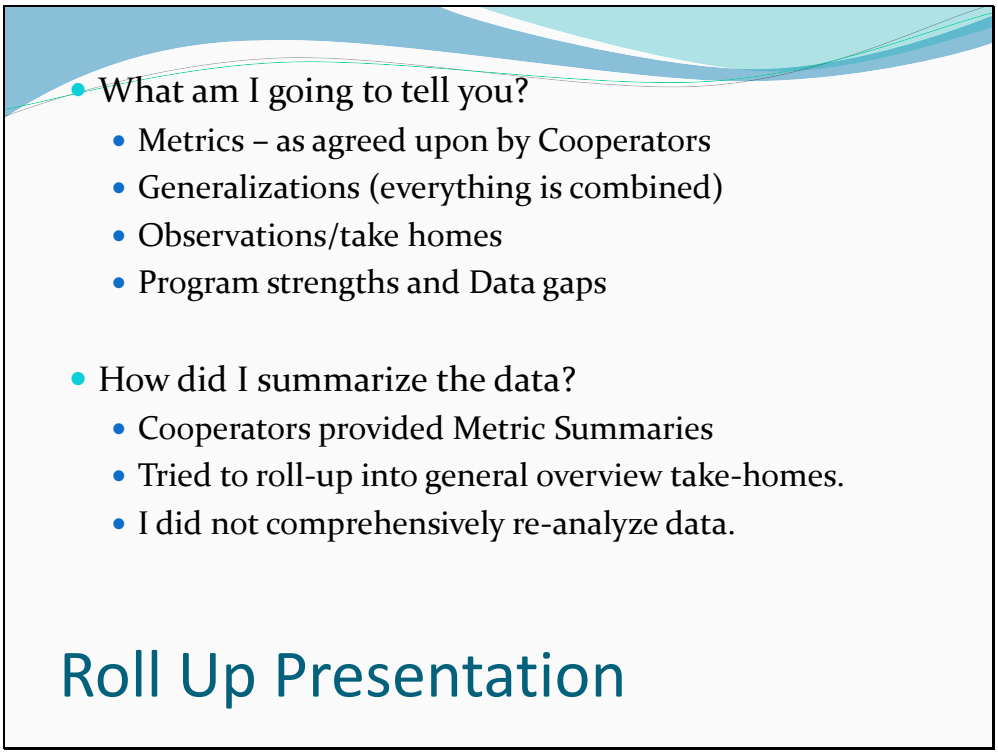
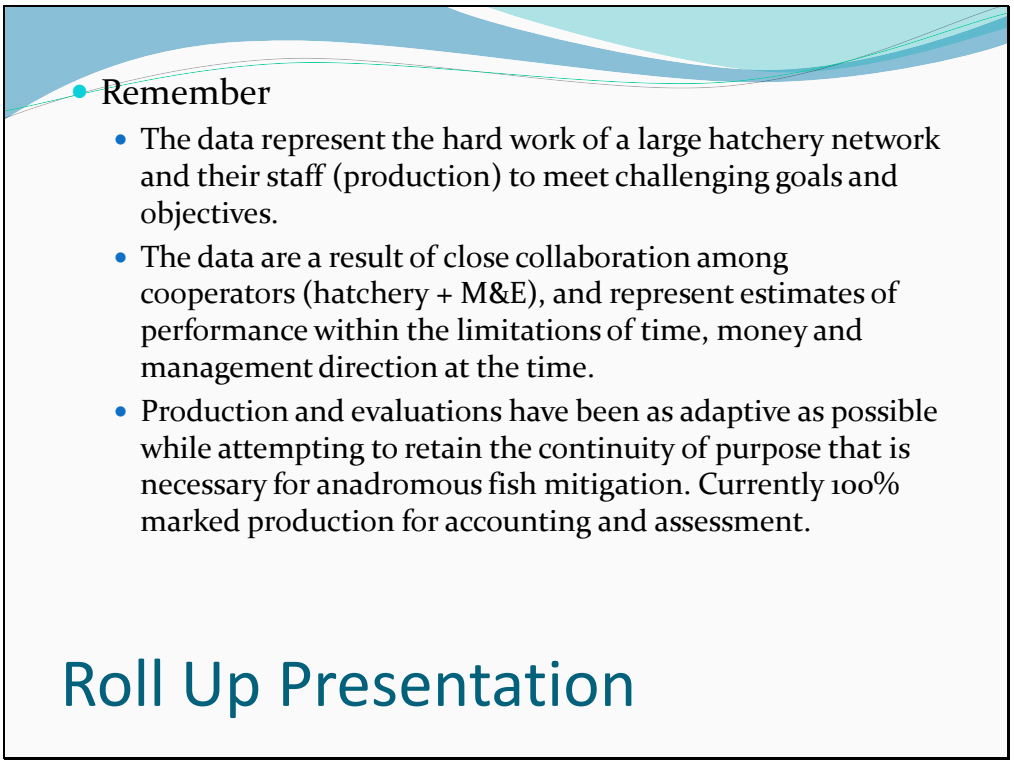
Mark Schuck is Evaluations Project leader for Washington Department of Fish and Wildlife. He has worked within the LSRCP program evaluations since 1982 when he began steelhead evaluations at Lyons Ferry Hatchery. He became project leader for all salmon and steelhead evaluations in 1995.

Slide 2



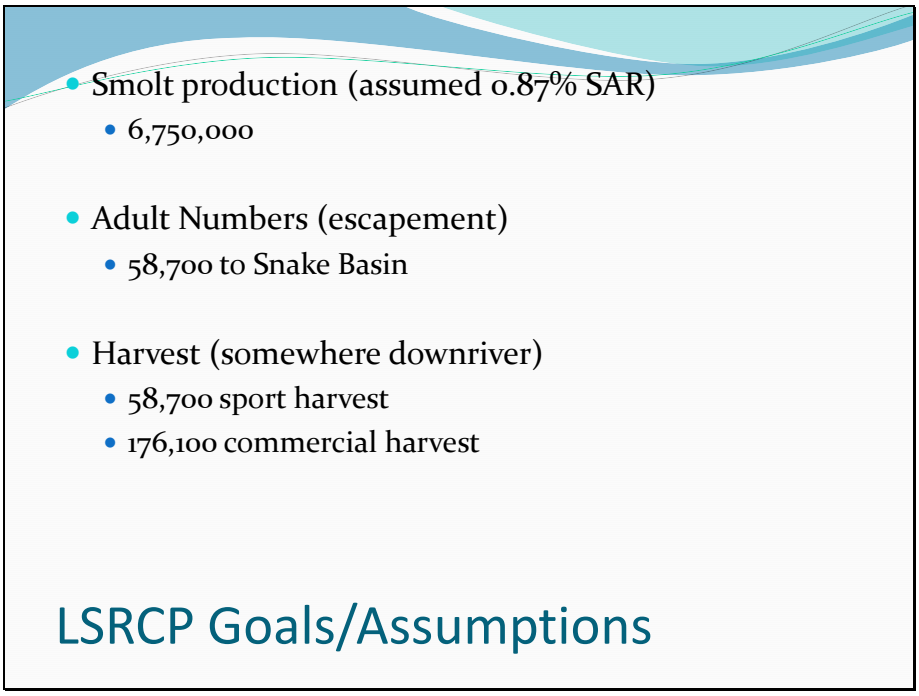
The roll-up presentation was meant to encapsulate the results that had been presented over the two-day symposium. The hope was that it would remind and emphasize to attendees the notable consistencies or exceptions that had been highlighted in the project presentations. As noted in this slide, I did not complete an exhaustive re-analysis of Cooperator's data, rather I combined common data sets that had been provided to me to show general program performance (i.e. – at a LSRCP program level, how had the performance compared with expectations, where did the program succeed, and where did it fail). This was to include recognition of evaluation studies' data gaps that prevented adequate or complete evaluation of program performance.

Slide 3



This is a disclaimer both for the ability to achieve and evaluate program goals, and the inability to summarize at too fine a detail without confusing attendees. Production and evaluation staffs work closely to monitor the program both within and across political boundaries, but long term studies are expensive and have had to be adaptive to stay current with relevant fisheries science. Substantial marking occurs annually to enable evaluations of these programs.

Slide 4



Goals and assumptions for the Spring/Summer Chinook programs as documented in the original 1975 Corps of Engineers document[1]. The escapement number was to the Project Area (Generally the Snake River basin, more particularly for most of the cooperators to above Lower Granite Dam) and harvest from that escapement was assumed. The downriver harvest portions of the program have had little mention in past LSRCP program reviews and are notable for their magnitude.

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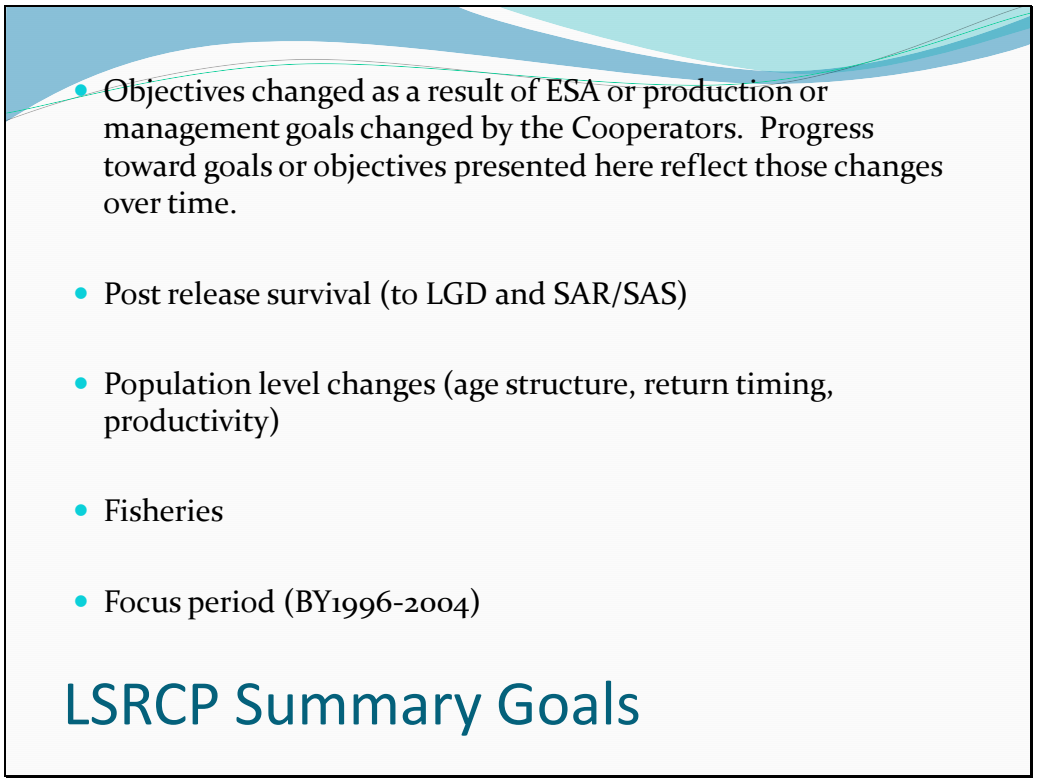
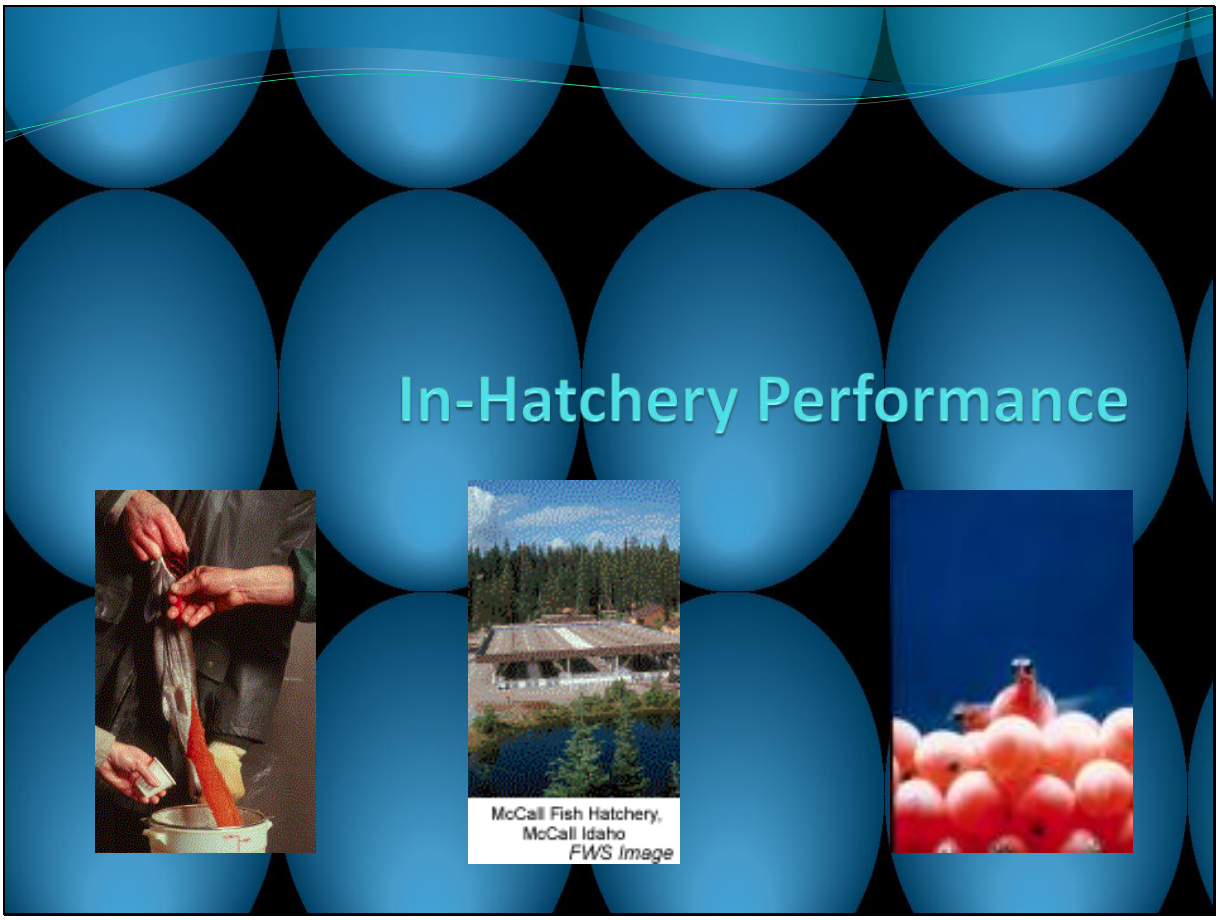
[1]Special Report: Lower Snake River Compensation Plan, Lower Snake river Washington and Oregon, June 1975. U.S. Corps of Engineers, Walla Walla, Washington. 95 pp plus appendices.

