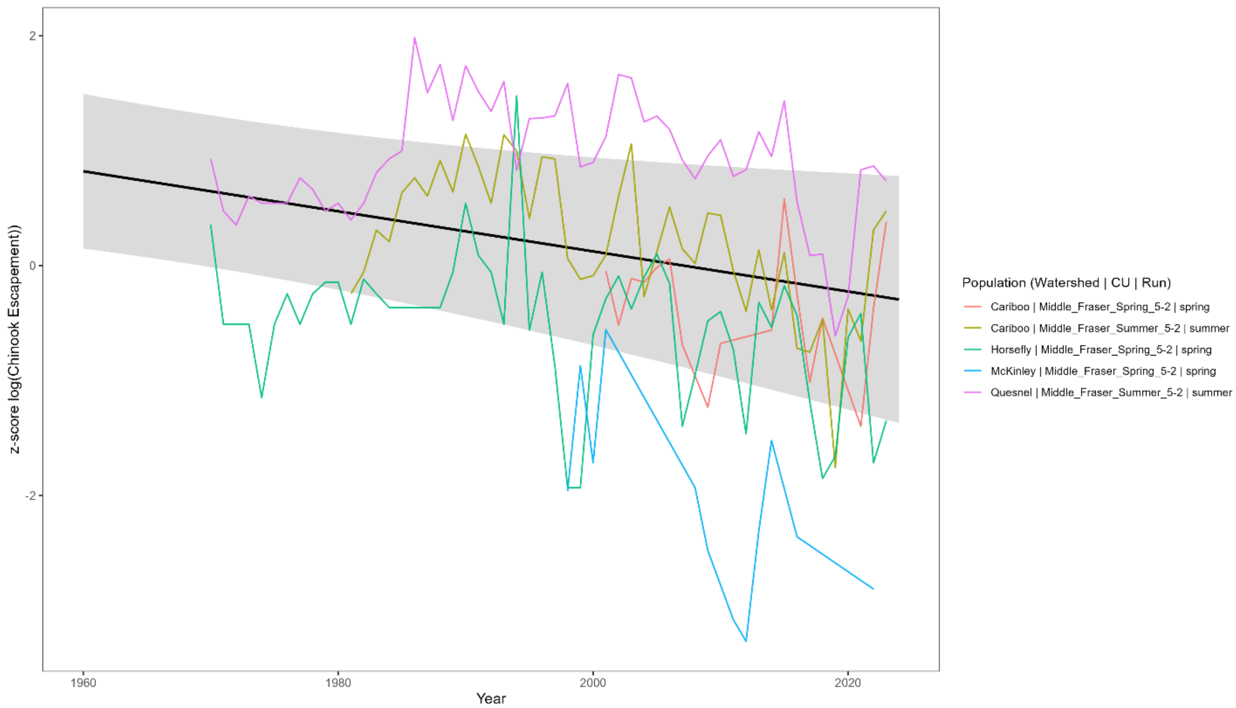

Figure 7: Timeseries of spawner escapement for Chinook salmon populations within the Quesnel watershed. Colored lines are individual population timeseries, while the thick black line represents the mean estimated trend for Chinook salmon escapement in the Quesnel watershed. Shaded grey areas represent the upper and lower 95% confidence intervals for the trend in Chinook salmon escapement.

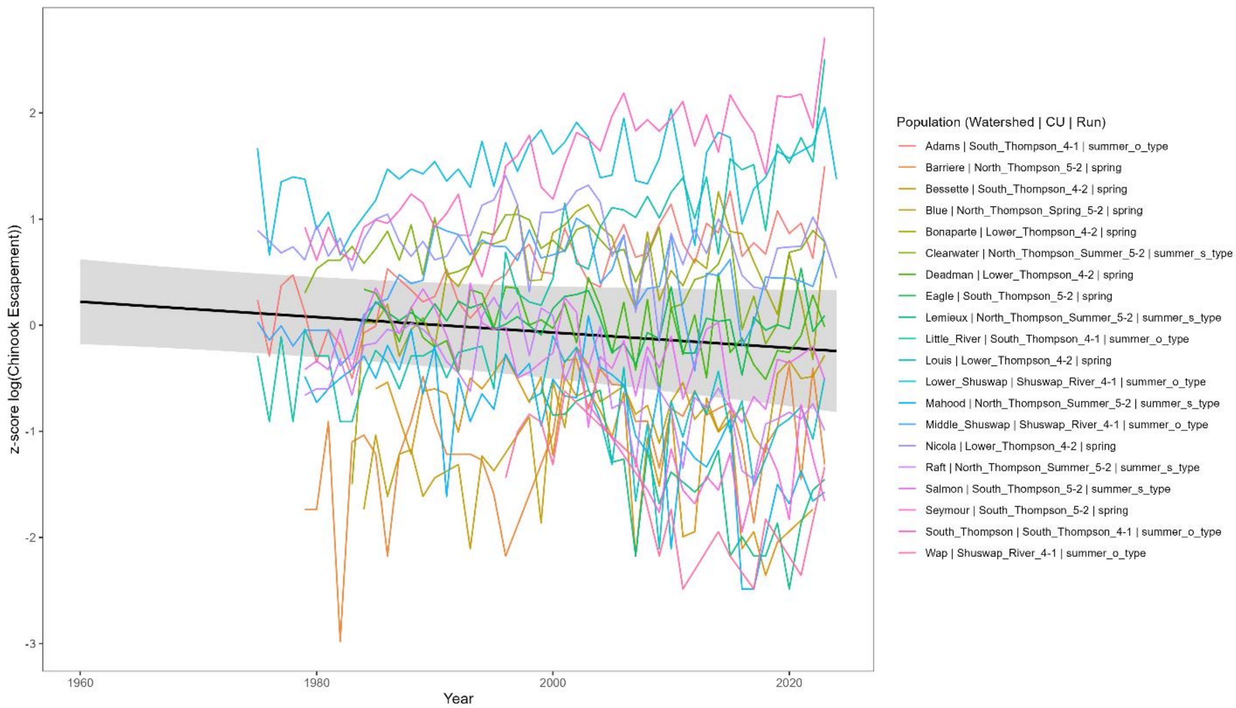

Figure 8: Timeseries of spawner escapement for Chinook salmon populations within the Thompson watershed. Colored lines are individual population timeseries, while the thick black line represents the mean estimated trend for Chinook salmon escapement in the Thompson watershed. Shaded grey areas represent the upper and lower 95% confidence intervals for the trend in Chinook salmon escapement.

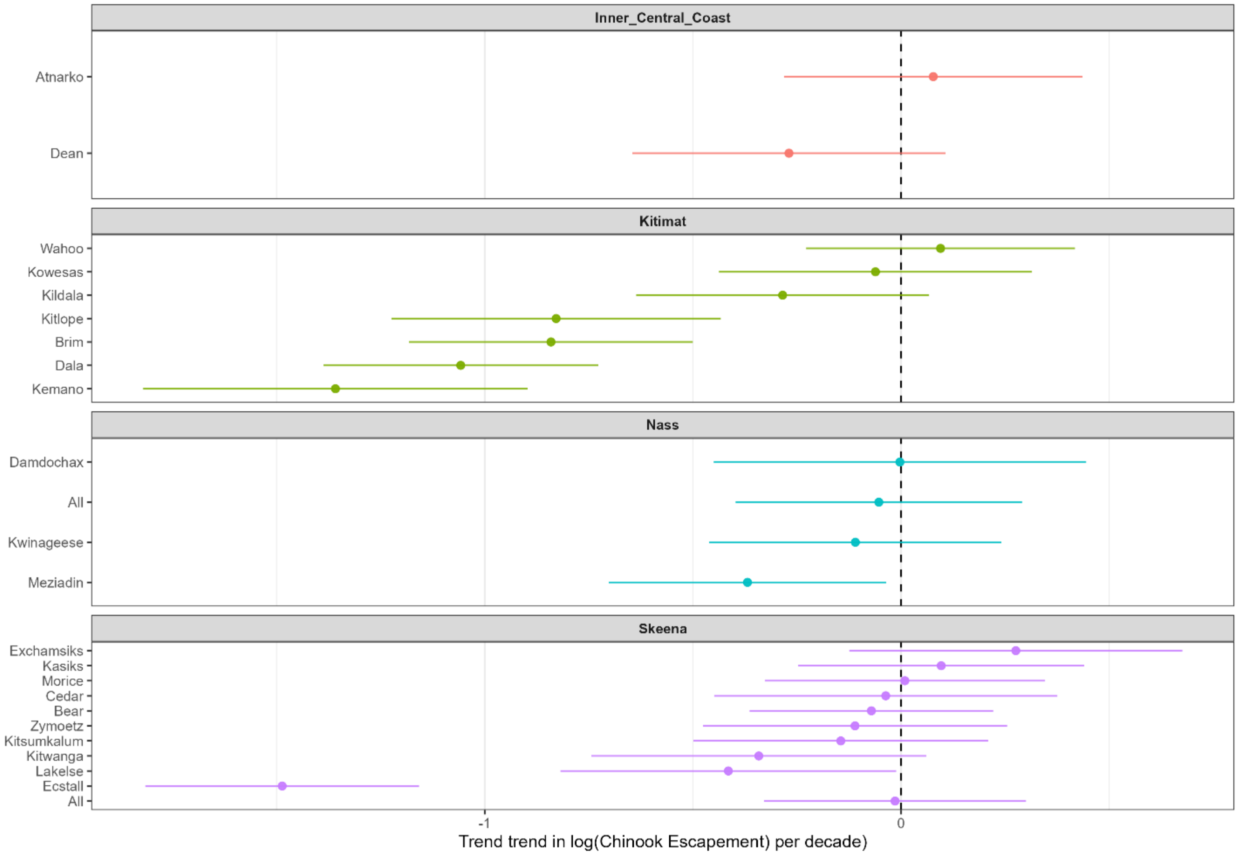

Figure 9: Individual population trends in Chinook salmon populations across the four stronghold watersheds/regions (panels) in the North Coast ecoregion. Mean estimates for decadal log trends in abundance are shown as points, and 95% confidence intervals are plotted as horizontal colored whiskers. Dashed line indicates zero trend.

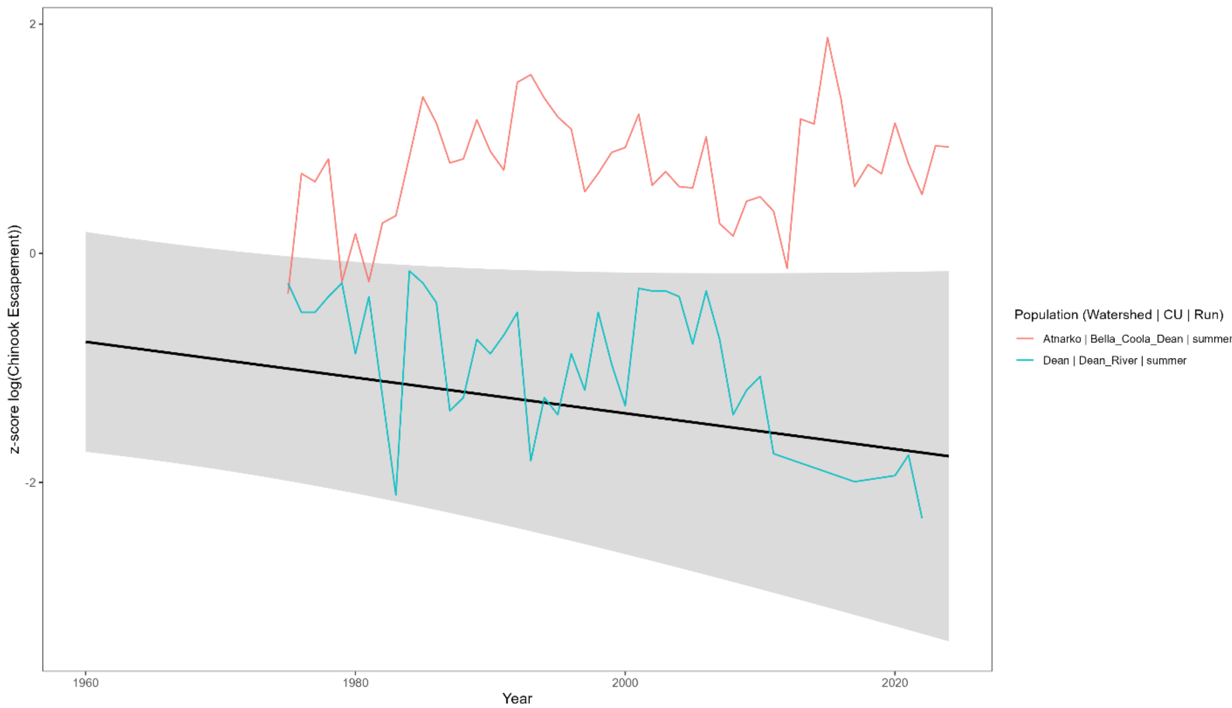

Figure 10: Timeseries of spawner escapement for Chinook salmon populations within the Inner Central Coast stronghold region. Colored lines are individual population timeseries, while the thick black line represents the mean estimated trend for Chinook salmon escapement across the stronghold. Shaded grey areas represent the upper and lower 95% confidence intervals for the trend in Chinook salmon escapement.

