Risk management of non-target fish taxa as related to salmon supplementation

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Abstract

Salmon supplementation and reintroduction programs have the potential to negatively impact other valued fish taxa, which are not the target of enhancement (non-target taxa). We evaluated the impacts of spring Chinook Salmon *Oncorhynchus tshawytscha* supplementation and Coho Salmon *O. kisutch* reintroduction (hereafter supplementation) to non-target fish taxa in the upper Yakima Basin following implementation of a production scale salmon supplementation program. Field methods included backpack electrofishing and snorkeling in tributaries, and drift-boat electrofishing in the main stem. We used three sequential steps in our evaluation: First, we determined if spatial overlap in distribution occurred between supplementation fish and non-target taxa. Second, if overlap occurred, we determined if a change in abundance, size, or biomass occurred during supplementation. Lastly, if a change occurred we determined if the change could be reasonably attributed to supplementation. Spatial overlap and changes in abundance, size, or biomass were determined to be significant if they exceeded containment objectives. Salmon rarely overlapped Cutthroat Trout *O. clarkii* and Bull Trout *Salvelinus confluentus* in tributaries, but some overlap of Cutthroat Trout occurred in relatively high elevations of the main stem, and considerable overlap with Rainbow Trout occurred in tributaries and the main stem. Salmon overlapped Mountain Whitefish *Prosopium williamsoni* and sucker species (Catostomidae) in the main stem, and dace (Cyprinidae) and sculpin (Cottidae) species in tributaries. With the exception of steelhead *O. mykiss*, the lower 90% confidence limit of abundance, size, and biomass was above the containment objective for non-target taxa that overlapped significantly with salmon. We used Rainbow Trout as an analog for steelhead. The lower 90% confidence limit of Rainbow Trout size in both tributaries and in the main stem, were below our containment objectives for steelhead. Comparisons of Rainbow Trout size in tributaries, and size in main stem sections with relatively high and low salmon abundance revealed that these changes were unlikely to be the result of supplementation (before-after-control-impact analysis: $P > 0.05$). The weight of evidence indicates that salmon supplementation and reintroduction has not impacted valued species in the upper Yakima Basin beyond predetermined containment objectives and thus, risk containment actions are not warranted at this time.

