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Research Article

From policy to practice: declines in monitoring and Pacific salmon conservation in Canada

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Abstract

Canada's Wild Salmon Policy (WSP) offers a framework for conserving the genetic and geographic diversity of wild Pacific salmon. A cornerstone of the Policy is the annual assessment of endangered status for each Conservation Unit (CU). We evaluated the extent of monitoring as a foundation for WSP implementation and its goal of safeguarding salmon diversity. Publicly reported annual counts of spawning populations have declined by 32% since the Policy's release, driven largely by reductions in high-quality surveys. Synchrony among spawning populations within CUs is low and variable, underscoring the limitations of relying on indicator populations to represent CU-level trends. Nearly half of Canada's Pacific salmon CUs with publicly available data currently lack sufficient information to assess status using the recent generational metric, with 27 additional CUs having insufficient data since the Policy's release. This erosion of population-level spawner data compromises the ability to detect biological change and inform timely conservation responses. Rebuilding broad and representative monitoring programs is essential to fulfill the WSP's core commitment to conserving wild salmon diversity.

Key words: conservation status, escapement monitoring, population recovery, stock assessment, fisheries management

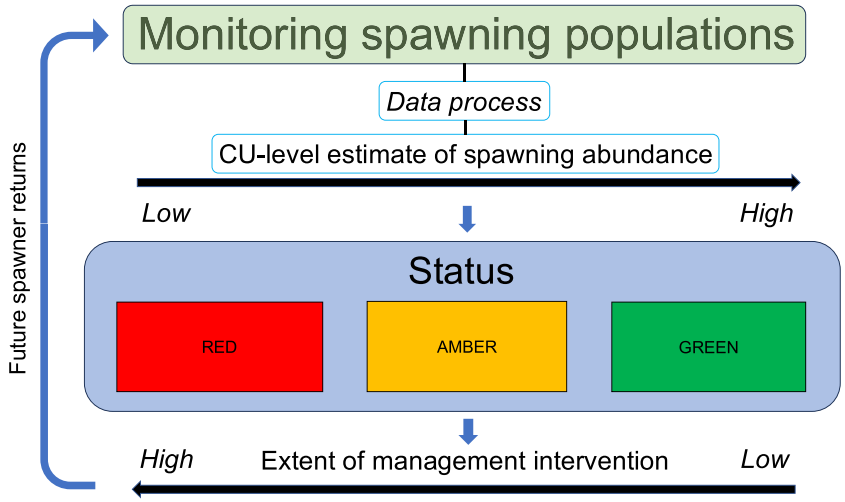
Introduction

Pacific salmon (*Oncorhynchus* spp.) underpin ecosystems, cultures, and economies in Canada. Within each species, hundreds of locally adapted spawning populations contribute to biodiversity, resilience, and ecosystem stability (Groot and Margolis 1991; Hilborn et al. 2003; Schindler et al. 2010). Overfishing and habitat loss over the last century have influenced widespread declines in abundance and diversity in British Columbia (BC) and Yukon (Slaney et al. 1996; Price et al. 2019, 2021; PSF 2025). Climate change is further compounding risks to salmon diversity by driving shifts in migration timing, life histories, and productivity (Cline et al. 2019; Oke et al. 2020; Crozier et al. 2021). In response to conservation concerns, Canada developed the Wild Salmon Policy (WSP), with an overarching goal to "restore and maintain healthy and diverse salmon populations and their habitats" (DFO 2005).

The WSP outlines a science-based framework for assessing, managing, and protecting Pacific salmon populations. Introduced in 2005, the WSP was seen as transformative for shifting salmon management toward conservation-first principles (Cohen 2012), and timely as it addressed long-standing concerns about declining salmon populations and insufficient monitoring (Office of the Auditor General of Canada 1999, 2004; Irvine 2009). The Policy also was seen as a response to widespread criticism of Canada's management of Pacific salmon, and the demand for stronger oversight, improved data collection, and ecosystem-based conservation strategies. The main feature of the WSP is the Conservation Unit (CU) concept, which recognizes distinct groups of salmon spawning populations as a key scale for monitoring and management. While the WSP provides a clear roadmap for safeguarding the genetic and geographic diversity of wild salmon, its success depends on effective implementation.

Assessment is a key pillar of the WSP. The first of six strategies (i.e., Strategy 1) outlined to implement the Policy is the *Standardized monitoring of wild salmon status* (DFO 2005). This strategy identifies three levels of monitoring programs to assess the annual status of Pacific salmon: (1) Indicator systems—comprehensive programs involving quantitative information on spawning adults that enable estimates of productivity and sustainable rates for exploitation, (2) Intensive monitoring—annual counts of salmon to provide consistent indices of spawners between years, and (3) Extensive monitoring—salmon counts across broad areas to examine spatial patterns in trends. Each level involves the acquisition of quantitative information on spawning adults. The WSP further states that a statistically based monitoring plan will be designed for each CU with the aim to "assess the annual abundance of the CU and the distribution of spawners". As outlined in the Policy, assessment results based on metrics rooted in spawner abundance for each CU will determine the biological status of the CU, and the CU's assigned status will then help guide resource management planning and