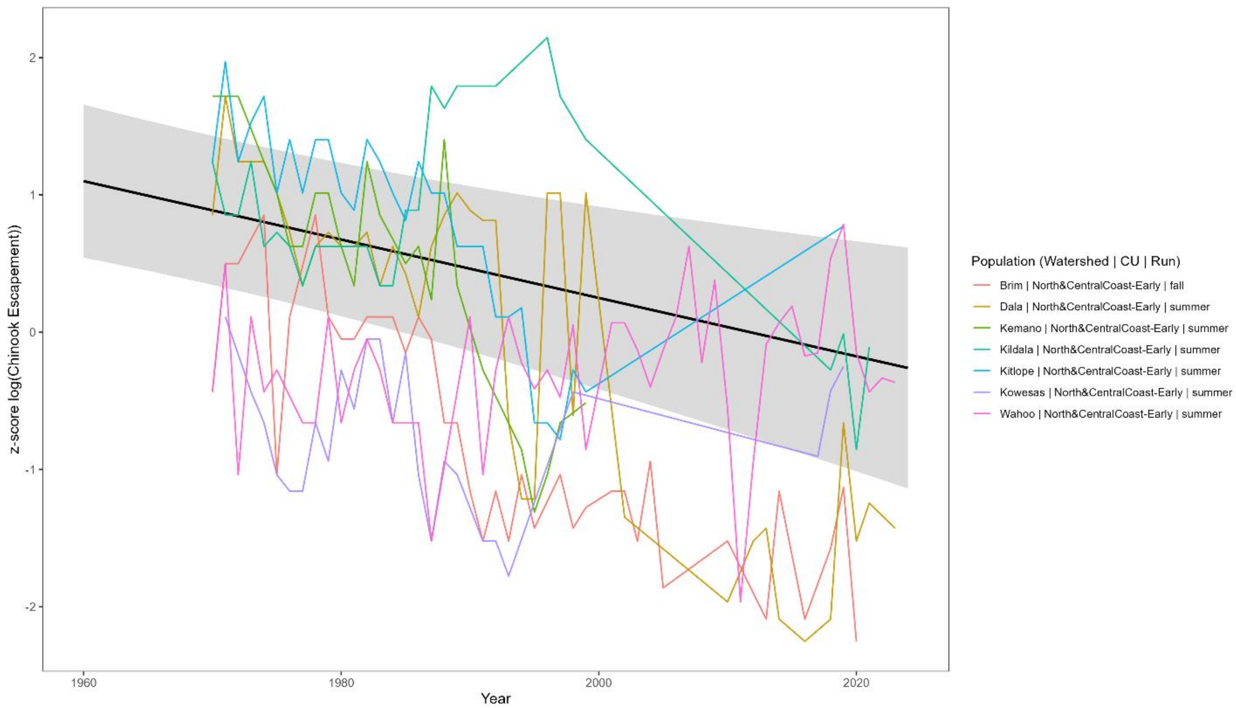

Figure 11: Timeseries of spawner escapement for Chinook salmon populations within the Kitimat Fjords candidate stronghold region. Colored lines are individual population timeseries, while the thick black line represents the mean estimated trend for Chinook salmon escapement across the stronghold. Shaded grey areas represent the upper and lower 95% confidence intervals for the trend in Chinook salmon escapement.

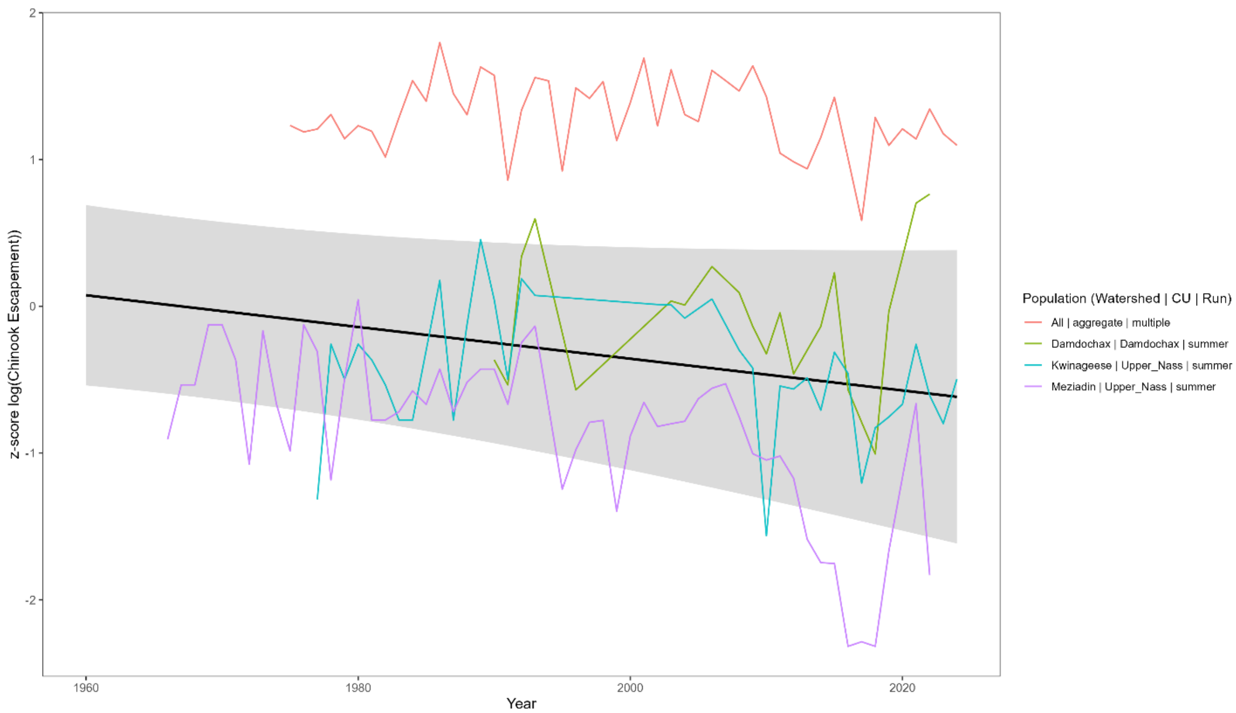

Figure 12: Timeseries of spawner escapement for Chinook salmon populations within the Nass stronghold. Colored lines are individual population timeseries, while the thick black line represents the mean estimated trend for Chinook salmon escapement across the stronghold. Shaded grey areas represent the upper and lower 95% confidence intervals for the trend in Chinook salmon escapement.

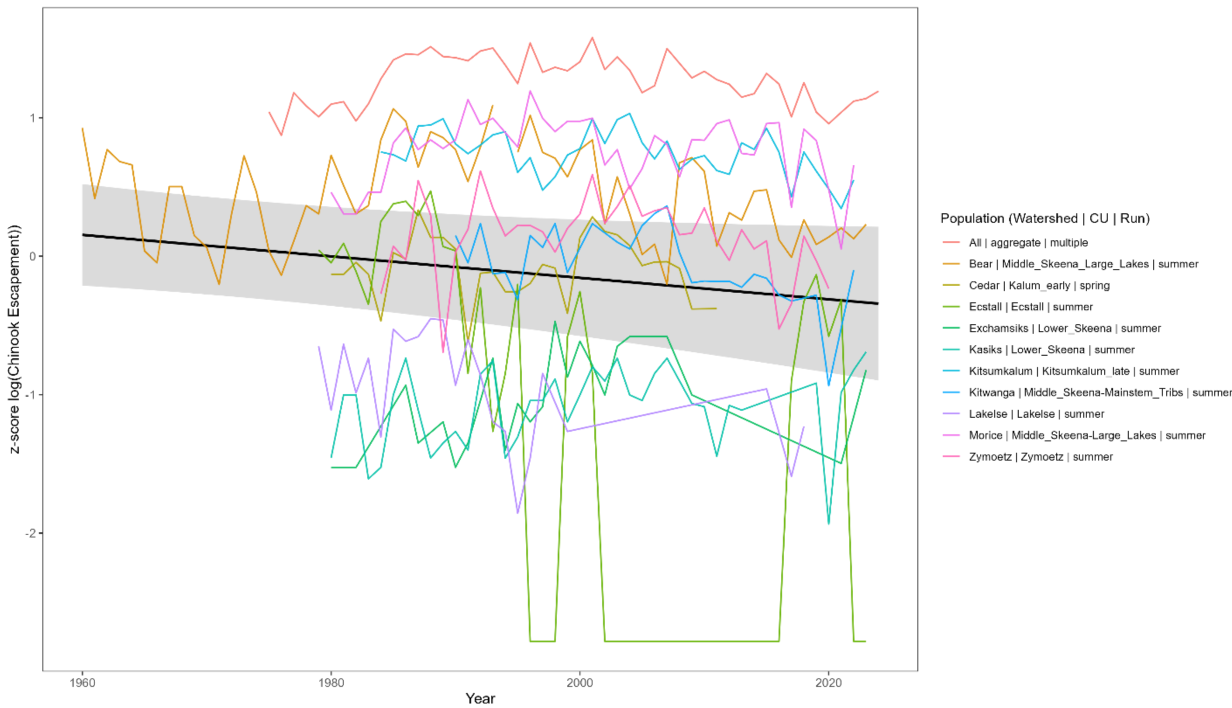

Figure 13: Timeseries of spawner escapement for Chinook salmon populations within the Skeena stronghold. Colored lines are individual population timeseries, while the thick black line represents the mean estimated trend for Chinook salmon escapement across the stronghold. Shaded grey areas represent the upper and lower 95% confidence intervals for the trend in Chinook salmon escapement.

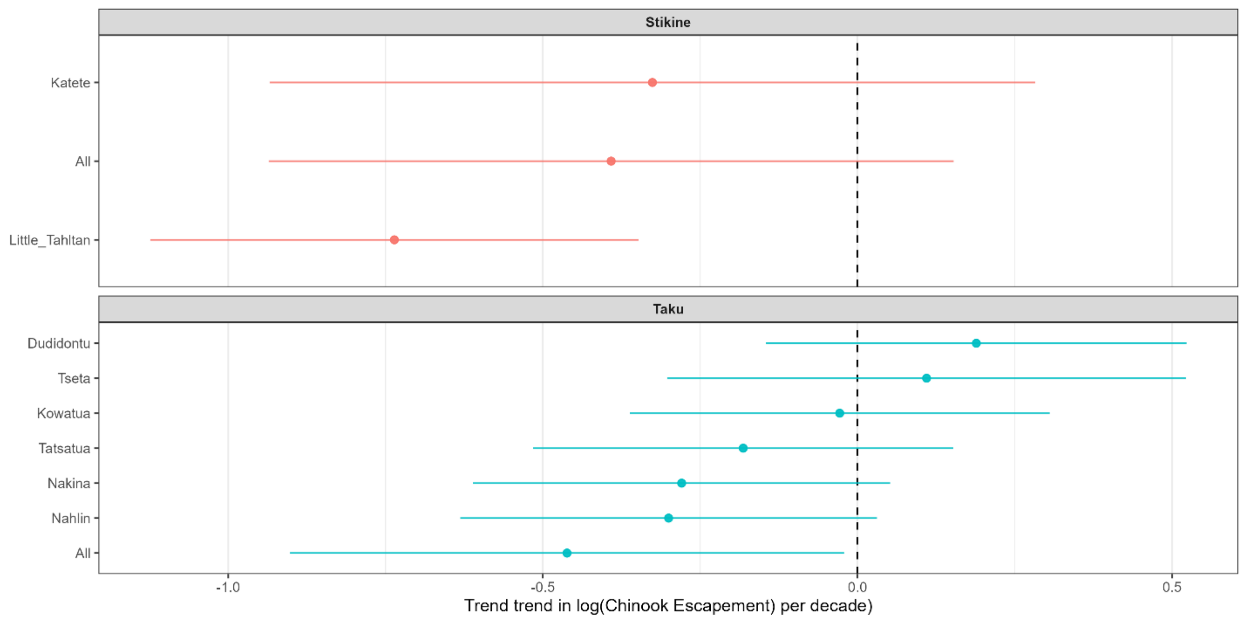

Figure 14: Individual population trends in Chinook salmon populations across the Stikine and Taku watersheds in the Northern Transboundary ecoregion. Mean estimates for decadal log trends in abundance are shown as points, and 95% confidence intervals are plotted as horizontal colored whiskers. Dashed line indicates zero trend.

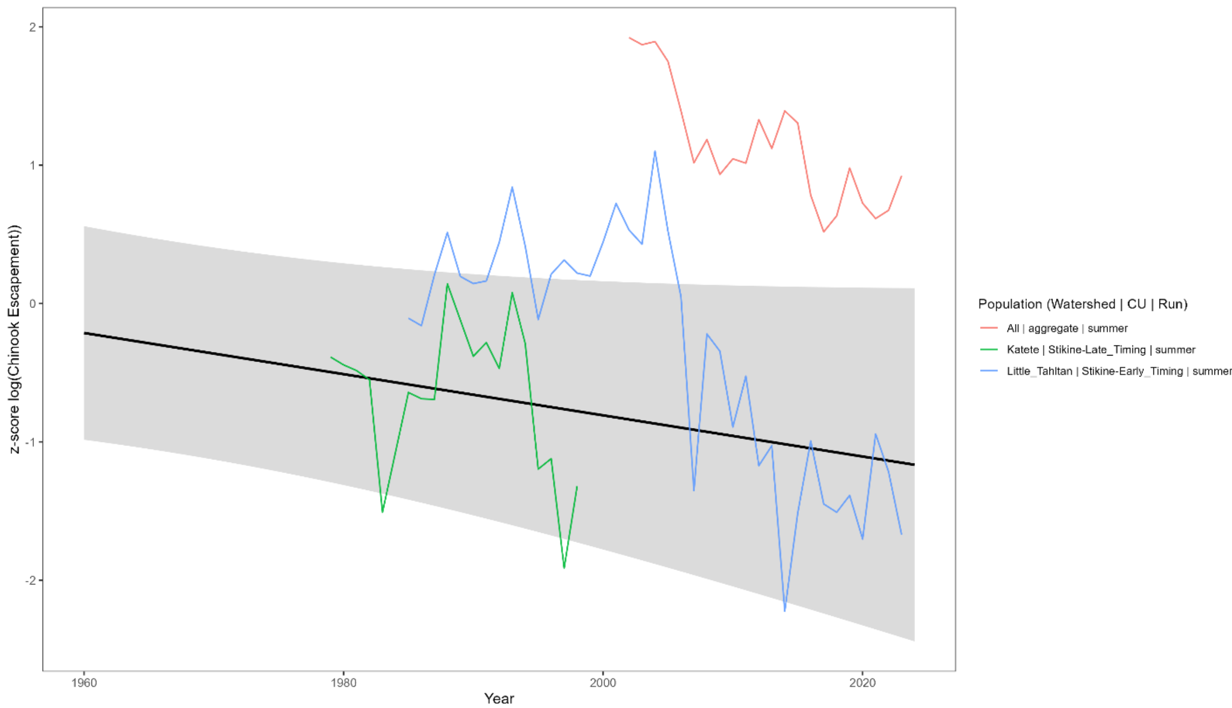

Figure 15: Timeseries of spawner escapement for Chinook salmon populations within the Stikine candidate stronghold. Colored lines are individual population timeseries, while the thick black line represents the mean estimated trend for Chinook salmon escapement across the stronghold. Shaded grey areas represent the upper and lower 95% confidence intervals for the trend in Chinook salmon escapement.