Slide 5

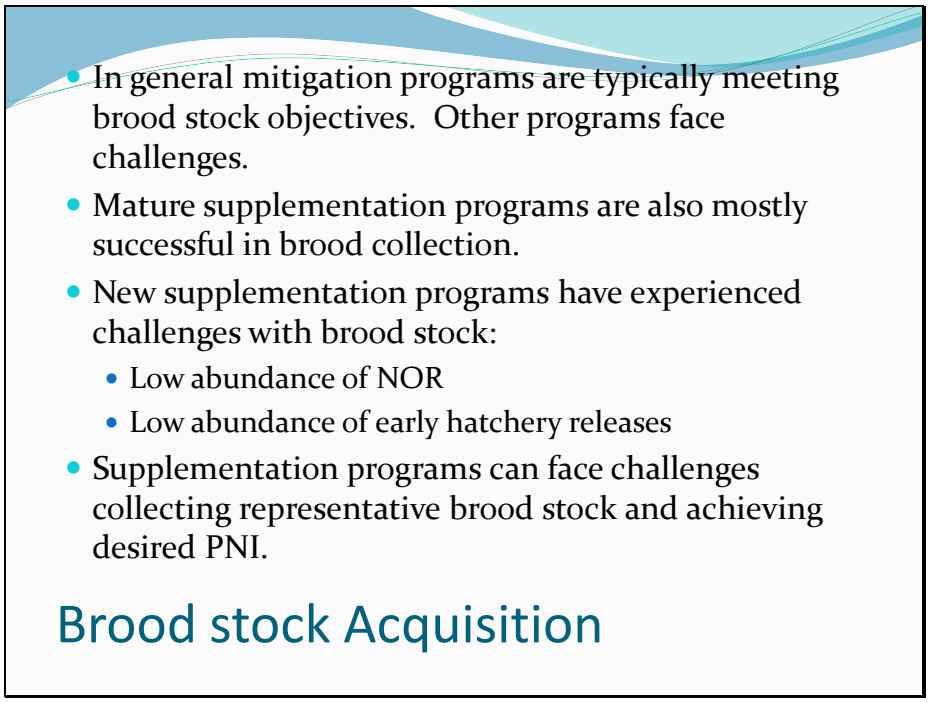


Reviewers should remember that progress toward achieving LSRCP goals and the Cooperator's management objectives are relative in this roll up presentation: i.e. – where production or survival targets have been changed by the management entity, their progress toward achieving that new target is captured here and may be greater or less than in the original LSRCP document. The summary goals presented herein are those for which roll-up metrics could be reasonably summarized to inform attendees. Many of the metrics presented did not capture the entire program duration, but data extending back to the early 1980's is often included to provide context and better show trends.

Slide 6

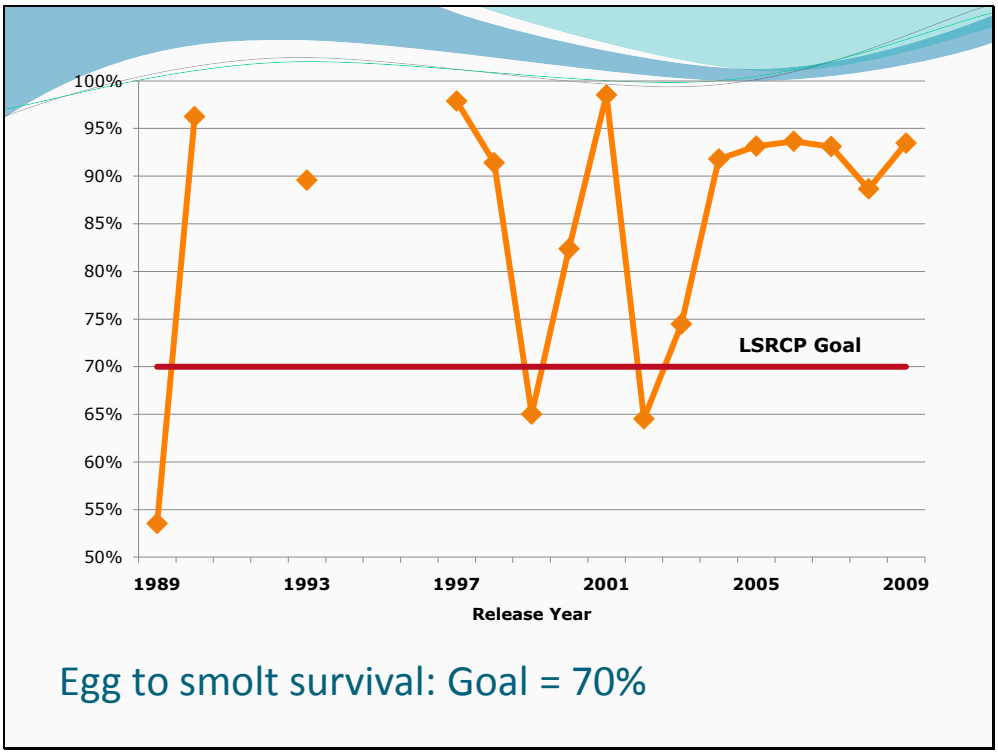

In-Hatchery Performance
McCall Fish Hatchery,
McCall Idaho
FWS Image

Slide 7



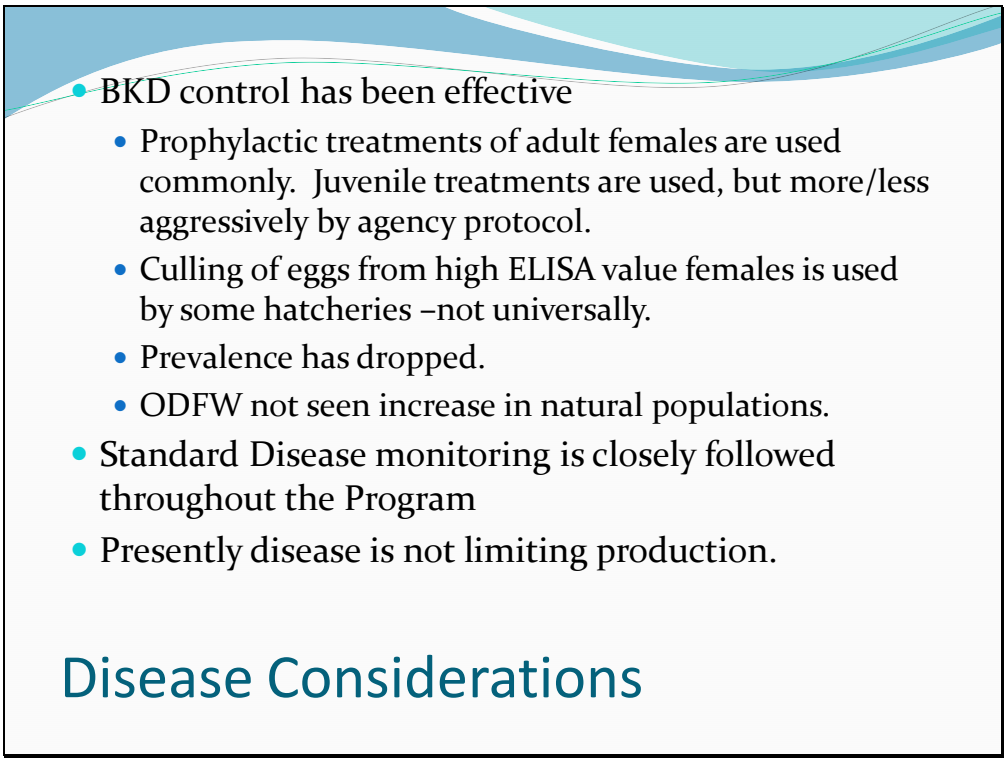
Brood stock is the cornerstone of production programs. The conventional hatchery mitigation programs in LSRCP have generally been successful at meeting brood needs. Supplementation programs, especially newer ones, have been challenged in meeting broodstock needs where constraints are in place to control pNOB, pHOS and PNI, or where low abundance of natural fish has simply prevented reaching brood stock needs. The recent upturn in spring/summer Chinook abundance has positively affected these programs.

Slide 8



This summarizes survival for all programs combined, by release year since 1989. The LSRCP assumption/goal was that properly operated hatchery programs should achieve an eyed egg to smolt (release) survival of 70%. As the accompanying graph depicts, the program has achieved that level of performance in most years, and nearly so in two of the three years where survival was below the goal. These data represent hatchery performance only for programs that collected their own eggs. Total smolt production often included eyed-egg transfers from other established hatcheries, especially in early years. For years with no percentage plotted, there were incomplete hatchery data to calculate a collective performance. Individual hatchery data sets will contain more information from which specific survival estimates could be derived.

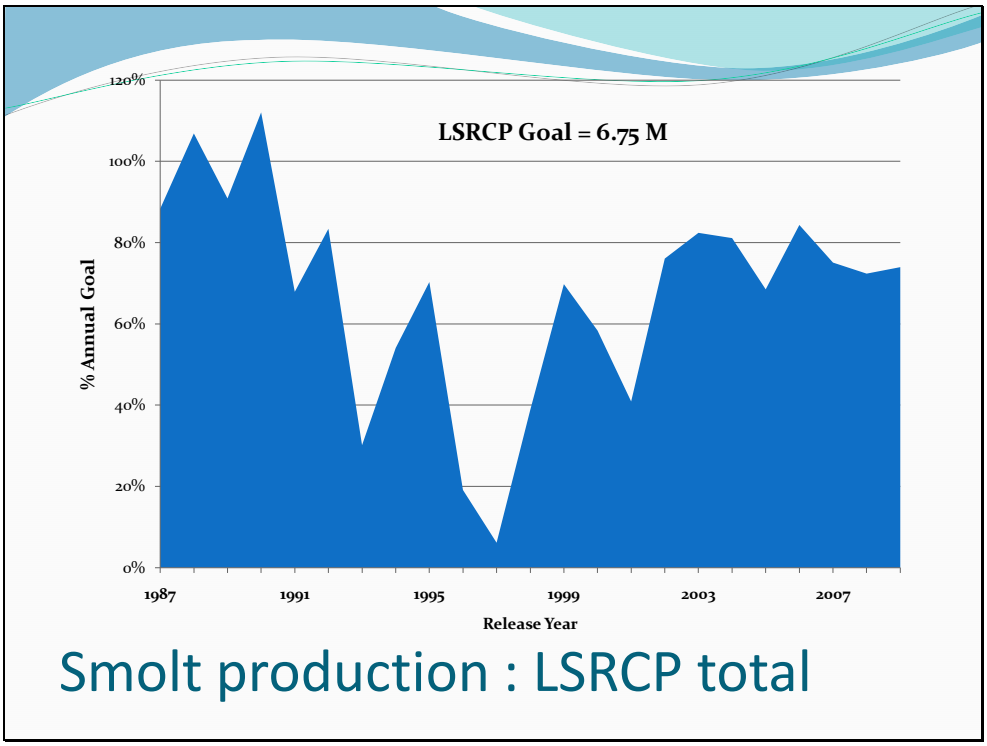
Slide 9



Disease within a hatchery can devastate populations and seriously degrade the beneficial hatchery effect of high egg to release survival. BKD is a prevalent disease of Chinook that was, and continues to be, a focus of control efforts. The cooperators continue to utilize adult broodstock injections to control the disease prior to spawning, which has effectively controlled its incidence. Each cooperator differentially practices disease control within their hatchery. There is no general treatment regime such as culling of eggs from high ELISA values females, or prophylactic administration of medicated feed to juveniles.

