

Council Document ISRP 2000-2

**Independent Scientific Review Panel
for the Northwest Power Planning Council**

**Review of the Tucannon River
Captive Broodstock Master Plan**

**Steps One through Three of the Northwest Power Planning Council's
Three-Step Review Process**

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ISRP 2000-2
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ISRP Review of the Tucannon River Captive Broodstock Master Plan

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ISRP Review of the Tucannon River Captive Broodstock Master Plan

REVIEW PROCESS

The Tucannon River Captive Broodstock Master Plan was the second project reviewed by the ISRP as part of the Northwest Power Planning Council's Three-Step Review. The Tucannon Master Plan review was unusual because it included all three steps of the Three-Step process in a single plan for review, rather than having the three steps (conceptual design, preliminary design, and final design) reviewed in a sequential iterative fashion. Justification for this (hopefully) unusual approach was based on the small scope of the project and the desire to reduce engineering design and review costs through consolidation of the three steps into a single review. Council staff supported this approach.

The ISRP review included several steps. The ISRP selected two members and a Scientific Peer Review Group member to conduct the review. These three members individually reviewed the Tucannon River Captive Broodstock Master Plan and supporting documents. The reviewers commented on each of the responses included in the Master Plan to the questions (or criteria) asked by the Council as part of the Three-Step review. The ISRP members then discussed their reviews via teleconference and identified areas where more information was needed from the Washington Department of Fish and Wildlife (WDFW) and drafted a preliminary review (appendix 5). This preliminary review was discussed with the full ISRP. Consensus was reached on the approach, and questions to obtain further information from WDFW were refined. The ISRP then submitted a request for additional information to WDFW (appendix 1). Joe Bumgarner of the Washington Department of Fish and Wildlife provided a written response to the questions (appendix 2). The ISRP reviewed the responses and developed a second set of questions to discuss with WDFW representatives via teleconference (appendix 3). The teleconference took place on February 22, 2000 and included Joe Bumgarner representing WDFW, Erik Merrill from the Council, and the three ISRP subcommittee members (appendix 4). The ISRP reviewers then summarized their findings and finalized their report. The ISRP findings are described below.

CONCLUSION

The Tucannon River Captive Broodstock Master Plan passes its Three-Step Review.

RECOMMENDATION

The ISRP recommends that the Tucannon Program proceed with implementation if the following conditions are met.

CONDITIONS

The ISRP, in its review of the Plan, had several concerns that were somewhat alleviated by correspondence and conversation with WDFW staff. The ISRP recommendation stated above is given with the understanding that:

1. WDFW will work with the Tucannon Watershed Council to develop explicit milestones that forge linkages and a coordinated timeline between the habitat restoration activities in the basin and those of the artificial production programs (captive brood and supplementation). The coordinated milestones will help optimize the results of the habitat restoration activities in the Tucannon subbasin with the development of the captive broodstock and supplementation activities. (*Three-Step Question 3. Factors limiting production of the target species; Question 5. Alternatives for resolving the resource problem*)
2. Future annual reports from the WDFW Tucannon artificial production program will place greater emphasis on statistical analysis of the data collected during the program's monitoring and evaluation activities. Statistical analysis and consulting assistance is available within WDFW (according to Joe Bumgarner, WDFW) and should be utilized. (*Three-Step Question 20. Monitoring and evaluation plans*)
3. Future funding will be determined on an annual basis with consideration of the project's results and linkage with habitat work.

POTENTIAL ISRP ANALYSIS

Finally, the ISRP may wish to work with WDFW to examine in greater detail the existing monitoring data on Tucannon River chinook. Such an exercise should likely benefit WDFW and the Tucannon program; however, the primary purpose of the exercise would be for the ISRP to address larger scale issues of artificial production and monitoring than exist solely in the Tucannon program.

**Appendix 1. ISRP Questions #1 to WDFW
on the Tucannon River Captive Broodstock Master Plan**

INDEPENDENT SCIENTIFIC REVIEW PANEL

Northwest Power Planning Council
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January 27, 2000

MEMORANDUM

TO: Mark Fritsch, NWPPC

FROM: Rick Williams, ISRP Chair

SUBJECT: ISRP Questions on the Tucannon River Captive Broodstock Master Plan

Introduction:

Because the Tucannon Master Plan includes all three steps of the 3-Step Process in a single package for review (in contrast to the usual independent review of each of the three steps), it is imperative that questions and uncertainties identified in this review process be resolved.