Figure 16: Timeseries of spawner escapement for Chinook salmon populations within the Taku stronghold. Colored lines are individual population timeseries, while the thick black line represents the mean estimated trend for Chinook salmon escapement across the stronghold. Shaded grey areas represent the upper and lower 95% confidence intervals for the trend in Chinook salmon escapement.

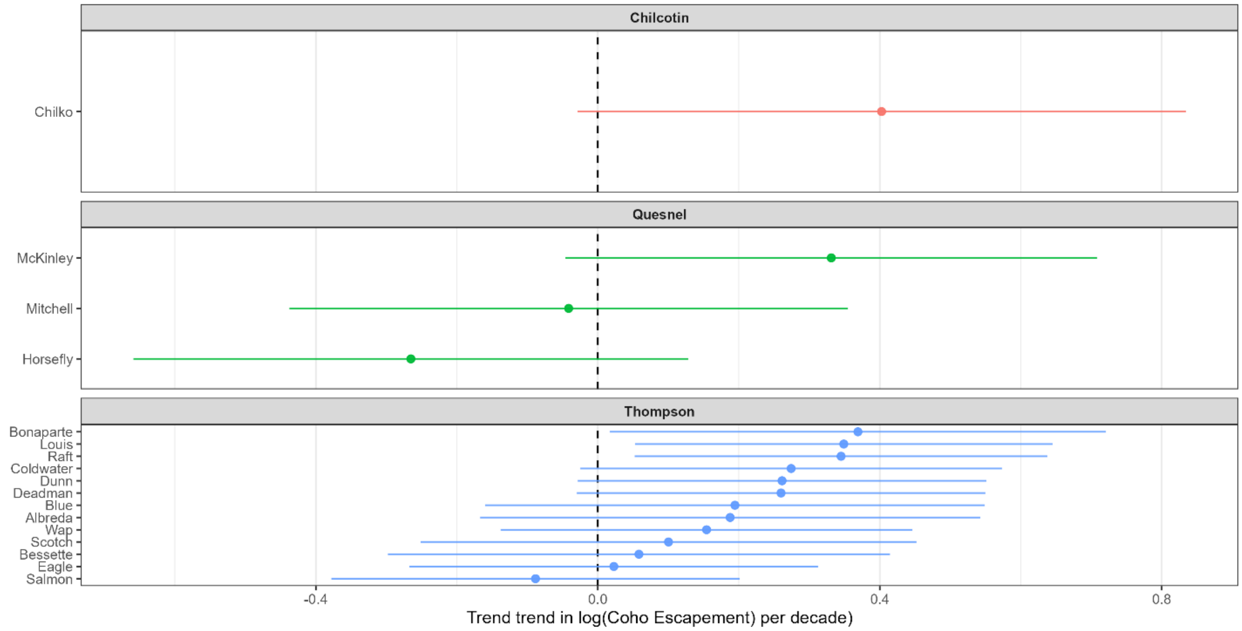

Figure 17: Individual population trends in coho salmon populations across the three stronghold watersheds in the Fraser River ecoregion where escapement data was available. Mean estimates for decadal log trends in abundance are shown as points, and 95% confidence intervals are plotted as horizontal, colored whiskers. Dashed line indicates zero trend.

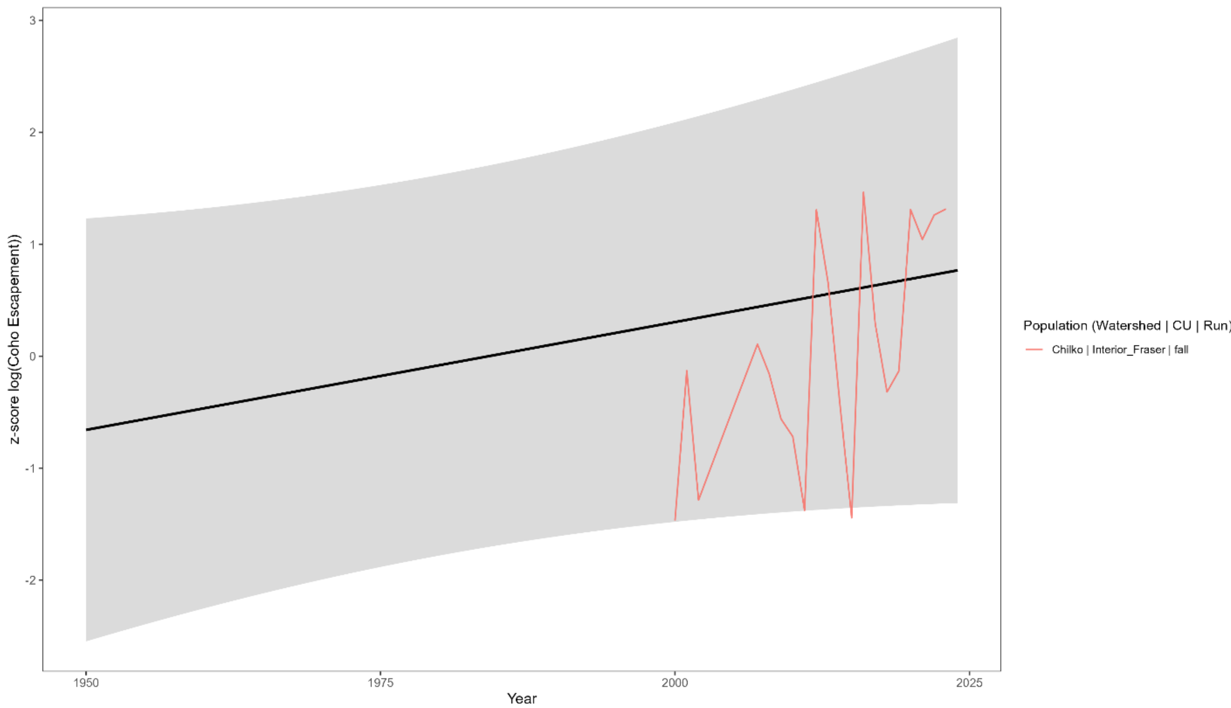

Figure 18: Timeseries of spawner escapement for coho salmon populations within the Chilcotin candidate stronghold. Colored lines are individual population timeseries, only one location (Chilko River) is consistently monitored for coho escapement. Shaded grey areas represent the upper and lower 95% confidence intervals for the trend in coho salmon escapement.

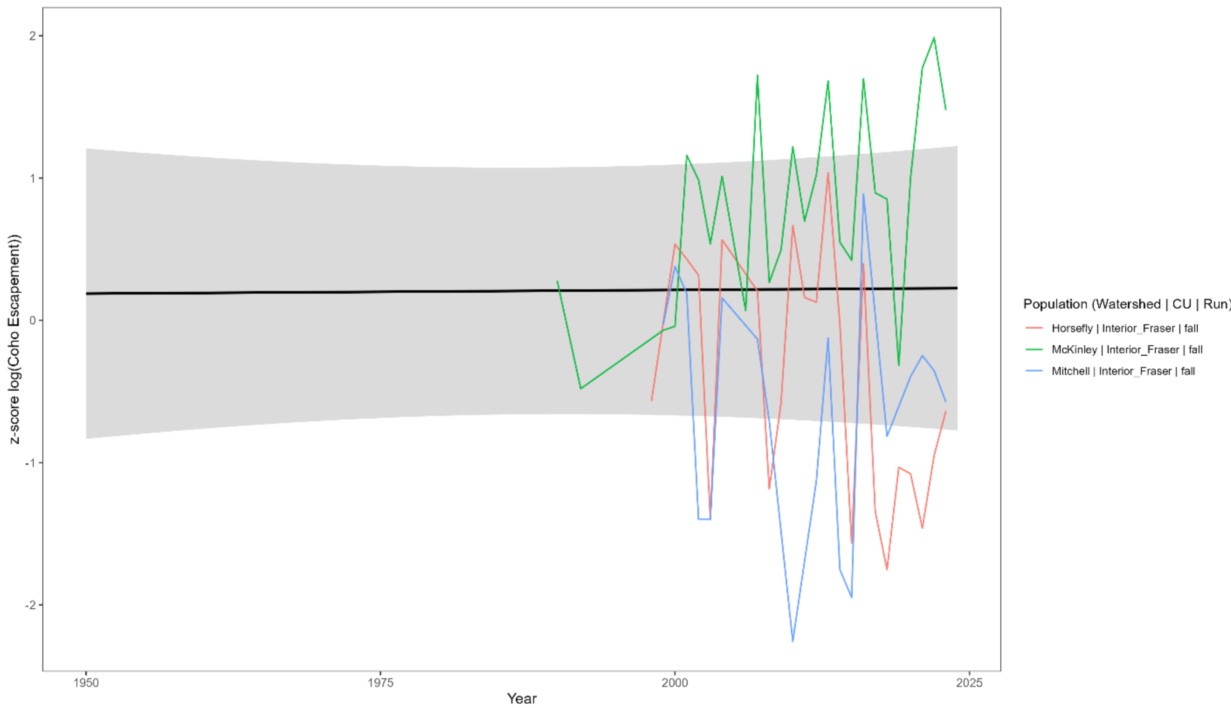

Figure 19: Timeseries of spawner escapement for coho salmon populations within the Quesnel candidate stronghold. Colored lines are individual population timeseries, while shaded grey areas represent the upper and lower 95% confidence intervals for the trend in coho salmon escapement.

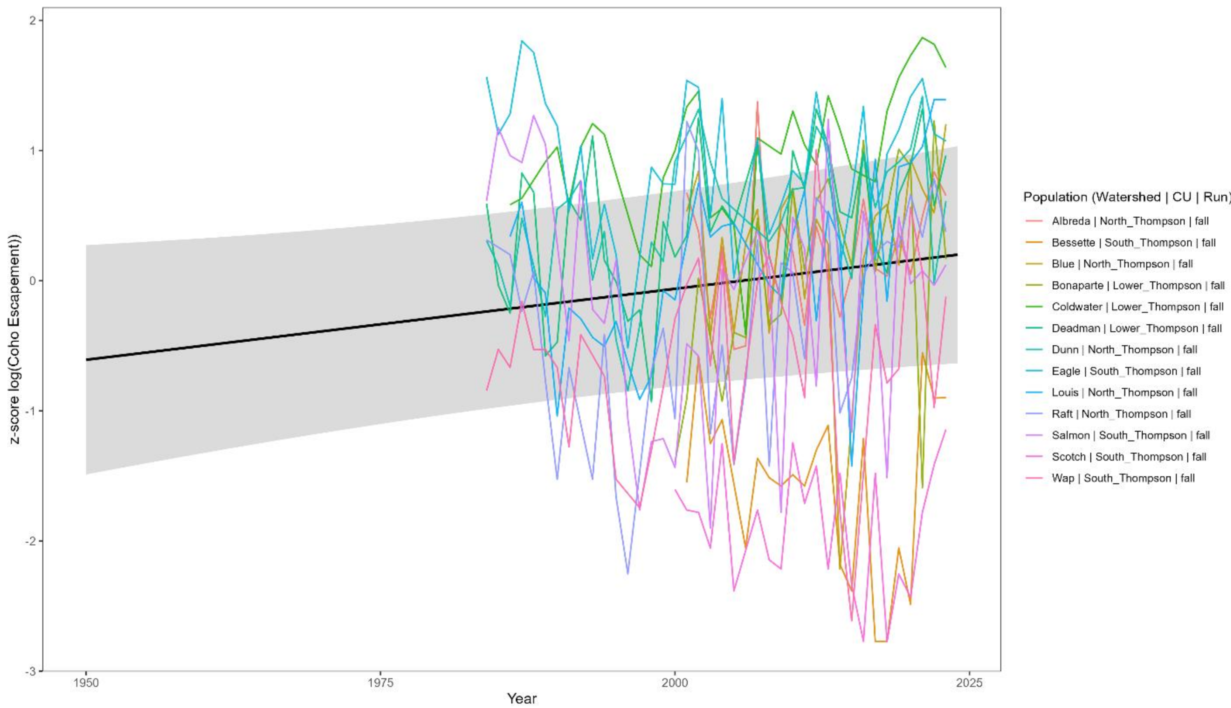

Figure 20: Timeseries of spawner escapement for coho salmon populations within the Thompson candidate stronghold. Colored lines are individual population timeseries, while shaded grey areas represent the upper and lower 95% confidence intervals for the trend in coho salmon escapement.