Fig. 1. Flow diagram displaying how the annual monitoring of salmon spawning abundance feeds into biological status assessments for Conservation Units (CU) under Canada's Wild Salmon Policy. The CU's assigned status will then guide the extent of management intervention, with subsequent monitoring informing whether management measures were successful or requiring further intervention.



conservation decisions (Fig. 1). For example, when spawner abundance is high and a CU's status is assessed as healthy (Green), the need for management intervention will be low. However, when spawner abundance is low and a CU's status is assessed as at risk (Red), a detailed assessment of impacts from fishing and habitat degradation should be triggered and a response initiated to protect the fish, reduce the potential risk of further loss, and to restore diminished abundance (DFO 2005). Subsequent annual monitoring of spawner abundance can then be used to evaluate population- and CU-level responses to recovery actions and management effectiveness. Thus, the acquisition of annual numbers of adults returning to spawn in each CU, and the distribution of spawners across populations within CUs, is fundamental to the ongoing assessment of population health and management effectiveness, and the application of conservation decisions as part of the WSP.

The goal of our paper is to evaluate the extent of monitoring wild salmon populations, both as a foundation of WSP implementation and its goal of safeguarding salmon diversity, and as a targeted update of previous assessments (e.g., Price et al. 2008, 2017). Specifically, we measure trends in publicly reported monitoring data on spawning salmon over the life of the Policy, evaluate synchronization dynamics among spawning populations within CUs, and quantify the number of salmon CUs with sufficient data to assess biological status using the recent generational trend metric.