Standard disease monitoring and control efforts from the Pacific Northwest are employed throughout the program and there is general agreement that disease does not currently limit production at any facility.

Slide 10

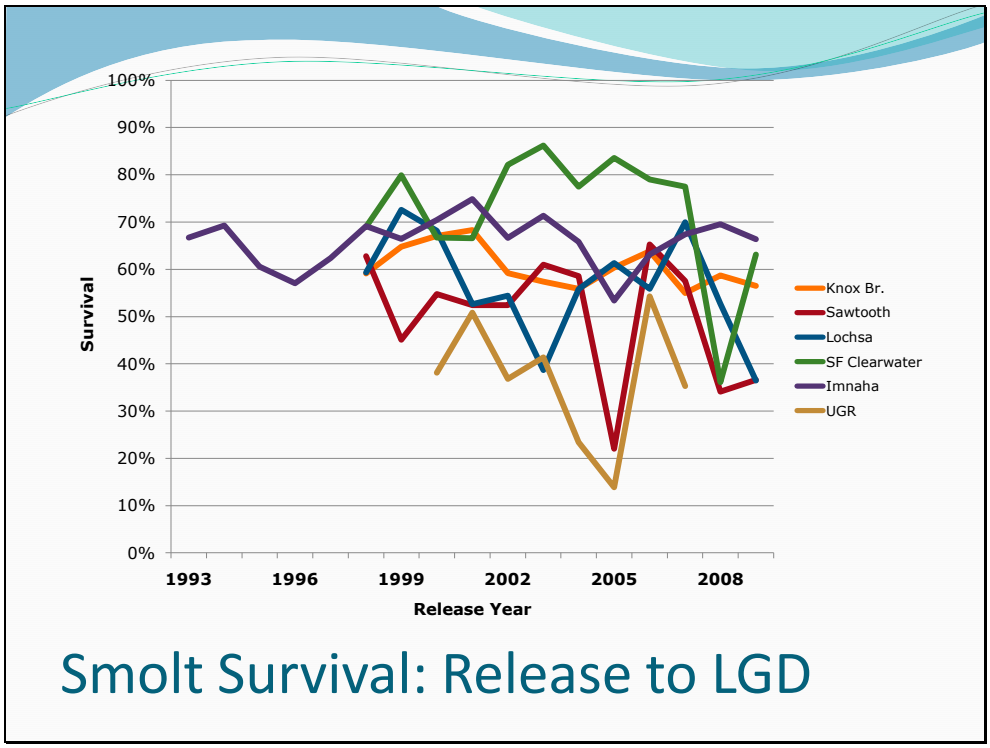


This slide depicts the percent of the program production goal annual smolt releases have met. It does not include parr releases, but does include smolt releases that came from hatcheries outside the basin to boost production releases toward the goal. The severe decrease in smolt releases in the mid 1990's was directly related to adult abundance.

Since that time adult abundance has greatly improved and smolt production responded. However, failure to reach 100% of the goal since those low abundance years has resulted from changes to the program in response to ESA listings, recommendations that arose from new studies on the effects of hatchery fish on natural populations, hatchery review recommendations, management decisions to limit production releases in some areas to limit hatchery fish abundance, and low returns of conventional hatchery, natural origin, or endemic origin hatchery fish to support mitigation and supplementation programs.

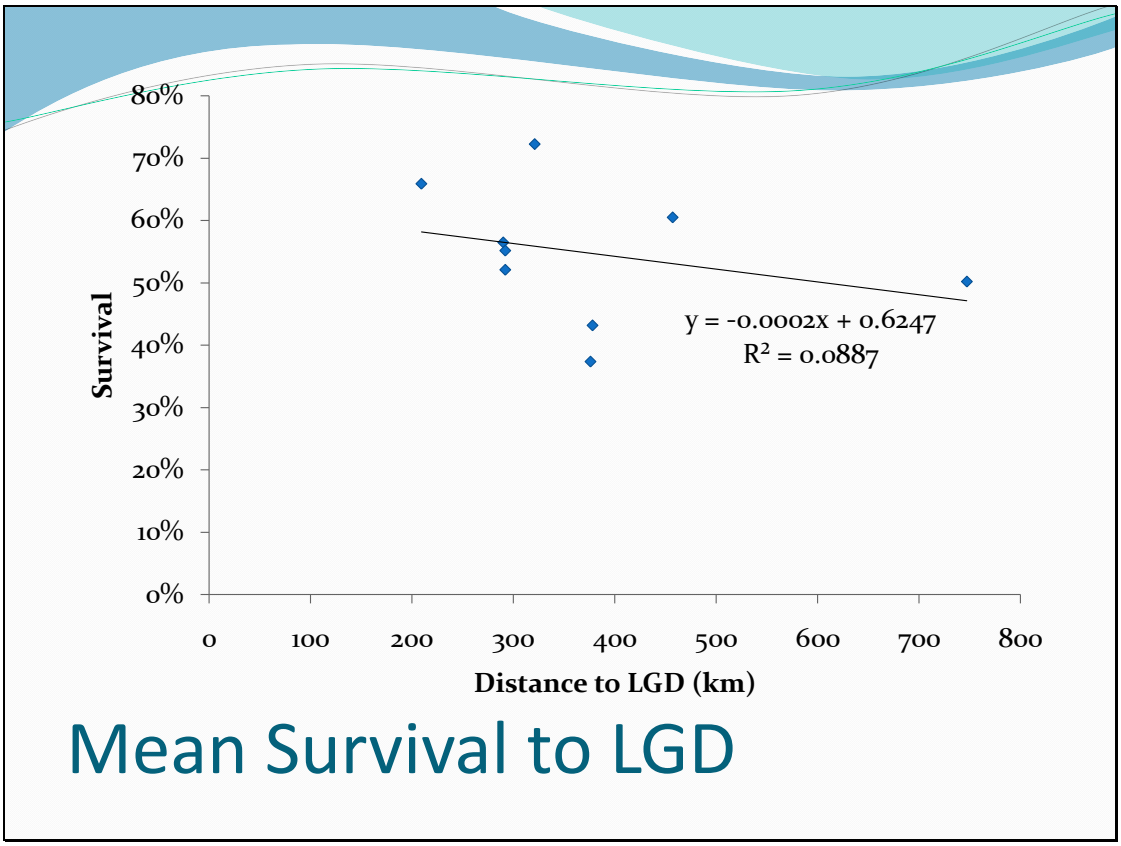
Slide 11

Slide 12



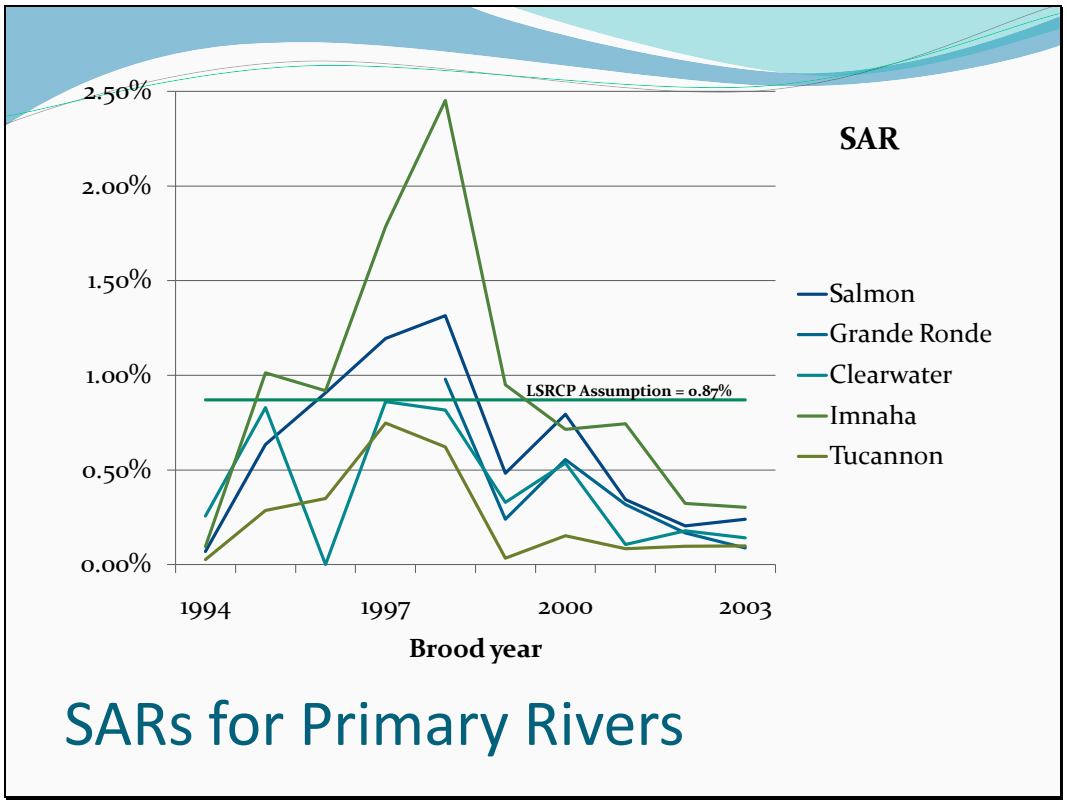
Smolt survival to Lower Granite Dam (LGD) has been a key monitoring metric of cooperators. Although at first glance this appears a jumble – there is some synchrony among programs between years despite the within year survival differences among the releases. This diversity between migration years and among programs may be strongly affected by environmental and river conditions in the year of release.

Slide 13



In developing the symposium, many metrics were discussed that might represent relative performance of hatcheries and stocks across a large program like the LSRCP. One possible factor affecting smolt performance, in this case survival from release to LGD, was distance traveled. I plotted survival by facility (or release site) and distance to LGD but found no strong relationship. It appears that other factors play a more important role in juvenile survival than distance traveled. (Note: these data points were developed from the same survivals used in the previous slide.)

Slide 14

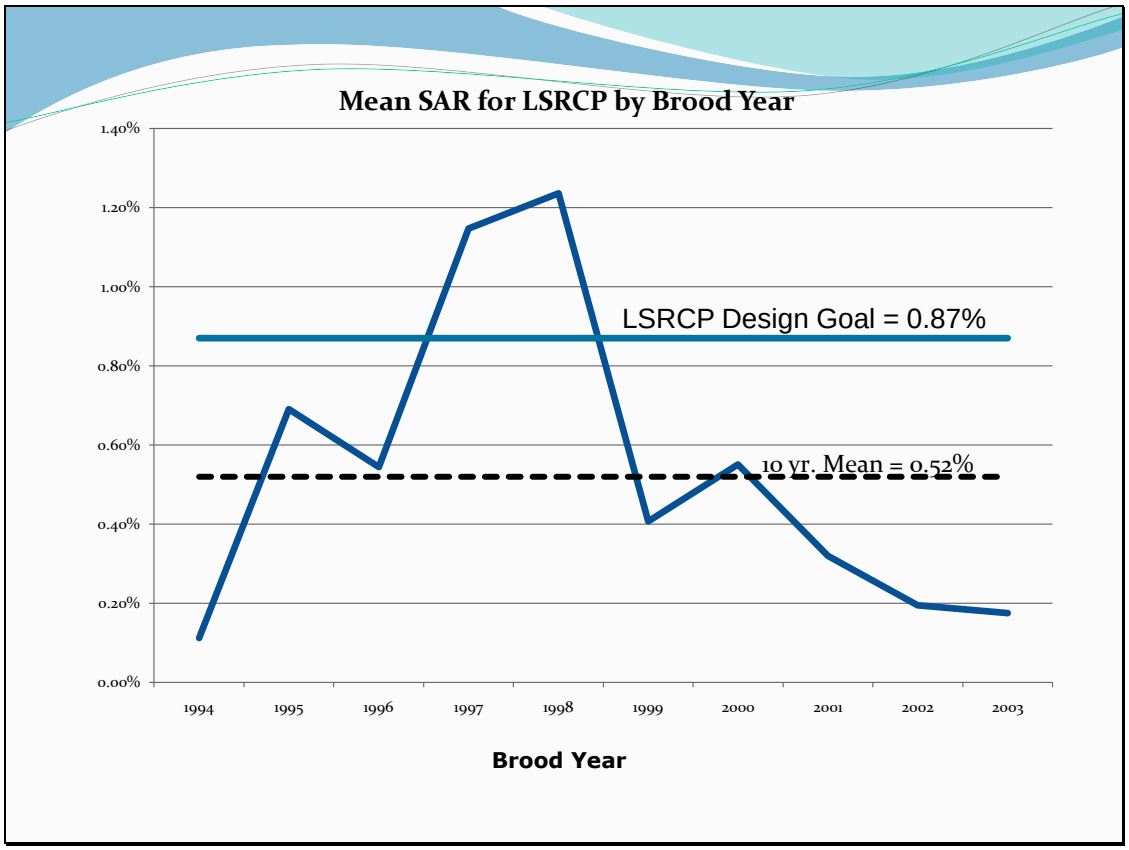


The LSRCP hatchery program was sized for production based on an assumed SAR*of 0.87%. Performance by river system was summed for all releases by brood year. Despite the diversity among programs there is substantial synchrony among years, which suggests that the migration corridor and ocean are very important drivers of program success. The programs are not achieving the assumed SAR in most years, which also suggests that either the original assumption of survival was in error, or productivity is being driven down by factors other than the hatchery environment.