Observations:

The plan and supporting documents are coherent and well constructed. The project sponsors appear to have extensive knowledge in the Tucannon, and the project should benefit by the continuity of their effort. However, due to the severe habitat conditions that likely will not be ameliorated in the near future, the likelihood of benefits to the stock from this project are minimal. For example, the high water temperatures appear to be a significant limiting factor.

The human population in the Tucannon subbasin is small, which theoretically would allow for better coordination and a concerted habitat restoration effort that could result in positive changes. However, local interests appear entrenched in the status quo and timely restoration seems unlikely. Moreover, the disappointing results with supplementation efforts in the Tucannon to date do not give confidence that captive broodstock efforts will fare any better in the critical timeframe. In fact, the supplementation effort may interfere with this project.

However, if this project were operated as a rigorous experiment, information gained could be valuable in informing future captive broodstock efforts throughout the basin.

The ISRP identified several questions and points that need clarification:

Question 2. Measurable and time-limited objectives:

1. How many eggs were collected from the BY 1997 and 1998 fish? What is their survival to date? How many 1999 BY eggs were collected? Is it likely that the 150,000 smolt release target will be met for those three years?
2. Point #10 under Policies of the APR in the 3-Step Summary, which suggested that if the rebuilding efforts failed, the project's goal might be switched to one of mitigation. If the project fails, it seems unlikely that there will be sufficient broodstock available to provide the basis for a mitigation goal.

Question 3. Factors limiting production of the target species.

1. See the "observations" section above regarding habitat issues.
2. Data presented on p. 11 of the Master Plan also suggest that straying might be more of a problem than the plan notes. More rigorous M&E should be directed at understanding the numbers and impact of out-of-basin strays. Is more planned?
3. The project is likely to fail without increases in the SARs for both hatchery and wild chinook. Reduction of juvenile mortalities within the Tucannon basin seems possible through in-basin habitat improvement and restoration, while reduction of mortalities throughout the downstream hydro corridor and into the ocean are hoped for, but very uncertain. The most certain actions to reduce juvenile mortalities will be those taken directly within the Tucannon basin. Currently, the master plan lacks adequate information on the link between the captive broodstock program and habitat restoration. Is additional information available that you can provide to address this issue?

Question 5. Alternatives for resolving the resource problem.

The alternative section was clearly presented, but did not include discussion of one major option: terminate the supplementation program, coincident with the adoption of the captive broodstock operation. Has this been debated? Will the practices of the LSRCP supplementation facilities have detrimental effect on the captive broodstock effort?

Question 13. Brood stock selection and acquisition strategies

Egg-taking from supplementation program adults at Lyons Ferry seems appropriate and the preferred alternative. But if the number of adults is inadequate for both programs, which gets priority?

Question 14. Rational for the number and life-history stage of the fish to be stocked, particularly as they relate to the carrying capacity of the target stream and potential impacts to other species

It appears that all 150,000 smolts from captive breeding program plus some or all of the supplementation smolts would be placed into Curl Lake. The estimated carrying capacity of the 2.1 acre Curl "Lake" is not provided in the report. Has it been assessed?

Question 16. Production policies and procedures

1. On p1 "one hatchery production failure" occurred in the (recent?) history of the program, but neither the date nor the cause is identified. Is this relevant?
2. Utilization of 100% spring source water at Lyons Ferry is a dream for simply maximizing salmonid production but is a major drawback in producing quality smolts that vaguely resemble wild chinook. A small, 10-yr-old chiller appears key to be able to mimic natural temperatures, but no funds were requested to upgrade or replace it. Why?
3. What is the risk of whirling disease in the future at either hatchery facility?
4. Measures taken to avoid a hatchery catastrophe were not discussed. For example, what are consequences of sudden chiller failure on developing embryos?

Question 32. Measure 7.1A: Evaluation of carrying capacity and limiting factors that influence salmon survival.

The target is 600 adults/year? Master Plan p3 indicates 300 adults/year, apparently from the same smolt numbers?

20. Monitoring and evaluation plans, including a genetics monitoring program

The ISRP found the monitoring and evaluation plan lacking in detail and scope. A more detailed proposal for monitoring and evaluation should be described, i.e. track lineages by pedigree and fully implement PIT tag and survey efforts. Is more information on the following questions available?