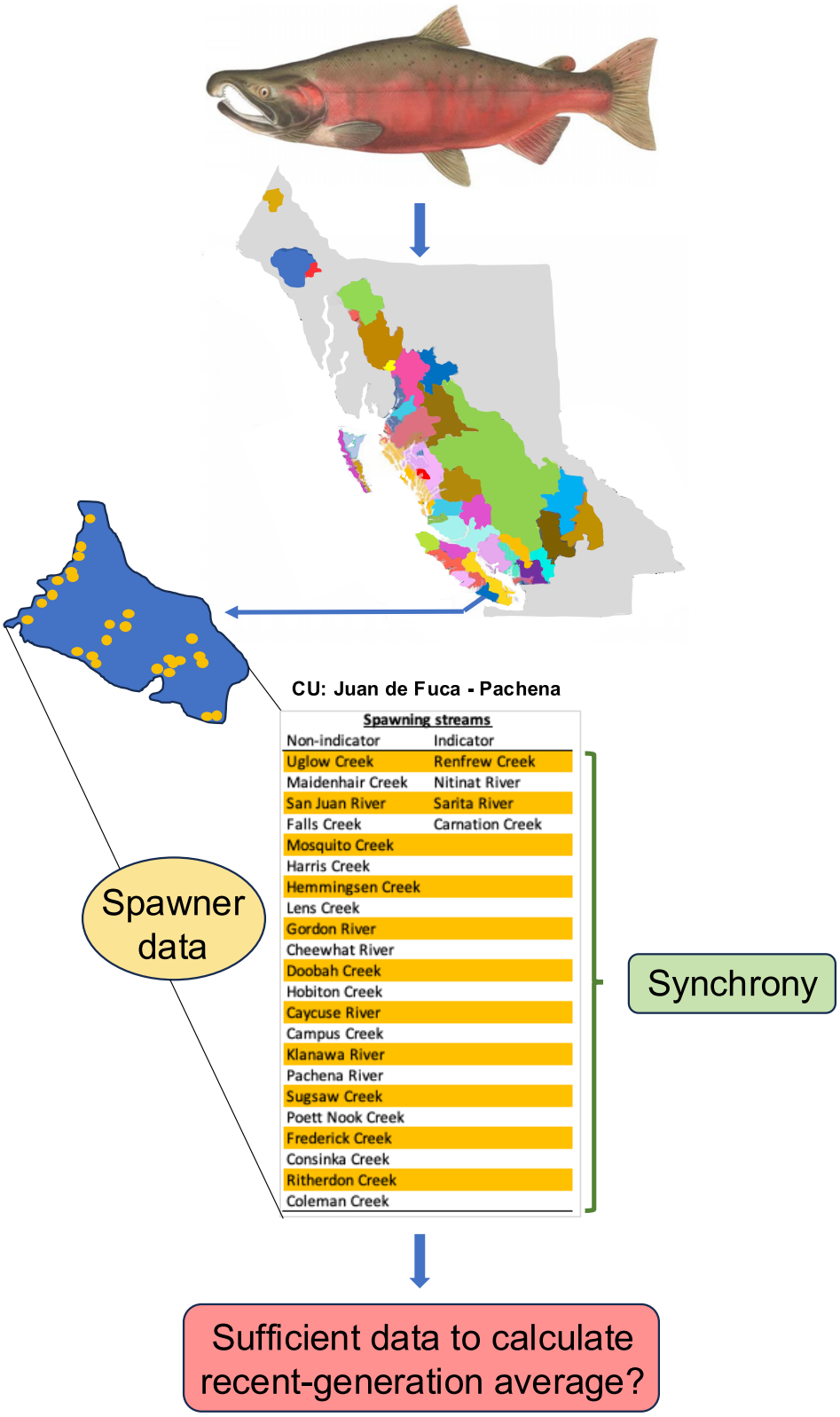
Methods

We examined stream-specific spawner estimates for the five major Pacific salmon species in Canada: *Oncorhynchus tshawytscha* (Chinook), *Oncorhynchus keta* (chum), *Oncorhynchus kisutch* (coho), *Oncorhynchus gorbuscha* (pink), and *Oncorhynchus nerka* (sockeye). These data are contained in Canada's Department of Fisheries and Oceans (DFO) salmon spawner database, NuSEDS, and include documented spawning populations monitored in BC and Yukon between 1950 and 2023. NuSEDS is the most comprehensive, publicly accessible dataset for annual spawning salmon counts in Canada, widely used by DFO for fisheries management and by independent researchers for conservation science. While NuSEDS records typically undergo case-specific processing prior to formal status assessments (e.g., Grant et al. 2011), such verified data are not available in public form. We therefore used the data processed by Atkinson et al. (2025) for our large-scale review, which applied consistent rules for correcting likely errors and omissions. These data were derived from two NuSEDS files: (1) All Areas NuSEDS—contains annual counts of spawning fish, and (2) Conservation Unit Census Sites—associates each census location (which we assume to be a unique spawning population) to its respective CU (DFO 2025). Datasets were then merged to link each spawning population's time series to its respective CU and are available online (Carturan and Peacock 2024).

We quantified annual monitoring of spawning salmon at two levels: (1) spawning population—an isolated group of salmon of a particular species that spawn at a specific location, and (2) CU—spawning populations that may be aggregated into species-specific CUs determined by geographic and genetic similarities (Holtby and Ciruna 2007; Fig. 2). We defined a spawning population as "monitored" in any given year if it had a numeric estimate of spawning fish, including zero counts; a CU was defined as monitored if it had at least one of its component populations with a numeric estimate reported in NuSEDS.

The NuSEDS data used in our analysis do not necessarily capture the full breadth of annual monitoring effort, and data quality and availability can vary among spawner populations, CUs, and years. However, NuSEDS is composed of the largest subset of spawner data made publicly available for independent assessments. Estimates for some years and

Fig. 2. Flow diagram displaying the spawning abundance data structure for Pacific salmon outlined in Canada's Wild Salmon Policy and used in the manuscript to assess population-level synchrony and adequacy of annual monitoring for status evaluation. Here, coho salmon (*Oncorhynchus kisutch*) are divided into 44 Conservation Units; one of which is Juan de Fuca–Pachena, with 26 indicator and non-indicator spawning streams (adapted from Holtby and Ciruna 2007).



spawning populations not in NuSEDS may exist elsewhere (e.g., Winther et al. 2024; JTC 2025). Yukon Chinook and chum are a clear example of this, where only 9 of 15 reported CUs have a spawner survey record in NuSEDS since the adoption of the WSP—none since 2008—despite recent surveys being reported through other sources. Thus, the decline in annual spawner estimates for this region and period is likely more a reflection of change in reporting rather than actual monitoring effort.

While 420 Pacific salmon CUs were originally described (Holtby and Ciruna 2007), the total number and composition continue to evolve (Wade et al. 2019). Of the 391 CUs listed in NuSEDS, 343 are identified as *Current*. Because of known Yukon reporting gaps, we include only *Current* CUs associated with BC ($n = 328$; but see our Supplementary Material A) in our assessment of monitoring trends at the CU level and how they relate to evaluations of CU status. We excluded CUs listed as *Extirpated* because they are no longer monitored. We also recognize that delays inherent in the verification and data entry process for spawner surveys may result in a time lag in NuSEDS reporting, which could be mistakenly interpreted as reduced monitoring effort. To account for this, we include data only to 2022. While similar challenges are encountered with data before the mid-1990s—where verification and entry of earlier records varies by species and area—we assume that these data are accurate.

We were interested to know whether any observed changes in salmon spawner survey coverage reported in NuSEDS over time were related to the quality of the estimates. For example, if the number of annual spawner estimates had declined recently, was the decrease associated with a reduction in number of low-quality surveys reported? If so, perhaps the reduction in total surveys indicates a transition toward more reliable data collection, rather than a degradation of monitoring capacity. Here, we used linear regression to quantify the rate of change in monitoring effort between survey records classified as high-quality (High) versus low-quality (Low) in NuSEDS (*stream_survey_quality* column in the cleaned data file) since the adoption of the WSP.