Risk Management of Non-target Fish Taxa as Related to Salmon Supplementation

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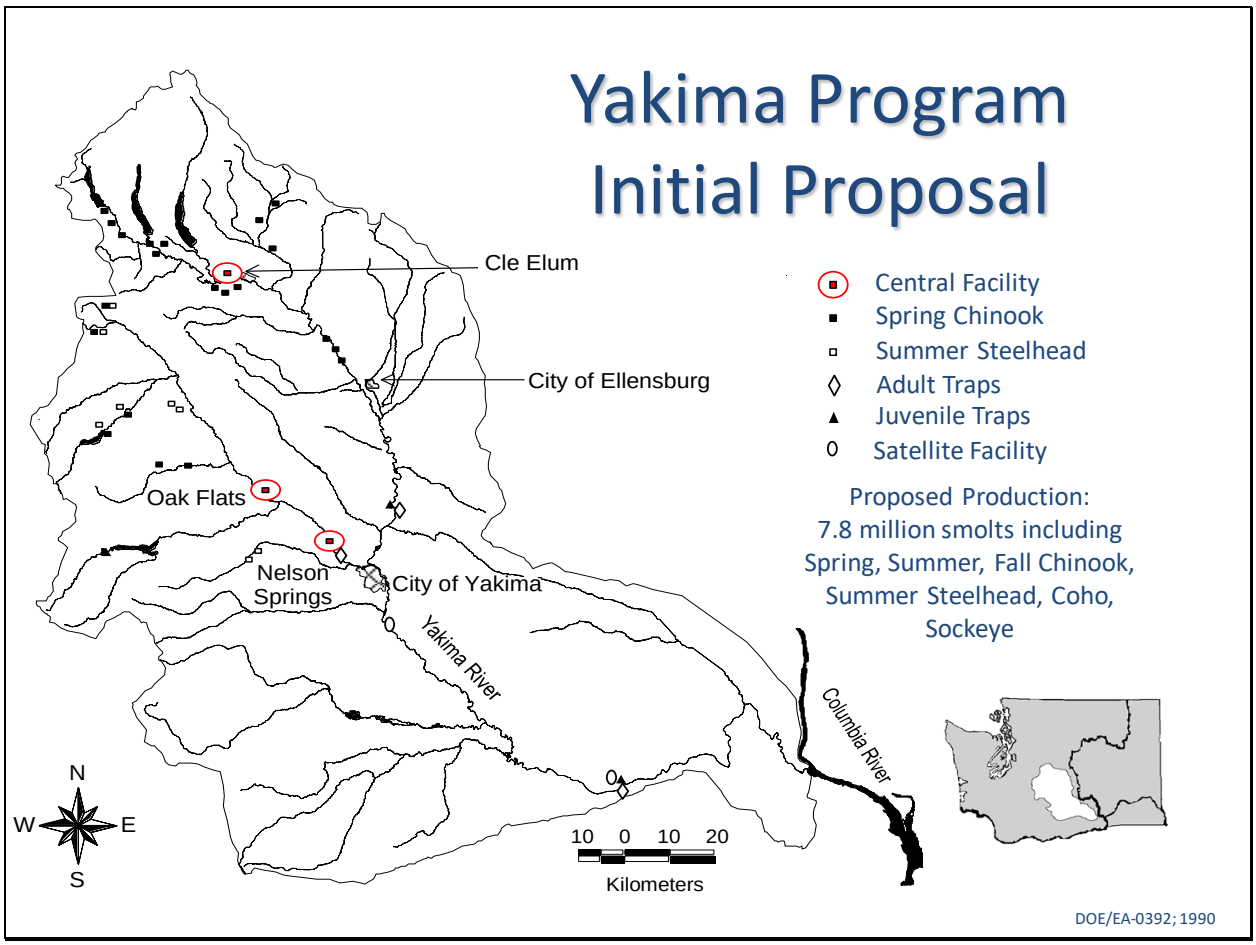
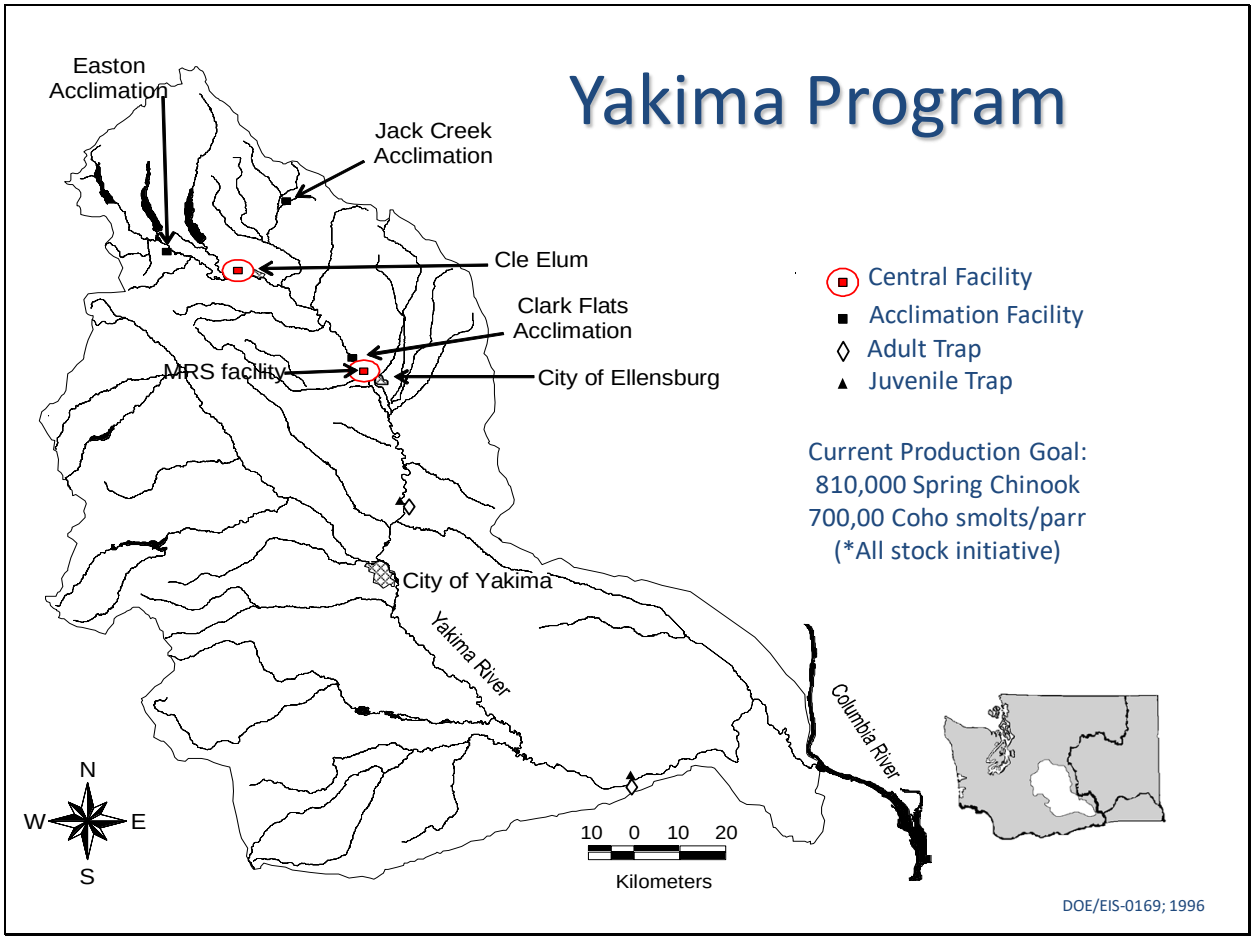
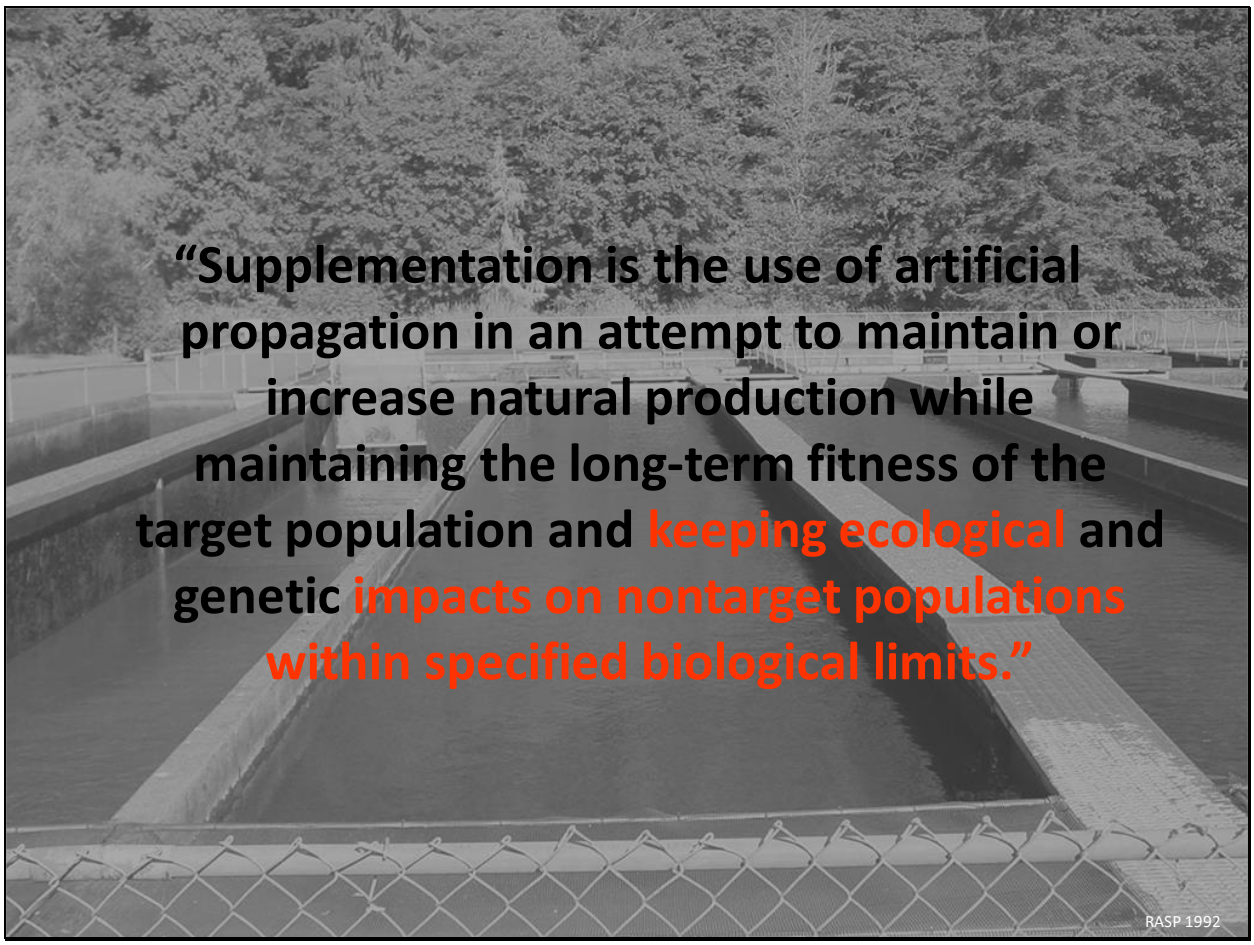
Salmon supplementation and reintroduction programs have the potential to negatively impact other valued fish taxa, which are not the target of enhancement (non-target taxa). The Yakima/Klickitat Fisheries Project's (YKFP) Non-target Taxa of Concern (NTTOC) monitoring program is one monitoring and evaluation (M&E) component of the YKFP and sets the bar for evaluating ecological risks associated with salmon supplementation and reintroduction projects. In this talk, we evaluate the effects of spring Chinook Salmon *Oncorhynchus tshawytscha* supplementation and Coho Salmon *O. kisutch* reintroduction (hereafter supplementation) to non-target fish taxa in the upper Yakima Basin following implementation of production scale salmon supplementation and reintroduction.