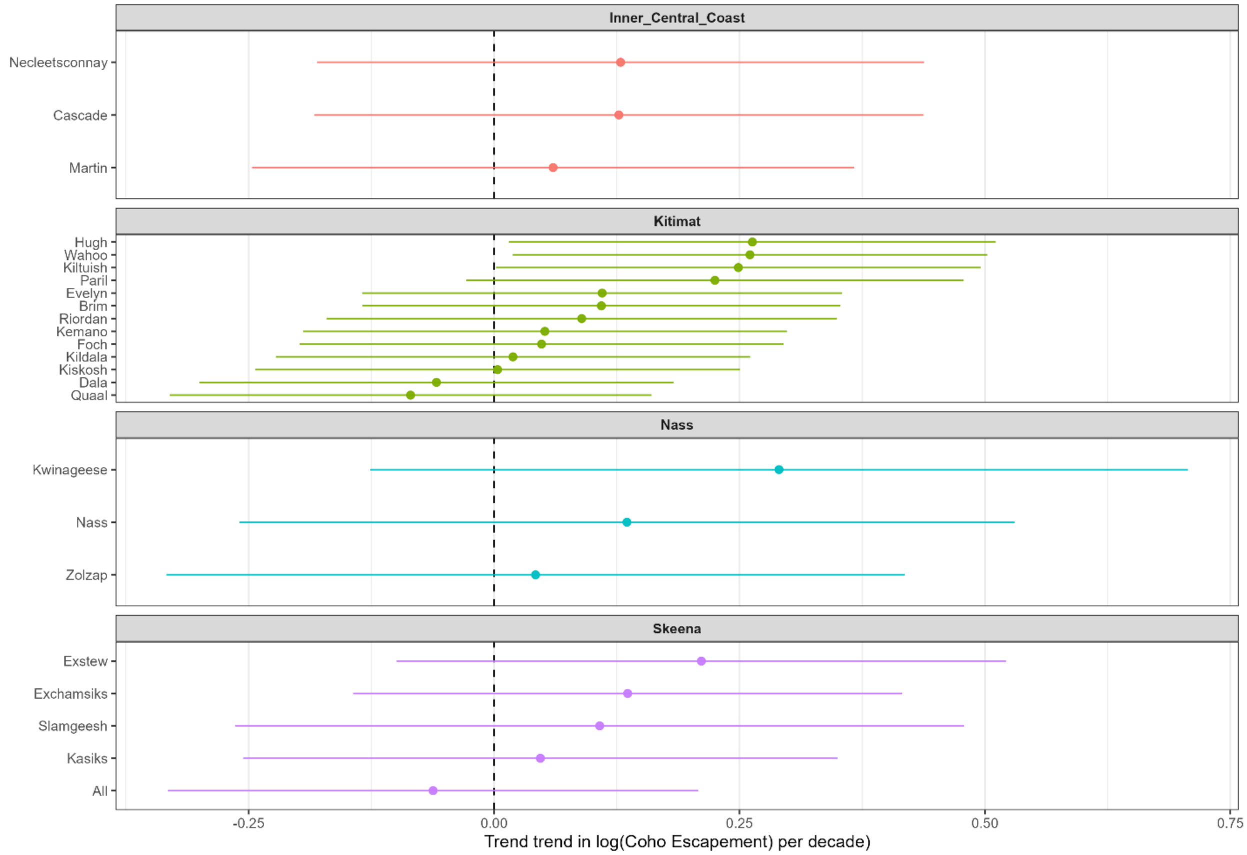

Figure 21: Individual population trends in coho salmon populations across the four stronghold watersheds/regions in the North Coast ecoregion where escapement data was available. Mean estimates for decadal log trends in abundance are shown as points, and 95% confidence intervals are plotted as horizontal, colored whiskers. Dashed line indicates zero trend.

Figure 22: Timeseries of spawner escapement for coho salmon populations within the Inner Central Coast stronghold. Colored lines are individual population timeseries, while shaded grey areas represent the upper and lower 95% confidence intervals for the trend in coho salmon escapement.

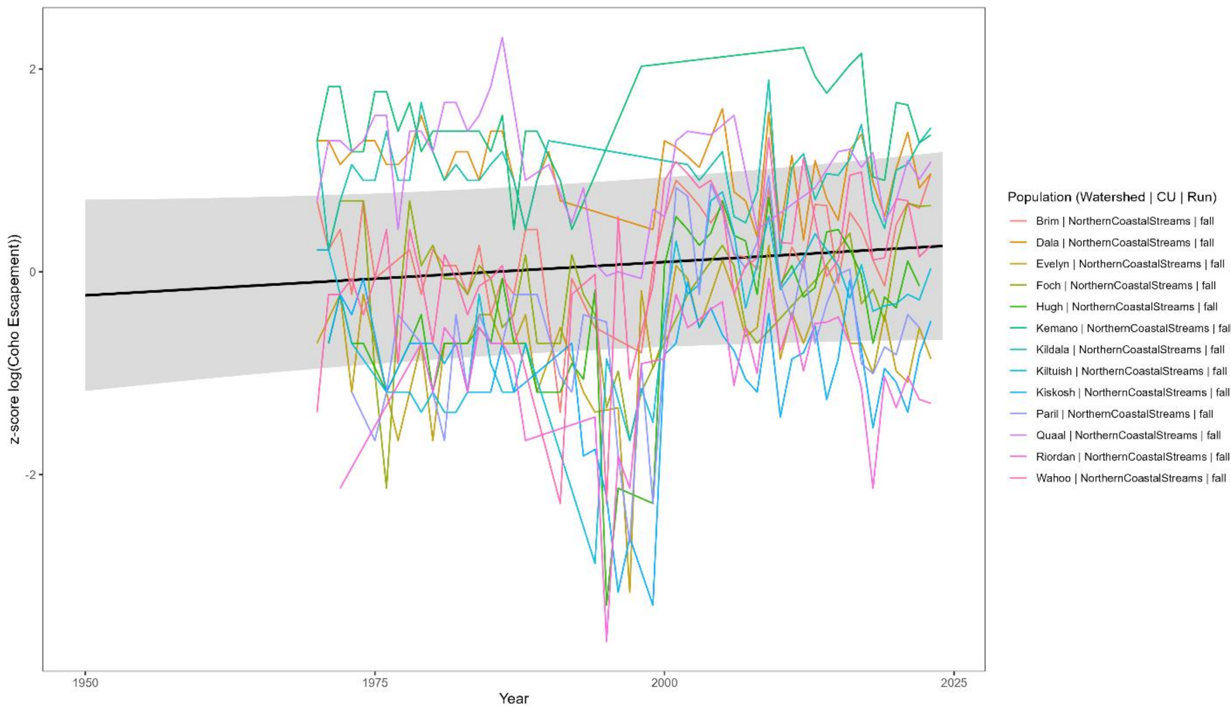

Figure 23: Timeseries of spawner escapement for coho salmon populations within the Kitimat & Fjords candidate stronghold. Colored lines are individual population timeseries, while shaded grey areas represent the upper and lower 95% confidence intervals for the trend in coho salmon escapement.

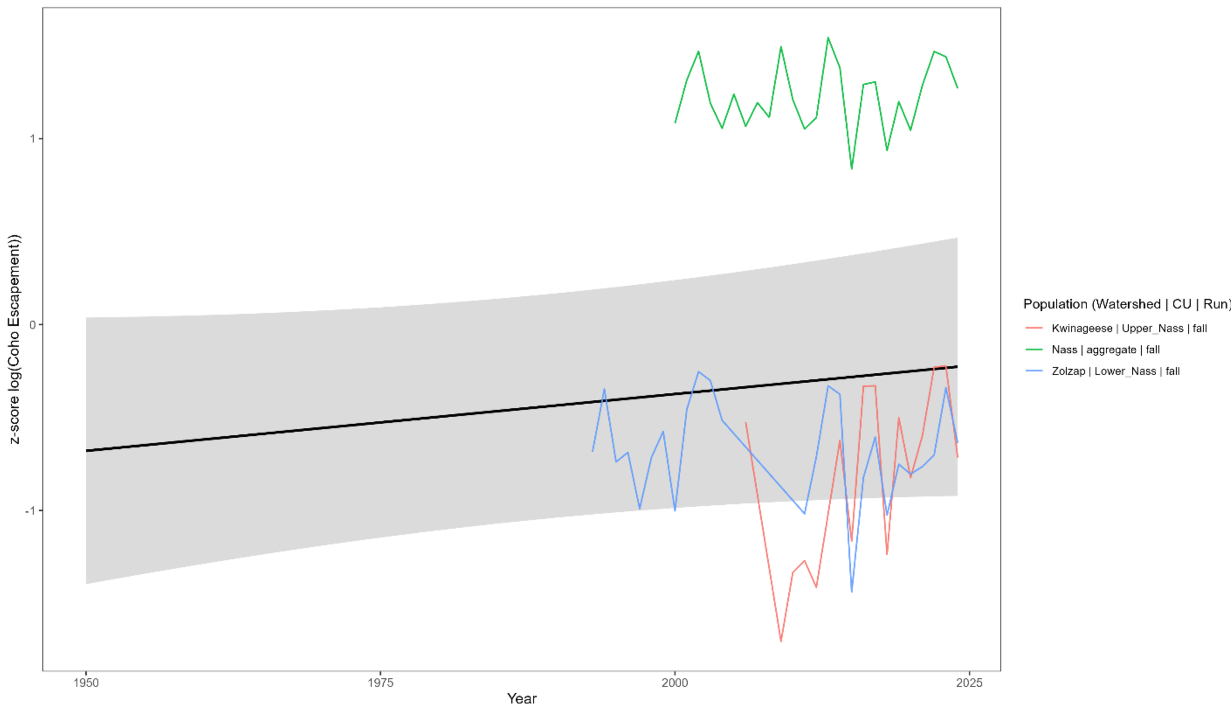

Figure 24: Timeseries of spawner escapement for coho salmon populations within the Nass stronghold. Colored lines are individual population timeseries, while shaded grey areas represent the upper and lower 95% confidence intervals for the trend in coho salmon escapement.

Figure 25: Timeseries of spawner escapement for coho salmon populations within the Skeena stronghold. Colored lines are individual population timeseries, while shaded grey areas represent the upper and lower 95% confidence intervals for the trend in coho salmon escapement.

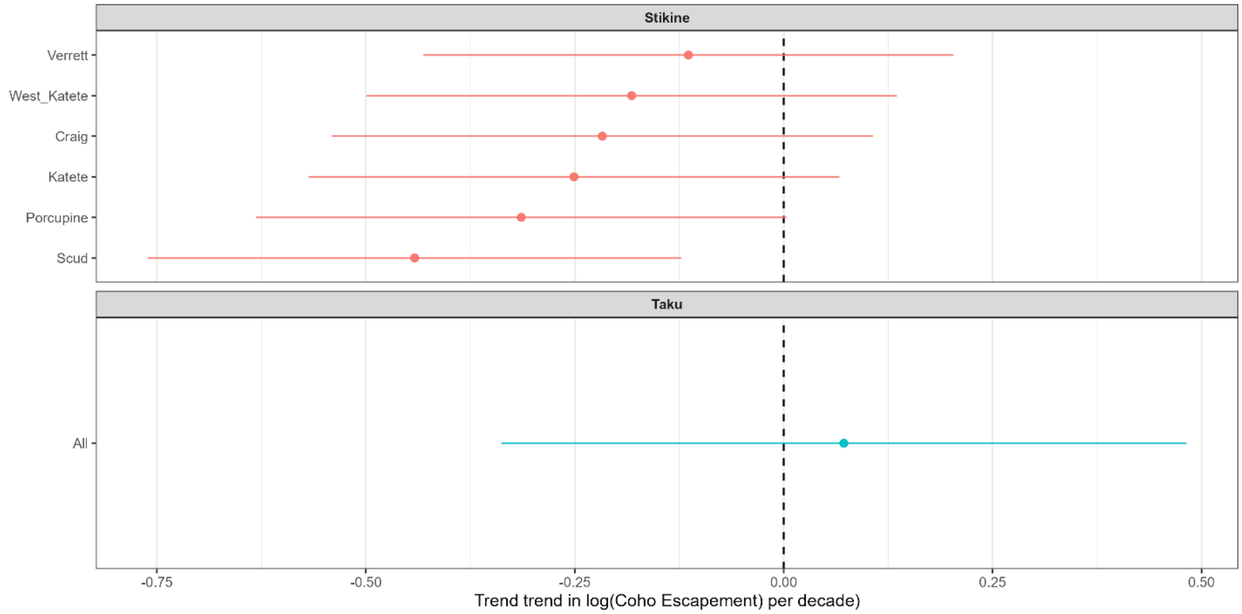

Figure 26: Individual population trends in coho salmon populations across the two watersheds in the Northern Transboundary ecoregion. Only aggregate watershed-scale coho abundance is estimated for the Taku River. Mean estimates for decadal log trends in abundance are shown as points, and 95% confidence intervals are plotted as horizontal, colored whiskers. Dashed line indicates zero trend.

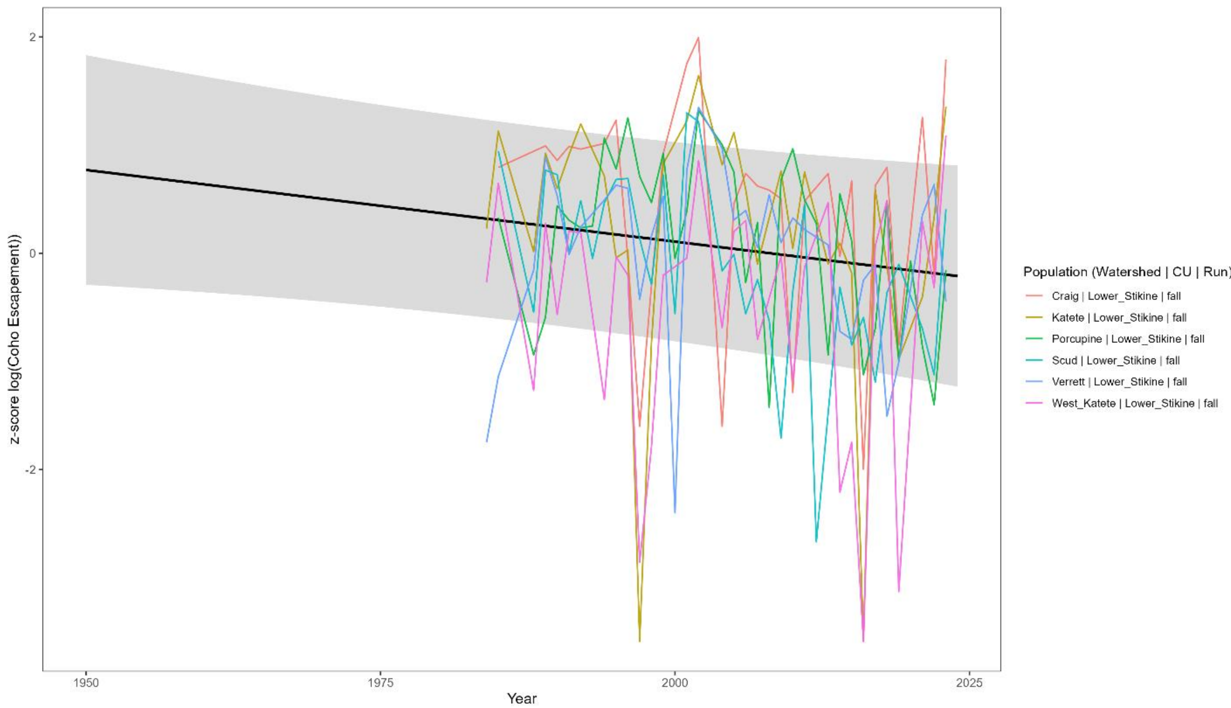

Figure 27: Timeseries of spawner escapement for coho salmon populations within the Stikine candidate stronghold. Colored lines are individual population timeseries, while shaded grey areas represent the upper and lower 95% confidence intervals for the trend in coho salmon escapement.