•SAR = Smolt to adult returns (includes jacks) to the project area.

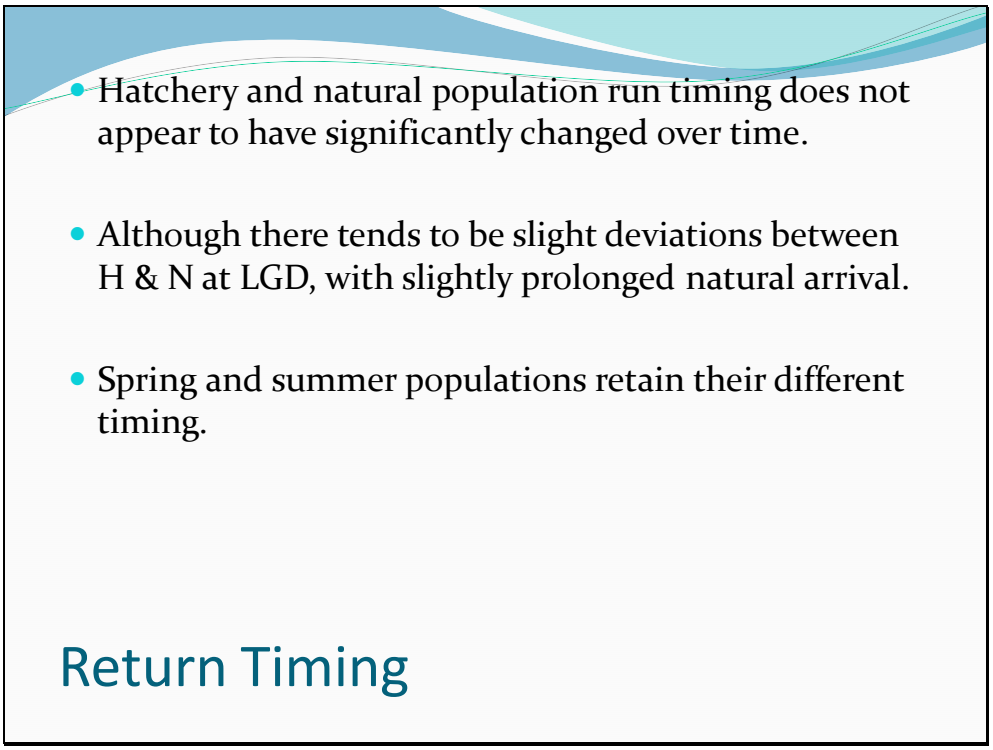
•The Grande Ronde line includes Captive Brood smolt release performance, which has lagged Conventional Hatchery Program fish performance.

Slide 15



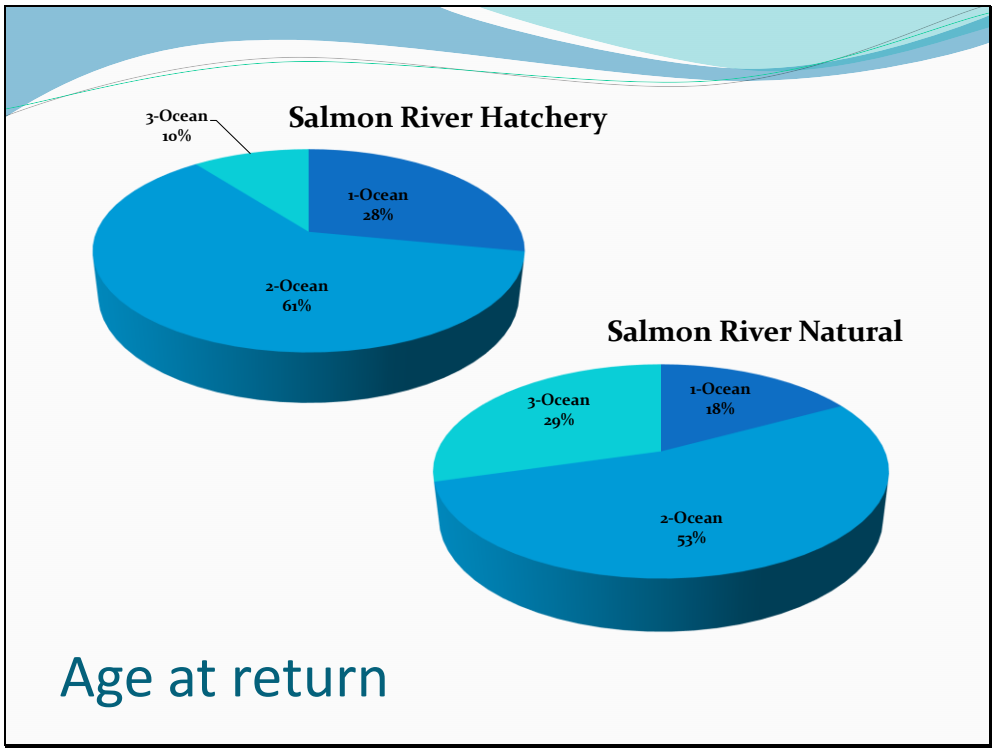
This is a further depiction of collective survival by brood year for the entire program. In 80% of brood years the SAR is below the assumed LSRCP goal, with the 10 year mean being only 60% of the target 0.87% SAR.

Slide 16



Each program evaluated the return timing of their adults and often compared them to natural populations. No significant changes in run timing were noted for any program, although there may be a slightly longer immigration period for the natural fish.

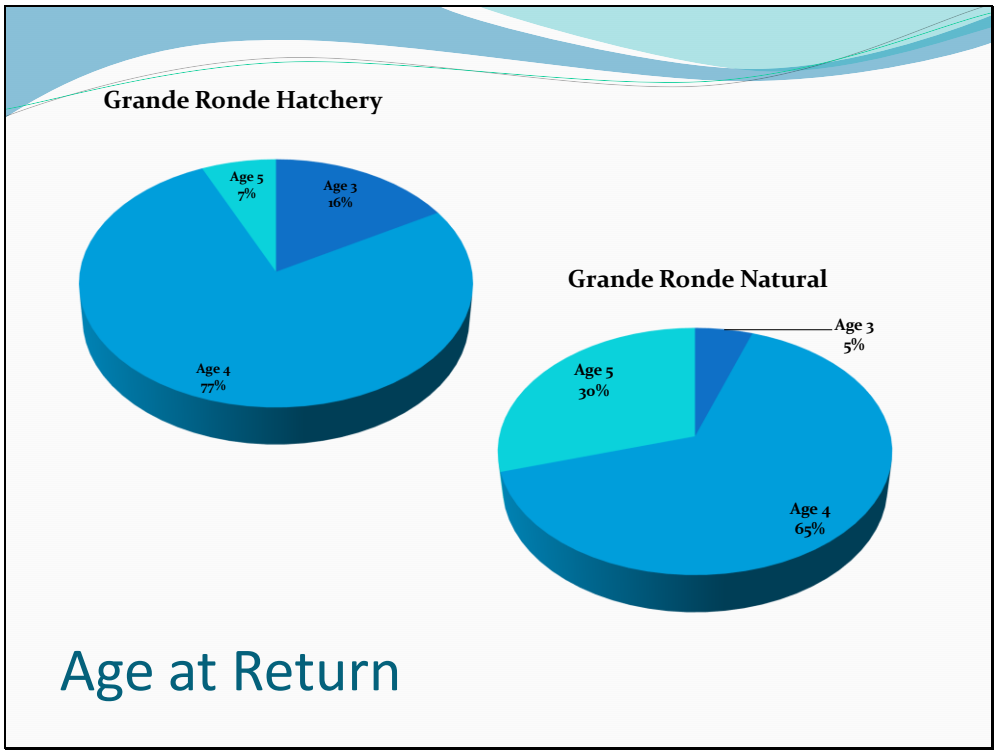
Slide 17



Age at return is evaluated to assess the impact of hatchery rearing environment on population age structure. Examining age structure over time and in comparison with natural population age structure is more instructive in attempting to understand if the effects are cumulative. Hatchery fish tended to return younger than their naturally rearing cohort. Each program reported age at return and when all the data were examined, a consistent increase in 1-ocean (age 3) returns (almost entirely jacks) was noted among all the programs. Moreover the increased return of 1-ocean fish was normally offset by a commensurate decrease in 3-ocean (age 5) fish, while 2-ocean (age 4) fish (the dominant age class in all cases) remained relatively constant. This and the following slide provide examples of the common shift in age structure noted in all the other programs. They were not all presented here as that served no purpose in describing the general response to hatchery rearing.

(Continued on next slide)

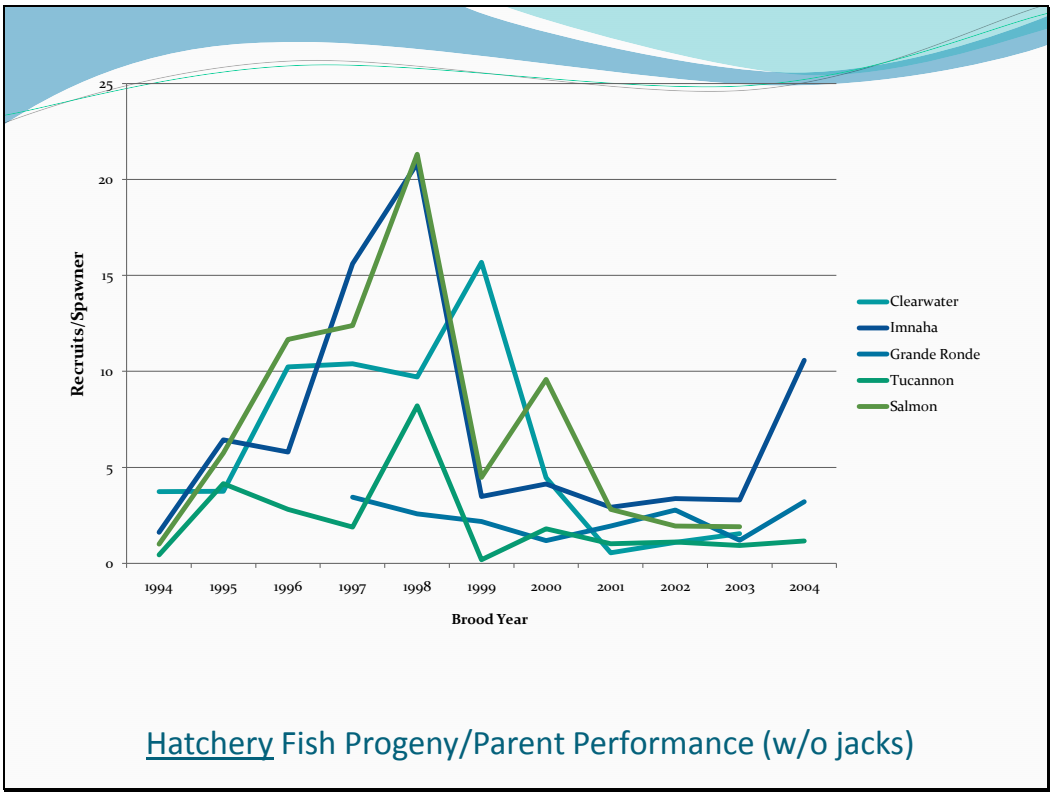
Slide 18



Interestingly, while cooperators noted the presence of mini-jacks (mature males that were adfluvial or fluvial) in some rivers, they did not appear to be a significant problem in any of the rivers. On the contrary, where sampling for mini-jacks had occurred on the Tucannon River, the mini-jacks captured were entirely of natural origin. Cooperators concluded that there was insufficient data to suggest that mini-jacks were an issue or concern (i.e. – no indication of excessive natural expression).