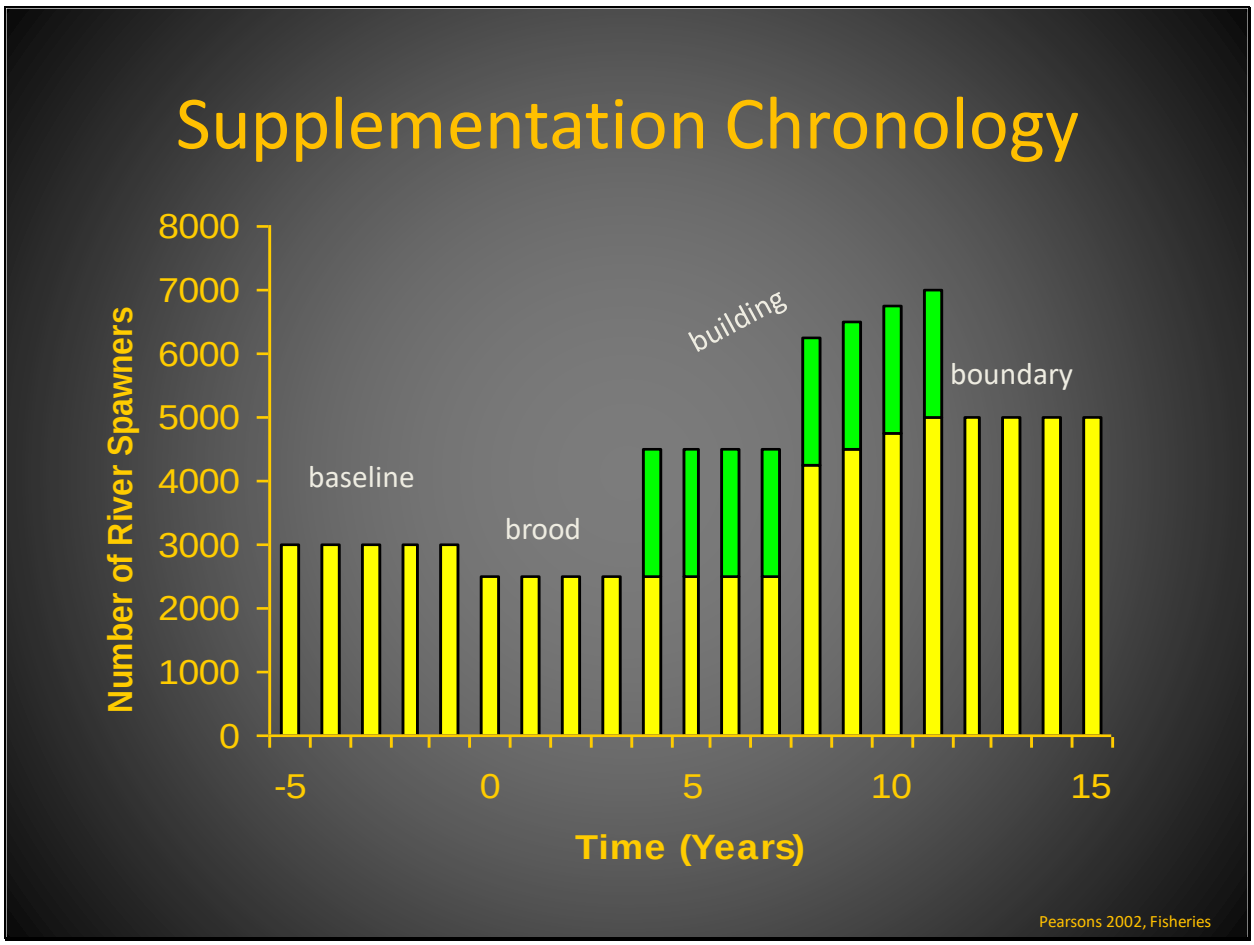
The initial conceptual design of the Yakima Fisheries Program as described in the Environmental Assessment in 1990 was large in scope and included a complex multi-species, multi-life stage production program and large geographic rearing and release plan.