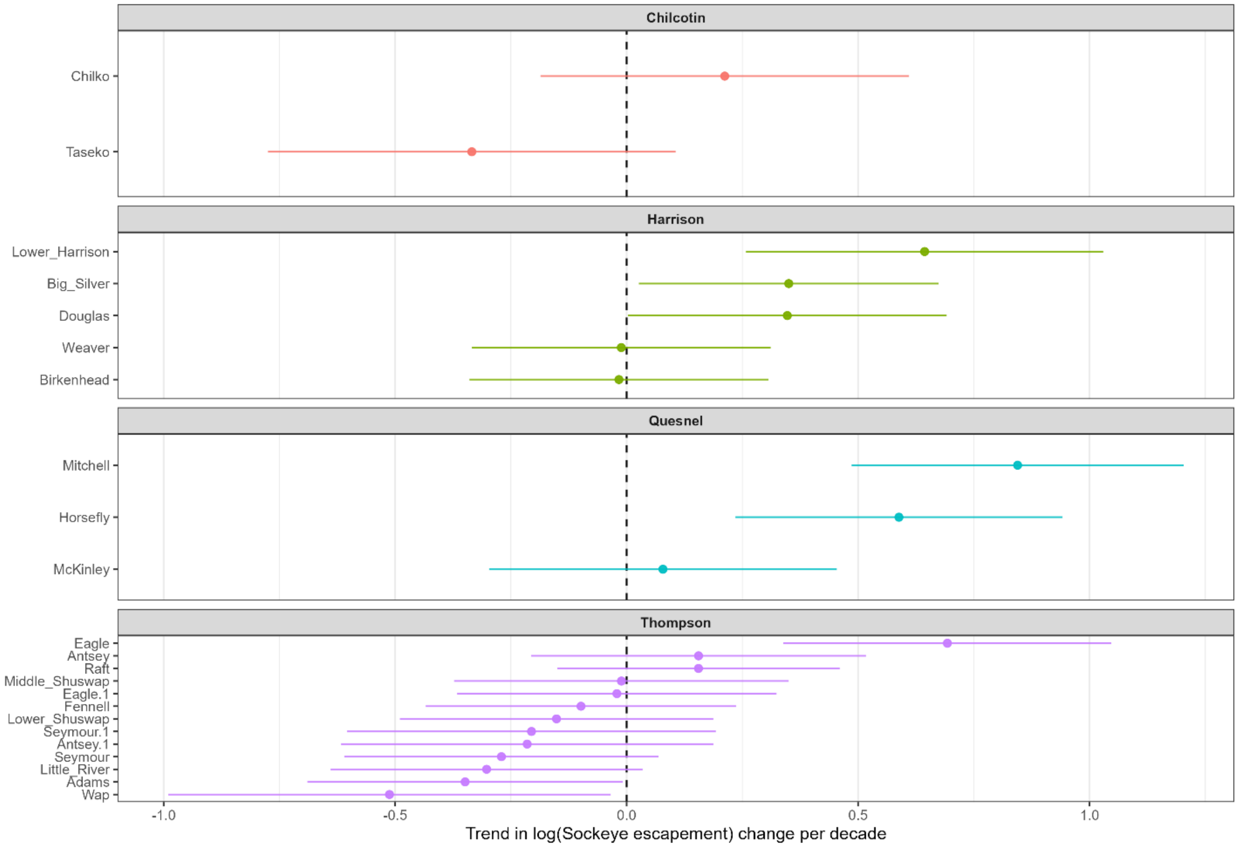

Figure 28: Individual population trends in sockeye salmon populations across the four stronghold watersheds in the Fraser River ecoregion. Mean estimates for decadal log trends in abundance are shown as points, and 95% confidence intervals are plotted as horizontal, colored whiskers. Dashed line indicates zero trend.

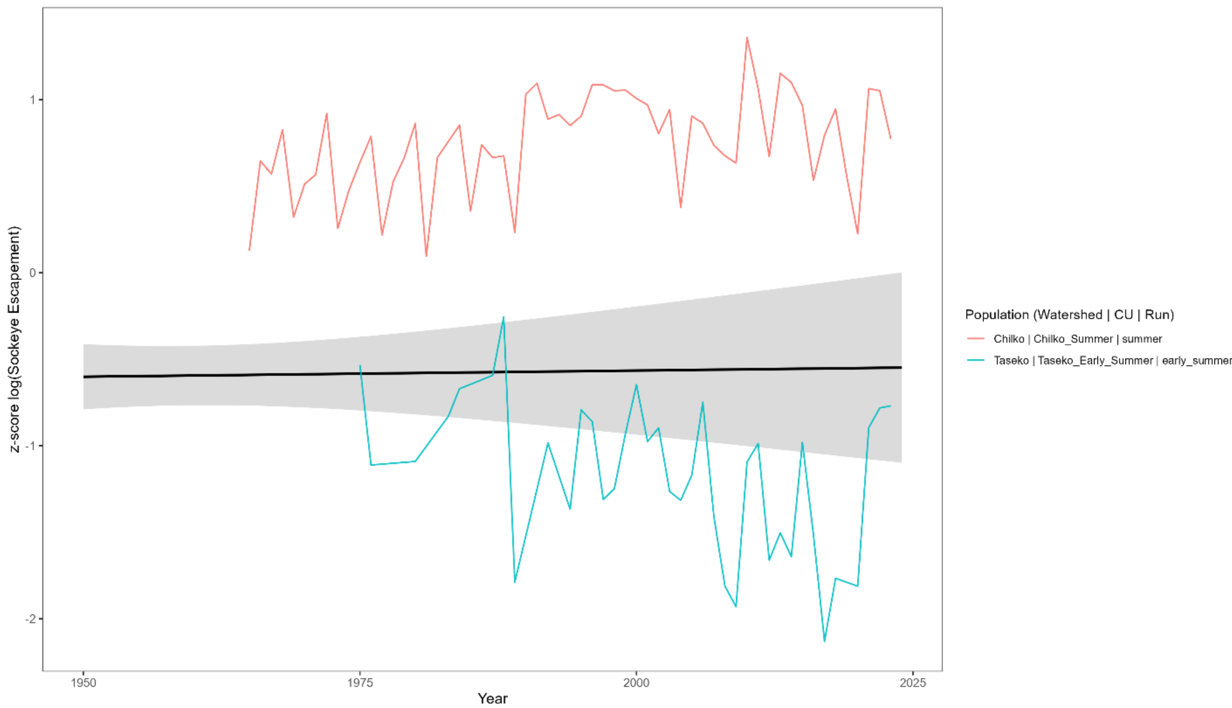

Figure 29: Timeseries of spawner escapement for sockeye salmon populations within the Chilcotin candidate stronghold. Colored lines are individual population timeseries, dark line represents the mean estimated trend for sockeye spawner abundance within the Chilcotin stronghold, while shaded grey areas represent the upper and lower 95% confidence intervals for the trend in sockeye salmon escapement.

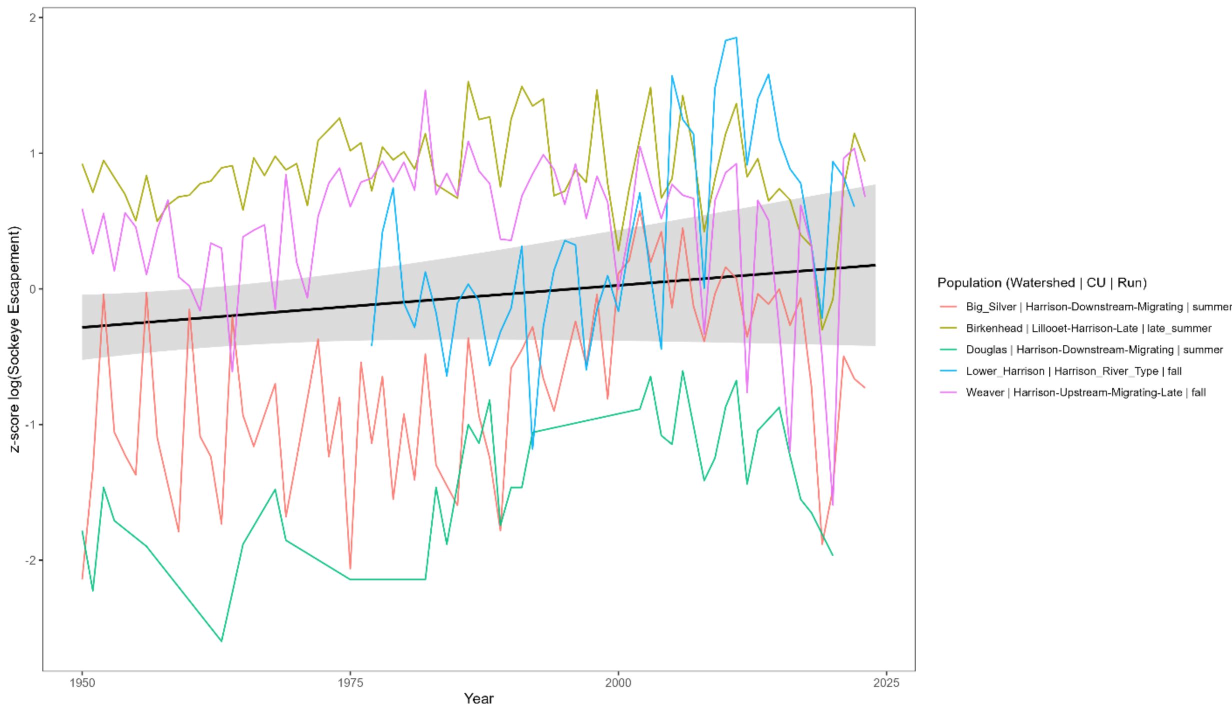

Figure 30: Timeseries of spawner escapement for sockeye salmon populations within the Harrison stronghold. Colored lines are individual population timeseries, the dark line is the median trend for sockeye escapement in the stronghold, while shaded grey areas represent the upper and lower 95% confidence intervals for the stronghold trend in sockeye salmon escapement.

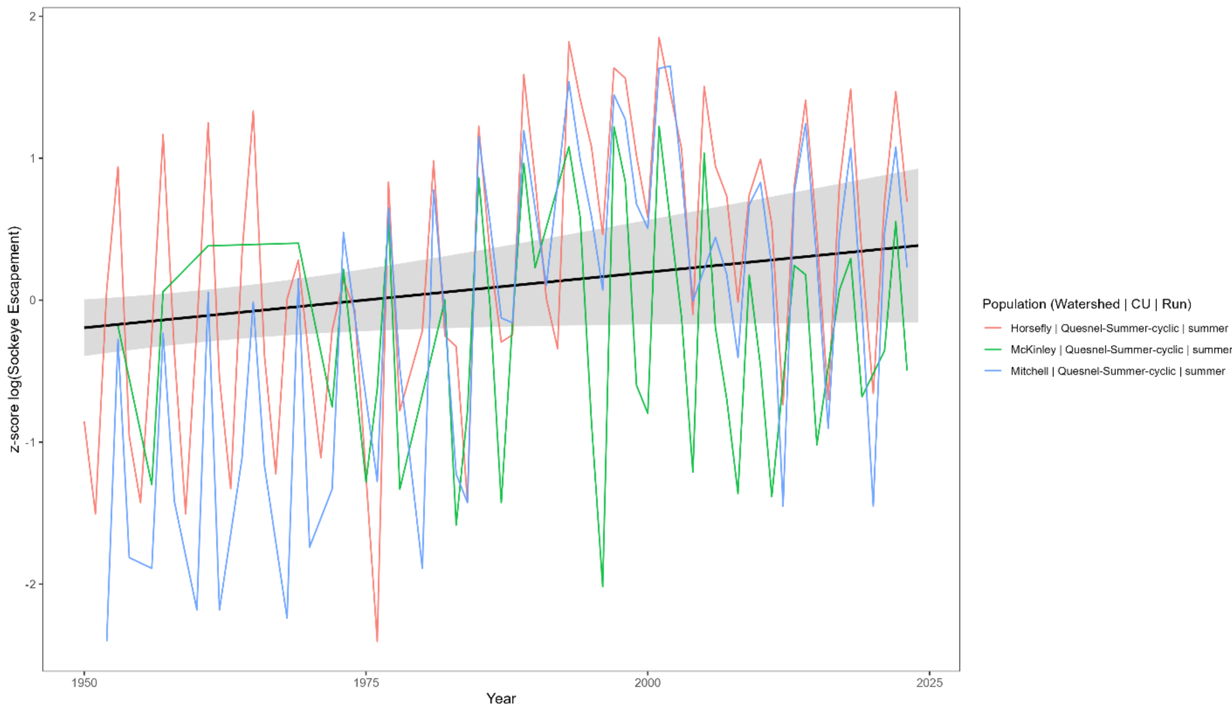

Figure 31: Timeseries of spawner escapement for sockeye salmon populations within the Quesnel candidate stronghold. Colored lines are individual population timeseries, the dark line is the median trend for sockeye escapement in the watershed, while shaded grey areas represent the upper and lower 95% confidence intervals for the watershed-level trend in sockeye salmon escapement.