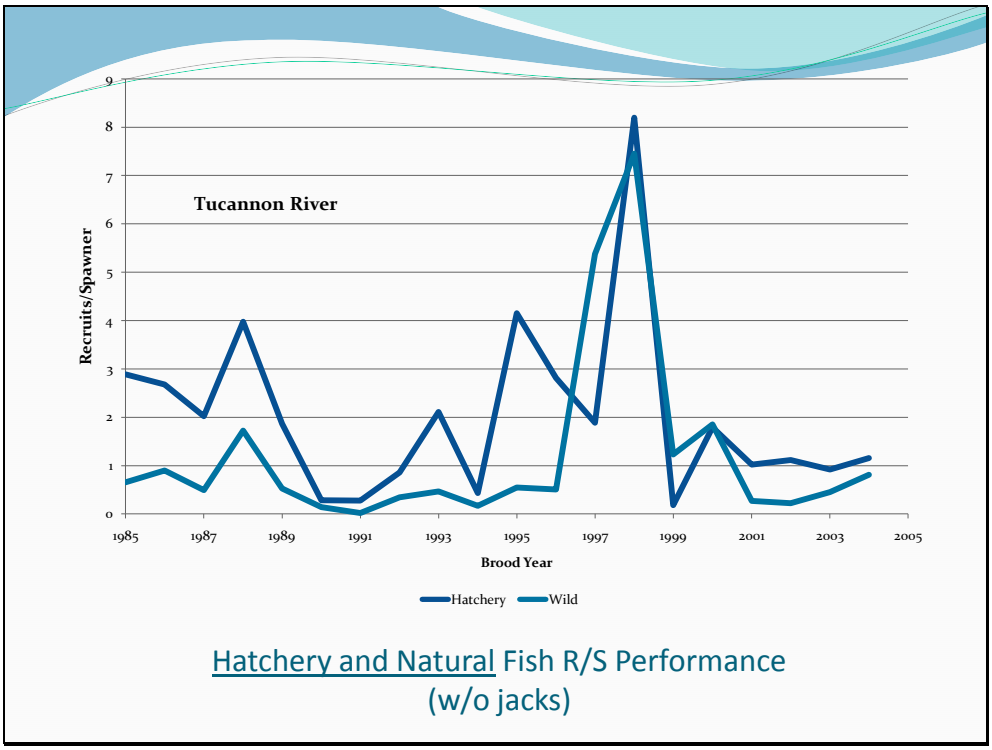
Possibly more important was that there was no identifiable trend in any of the populations (hatchery or natural) over time toward a steadily increasing number of younger fish. This suggests that age structure response in hatchery fish is environmentally driven and may not be affecting natural age structure because of domestication effects expressed into the natural population.

Slide 19



Progeny per parent ratios (Recruits/spawner) were examined for all hatchery programs to measure survivals relative to expectations (can programs sustain themselves), and in some cases to compare against natural population performance (see slides following). Highly variable performance over time among all the programs shows clearly in the above graph. Highs and lows appear to be driven by SARs (see previous) that are dependent upon river migration and ocean conditions.

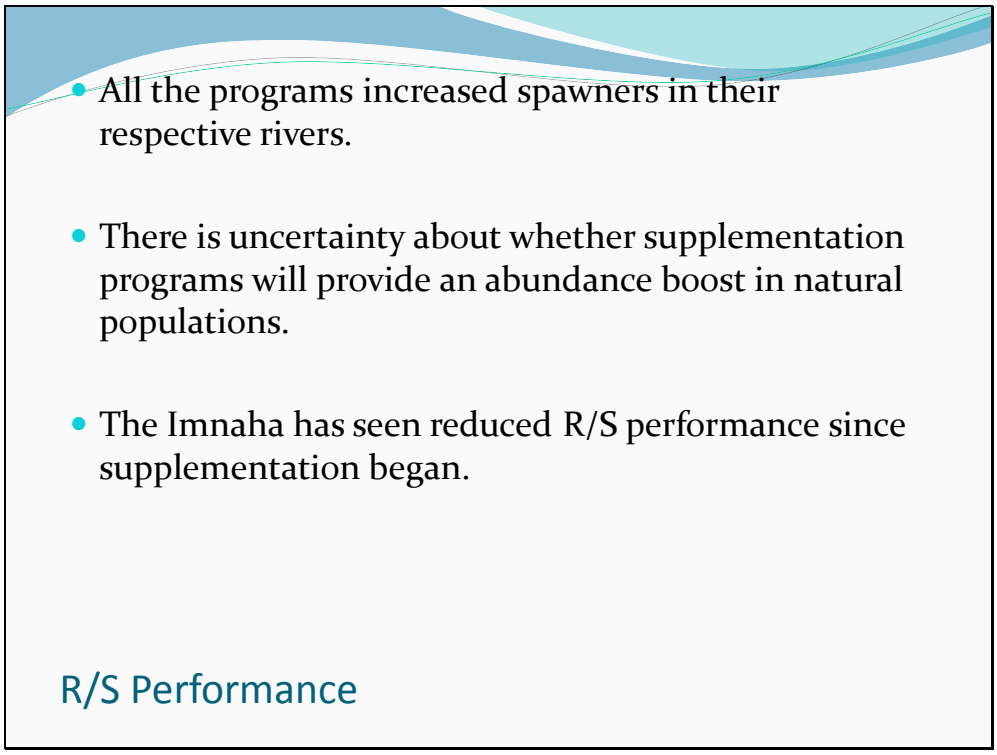
Slide 20



Hatchery and Natural Fish R/S Performance
(w/o jacks)

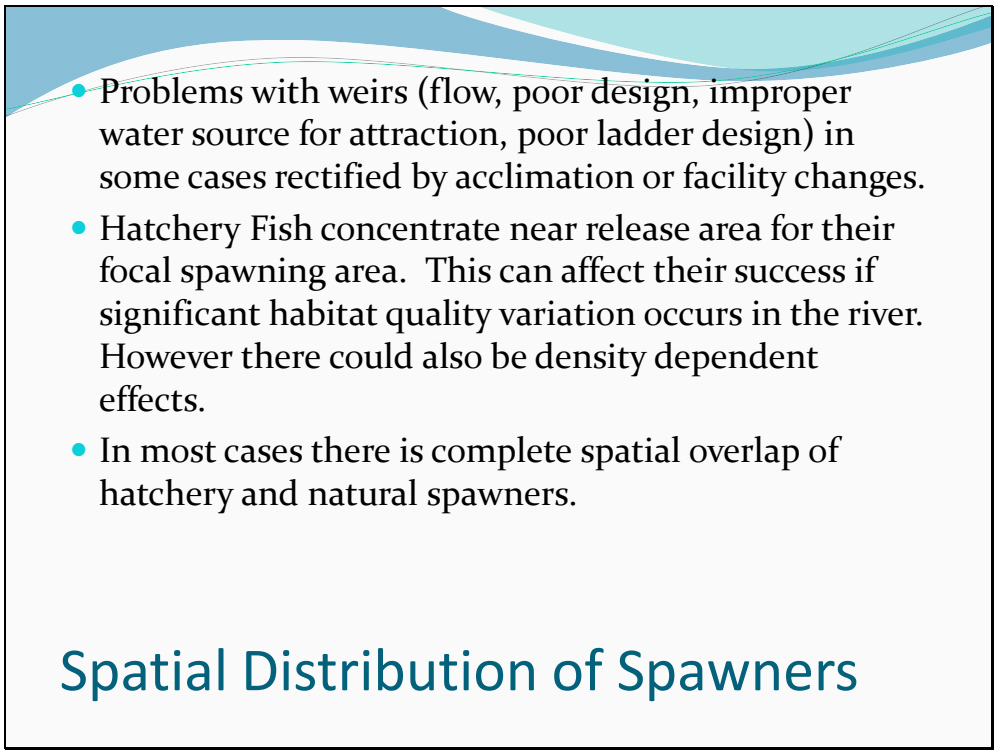
The Tucannon is a supplementation program where R/S has been monitored for both hatchery and natural populations since its inception. Similar annual fluctuations occur across the years shown above for both populations, however the hatchery consistently recruits more adults from each spawner as should be expected based on the early life history survival advantage provided by the hatchery. The natural population recruited above the replacement level (1.0) in only 5 of 20 years shown in the chart, and there was no clear negative relationship between the presence of hatchery fish over time and R/S performance.

Slide 21



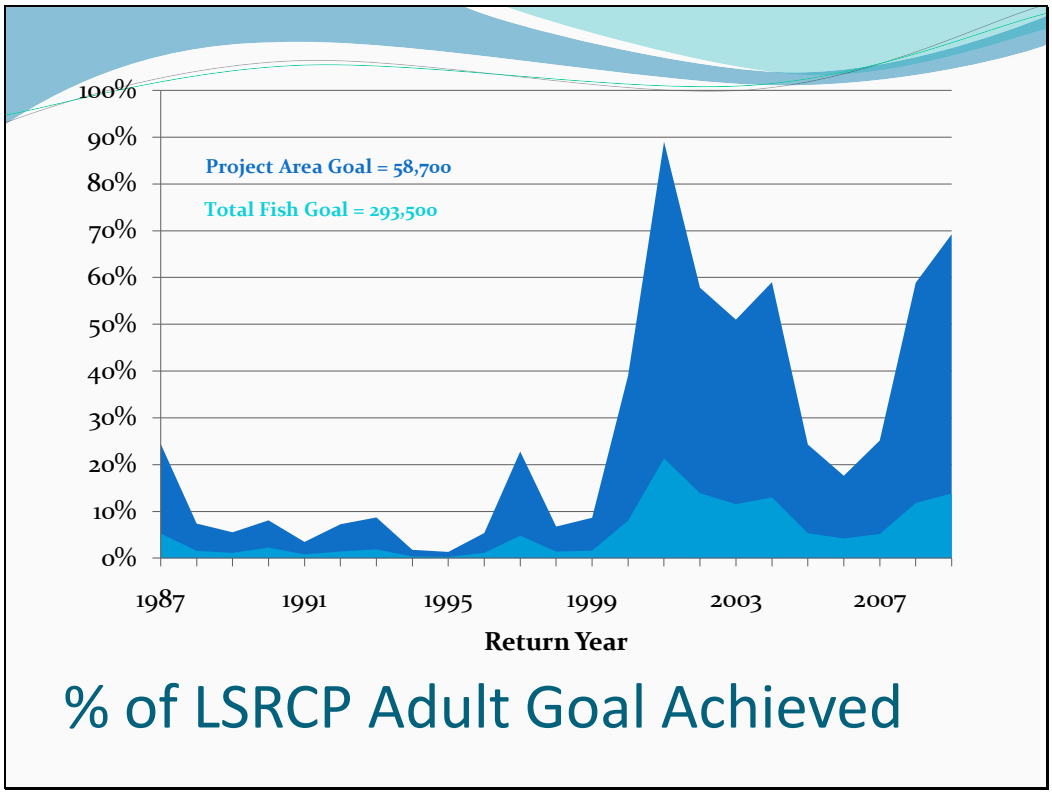
More supplementation efforts were begun after the critically low abundance levels of spring/summer Chinook in the mid 1990's. Because of that the data series on many LSRCP supplementation programs are relatively short. There were consistencies among all the programs that are captured here (including the Tucannon on previous slide). Supplementation remains experimental and there is not sufficient weight of evidence to conclude that they are benefiting natural populations. Further, there is evidence that in some rivers, natural population performance has been depressed by the presence of hatchery supplementation fish.