1. “Some” captive brood progeny will be killed to record meristic data to add to a long-term data set. Is this justified? Clear benefits should be identified, or this plan should be abandoned.
2. Exactly what variables will be measured (e.g. female fecundity, egg to hatching survival, etc.)?
3. For each variable, how it will be measured (e.g. PIT tag detections at McNary, lengths measured on fish recovered from a trap in at a weir at location X, etc.)?
4. What fish will this measurement pertain to (e.g. fish of wild spawned origin used as broodstock, fish of hatchery origin that were part of the escapement above location Y, etc.)?
5. What is the intended sample size, for each category of fish, for each variable measured?
6. Given the planned sample size, and expected variability of the quantity measured, what is the expected standard error for each variable measured for each category of fish?
7. What list of specific questions is the monitoring intended to answer?
8. How does the proposed plan address each of those questions?
9. What expected resolution will be provided in each of the answers delivered by the monitoring?
10. For every variable that is intended to be measured, what is the history until now of measuring that variable in the Tucannon project?
 - a. Date of initiation?
 - b. For how many years was this continued?
 - c. What were the sample sizes?
 - d. Where were the results reported?
 - e. Where are the data archived?
 - f. Where were statistical analyses from the data reported?
 - g. What were the conclusions from these data?
 - h. What was the observed variability of the quantity being measured?

**Appendix 2. WDFW response to ISRP Questions #1
on the Tucannon River Captive Broodstock Master Plan**

STATE OF WASHINGTON
Department of Fish and Wildlife
Fish Program - Science Division
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(509) 382-4755 FAX (509) 382-2427

February 1, 2000

MEMORANDUM

TO: Mark Fritsch, NWPPC

FROM: Joe Bumgarner, WDFW, Fish Biologist - Lyons Ferry/Tucannon Evaluations

**SUBJECT: Responses to ISRP Questions on the Tucannon River Captive Broodstock
Master Plan**

WDFW received the ISRP questions on 28 January, 2000. In order to keep the 3-Step review process moving quickly, WDFW addressed specifically nearly all the questions put forth by the ISRP. Some of the questions lacked specifics (i.e. the monitoring and evaluations section), and were difficult to answer. For that section (pages 9-15), WDFW expanded the monitoring and evaluations section using the general "variables" described in the Master Plan, and attempted to provide more detail (when possible) to the reviewers.

ISRP Introduction:

Because the Tucannon Master Plan includes all three steps of the 3-Step Process in a single package for review (in contrast to the usual independent review of each of the three steps), it is imperative that questions and uncertainties identified in this review process be resolved.

ISRP Observations:

The plan and supporting documents are coherent and well constructed. The project sponsors appear to have extensive knowledge in the Tucannon, and the project should benefit by the continuity of their effort. However, due to the severe habitat conditions that likely will not be ameliorated in the near future, the likelihood of benefits to the stock from this project are minimal. For example, the high water temperatures appear to be a significant limiting factor.

The human population in the Tucannon subbasin is small, which theoretically would allow for better coordination and a concerted habitat restoration effort that could result in positive changes. However,

local interests appear entrenched in the status quo and timely restoration seems unlikely. Moreover, the disappointing results with supplementation efforts in the Tucannon to date do not give confidence that captive broodstock efforts will fare any better in the critical time frame. In fact, the supplementation effort may interfere with this project.

However, if this project were operated as a rigorous experiment, information gained could be valuable in informing future captive broodstock efforts throughout the basin.

WDFW Comments Regarding "ISRP Observations" Section: Disagree with comment that "benefits to the stock from this project are minimal". Contrary to the ISRP belief that the Tucannon River is in "status quo" for habitat conditions, there are steps being taken to restore the habitat (see response to Question 3 #1, and review BPA reports from Columbia County Conservation District). Further, as stated in master plan on p3-paragraph #1, and p10, the problem is that by the time restoration efforts are at their full potential, the stock may disappear. The intent of this project is delay extinction by quickly increasing the number of adults back to the system, which should maintain the run in the short term. While it's a short term fix, it may just be enough to allow the habitat improvements to reach their full potential, where in-river survival will increase and naturally produced fish will return to a point above the replacement level.