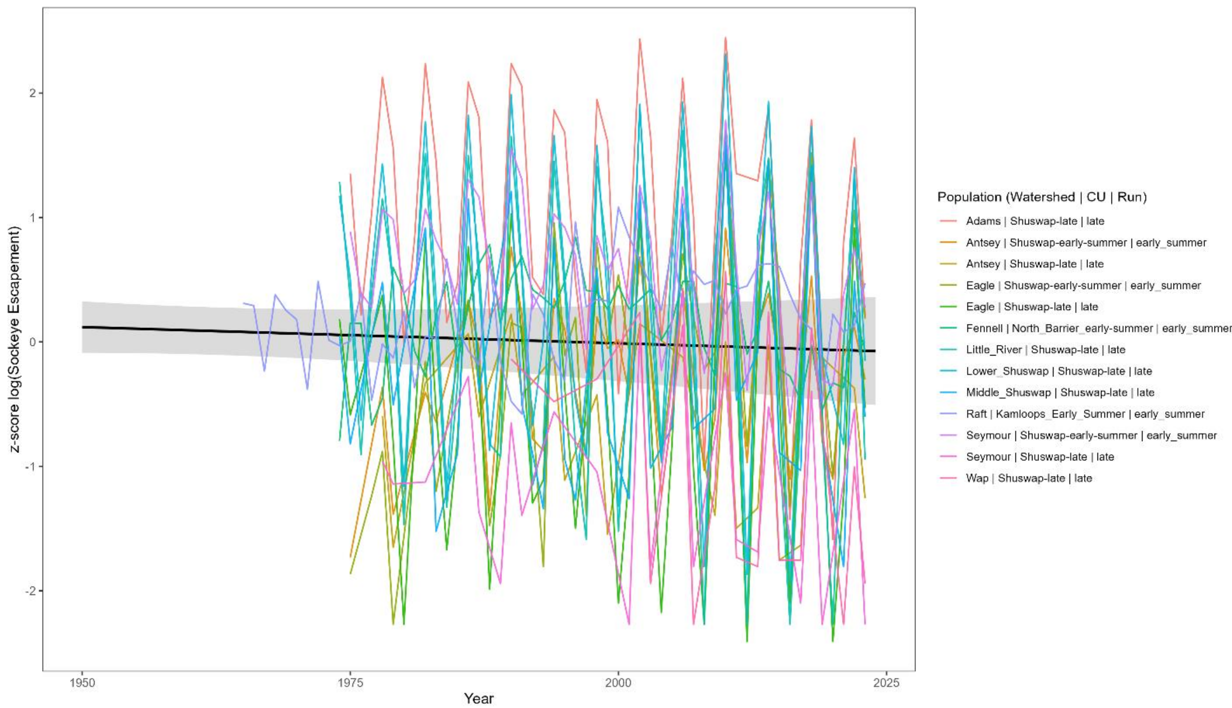

Figure 32: Timeseries of spawner escapement for sockeye salmon populations within the Thompson candidate stronghold. Colored lines are individual population timeseries, the dark line is the median trend for sockeye escapement in the watershed, while shaded grey areas represent the upper and lower 95% confidence intervals for the watershed-level trend in sockeye salmon escapement.

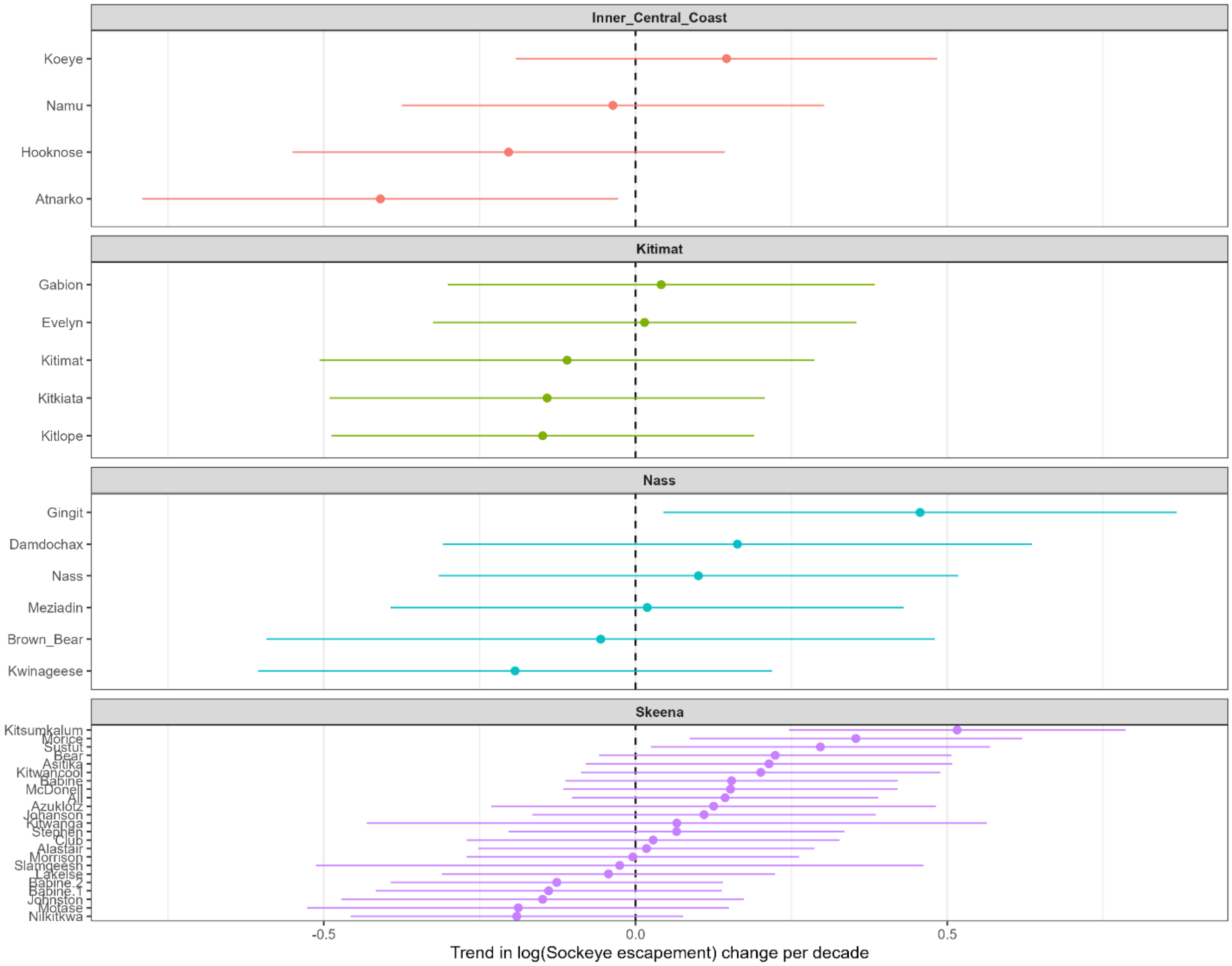

Figure 33: Individual population trends in sockeye salmon populations across the four stronghold watersheds/subregions in the North Coast ecoregion. Mean estimates for decadal log trends in abundance are shown as points, and 95% confidence intervals are plotted as horizontal, colored whiskers. Dashed line indicates zero trend.

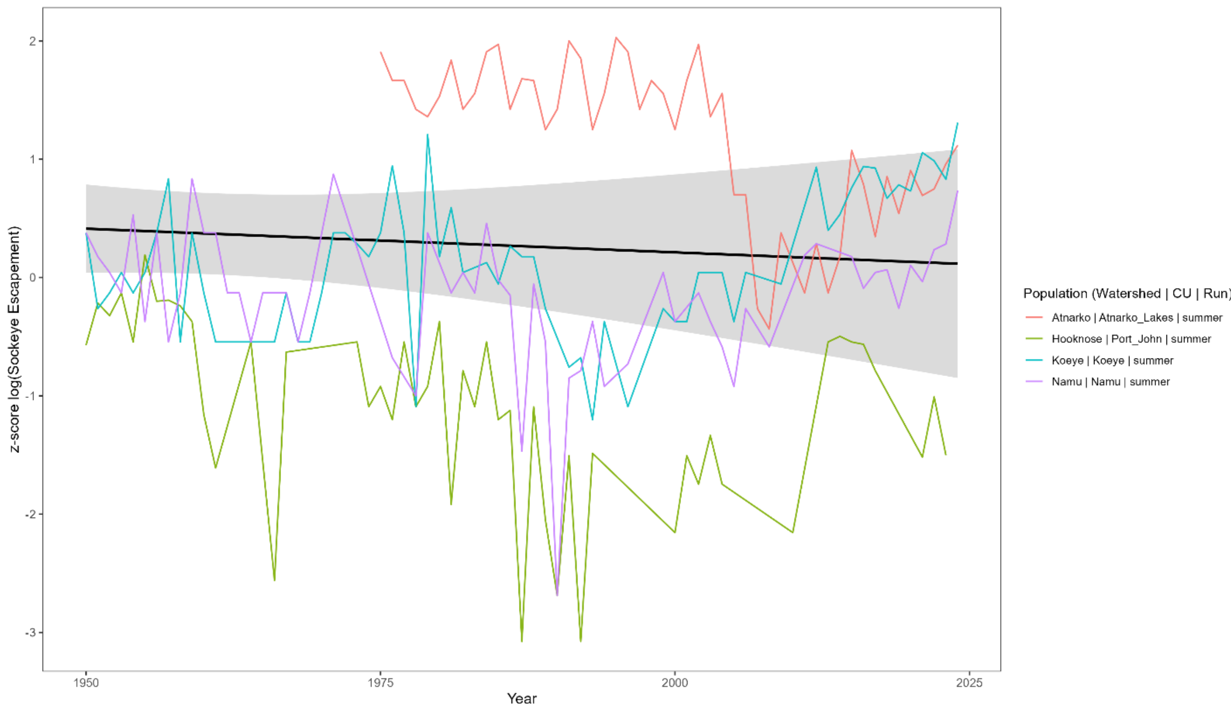

Figure 34: Timeseries of spawner escapement for sockeye salmon populations within the Inner Central Coast stronghold. Colored lines are individual population timeseries, while the dark line represents the mean estimated trend for the stronghold, and shaded grey areas represent the upper and lower 95% confidence intervals for the stronghold trend in sockeye salmon escapement.

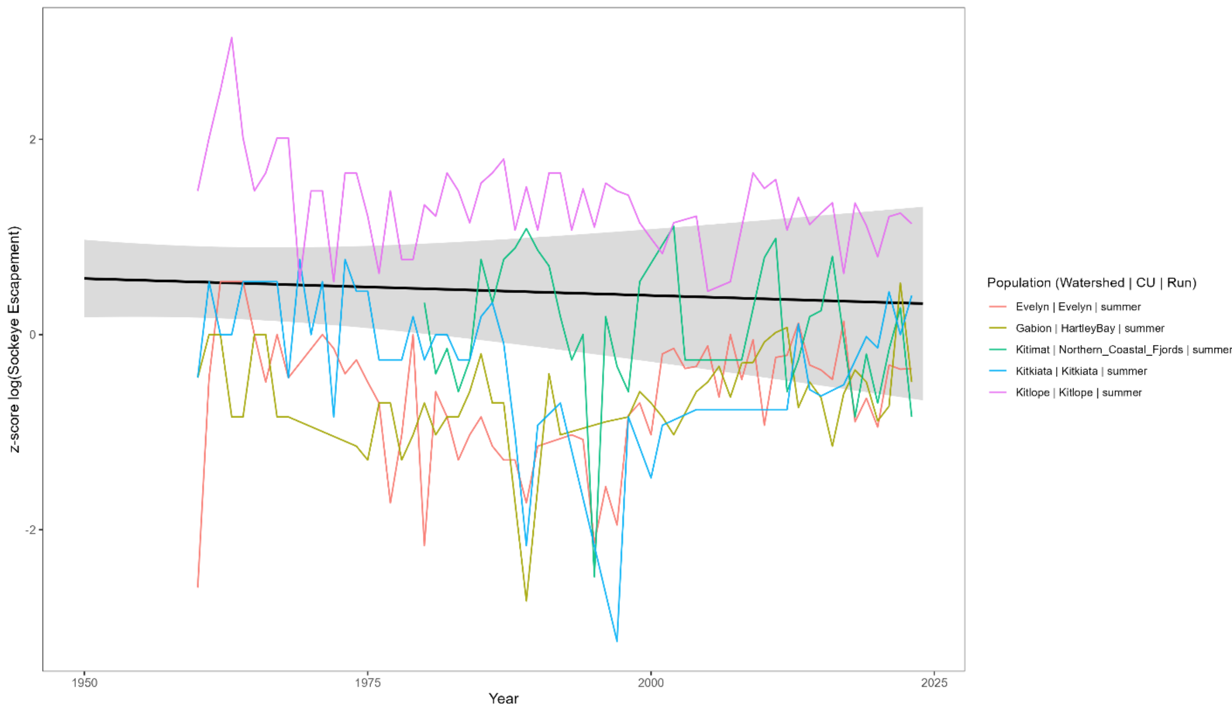

Figure 35: Timeseries of spawner escapement for sockeye salmon populations within the Kitimat & Fjords candidate stronghold. Colored lines are individual population timeseries, while the thick black line represents mean trend estimate sockeye across the Kitimat & Fjords candidate stronghold, and shaded grey areas represent the upper and lower 95% confidence intervals for the aggregate trend in sockeye salmon escapement.

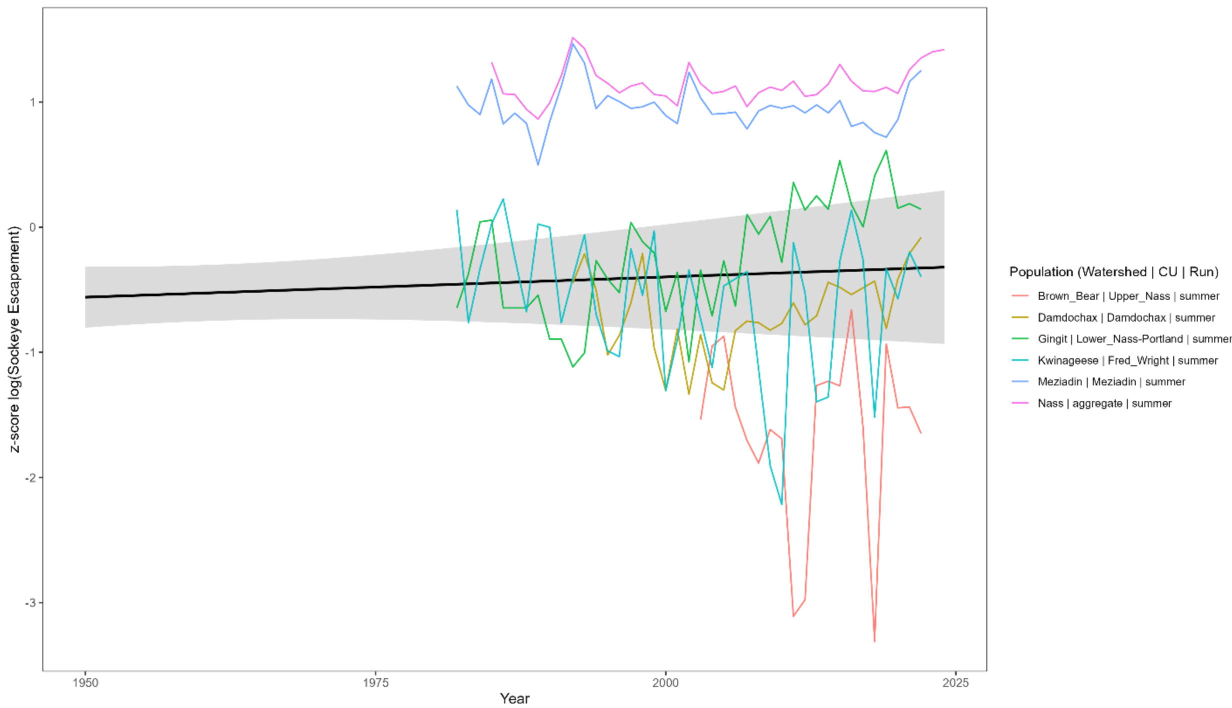

Figure 36: Timeseries of spawner escapement for sockeye salmon populations within the Nass stronghold. Colored lines are individual population timeseries, the thick black line represents mean trend estimate sockeye across the Nass stronghold, and shaded grey areas represent the upper and lower 95% confidence intervals for the aggregate trend in sockeye salmon escapement.