Certain spawning populations are classified as "indicators"—representative systems used to infer trends in adjacent, under-monitored, populations—based on the consistency of monitoring effort, the reliability of the resulting spawner estimates, and the methods of obtaining these fundamental data (English 2016). Indicator spawning populations are reported in the CU Census Sites dataset within "IS_INDICATOR" field. While some indicator designations in NuSEDS may not necessarily reflect those populations used in local management, our analysis uses the only publicly available classifications. We were interested to know whether indicator populations are more or less likely to be reliable "indicators" of the number of salmon returning annually to other "non-indicator" spawning populations within each CU in a future of increasing environmental change. Specifically, for each CU with at least one indicator spawning population with continuous data, we calculated annual synchrony using a backward-looking 18-year rolling window (i.e., each annual synchrony estimate incorporated 18 years of data—the period of interest since the adoption of the WSP) using the synchrony function in the R package, *codyn*—Community Dynamics Metrics (Hallett et al. 2022; R Core Team 2024). For each CU, we computed synchrony scores by iteratively pairing each indicator spawning population with at least one non-indicator spawning population with data in the CU using the Loreau and de Mazancourt (2008) metric. To maintain consistent pairwise correlations, we included only indicator populations with complete time series, and retained all non-indicator populations within CUs provided that each year contained at least one non-indicator to pair with each indicator. Pink salmon were excluded from the analyses because of their distinctive even- and odd-year population cycles. Of the 328 currently listed CUs in BC, only 22 CUs met the above criteria and were included in our analysis. The resulting synchrony scores for each pairing of indicator and non-indicator populations were then averaged to produce a single annual synchrony value per CU. A summary of the number of CUs, indicator spawning populations, and non-indicator spawning populations included in the synchrony analyses for each species is reported in Table 1.

We sought to understand how monitoring effort for salmon spawning populations relates to our ability to assess the biological status of CUs. One simple metric for biological status assessments recommended by DFO is *recent generational average spawner abundance*, which underpins both relative- and absolute-abundance metrics under the WSP (Holt et al. 2009). This offers a valuable contrast to DFO's formal status assessment process, which incorporates vetted data and additional metrics but typically requires substantially more time to complete. We quantified the number of CUs with sufficient spawner data over the most recent generation—which we compared to previous generations—to rapidly evaluate how many CUs have sufficient information to support simplistic biological status evaluations. A CU was classified as having sufficient data if it had at least one component spawning population with a numeric estimate (including zero counts) reported in NuSEDS over the recent generation, with no more than one missing year (with the assumption that 1 year can be reasonably infilled given that geometric mean is relatively robust). No missing years were permitted for pink salmon. Generation lengths were assigned based on the average age-at-maturity for each species and spawning region. For example, sockeye, chum, and Chinook in north coast regions (Smith Inlet to transboundary rivers) were assigned a generation time of 5 years, whereas all other populations of these species were assigned 4 years. All coho populations were assigned a generation time of 3 years, and all pink populations a generation time of 1 year. We emphasize that our goal is not to formally assess biological status or duplicate ongoing assessment processes, but rather to provide a rapid evaluation of the extent of data availability related to monitoring effort that could affect the assessment of population health.

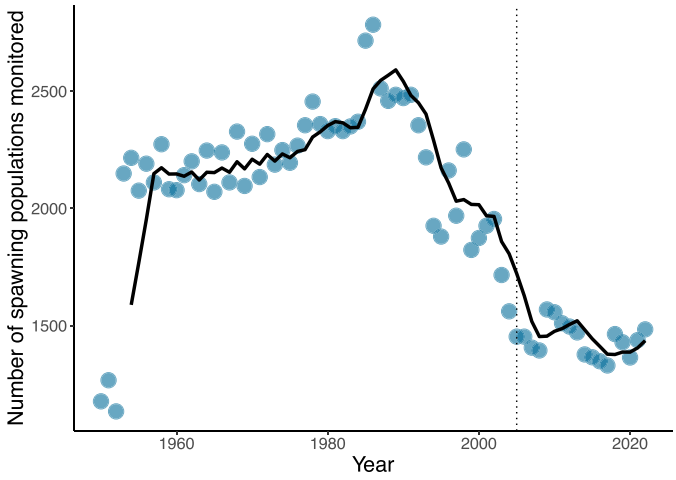
Results

There are 6766 unique census sites (i.e., assumed spawning populations) identified in NuSEDS for Pacific salmon in BC and Yukon; reported annual monitoring of these populations has ranged from 1134 (1952) to 2776 (1986; Fig. 3). The

Table 1. Summary table of data included in synchrony analysis using 18-year rolling windows, including the Conservation Units (CUs) of each species, region of occurrence in British Columbia, number of Indicator spawning populations with continuous time series (1988–2022), and number of associated non-indicator spawning populations for each CU.

Species	Conservation Unit	Region	Number of Indicator populations	Number of non-Indicator populations
Chinook	CK-10	South coast	2	10
Chinook	CK-11	South coast	4	9
Chinook	CK-12	South coast	10	23
Chinook	CK-27	South coast	1	13
Chinook	CK-31	South coast	3	50
Chinook	CK-53	North coast	1	9
Chum	CM-04	South coast	8	130
Chum	CM-08	South coast	1	34
Chum	CM-10	South coast	7	153
Chum	CM-15	South coast	1	44
Chum	CM-20	North coast	6	44
Coho	CO-08	South coast	2	26
Coho	CO-09	South coast	2	19
Coho	CO-11	South coast	1	44
Coho	CO-12	South coast	1	79
Coho	CO-13	South coast	4	74
Coho	CO-16	South coast	1	20
Coho	CO-17	South coast	4	88
Sockeye	SEL-03-04	South coast	1	2
Sockeye	SEL-06-13	South coast	3	4
Sockeye	SEL-06-14	South coast	16	24
Sockeye	SEL-09-03	South coast	2	60
Sockeye	SEL-21-02	North coast	1	19