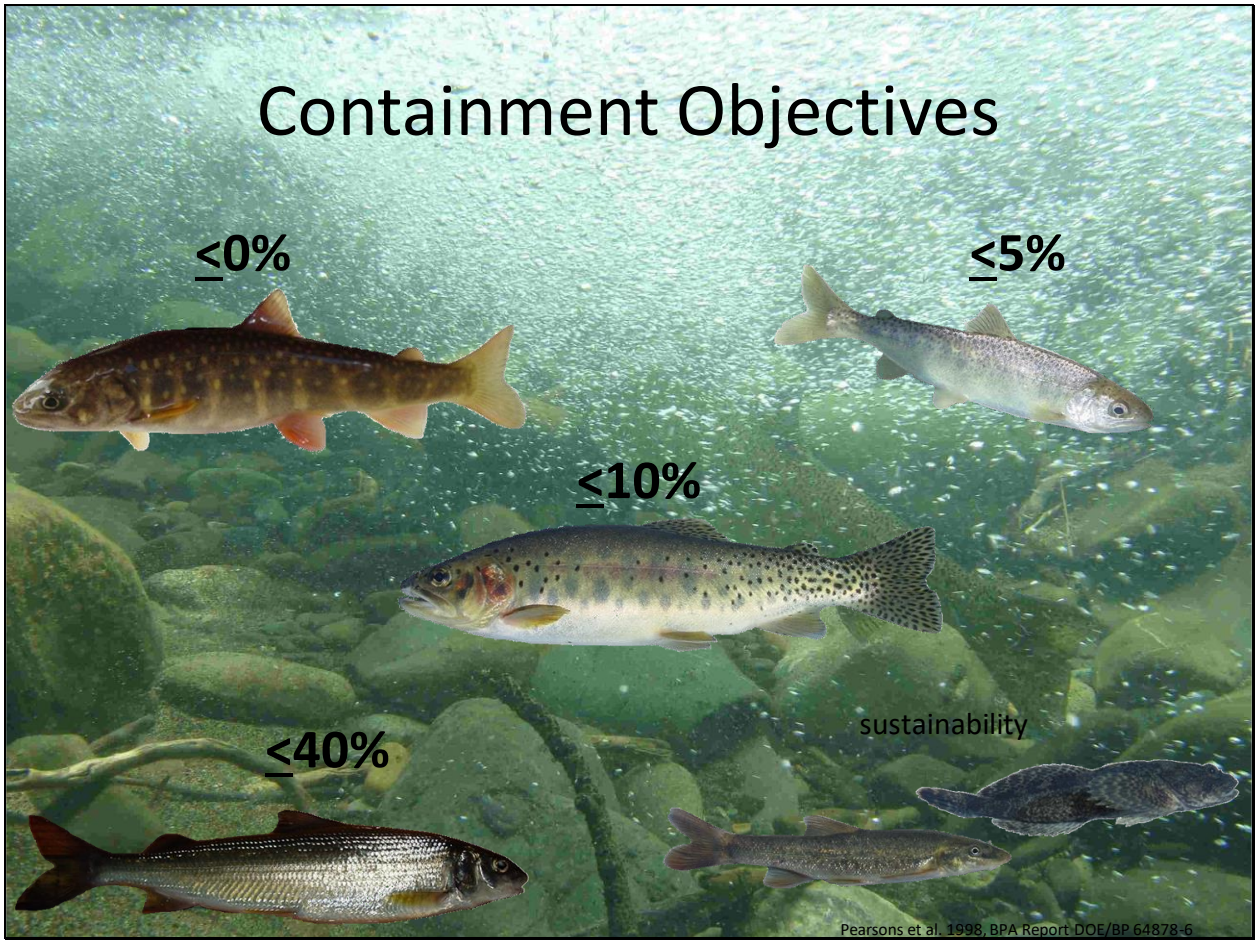
The final Yakima Fisheries Program conceptual design presented in the1996 Environmental Impact Statement (EIS) was far reduced in size and scope than that contained in the 1990 assessment (i.e., single central facility (CESRF); lower production targets, etc.), although we acknowledged the program would be an all stocks initiative and that additional species would come online for production as additional funding became available. Construction was initiated on the MRS central facility in 2018 and was recently completed.



The Regional Assessment of Supplementation Project (RASP; 1992) definition of supplementation.