This project was not designed to be a "rigorous experiment". The cost of the facility modifications, the production plan and rearing strategies, and the monitoring and evaluation plan were purposely kept simple to keep costs low. WDFW has repeatedly been questioned by Council staff regarding the cost of this particular program, and future costs that can be expected. The Council has repeatedly stated they do not want to see a continual increase in costs, or a sudden jump in cost in the program after it has been approved for funding. In direct meeting with Council staff, WDFW assured them that costs would not suddenly jump. The out-year budget package presented reflects that. If the program were to be re-designed as a "rigorous experiment" as suggested by the ISRP, the cost of the project would likely triple, as more facility modifications, and more personnel to conduct controlled experiments and report the results would be necessary. WDFW sincerely doubts the Council would look favorably on that following the discussions we've had with them. Further, given the late start of this project compared to other captive brood projects, and the previous work conducted by NMFS and others, it seems imprudent and unnecessary to introduce another "rigorous experiment" captive brood project.

The ISRP identified several questions and points that need clarification by WDFW. Each ISRP question has been restated and noted by underline.

Question 2. Measurable and time-limited objectives:

1. How many eggs were collected from the BY 1997 and 1998 fish? What is their survival to date? How many 1999 BY eggs were collected? Is it likely that the 150,000 smolt release target will be met for those three years?

Initially 1,200 emergent fry from the incubation stacks were collected from each of the 1997, 1998, and 1999 brood years (BY) (note: emergent fry, not eggs were collected for the captive broodstock). The 1,200 fry were made up of between 15-30 unique "families" from each brood year (the number of "families" vary from each brood year due to parent crosses, and disease results), all coming from the supplementation program. After the fish were reared for one year, the family sizes were reduced

to ~30 fish/family or a planned 430-450 fish/brood year for the captive broodstock. Mortalities experienced during the first year of rearing of the 1,200 fish from the 1997 and 1998 BY has averaged less than 5%, identical to mortality rates documented for the supplementation program over the same time period.

From January 1999 to October 1999, 4 fish (0.9%) from the 1997 BY died. During October 1999, 92 mature jacks were removed from the population, and the remaining immature fish were moved to a recently completed 20' circular tank. Following the stress and handling from the move, 31 fish died during November. No fish from the 1997 BY have died since. Total mortality in the past year of the 1997 BY fish is 29.2%. If the mature jacks are not included, the mortality is 8.1%. This mortality level is consistent with those experienced in other WDFW captive brood programs (Dungeness River spring chinook - Hurd Creek Hatchery)

The 1998 BY fish were reduced to 430 fish during September 1999. Fish were tagged by family group at that time, and then kept inside the north hatching room at Lyons Ferry Hatchery while the 20' circular tanks were completed. The 1998 BY fish were moved to the 20' circular in mid-November. No Mortalities have occurred to date.

If mortalities remain at the current low levels, we will be able to meet the 150,000 smolt release from each of the BY's, though much will depend on female fecundity of the captive broodstock. In fact, it is likely that we could have more captive broodstock adults than needed to provide the smolt goal.

2. Point #10 under Policies of the APR in the 3-Step Summary, which suggested that if the rebuilding efforts failed, the project's goal might be switched to one of mitigation. If the project fails, it seems unlikely that there will be sufficient broodstock available to provide the basis for a mitigation goal.

Disagree with that conclusion. The discussions on whether or not to switch to a mitigation program will likely occur before the year 2010. Current production and expected returns in the next few years would still be adequate for future broodstock needs should the program be switched at that time. While a mitigation program (i.e. hatchery fish only) may start slowly at first, it should be remembered that hatchery origin fish produced from the current supplementation program survive at roughly 2-3 times the replacement rate. Based on that survival, it would take only a few generations to quickly build a large hatchery program. Further, it would not be the captive broodstock "project" that would be switched, it would be the supplementation program under the LSRCP.