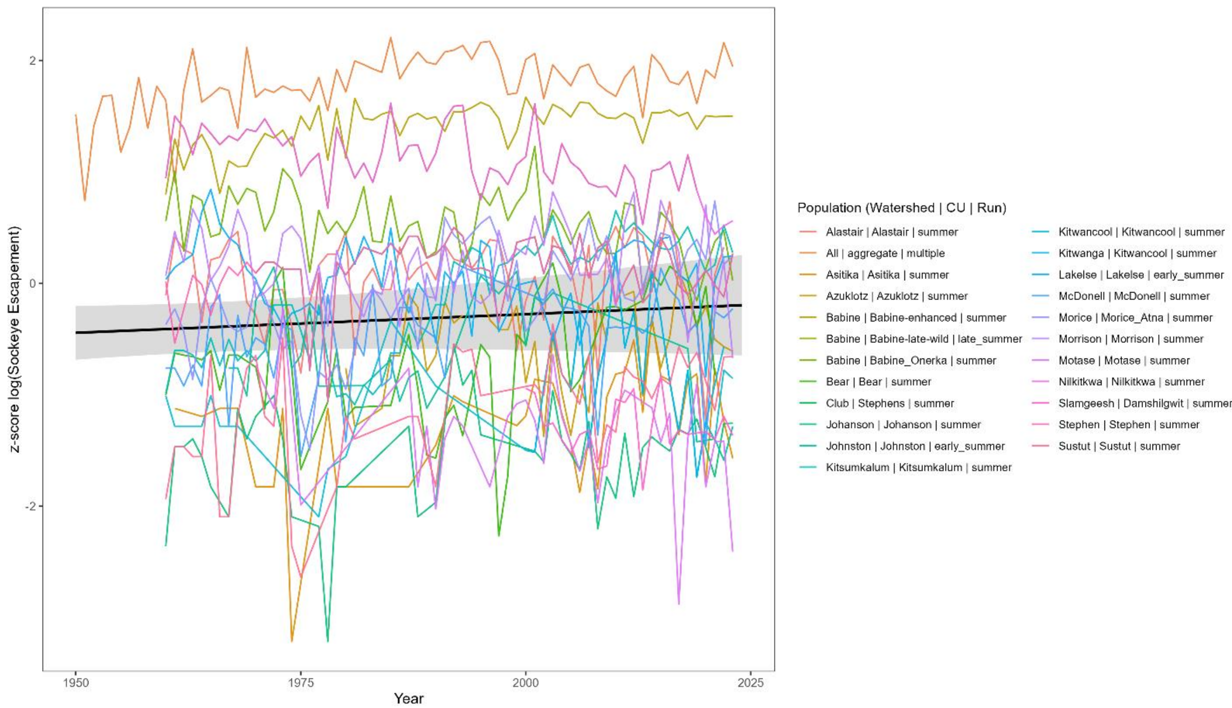

Figure 37: Timeseries of spawner escapement for sockeye salmon populations within the Skeena stronghold. Colored lines are individual population timeseries, the thick black line represents mean trend estimate sockeye across the Skeena stronghold, and shaded grey areas represent the upper and lower 95% confidence intervals for the aggregate trend in sockeye salmon escapement.

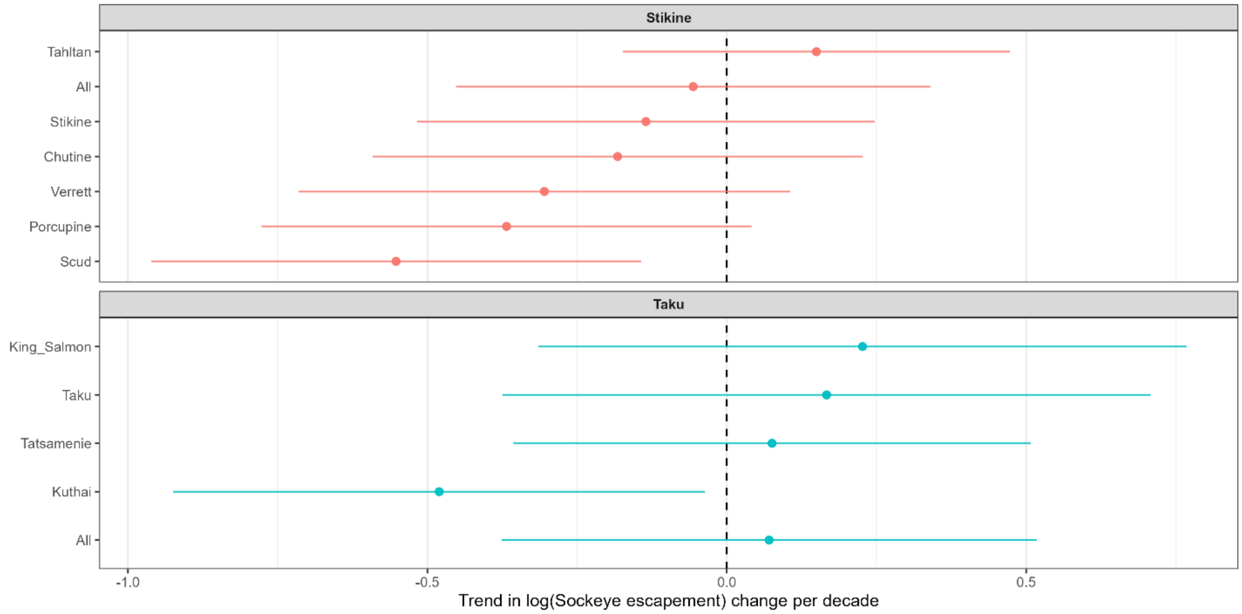

Figure 38: Individual population trends in sockeye salmon populations across the two stronghold watersheds in the Northern Transboundary ecoregion. Mean estimates for decadal log trends in abundance are shown as points, and 95% confidence intervals are plotted as horizontal, colored whiskers. Dashed line indicates zero trend.

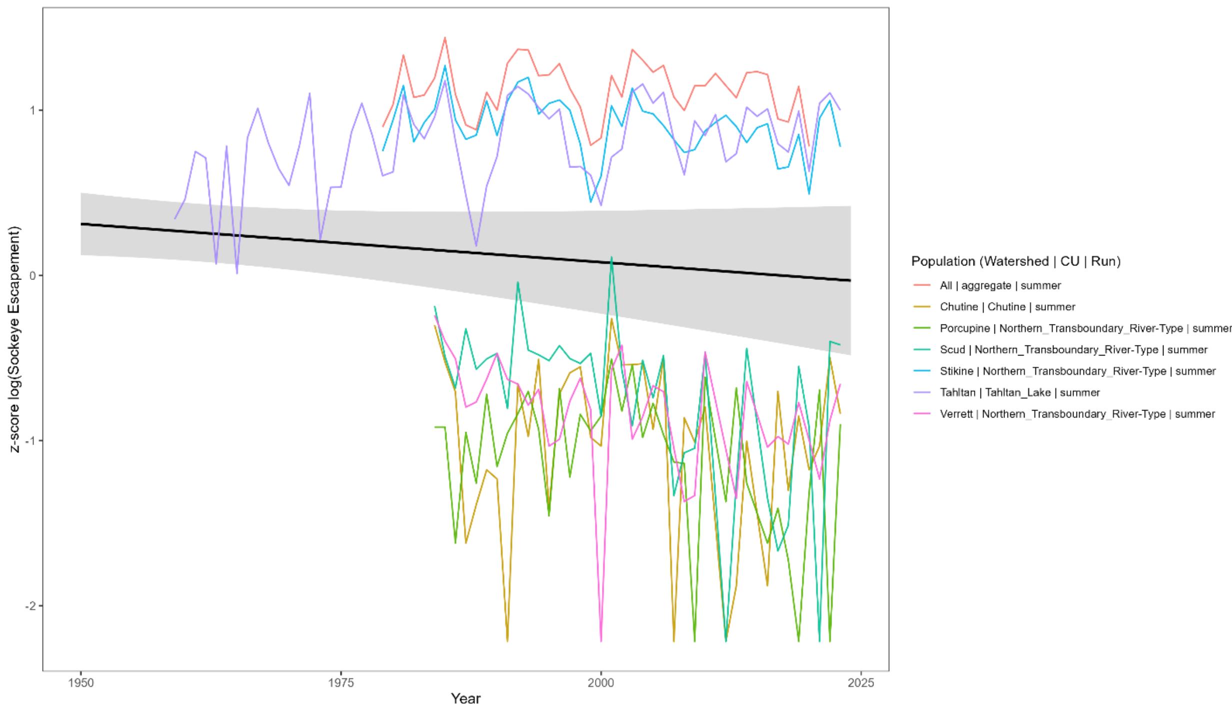

Figure 39: Timeseries of spawner escapement for sockeye salmon populations within the Stikine candidate stronghold. Colored lines are individual population timeseries, the thick black line represents mean trend estimate sockeye across the Stikine watershed, and shaded grey areas represent the upper and lower 95% confidence intervals for the aggregate trend in sockeye salmon escapement.

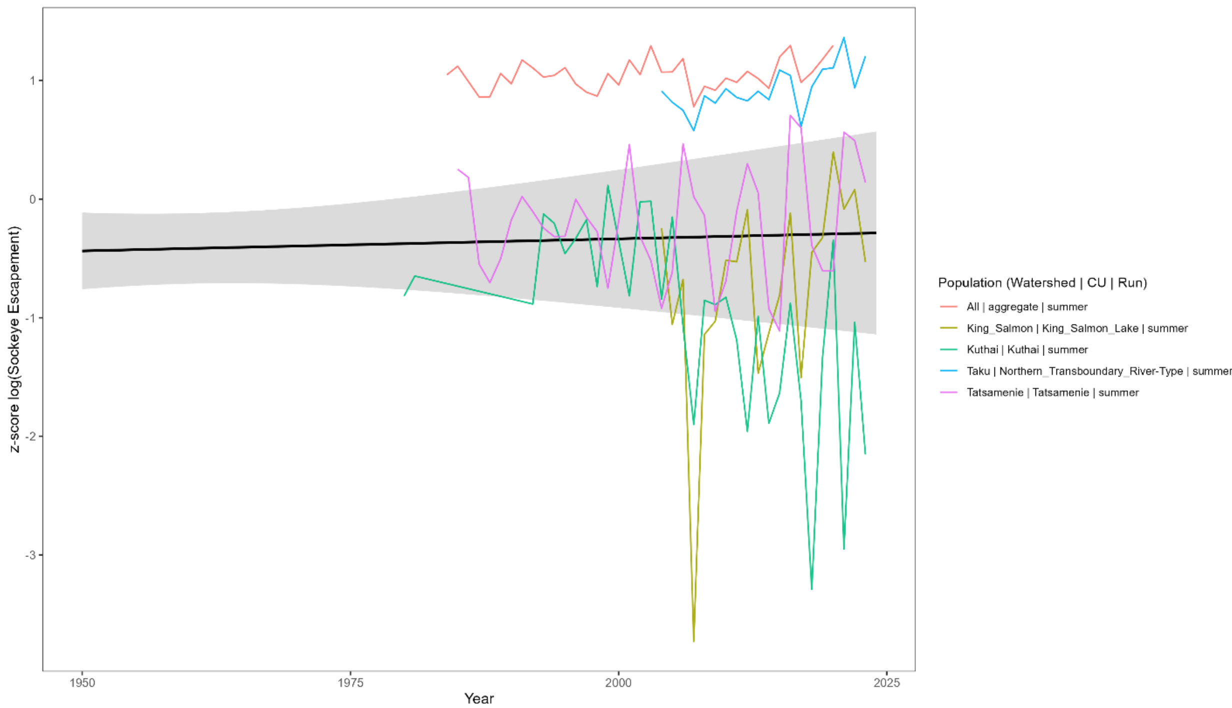

Figure 40: Timeseries of spawner escapement for sockeye salmon populations within the Taku stronghold. Colored lines are individual population timeseries, the thick black line represents mean trend estimate sockeye across the Taku watershed, and shaded grey areas represent the upper and lower 95% confidence intervals for the aggregate trend in sockeye salmon escapement.

Tables

Table 1: Species and run-timing diversity values for each of the 10 strongholds and candidates. The table lists the total diversity, number of locations and average diversity for locations in each stronghold.

Stronghold	**Ecoregion**	**Total Diversity**	**Mean Diversity**	**Locations**
Chilcotin	Interior Fraser	26	5.20	5
Harrison	Lower Fraser	34	5.67	6
Inner_Central_Coast	North Coast	76	6.33	12
Kitimat	North Coast	125	6.25	20
Nass	North Coast	46	6.57	7
Quesnel	Interior Fraser	17	3.40	5
Skeena	North Coast	133	6.65	20
Stikine	Transboundary	63	6.30	10
Taku	Transboundary	67	6.70	10
Thompson	Interior Fraser	97	3.88	25

Table 2: Estimated stronghold-level trends in escapement for Chinook, sockeye, and coho salmon. Parameter estimates are in units of log(change in abundance per decade), and bold highlighted parameters are for strongholds that met the criteria for a declining trend.