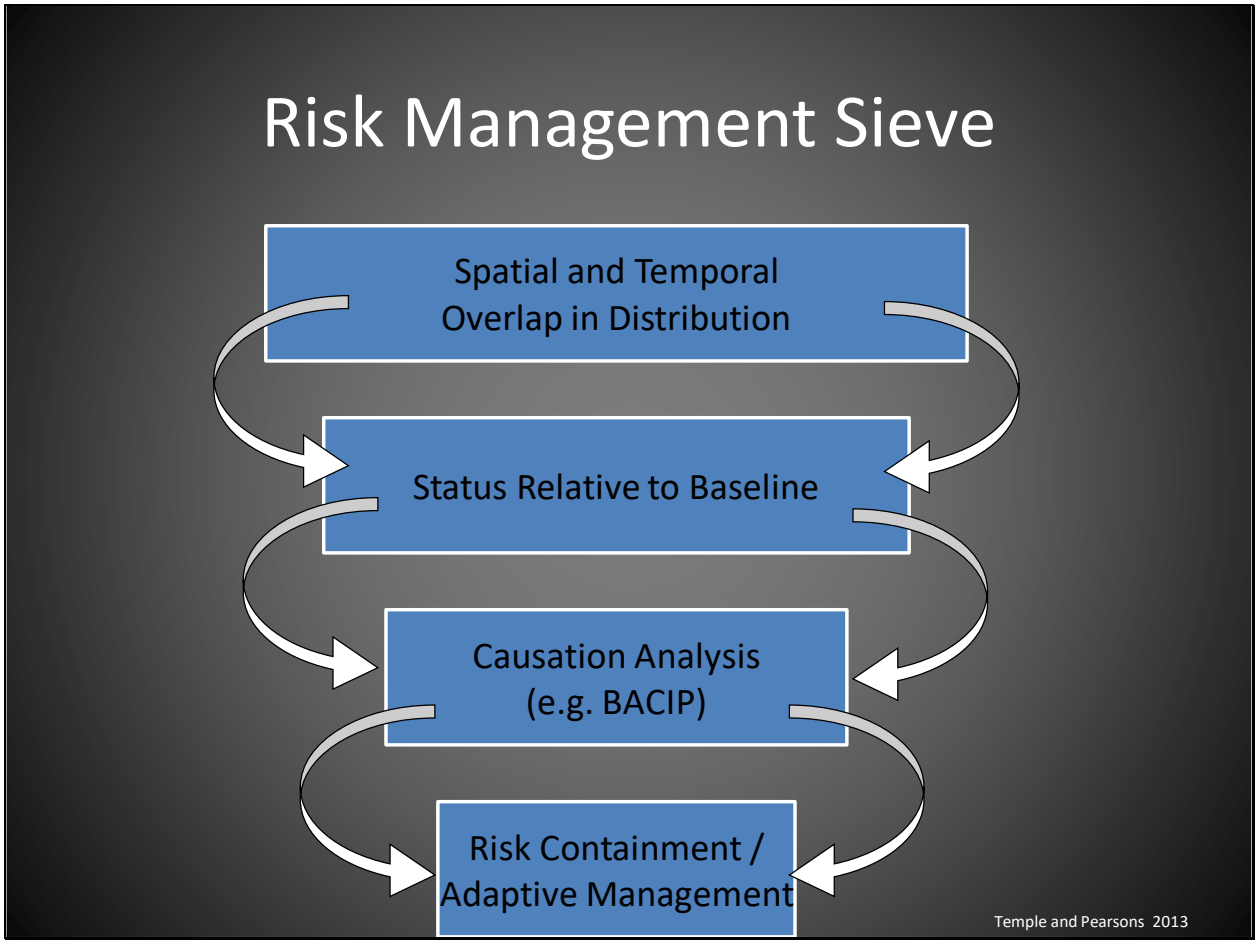


Theoretical chronology of supplementation as proposed by Pearsons (2002). The end goal is to increase the number of natural river spawners of the target taxa. Interaction potential with other valued fish species, termed non-target taxa of concern (NTTOC), is likely to be dynamic, changing in strength and direction as the abundance of the target taxa changes while progressing through the various stages of supplementation.

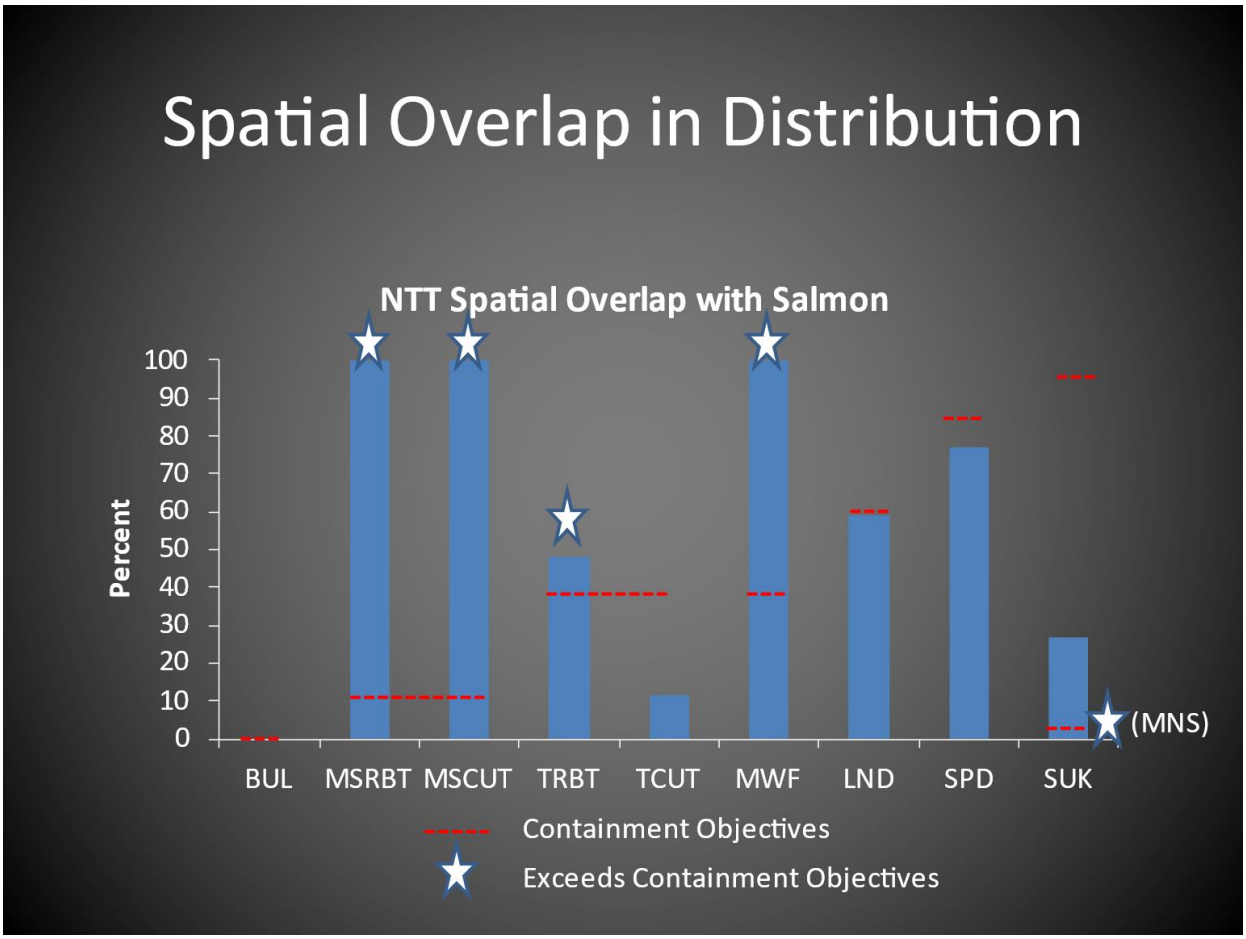


In 1998, containment objectives (CO) were established for our non-target taxa of concern. These objectives serve as benchmark values against which trends in abundance, size (and biomass), and distribution for each NTTOC can be judged relative to baseline, pre-supplementation conditions. Containment objectives for each NTTOC were agreed upon after extensive discussions between the co-managers with input from special interest groups (namely angler groups). Listed and protected taxa have the most conservative containment objectives (0%) followed by locally rare taxa (5%; Mountain Sucker, Naturally Produced Fall Chinook), 10% for valued utilization taxa (Mainstem Yakima River Rainbow Trout and Cutthroat Trout), 40% for valued utilization taxa in tributaries (Rainbow Trout and Cutthroat Trout) and Mountain Whitefish in the main stem Yakima River, and finally, simple sustainability for common native species such as dace and sculpins.

The large suite of species monitored (NTTOC) requires a large diverse set of sampling methods from night snorkeling and night boat electrofishing to counts at permanent facilities as well as tributary electrofishing surveys. We would like to acknowledge the huge contribution made from numerous individuals through the years and the long-term contributions of the co-managers and continued support from the Bonneville Power Administration.