Fig. 3. Annual number of Pacific salmon populations with a spawning estimate reported in NuSEDS in British Columbia and Yukon between 1950 and 2022. Vertical dash line is 2005, the year Canada's Wild Salmon Policy was released. Black line is 5-year running average trend.



average number of spawning populations enumerated annually has declined by 32% in the years since the adoption of the WSP ($\bar{x}$ = 1431 populations; 2005–2022) compared to the 50-year average prior to the Policy ($\bar{x}$ = 2151 populations; 1950–2004). While most spawner surveys prior to the mid-1990s were not evaluated for quality of coverage, the number of spawner surveys reported as *High* quality since 2005 has declined by 14% (slope = −0.63, R^2 = 0.22), whereas the number of reported *Low* quality surveys has increased by 34% (slope = 4.53, R^2 = 0.17; Fig. 4) over the same period.

The annual number of CUs in BC with at least one component spawning population that was monitored has declined by 12% (from 210 CUs in 2005 to 185 CUs in 2022), such that only 56% of currently listed (51% of all) Pacific salmon CUs reported in NuSEDS were monitored in the most recent year (Fig. 5). A total of 195 (of 328) currently classified CUs in BC have at least one indicator spawning population with survey data reported in NuSEDS since 1950. However, the number of CUs with at least one monitored indicator population has steadily declined from 172 CUs in 2005 to 131 CUs in 2022, such that only 46% of CUs (n = 151) on average had an indicator spawning population that was monitored since the WSP (Fig. 5).

Fig. 4. Trends in the annual number of salmon spawning surveys based on quality of coverage reported: High (grey circles), Low (black triangles), Unknown (red stars). Black lines are fitted linear regression trends. Vertical dash line is 2005, the year Canada's Wild Salmon Policy was released.

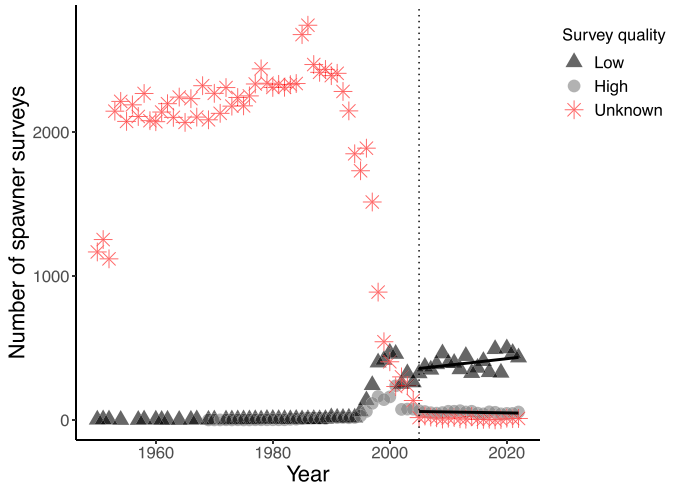
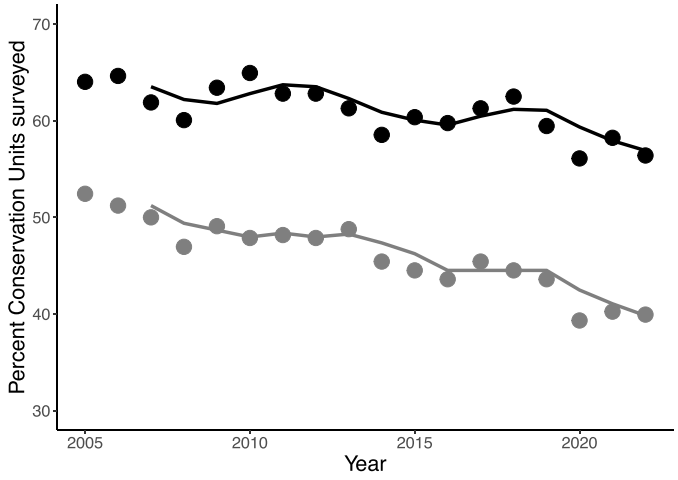


Fig. 5. Percentage of current Pacific salmon Conservation Units (CU) surveyed annually (i.e., at least one component spawning population within a CU with a numeric estimate) since the adoption of Canada's Wild Salmon Policy in 2005. Black dots are the percentage CUs with either indicator or non-indicator populations monitored, and grey dots are the percentage CUs with indicator populations monitored. Black and grey lines are 3-year running average trends.



For those CUs with an indicator spawning population, annual synchrony in spawning abundance—estimated with 18-year rolling windows—was low and highly variable across CUs and species over the last two decades, ranging from 0.001 to 0.999 (Fig. 6). However, synchrony patterns across CUs within species differed. For example, synchrony across Chinook CUs has been broadly trending upwards since the WSP, yet modestly trending downwards for sockeye over the same period. For Chinook, the 18-year period between 2004 and 2021 had the highest synchrony (0.750) across CUs, whereas the period between 1988 and 2005 had the lowest synchrony (0.289); these periods were reversed for sockeye, where synchrony across CUs was highest (0.656) between 1988 and 2005, and lowest (0.306) during 2004 and 2021.