Slide 22



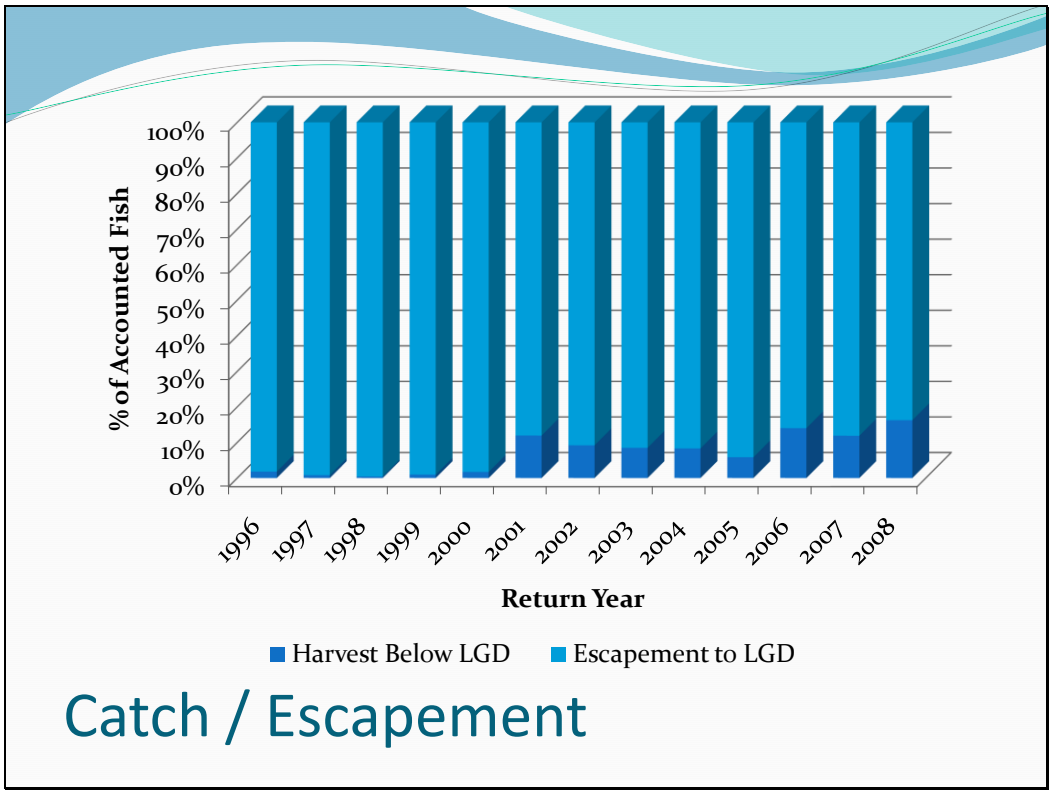
Hatchery fish releases occur directly from hatcheries, from remote acclimation facilities and from trucks directly into receiving waters. Because of these varying approaches, distribution of returning adults has been monitored. As noted above, hatchery fish may tend to congregate near release sites with slightly less diverse distribution then their natural cohort, but in general spawn in target rivers in similar locations.

Slide 23



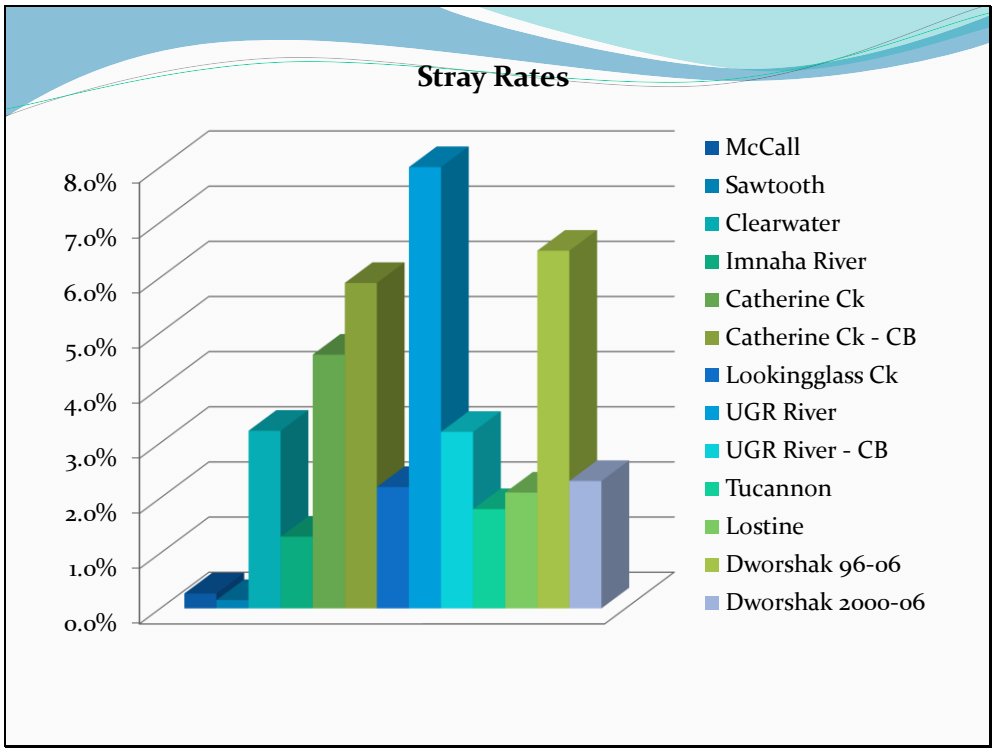
As previously mentioned there are two distinct parts to the LSRCP mitigation goal (escapement to the Snake River Project Area and below Project harvest contribution) that must be considered additively to represent the whole. The above chart depicts the collective LSRCP accounted adults and jacks, expressed as a % of the project area and total adult goals. Clearly in the early years of the program adult returns were poor, only returning more than 10% of the project area goal in 2 of the first 12 years. More recent performance has improved greatly with one year approaching 90% of the Project area goal. Performance is of course directly related to SARs and production levels. Total program returns (shown in red) lag far behind, barely exceeding 20% of the program goal in one year. The average contribution to the goal is less than 10% for the years shown. Reaching the total fish goals may never occur. Factors contributing to this may include an over estimate of Snake River fish to historical fisheries and an overly optimistic assumed SAR (0.87%) for the program.

Slide 24



This chart simply depicts the data presented in the previous slide in a different fashion. Downriver catch was assumed to have represented four times (4x) the escapement to the Snake during the 1960s when the baseline contributions for the LSRCP were negotiated. As this clearly shows, current downriver harvest is a fraction of Snake River escapement. It is important to understand that restrictions currently in place to protect ESA listed Snake River spring/summer Chinook populations may prevent fisheries of their historical magnitude of occurring prior to recovering and delisting under ESA. The affect this has on expectations for LSRCP to meet its original harvest goal is unknown and presently not being actively discussed.

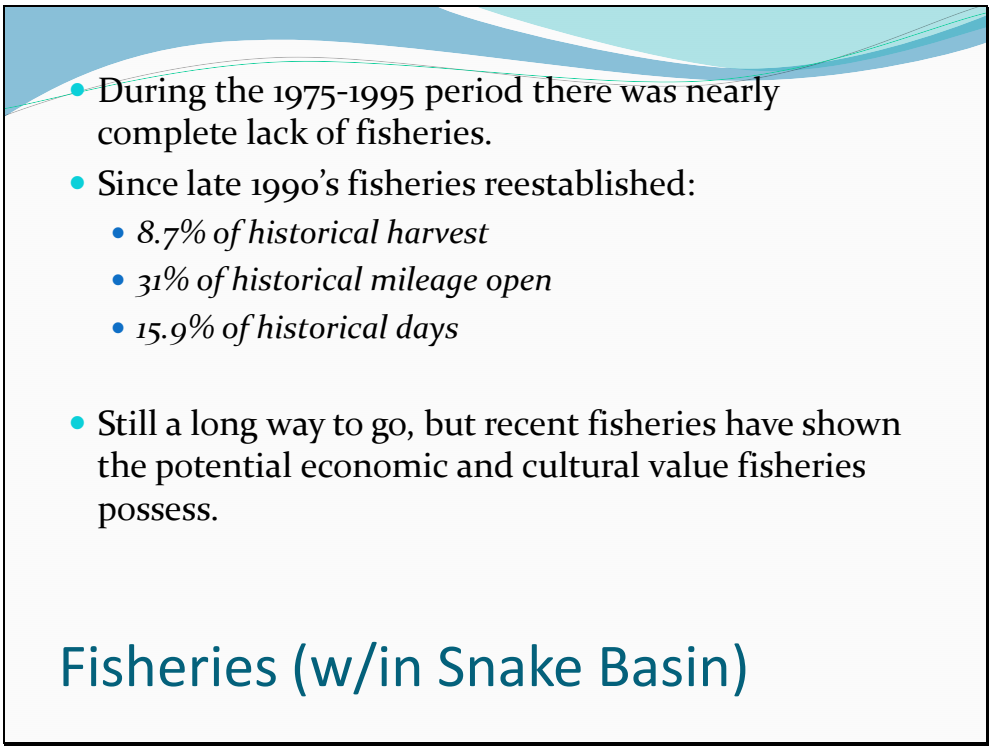
Slide 25



Stray rates are calculated based on the Oregon definition of straying which is: Captured or caught outside of its normal migration pathway. As the chart shows there is a broad diversity of stray rates from barely measurable to approaching 8%. There is also substantial variability in straying across years. For example, early stray rates from the Dworshak program were high (10-20%), driving the mean stray rate for the reporting period 1996-2006 to over 6%, however recent straying (2000-06 in chart) averages only about 2%.

These data may also be limited by the cooperators' ability to collect or document straying in all locations. For example the stray rate for Tucannon Chinook based on recovery of coded wire tags averages less than 2% for the reporting period, but recent detections of PIT tagged Tucannon Chinook showed more than 25% of detected fish passing above Lower Granite Dam and not returning to the Tucannon River. Such unidentified behavior contributes to a substantial underestimate of straying and SAR. Technological advancements can help better understand these variables and possibly their cause.

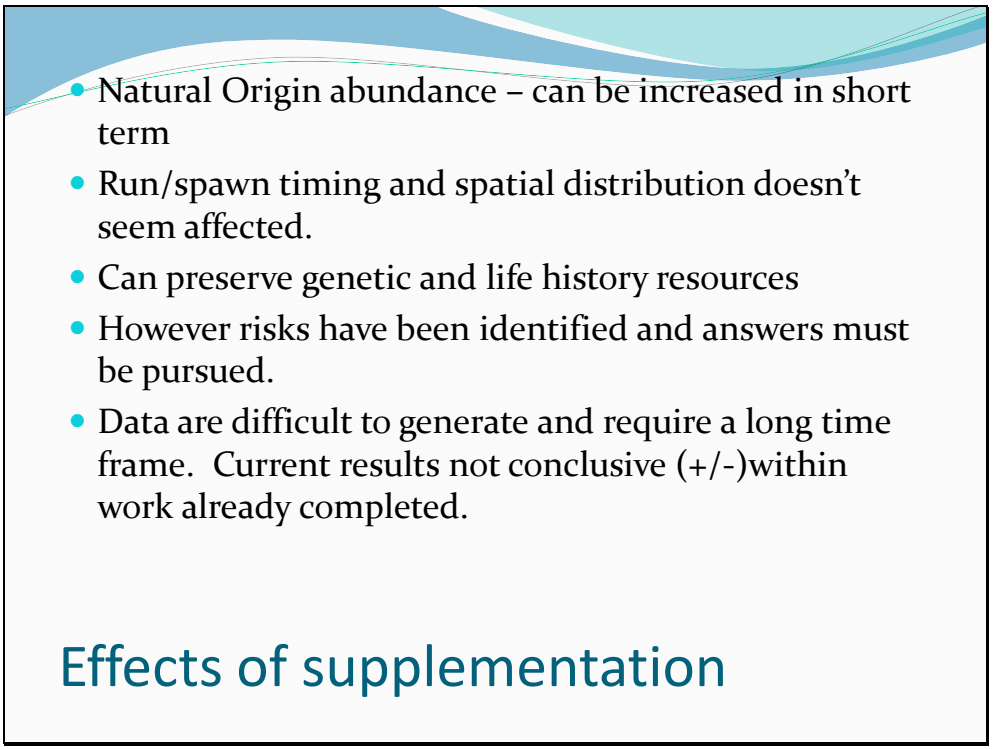
Slide 26



Fisheries have been identified as a high priority goal for all state and tribal entities involved with the LSRCP program from the beginning. The near total lack of fisheries within the Snake for over 20 years severed cultural and social ties to Chinook fisheries. The resurgence of fisheries starting in the late 1990's was greeted substantial enthusiasm, and the fisheries have developed in the intervening years with gradually increasing opportunity (miles, days and harvest) across the basin.

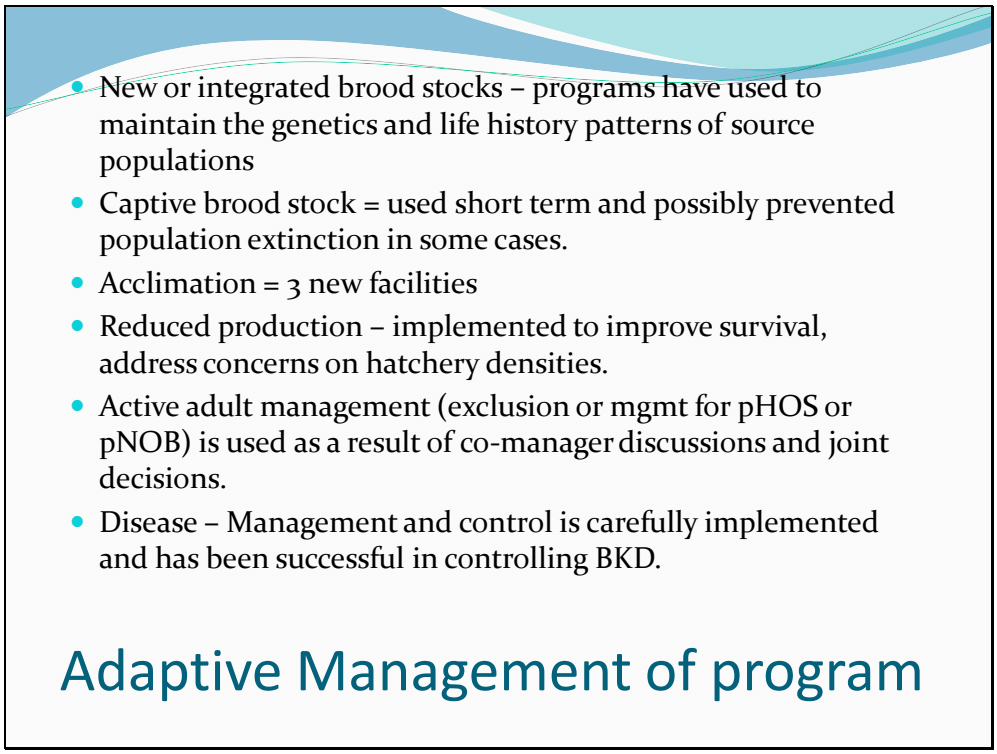
The value of fisheries to local communities and Tribal culture will continue to keep those fisheries a high priority for LSRCP cooperators as long as ESA listed natural fish can be protected.