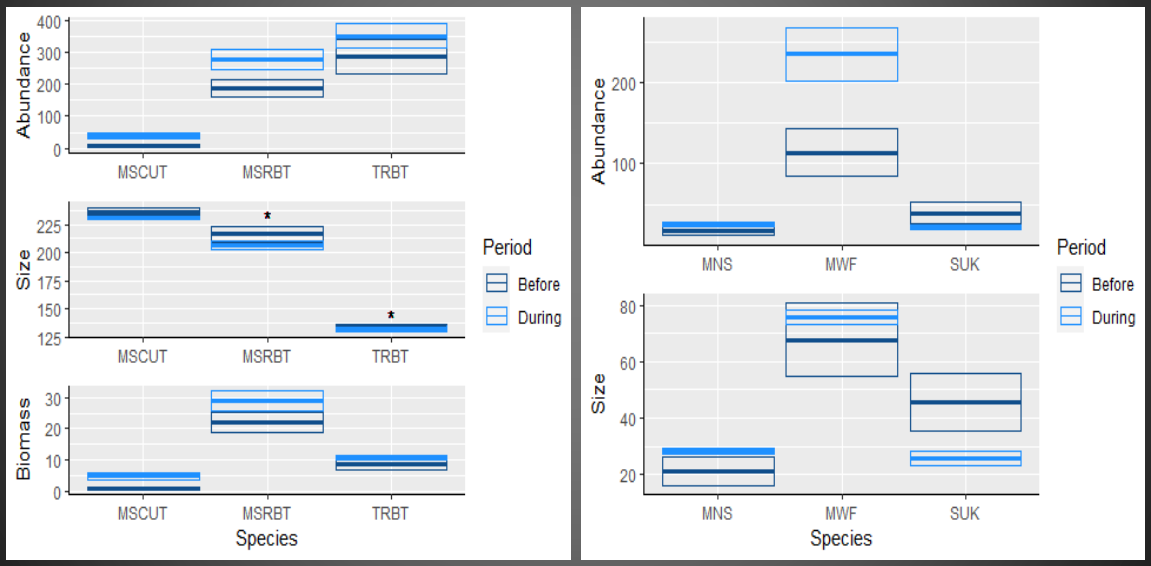


We adopted what we call the "Sieve" approach to managing ecological risks to NTTOC. First we determine if there is spatial or temporal overlap between the target taxa (Chinook and Coho in this case) and NTTOC. We quantify overlap and when overlap exceeds our containment objectives, the next stage in the sieve is triggered. Second, we determine if there have been changes in NTTOC status (abundance, size, or spatial distribution), relative to baseline conditions (before supplementation versus during supplementation comparisons). Third, if before versus during comparisons in NTTOC monitoring variables exceed our containment objectives, that triggers more refined analysis or additional experiments to determine causation. Finally, if declines in monitoring variables suggest supplementation actions negatively influence NTTOC beyond our objectives, we flag the issue and recommend risk containment actions to adaptively manage and remove or eliminate those risks.



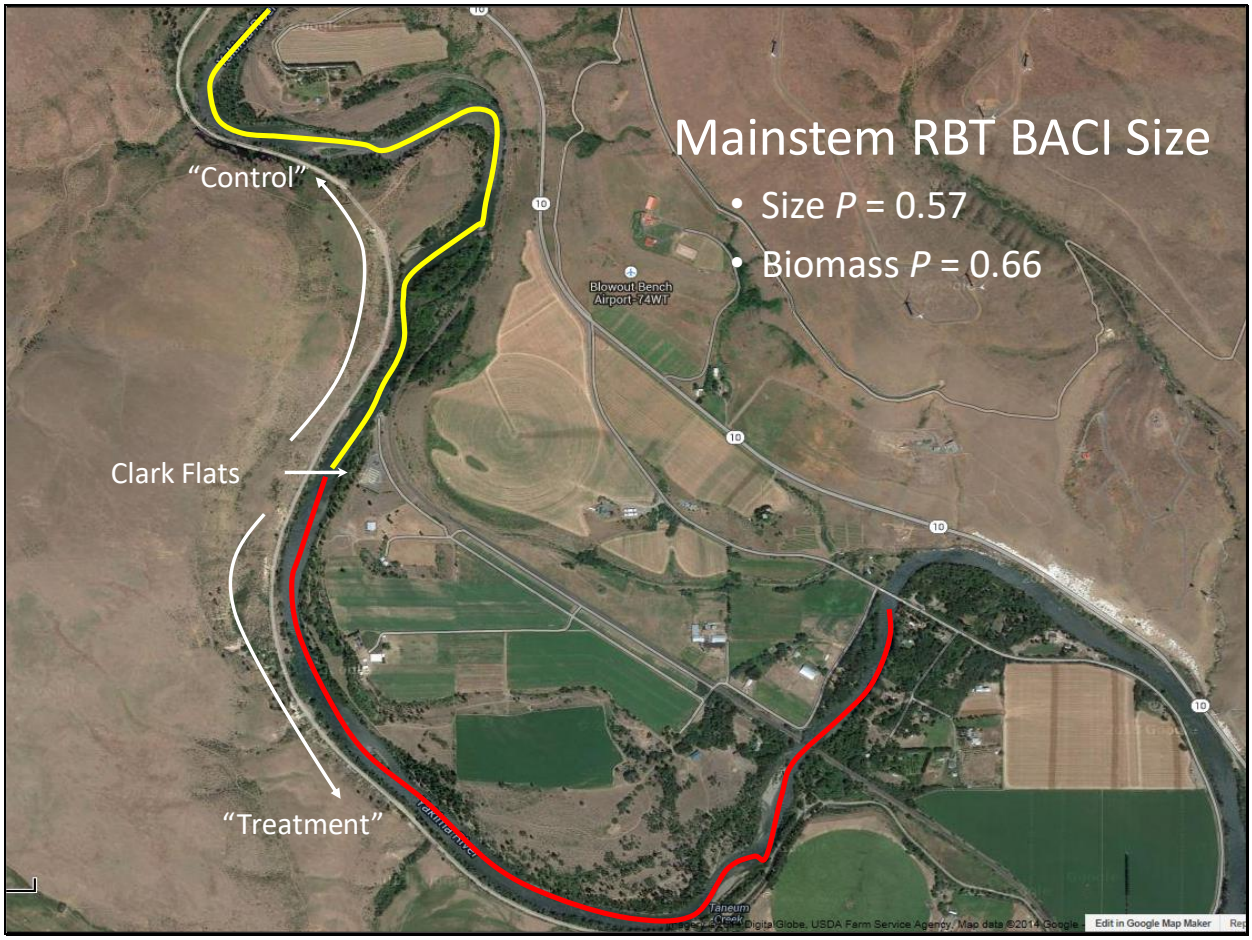
Rainbow and Cutthroat Trout (MSRBT and MSCUT, respectively), Mountain Whitefish (MWF), and Mountain Sucker in the mainstem Yakima River, and Rainbow Trout in upper Yakima Tributaries (TRBT) overlap in spatial distribution with supplemented spring Chinook and Coho salmon and the overlap exceeds our objectives. We evaluate Mountain Sucker status indirectly using the abundance, size structure, and biomass of all juvenile sucker species encountered.