Stronghold	**Chinook**	**Sockeye**	**Coho**
Chilcotin	***-0.196***	-0.005	0.212
Harrison	***-0.203***	0.132	NA
Inner Central Coast	-0.175	***-0.095***	0.090
Kitimat	***-0.378***	***-0.083***	0.094
Nass	***-0.183***	0.054	0.160
Quesnel	***-0.266***	0.216	0.009
Skeena	***-0.201***	0.056	0.108
Stikine	***-0.204***	***-0.180***	***-0.200***
Taku	***-0.187***	0.011	0.162
Thompson	***-0.162***	***-0.106***	0.174

Table 3: Estimated population-level trends in escapement for Chinook salmon. Parameter estimates are in units of log(change in abundance per decade), and bold highlighted parameters are for populations that met the criteria for a declining trend.

Stronghold	Population	Ecoregion	Run Type	log (change per decade)
Chilcotin	Chilko	Fraser	summer_s_type	-0.045
Chilcotin	Elkin	Fraser	summer_s_type	***-0.084***
Chilcotin	Lower_Chilcotin	Fraser	spring	-0.055
Chilcotin	Taseko	Fraser	summer_s_type	-0.005
Chilcotin	Upper_Chilcotin	Fraser	spring	***-0.585***
Harrison	Big_Silver	Fraser	summer	***-0.450***
Harrison	Birkenhead	Fraser	spring	0.026
Harrison	Lower_Harrison	Fraser	fall	***-0.125***
Harrison	Sloquet	Fraser	summer	***-0.183***
Quesnel	Cariboo	Fraser	spring	***-0.214***
Quesnel	Cariboo	Fraser	summer	***-0.390***
Quesnel	Horsefly	Fraser	spring	***-0.237***
Quesnel	McKinley	Fraser	spring	***-0.865***
Quesnel	Quesnel	Fraser	summer	-0.039
Thompson	Adams	Fraser	summer_o_type	0.504
Thompson	Barriere	Fraser	spring	0.302
Thompson	Bessette	Fraser	spring	***-0.815***
Thompson	Blue	Fraser	spring	0.499
Thompson	Bonaparte	Fraser	spring	0.337
Thompson	Clearwater	Fraser	summer_s_type	***-0.122***
Thompson	Deadman	Fraser	spring	***-0.162***
Thompson	Eagle	Fraser	spring	***-0.088***
Thompson	Lemieux	Fraser	summer_s_type	***-0.997***
Thompson	Little_River	Fraser	summer_o_type	1.196
Thompson	Louis	Fraser	spring	***-0.348***
Thompson	Lower_Shuswap	Fraser	summer_o_type	0.210
Thompson	Mahood	Fraser	summer_s_type	***-0.679***
Thompson	Middle_Shuswap	Fraser	summer_o_type	0.164
Thompson	Nicola	Fraser	spring	***-0.074***
Thompson	Raft	Fraser	summer_s_type	***-0.428***
Thompson	Salmon	Fraser	summer_s_type	***-0.244***
Thompson	Seymour	Fraser	spring	***-0.347***
Thompson	South_Thompson	Fraser	summer_o_type	0.758
Thompson	Wap	Fraser	summer_o_type	***-0.939***
Inner_Central_Coast	Atnarko	North Coast	summer	0.078
Inner_Central_Coast	Dean	North Coast	summer	***-0.269***
Kitimat	Brim	North Coast	fall	***-0.841***
Kitimat	Dala	North Coast	summer	***-1.057***
Kitimat	Kemano	North Coast	summer	***-1.358***

Kitimat	Kildala	North Coast	summer	***-0.284***
Kitimat	Kitlope	North Coast	summer	***-0.828***
Kitimat	Kowesas	North Coast	summer	-0.061
Kitimat	Wahoo	North Coast	summer	0.095
Nass	All	North Coast	multiple	-0.053
Nass	Damdochax	North Coast	summer	-0.002
Nass	Kwinageese	North Coast	summer	***-0.109***
Nass	Meziadin	North Coast	summer	***-0.369***
Skeena	All	North Coast	multiple	-0.014
Skeena	Bear	North Coast	summer	***-0.071***
Skeena	Cedar	North Coast	spring	***-0.036***
Skeena	Ecstall	North Coast	summer	***-1.486***
Skeena	Exchamsiks	North Coast	summer	0.276
Skeena	Kasiks	North Coast	summer	0.097
Skeena	Kitsumkalum	North Coast	summer	***-0.144***
Skeena	Kitwanga	North Coast	summer	***-0.341***
Skeena	Lakelse	North Coast	summer	***-0.415***
Skeena	Morice	North Coast	summer	0.009
Skeena	Zymoetz	North Coast	summer	***-0.110***
Stikine	All	Northern Transboundary	summer	-0.392
Stikine	Katete	Northern Transboundary	summer	***-0.326***
Stikine	Little_Tahltan	Northern Transboundary	summer	***-0.736***
Taku	All	Northern Transboundary	summer	-0.462
Taku	Dudidontu	Northern Transboundary	summer	0.189
Taku	Kowatua	Northern Transboundary	summer	***-0.028***
Taku	Nahlin	Northern Transboundary	summer	***-0.300***
Taku	Nakina	Northern Transboundary	summer	***-0.280***
Taku	Tatsatua	Northern Transboundary	summer	***-0.182***
Taku	Tseta	Northern Transboundary	summer	0.110

Table 4: Estimated population-level trends in escapement for sockeye salmon. Parameter estimates are in units of log(change in abundance per decade), and bold highlighted parameters are for populations that met criteria for a declining trend.

Stronghold	Watershed	Ecoregion	Run type	log (change per decade)
Chilcotin	Chilko	Fraser	summer	0.212
Chilcotin	Taseko	Fraser	early_summer	***-0.334***
Harrison	Big_Silver	Fraser	summer	0.350
Harrison	Birkenhead	Fraser	late_summer	-0.017
Harrison	Douglas	Fraser	summer	0.347
Harrison	Lower_Harrison	Fraser	fall	0.644
Harrison	Weaver	Fraser	fall	-0.012
Quesnel	Horsefly	Fraser	summer	0.588
Quesnel	McKinley	Fraser	summer	0.078
Quesnel	Mitchell	Fraser	summer	0.845
Thompson	Adams	Fraser	late	***-0.349***
Thompson	Antsey	Fraser	early_summer	0.155
Thompson	Antsey	Fraser	late	***-0.215***
Thompson	Eagle	Fraser	early_summer	0.693
Thompson	Eagle	Fraser	late	-0.021
Thompson	Fennell	Fraser	early_summer	-0.099
Thompson	Little_River	Fraser	late	***-0.302***
Thompson	Lower_Shuswap	Fraser	late	***-0.151***
Thompson	Middle_Shuswap	Fraser	late	-0.011
Thompson	Raft	Fraser	early_summer	0.155
Thompson	Seymour	Fraser	late	***-0.205***
Thompson	Seymour	Fraser	early_summer	***-0.270***
Thompson	Wap	Fraser	late	***-0.512***
Inner_Central_Coast	Atnarko	North Coast	summer	***-0.409***
Inner_Central_Coast	Hooknose	North Coast	summer	***-0.204***
Inner_Central_Coast	Koeye	North Coast	summer	0.146
Inner_Central_Coast	Namu	North Coast	summer	-0.036
Kitimat	Evelyn	North Coast	summer	0.014
Kitimat	Gabion	North Coast	summer	0.041
Kitimat	Kitimat	North Coast	summer	***-0.110***

Kitimat	Kitkiata	North Coast	summer	***-0.142***
Kitimat	Kitlope	North Coast	summer	***-0.149***
Nass	Brown_Bear	North Coast	summer	-0.056
Nass	Damdochax	North Coast	summer	0.163
Nass	Gingit	North Coast	summer	0.456
Nass	Kwinageese	North Coast	summer	***-0.193***
Nass	Meziadin	North Coast	summer	0.019
Nass	All	North Coast	summer	0.101
Skeena	Alastair	North Coast	summer	0.017
Skeena	All	North Coast	multiple	0.144
Skeena	Asitika	North Coast	summer	0.214
Skeena	Azuklotz	North Coast	summer	0.125
Skeena	Babine	North Coast	summer	0.154
Skeena	Babine wild	North Coast	summer	***-0.126***
Skeena	Babine late wild	North Coast	late_summer	***-0.139***
Skeena	Bear	North Coast	summer	0.224
Skeena	Club	North Coast	summer	0.028
Skeena	Johanson	North Coast	summer	0.110
Skeena	Johnston	North Coast	early_summer	***-0.149***
Skeena	Kitsumkalum	North Coast	summer	0.516
Skeena	Kitwancool	North Coast	summer	0.201
Skeena	Kitwanga	North Coast	summer	0.066
Skeena	Lakelse	North Coast	early_summer	-0.044
Skeena	McDonell	North Coast	summer	0.152
Skeena	Morice	North Coast	summer	0.353
Skeena	Morrison	North Coast	summer	-0.004
Skeena	Motase	North Coast	summer	***-0.188***
Skeena	Nilkitkwa	North Coast	summer	***-0.191***
Skeena	Slamgeesh	North Coast	summer	-0.025
Skeena	Stephen	North Coast	summer	0.066
Skeena	Sustut	North Coast	summer	0.296
Stikine	All	Northern Transboundary	summer	-0.056
Stikine	Chutine	Northern Transboundary	summer	***-0.182***
Stikine	Porcupine	Northern Transboundary	summer	***-0.368***
Stikine	Scud	Northern Transboundary	summer	***-0.552***
Stikine	Stikine	Northern Transboundary	summer	***-0.135***
Stikine	Tahltan	Northern Transboundary	summer	0.150
Stikine	Verrett	Northern Transboundary	summer	***-0.305***

Taku	All	Northern Transboundary	summer	0.071
Taku	King_Salmon	Northern Transboundary	summer	0.227
Taku	Kuthai	Northern Transboundary	summer	***-0.480***
Taku	Taku	Northern Transboundary	summer	0.167
Taku	Tatsamenie	Northern Transboundary	summer	0.076

Table 5: Estimated population-level trends in escapement for coho salmon. Parameter estimates are in units of log(change in abundance per decade), and bold highlighted parameters are for populations that met criteria for a declining trend.

Stronghold	Population	Ecoregion	Run_type	log(change per decade)
Chilcotin	Chilko	Fraser	fall	0.403
Quesnel	Horsefly	Fraser	fall	***-0.265***
Quesnel	McKinley	Fraser	fall	0.331
Quesnel	Mitchell	Fraser	fall	-0.041
Thompson	Albreda	Fraser	fall	0.188
Thompson	Bessette	Fraser	fall	0.058
Thompson	Blue	Fraser	fall	0.195
Thompson	Bonaparte	Fraser	fall	0.369
Thompson	Coldwater	Fraser	fall	0.274
Thompson	Deadman	Fraser	fall	0.260
Thompson	Dunn	Fraser	fall	0.261
Thompson	Eagle	Fraser	fall	0.023
Thompson	Louis	Fraser	fall	0.349
Thompson	Raft	Fraser	fall	0.345
Thompson	Salmon	Fraser	fall	***-0.088***
Thompson	Scotch	Fraser	fall	0.100
Thompson	Wap	Fraser	fall	0.154
Inner_Central_Coast	Cascade	North Coast	fall	0.127
Inner_Central_Coast	Martin	North Coast	fall	0.060

Inner_Central_Coast	Necleetsconnay	North Coast	fall	0.129
Kitimat	Brim	North Coast	fall	0.109
Kitimat	Dala	North Coast	fall	***-0.059***
Kitimat	Evelyn	North Coast	fall	0.110
Kitimat	Foch	North Coast	fall	0.048
Kitimat	Hugh	North Coast	fall	0.263
Kitimat	Kemano	North Coast	fall	0.052
Kitimat	Kildala	North Coast	fall	0.019
Kitimat	Kiltuish	North Coast	fall	0.249
Kitimat	Kiskosh	North Coast	fall	0.004
Kitimat	Paril	North Coast	fall	0.225
Kitimat	Quaal	North Coast	fall	***-0.085***
Kitimat	Riordan	North Coast	fall	0.089
Kitimat	Wahoo	North Coast	fall	0.261
Nass	All	North Coast	fall	0.135
Nass	Kwinageese	North Coast	fall	0.290
Nass	Zolzap	North Coast	fall	0.042
Skeena	Exchamsiks	North Coast	fall	0.136
Skeena	Exstew	North Coast	fall	0.211
Skeena	Kasiks	North Coast	fall	0.047
Skeena	Slamgeesh	North Coast	fall	0.108
Stikine	Craig	Northern Transboundary	fall	***-0.217***
Stikine	Katete	Northern Transboundary	fall	***-0.251***
Stikine	Porcupine	Northern Transboundary	fall	***-0.314***
Stikine	Scud	Northern Transboundary	fall	***-0.442***
Stikine	Verrett	Northern Transboundary	fall	***-0.114***
Stikine	West_Katete	Northern Transboundary	fall	***-0.182***
Taku	All	Northern Transboundary	fall	0.072

Table 6: Stronghold assessment scores for 10 candidate strongholds in British Columbia. Current strongholds are highlighted in italic bold font, while the star next to the Chilcotin watershed indicates the latest addition to the WSC Stronghold network.

Stronghold	Anthropogenic habitat threats	Salmon Biodiversity	Stronghold trend	Population declines	Hatchery contribution	Total
Nass	0.925	0.988	0.667	0.711	1	4.291
Taku	0.99	1	0.667	0.694	0.833	4.184
Inner Central Coast	0.885	0.95	0.667	0.667	0.83	4.000
Chilcotin*	0.63	1	0.667	0.7	1.00	3.999
Harrison	0.78	1	0.5	0.63	1.00	3.91
Skeena	0.76	1	0.667	0.691	0.667	3.784
Kitimat	0.885	0.94	0.333	0.467	0.833	3.458

Quesnel	0.46	0.65	0.667	0.62	1.00	3.400
Stikine	0.965	0.94	0.000	0.103	1.000	3.008
Thompson	0.32	0.75	0.333	0.59	1.00	2.990