Slide 27



These are general conclusions for supplementation programs currently in effect within the LSRCP program. As noted above there are insufficient results to conclude broadly about the effectiveness of supplementation. With implementation of hatchery review recommendations, use of local brood stocks and supplementation is being pursued. While there are often clear short term benefits from these programs, these efforts need continued monitoring and research to ensure the presumed long term benefits occur.

Slide 28

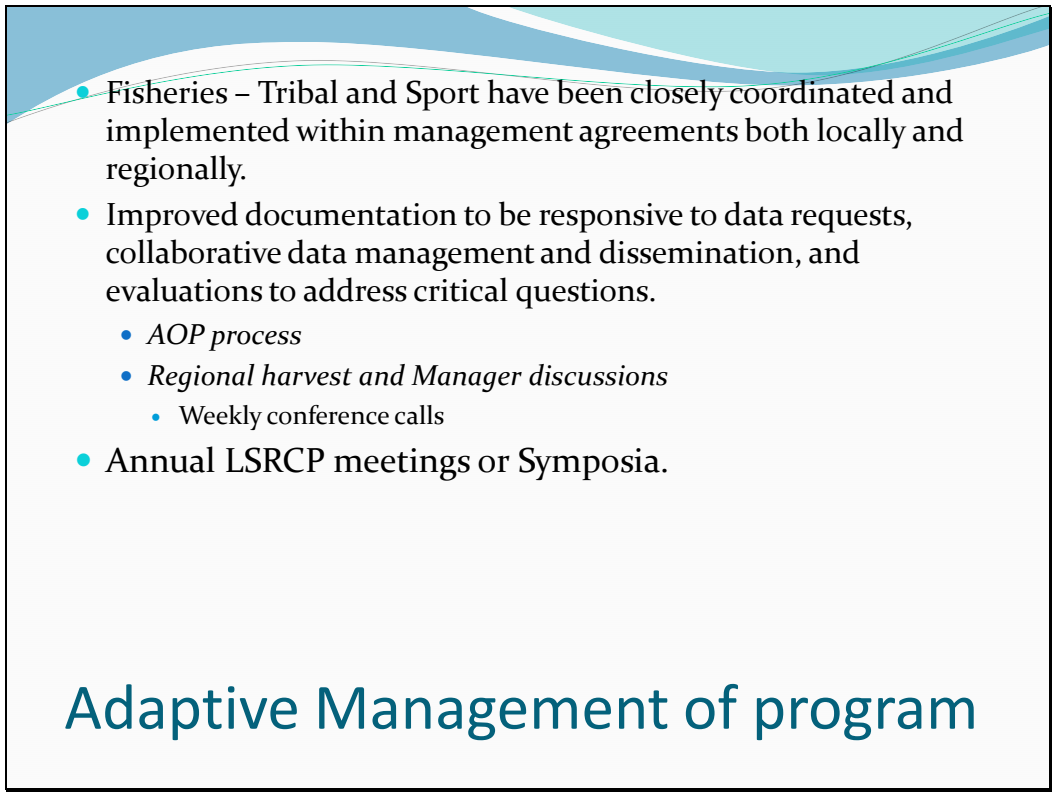


Adaptation has been constant within the program. From adopting different size, time or type of release to improve survivals, to reducing rearing densities to reduce disease prevalence and severity, to utilizing captive brood stocks to prevent extirpation of populations. The LSRCP cooperators have applied a broad array of changes to the program during its life span.

Recent adaptations have been the adoption and development of endemic brood stock programs, often including agreement among the managers to actively manage hatchery and wild fish numbers escaping above program facilities to control hatchery fractions spawning in nature.

To achieve such flexibility and implement often unproven management concepts, the cooperators have engaged in continuous coordination and negotiation efforts such as annual operation plan (AOP) development and the joint development of Hatchery and Genetic Management Plans and regional research plans (see next slide).

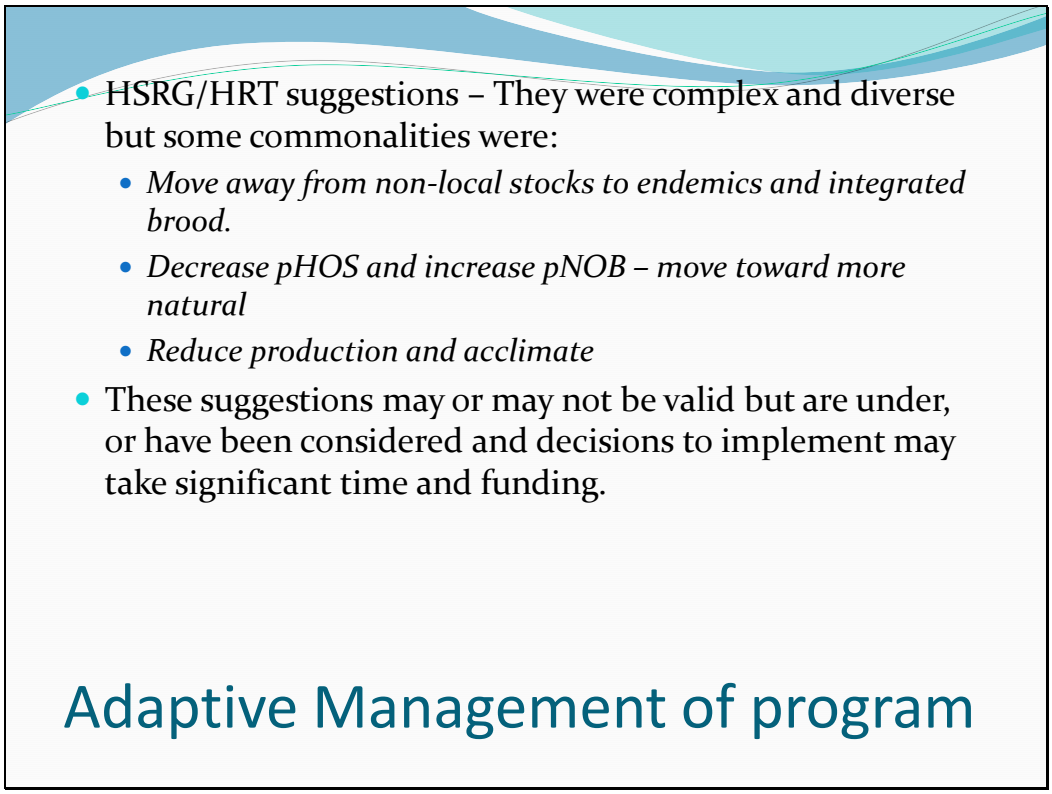
Slide 29



Such communication has greatly improved inter-agency cooperation. The continual demand for research and monitoring data has encouraged the development of regional data bases to facilitate sharing. These efforts, often coupled with weekly manager conference calls have kept cooperators engaged with each other and often working more closely toward shared priorities.

Certainly the annual LSRCP cooperator meetings and regular program symposia, such as this one, have helped share LSRCP successes and failures and invited critical review of production and research.

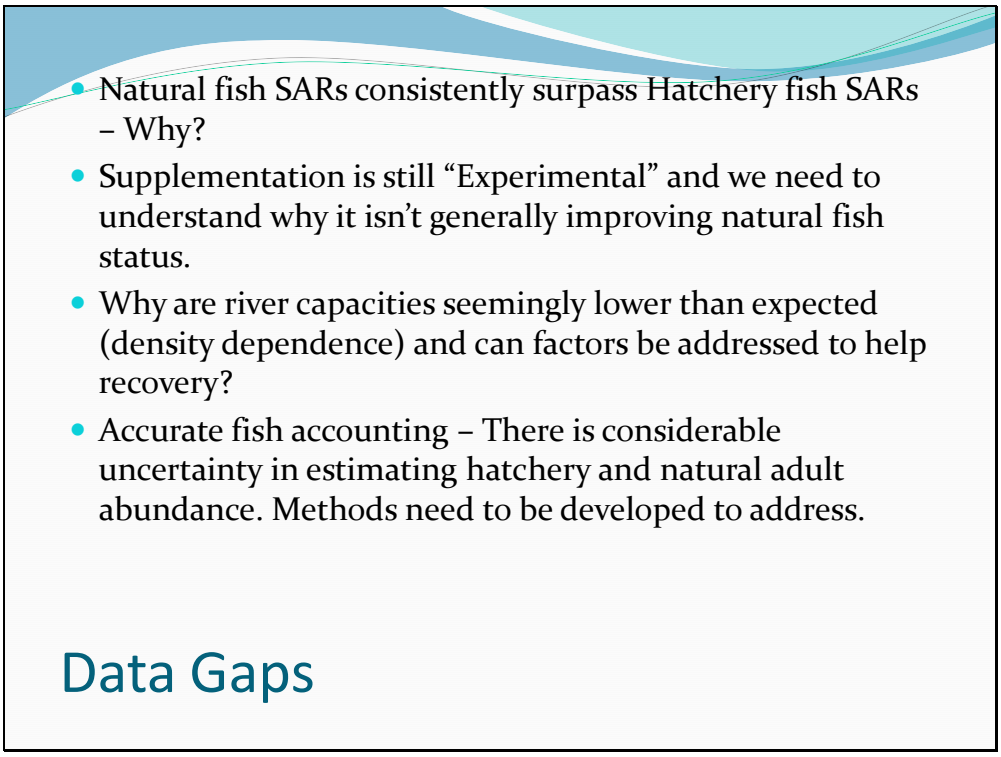
Slide 30



As previously mentioned, critical review of programs has been invited. Two such reviews in recent years by the HSRG and the US Fish and Wildlife Service's HRT have prompted several common recommendations for LSRCP programs.

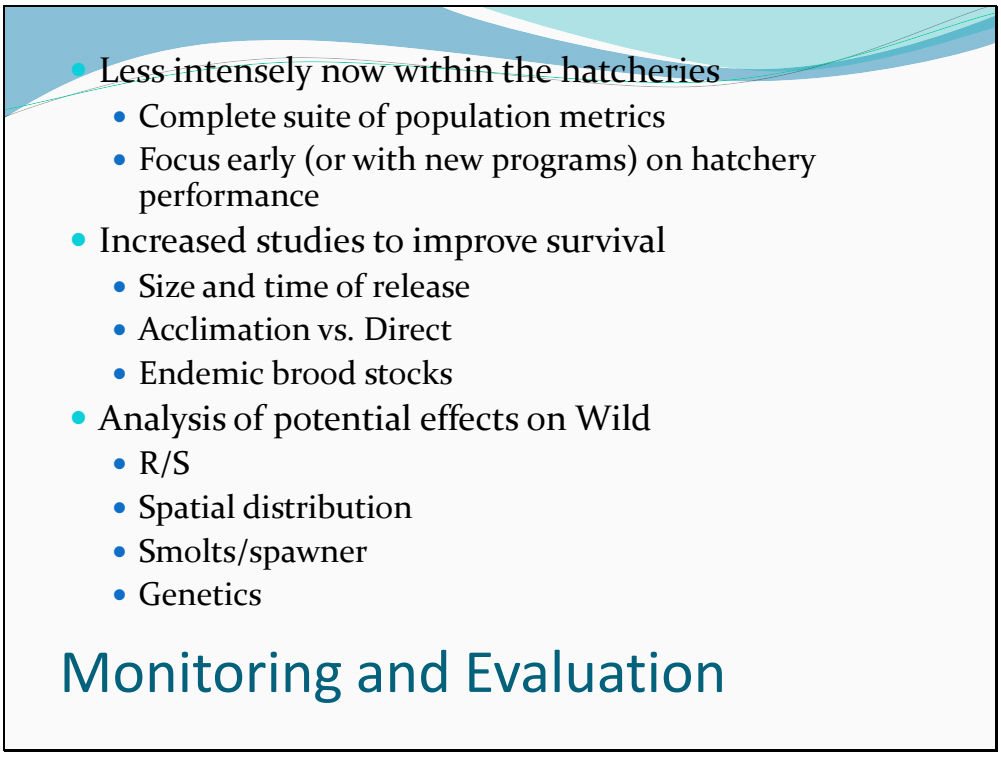
These remain under consideration and a concerted effort has been made (at the request of LSRCP staff) by all cooperators to address these recommendations in HGMPs, which are being used to obtain the needed ESA consultation coverage for these programs.