Status – Change Relative to Baseline

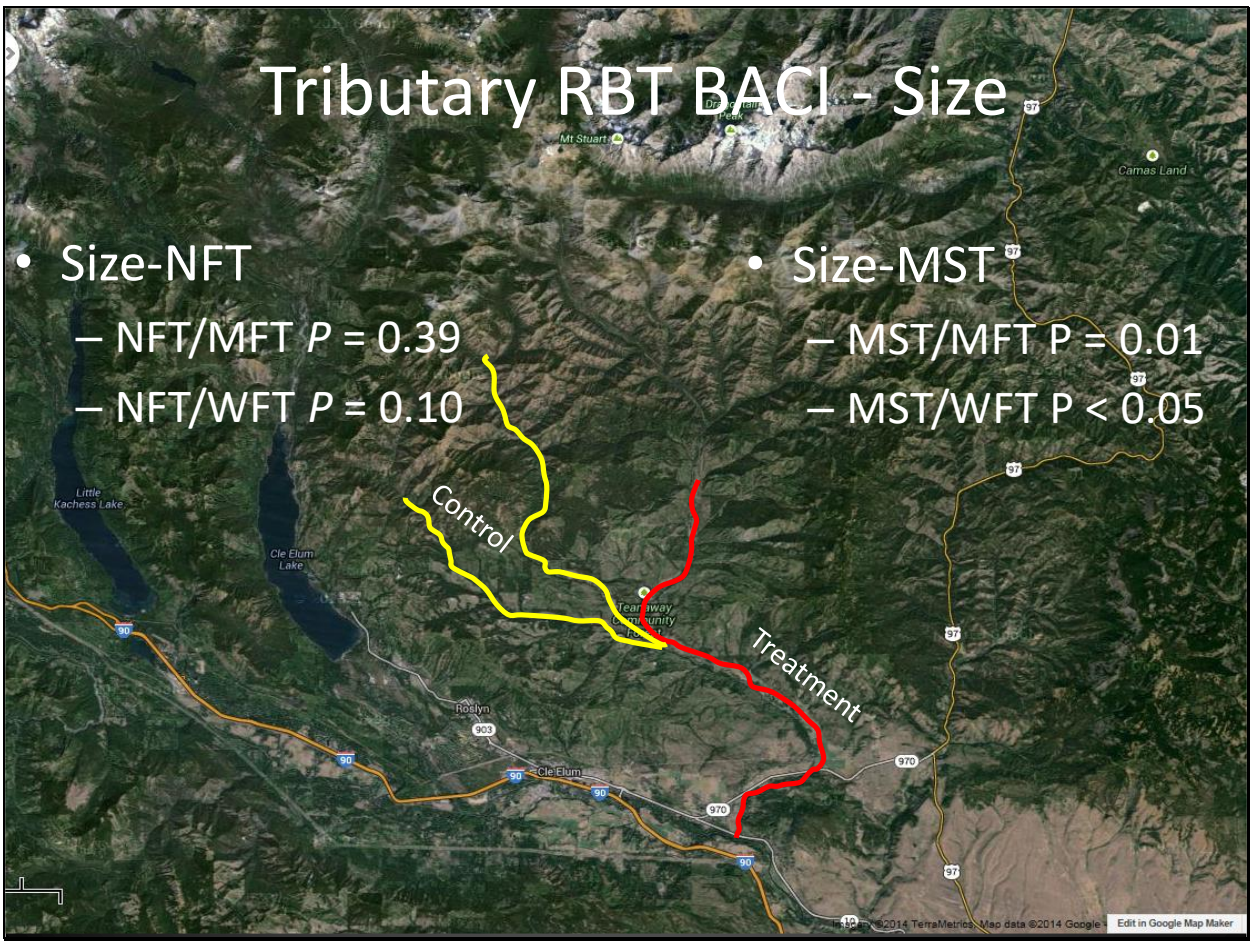


* Exceeds Containment Objective

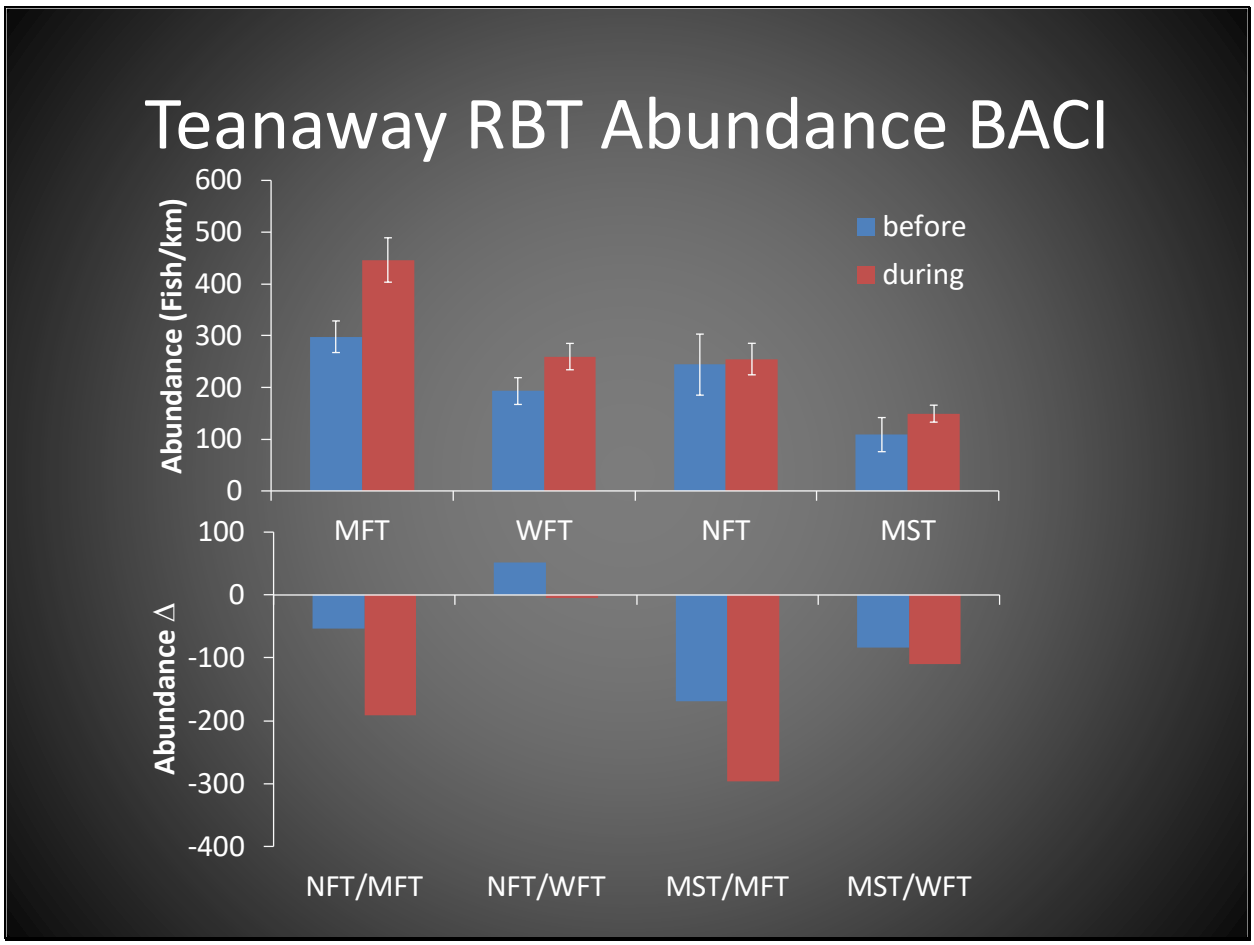
Given the overlap in distribution between NTTOC and supplemented salmon, we compare the abundance, size, and biomass of trout and the abundance and size of non-trout NTTOC between pre-supplementation and during supplementation conditions. Statistical tests are one-way because we are more concerned with evaluating potential decreases in our monitoring variables. In the figure above, statistically significant declines are identified with an asterisk.