Our rapid evaluation of publicly reported spawner data shows that 46% of Canada's Pacific salmon CUs have insufficient information over the most recent generation to assess biological status (Fig. 7). Since the adoption of the WSP, 27 additional CUs in BC (identified as Current) have insufficient data reported in NuSEDS to assess status. Combined, Chinook and sockeye account for roughly 60% (16 of 27) of the increase in CUs with insufficient data since the WSP, followed by coho (6 CUs; Fig. 8). Sockeye salmon are by far the species with the highest proportion of currently listed CUs in BC with insufficient data (58%; 99 of 170) to assess status over the most recent generation. Chum salmon have the lowest proportion of CUs with insufficient data (21%), followed by coho, pink, and Chinook with 22%, 25%, and 28%, respectively.

Discussion

The assessment of Pacific salmon populations and their habitats is a key pillar of Canada's WSP, requiring the evaluation of the annual number of salmon returning to spawning grounds for each CU. Despite the foundation of monitoring as part of the WSP, annual counts of spawning salmon began a downward trend four decades ago that has persisted throughout the life of the Policy, such that these reported counts are now at their lowest level in 70 years. Spawner information at the CU level reported in NuSEDS has similarly declined to its lowest level, such that only 56% of currently listed (51% of all) Pacific salmon CUs have at least one estimate of spawning salmon in the most recent year. Our rapid assessment of publicly available data suggests that nearly one half of CUs in Canada have insufficient data to determine their current state of health. A rich legacy of information on spawning salmon is eroding and likely compromising the ability to undertake assessments that would otherwise inform conservation-based management decisions required to safeguard diversity.

The variability in synchrony among spawning populations suggests that a reliance on specific indicators will only capture a fraction of temporal fluctuations in abundance patterns observed within CUs. Indicator spawning populations are often regarded as reliable proxies for fluctuations in spawning abundance among nearby non-indicator populations (English 2016). We found that, although numbers of salmon returning to indicator and non-indicator spawning populations within CUs are highly variable and at a relatively low level of synchrony, some modest directional patterns at the species level were apparent. For example, synchrony across Chinook CUs has broadly trended upward since the WSP, yet modestly trended downward for sockeye over the same period. Nonetheless, the strongest pattern that emerged from our analysis is that synchrony among spawning populations within CUs generally fluctuated randomly and independently. This lack of within-CU synchrony could, at least in part, be influenced by poor survey quality and data gaps, particularly among non-indicator populations that

Fig. 6. Annual degree of synchrony in spawning escapement for each Conservation Unit (CU; thin coloured lines) with indicator spawning populations for each Pacific salmon species. Each year is the end of the 18-year rolling window. Thick coloured lines are the arithmetic mean synchrony score across the CUs listed in Table 1. A synchrony score of 1 denotes complete synchronization, whereas a synchrony score of 0 denotes complete asynchrony.

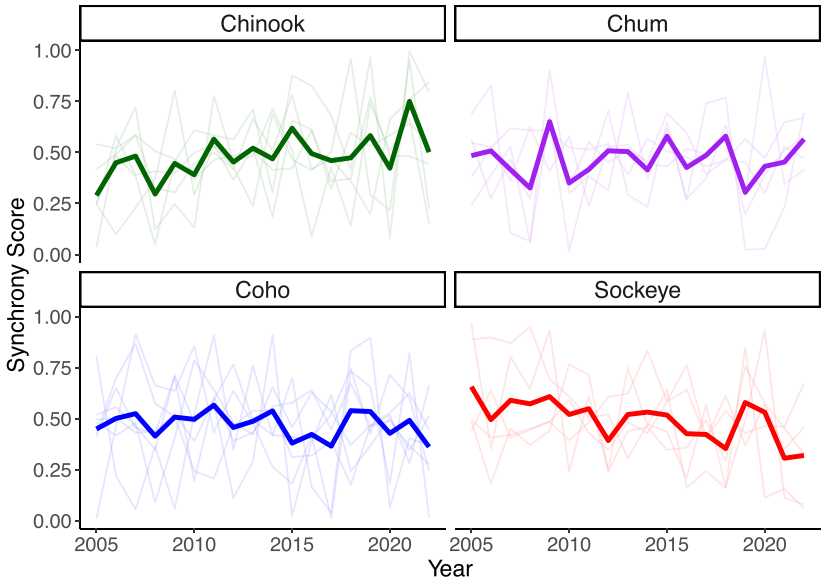
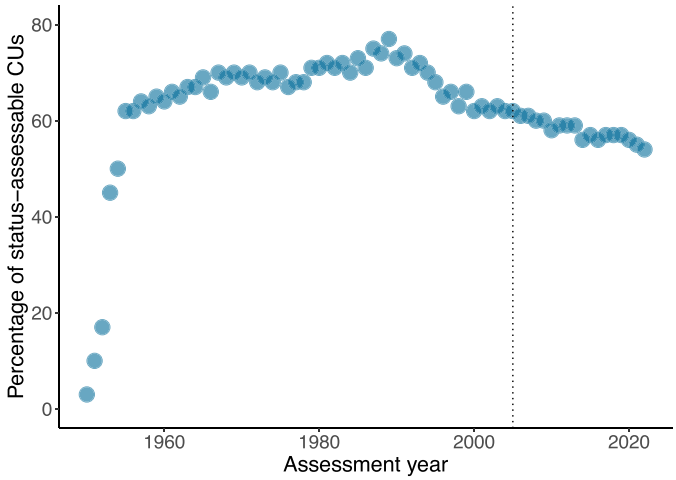