Slide 31



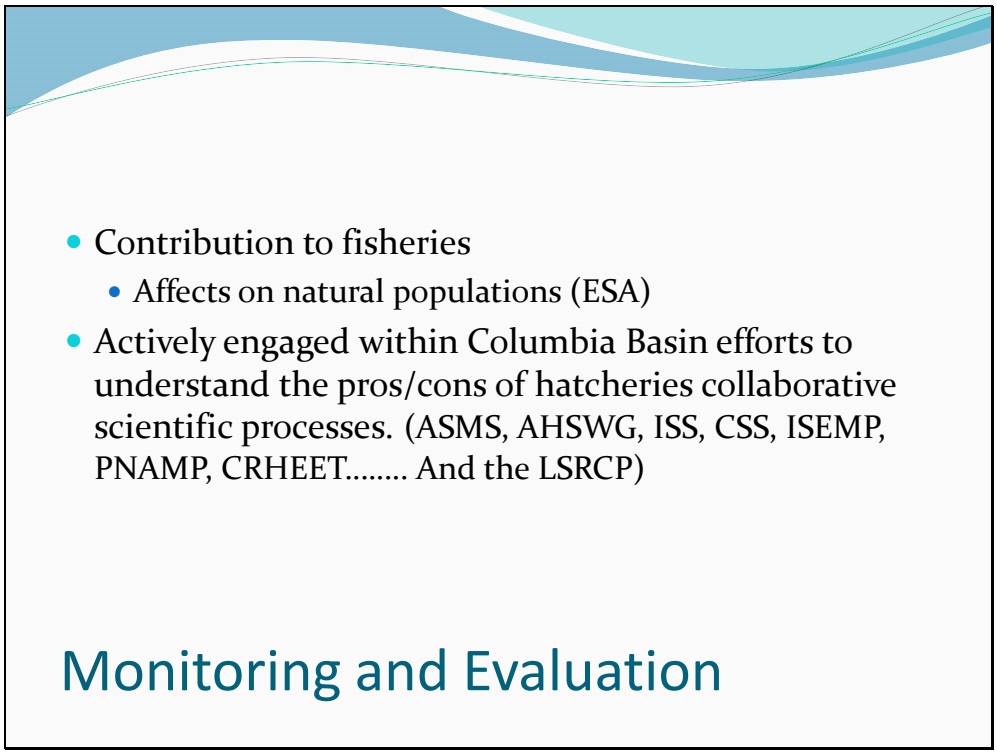
As programs mature and results from evaluation studies are completed, many questions are answered and adaptations made. However with expanding fishery knowledge and improvement in science technology, many answers remain elusive. In many cases the data collected are insufficient to provide conclusive results and will require further study, either for more years to understand natural variability or through implementation of altered approaches using different or more accurate methods. The LSRCP evaluation program remains committed to filling these data gaps with scientifically sound research and results.

Slide 32



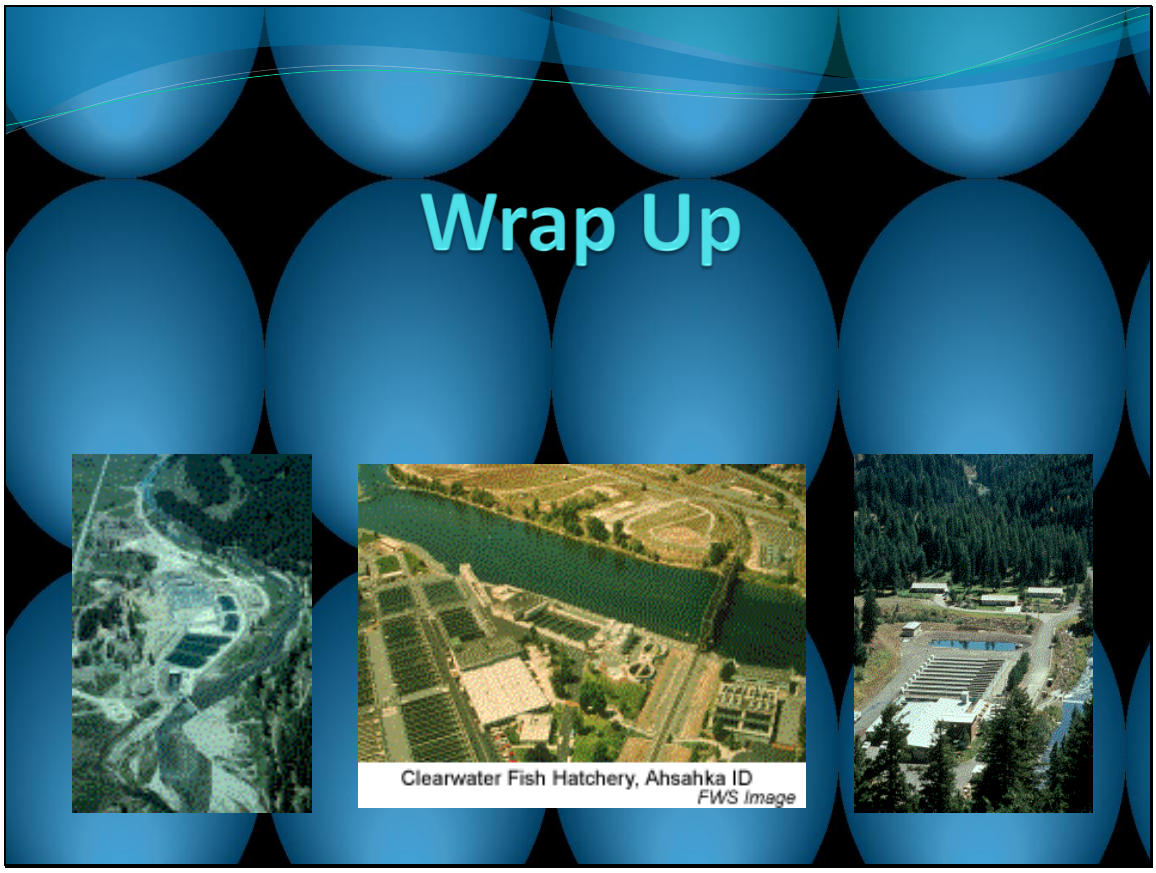
Evaluation studies will have to be adaptable into the future as they have in the past, moving from a hatchery centric focus to ensure production was producing quality smolts to more survival studies that will improve survival of the hatchery product. The more recent emphasis on understanding the effects of hatchery fish on ESA listed natural populations arose from a desire by managers to protect critical natural populations while maintaining the mitigation benefits of downriver and within Snake basin fisheries.

Slide 33



Regardless of the focus of studies in the Snake basin, LSRCP funded evaluation staff from all the cooperators often serve as crucial members to regional scientific processes. Staff members serve on a host of standing and Ad Hoc committees pursuing a better understanding of the effects of hatcheries at recovering ESA listed populations. This activity has been and will continue to be supported by the LSRCP administration.

Slide 34



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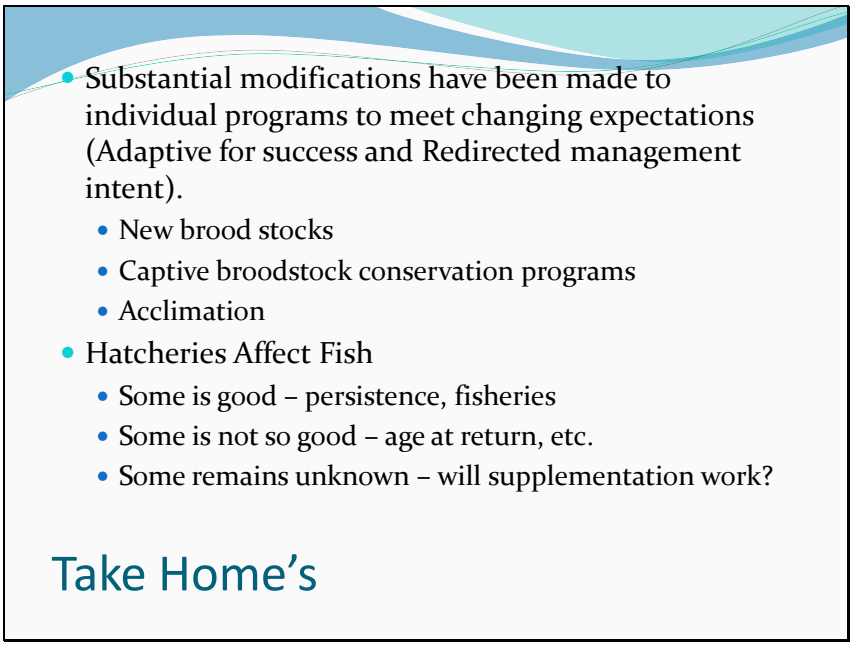
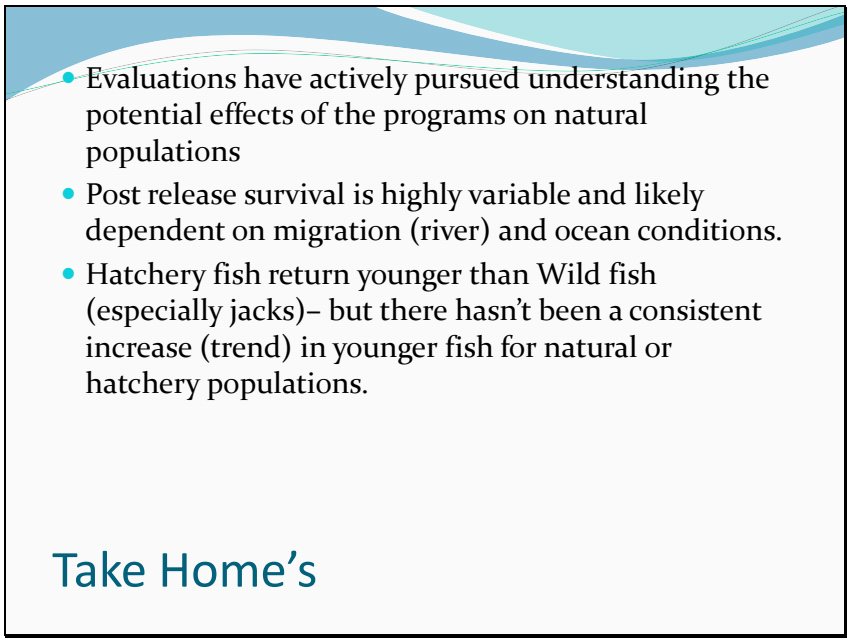
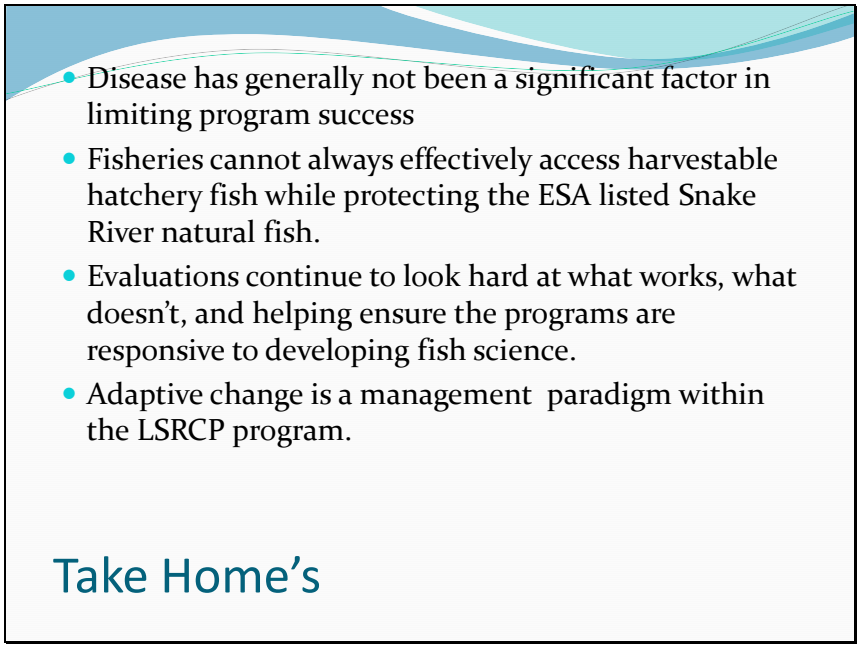
Slide 36



Slide 37



Slide 38



Although the LSRCP program hasn't met its goals the cooperators generally believe that the Snake basin spring / summer Chinook populations are probably better off with then than they otherwise would have been.