The statistically significant decline in Rainbow Trout size in the main stem Yakima River during the supplementation period (that exceeds our objectives) triggers a more robust analysis. We use a Before-After-Control-Impact (BACI) analysis to evaluate causation. In this case, MSRBT size in areas of high verses lower densities of the target taxa (supplemented salmon) indicate the decrease in size and biomass is not statistically significant.

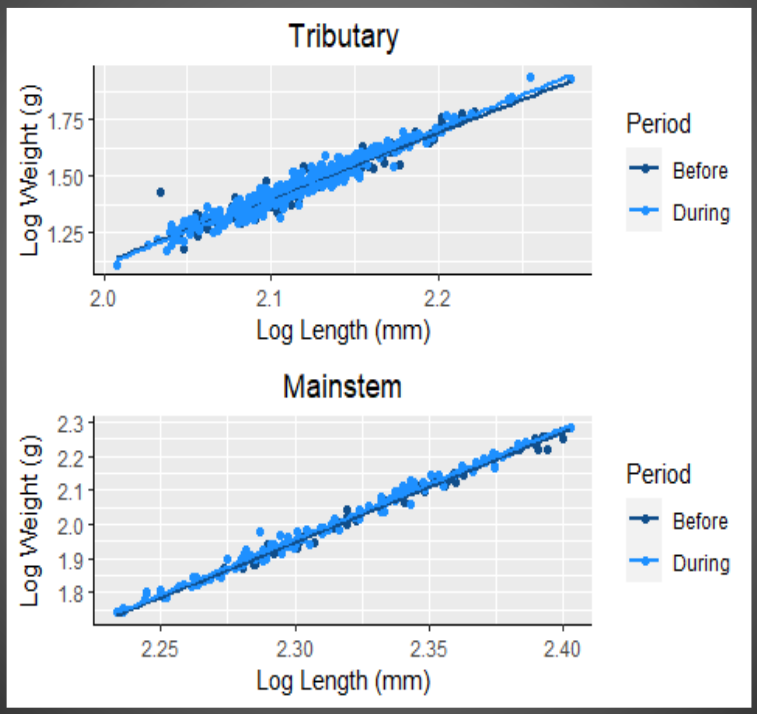


Similarly, because tributary Rainbow Trout size was decreased during the supplementation years relative to the baseline period, a more refined analysis is triggered. As we did for Rainbow Trout in the main stem Yakima River, we used a BACI statistical test to compare size in treatment relative to control locations. Rainbow Trout size in treatment locations in the North Fork Teanaway were not significantly different before versus during supplementation after accounting for size in control streams. Conversely, Rainbow Trout size in the main stem Teanaway river was significantly different. Thus, half the comparisons were significant and half were not.



Since our tributary size BACI results were somewhat ambiguous, we extended the evaluation to include trends in tributary Rainbow Trout abundance in the Teanaway Basin. Abundance in the Teanaway has increased relative to baseline conditions suggesting the decrease size BACI does not translate to decreased survival. The abundance delta values (treatment stream minus control stream) above help visualize an abundance BACI test showing that post supplementation abundance of Teanaway Basin Rainbow Trout is generally greater in treatment streams than in the control streams. This is informative given that 1/3 of the hatchery spring Chinook salmon production is released in the Teanaway Basin.

RBT “Condition”



Finally, as a precaution, we evaluated Rainbow Trout condition (log transformed fish length and weight) before versus during salmon supplementation to determine if there are differences in the length versus weight relationship between the periods. As indicated in the figure above, the trend lines are very closely aligned suggesting no biologically important difference in trout size.

Risk Containment Monitoring Summary

- Naturally produced Spring Chinook widely distributed – (distributional overlap with NTT)
- Continue to observe small *O. mykiss* size differences in tributaries and main stem areas triggering risk containment analysis
- Weight of evidence suggests observed decrease not related to supplementation activities at this time
- New since our last S&M conference–post implementation risk containment monitoring now incorporates MRS Coho (Type I interactions)

To summarize, the NTTOC risk containment monitoring program is working as it was intended, flagging concern areas, providing a framework for evaluation, and making a process to make management recommendations under the adaptive management framework. At this time, we do not believe the changes we have observed in NTTOC monitoring variables are associated with our hatchery salmon supplementation activities. We have now extended our NTTOC evaluation to include direct releases of locally produced Coho salmon from the recently completed MRS Coho central facility as described in the Coho Master Plan.

The End.

Forward any questions to gabriel.temple@dfw.wa.gov, timothy.webster@dfw.wa.gov, scott.coil@dfw.wa.gov, or cade.lillquist@dfw.wa.gov.

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Thank you.