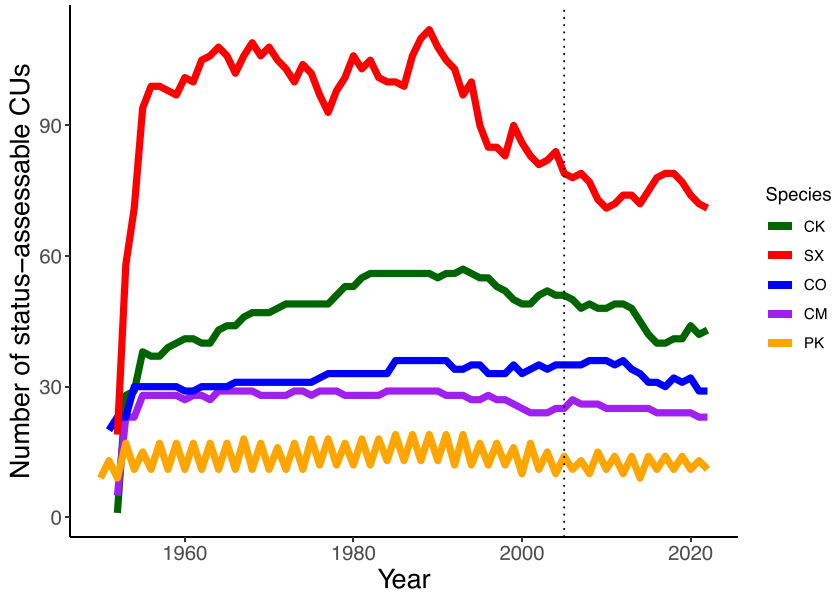
Fig. 7. Percentage of Pacific salmon Conservation Units (CU) in Canada with sufficient spawner survey data to assess biological status each year based on the single generation abundance metric. Vertical dash line is 2005, the year Canada's Wild Salmon Policy was released.



are less frequently monitored. However, even when evaluating CUs with survey data of relatively high-quality and low numbers of indicator/non-indicator pairings, these populations were most often not in sync—suggesting that this pattern may more likely reflect the inherent response diversity of salmon populations to their environment. Such a consistently weak synchrony signal underscores the need for caution in over-relying on indicator populations to represent CU-level trends. To strengthen future assessments, we recommend that indicator designations be periodically reviewed and reported, with a commitment to monitor these populations consistently, and to evaluate their ongoing effectiveness as proxies for under-monitored systems.

What might an effective monitoring program look like to adequately capture population trends at the CU level? Broadly, the WSP provides the framework: "a statistically based and cost-effective monitoring plan will be designed for each CU…to assess the annual abundance of the CU and the distribution of spawners" (DFO 2005, page 19). Specifically, monitoring efforts for Pacific salmon should minimize missing data, maximize the number of populations monitored, and ensure that the diversity of population trends within CUs is represented. Evidence from simulations shows that increasing the proportion of missing data can severely weaken the ability to classify conservation status correctly, and that monitoring a larger number of spawning populations—even with less precise estimates—is more informative than obtaining highly precise counts for just a few sites (Holt et al. 2011). When populations exhibit differing trends, rotating surveys among diverse sites helps detect shifts in abundance and distribution that could be missed by repeatedly monitoring only high-abundance indicator populations (Urquhart and Kincaid 1999; Peacock and Holt 2012). Notably, the power to detect real declines is higher when monitoring covers more populations consistently over time. The geographic distribution of spawners within a CU (i.e., within-CU diversity) is itself an important indicator of population health (Holt et al. 2009), and an assessment program that focuses only on designated indicator streams could easily miss important and significant changes in both the number of spawners and the availability of habitat (Peacock and Holt 2012). When combined, strategic sampling approaches with multiple measures—including

Fig. 8. Number of Conservation Units (CU) of each Pacific salmon species in Canada with sufficient spawner survey data to assess biological status each year based on the single generation abundance metric (CK, Chinook; SX, sockeye; CO, coho; CM, chum; PK, pink). Vertical dash line is 2005, the year Canada's Wild Salmon Policy was released.



abundance, trends, and spatial distribution—that outline clear thresholds for conservation concern, can make monitoring programs better able to capture population trends at the CU level under increasing environmental change.

Sockeye salmon are culturally vital, economically important, and comprise the greatest diversity of CUs among Pacific salmon in Canada; yet, this species has the highest proportion of CUs with insufficient spawner data to assess status. Because of their strong site fidelity and complex life histories, lake-type sockeye salmon exhibit substantial genetic differentiation among populations, resulting in a large number of designated CUs. While this assessment of high population diversity is scientifically robust and (in our opinion) appropriate, it also poses a considerable challenge for effective monitoring and management. Numerous sockeye CUs are relatively small in abundance, and occur in remote areas of BC's mid coast, which adds to enumeration challenges. However, many sockeye CUs with insufficient data are situated near human communities that were previously monitored. Reviving the enumeration of sockeye for these CUs (and other species) could serve as a simple but meaningful first step toward restoring salmon assessment capacity and reversing data decline.

Importantly, the central role of salmon in Indigenous culture presents opportunities for expanding community-led monitoring. Building partnerships in regions where monitoring once occurred—supported by targeted investment and previously proposed strategies (e.g., English 2016; Price et al. 2017)—alongside community-based and technology-enabled approaches (e.g., drones, video counts), could substantially increase coverage and support more informed conservation decisions. Ultimately, enumeration must be recognized as a core conservation priority. The federal government's recent $647 million investment through the Pacific Salmon Strategy Initiative—phase 1 of which ends in 2025—seems to have missed an opportunity to revive monitoring programs that have long suffered from chronic underfunding and lack of prioritization. Major investments by provincial and federal governments should prioritize the rebuilding of monitoring efforts to restore the foundational data systems necessary for informed salmon management.

While our analysis relies on the most comprehensive public data source available for spawner information in Canada (i.e., NuSEDS), there are important limitations. First, formal status assessments may incorporate additional information not reported in NuSEDS for CUs we identified as having insufficient data. Our exclusion of Yukon CUs—where reporting gaps are known—was intended to avoid overestimating the extent of data deficiency. Admittedly, status evaluations are best performed on a CU-by-CU basis, where local information can more adequately inform population trends. We re-emphasize that our goal is not to duplicate formal status assessment processes as intended under the WSP, but rather to provide a rapid and transparent evaluation of publicly available data to support such assessments. Second, the observed decline in monitoring effort may partly reflect changes in survey design. For example, a recent shift from many low-quality surveys to fewer high-quality aggregate estimates may appear as reduced monitoring. However, our results show that the number of high-quality surveys has declined since the WSP's adoption, while low-quality surveys have increased—indicating a genuine erosion in the integrity and reliability of spawner information. Third, our criteria for data sufficiency reflect a conservative threshold based on a single metric—recent generational average abundance—which required a minimum of only one spawning population estimate per CU. Robust status evaluations require multiple lines of evidence beyond recent spawner trends (Holt et al. 2009; Grant and

Pestal 2013). Futhermore, current status evaluations (including ours based on sufficiency of data) do not rely on broad coverage of spawner surveys throughout a CU; such within-CU diversity is an important but currently overlooked dimension of status assessments arguably critical for conserving the spatial distribution and ecological resilience of populations. To improve future evaluations, we recommend the collation and public reporting of a quality controlled, officially approved, regional dataset that includes population- and CU-level spawner estimates across monitoring systems, thereby enabling more complete and independent assessments of salmon population status in Canada. This must be done in a way that respects Indigenous data sovereignty, ensuring that First Nations retain full authority over how their data are shared, interpreted, and used, and that partnerships are grounded in consent, trust, and mutual benefit.

We suggest that monitoring the health of wild salmon populations is more urgent than ever for at least three reasons. First, climate change is posing unprecedented challenges for salmon as warming water temperatures, shifting flow regimes, and glacier retreat drive expansion and contraction of populations (Pitman et al. 2021; Iacarella and Weller 2024). Monitoring is of foundational importance to effective adaptation and mitigation to climate change (Moore and Schindler 2022). Second, recent analyses suggest that many Pacific salmon populations in Canada are declining and in need of conservation action (PSF 2025). Monitoring would help evaluate the efficacy of past conservation measures, inform future actions, and more adequately assess the extent of concern for data-limited populations. Importantly, reduced survey effort for CUs with declining abundance increases the risk of missing local extirpations. Third, many salmon fisheries have been closed in BC due to conservation concerns (Walters et al. 2019; Atkinson et al. 2025); monitoring data would help identify potential opportunities to open fisheries and the economic and social benefits that they provide.

Conclusion

The WSP provides a clear framework to safeguard the diversity of Pacific salmon, but its success depends on turning policy into practice. Our analysis reveals a substantial erosion of salmon spawner monitoring, with nearly half of CUs now lacking sufficient data reported in NuSEDS to assess status. Revitalizing broad and representative monitoring programs—ones that capture spatial, ecological, and life-history diversity across spawning populations—is essential for detecting biological change. When paired with responsive and evidence-based decision-making, robust data systems capable of detecting biological change can drive more effective management and conservation outcomes. In turn, this would strengthen recovery planning, enable the rebuilding of fisheries, and uphold the WSP's core commitment to safeguarding salmon diversity.

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Data availability

All data used for this study are from public sources stewarded by Fisheries and Oceans Canada; data and code are archived at Price (2025).

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Competing interests

The authors acknowledge no competing interests.

Supplementary material

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