Question 3. Factors limiting production of the target species:

1. See the "observations" section above regarding habitat issues.

Disagree with the conclusions reached in the "observations" section, and in particular regarding the "local interests appear entrenched in the status quo". Since 1996, habitat restoration projects have been ongoing in the Tucannon Basin under the Model Watershed Program. This program (funded by BPA), requires a cost share with local landowners to complete the projects. As with any river system, 100% compliance of local landowners does not occur as they can see no apparent benefits to them. In many ways they are right. Spring chinook fisheries on the Tucannon River last occurred in the 1960's, and given current numbers of fish returning, it seems unlikely that a non-tribal fishery

will occur any time soon. However, there have been good cooperative efforts by major landowners that have property in the area where spring chinook rear. These projects have included large woody debris structures and rock weirs to create pools and cover for fish, fencing projects to reduce livestock grazing, riparian tree plantings, and no-till practices to reduce sediment input (See attached Tucannon Model Watershed annual reports to BPA - 1996, 1997, and 1998)

Water temperatures are a limiting factor for parts of the Tucannon River, and may be limiting the usable area by spring chinook in the basin. However, spring chinook typically inhabit the upper-most reaches of a watershed. The Tucannon River population is no an exception. Spring chinook in the Tucannon River inhabit an area primarily between river kilometer 40-80. Mean summer temperatures at river kilometer 40 generally range in the low to mid-70's, they reduce to the mid-to-low 60's at river kilometer 60, and in the low 50's above river kilometer 70. The current supplementation program and the proposed captive broodstock program will acclimate and release smolts from river kilometer 66. If the adults return within 10 river kilometers of the acclimation site (as expected), then subsequent juveniles in the river will be rearing in optimal temperatures for survival and growth.

If current habitat restoration efforts succeed, then water temperatures should be reduced below river kilometer 40. This would likely result in more spring chinook rearing below river kilometer 40, which will increase the production potential of the river.

2. Data presented on p.11 of the Master Plan also suggest that straying might be more of a problem than the plan notes. More rigorous M&E should be directed at understanding the numbers and impact of out-of-basin strays. Is more planned?

No, the reviewer mixed the species of interest. The reference to Page 11 of the Master Plan is in reference to fall chinook (Other listed species in the basin). Fall chinook inhabit the lower 15-20 river kilometers of the Tucannon River. Adult fall chinook are present from October to December each year, and any juveniles produced migrate from the system the following spring. Therefore, stray fall chinook are not an issue as they are spatially and temporally segregated from the spring chinook population.

As a note, spring chinook from other basins do stray into the Tucannon River. Since 1985, we've documented 30-35 stray fish (fish with coded-wire tags or RV or LV fin clipped). Based on expansion rates for those fish, stray spring chinook in the Tucannon River represent only 1-2% of the spawning population, similar to what occurs between natural populations. We feel these stray rates are acceptable in the basin, and since we remove any strays that are collected for the hatchery broodstock, the risk of amplifying the stray genes to the population is eliminated.

3. The project is likely to fail without increases in the SAR's for both hatchery and wild chinook. Reduction of juvenile mortalities within the Tucannon basin seems possible through in-basin habitat improvement and restoration, while reduction of mortalities throughout the downstream hydro corridor and into the ocean are hoped for, but very uncertain. The most certain actions to reduce juvenile mortalities will be those taken directly within the Tucannon basin. Currently, the master

plan lacks adequate information on the link between the captive broodstock program and habitat restoration. Is additional information available that you can provide to address this issue?

For the links to the habitat restoration efforts, see the explanation given under question 1 above, and re-check the Master Plan on pages 3, 10, and 28. We disagree with the statement that the "project" will fail without increases in SAR's, it should be the "purpose" of the project (rebuilding and recovery of the population). We fully expect to succeed in raising captive brood fish and releasing quality smolts that will produce adult returns to the basin.

The SAR of hatchery origin juveniles should not be put in the same context as the habitat issue within the basin. Hatchery origin juveniles spend only 1-3 weeks in the Tucannon River before migrating out of the basin. They are not subjected to low river flow, sediment, and increased water temperatures, so this has little bearing on their survival rate. Yet we know that a percentage of both the hatchery and natural population are removed at each of the six mainstem dams during smolt outmigration (30-40% of the population before they pass Bonneville Dam).

We agree that the habitat issues within the basin need to be addressed, and they are. However, as stated in the Master Plan, habitat problems will not be solved overnight, and some of the restoration efforts will require 15-20 years before the full benefit is reached. In the meantime, the spring chinook population may disappear. That is why we have structured the program as is. It's short term (to reduce the hatchery domestication effects or genetic change), and intended to provide a quick increase in adults back to the river. This cycle will take ten years to complete, by which time many of the current habitat issues should be well on the way to being fixed.

Question 5. Alternative for resolving the resource problem.

The alternative section was clearly presented, but did not include discussion of one major option: terminate the supplementation program, coincident with the adoption of the captive broodstock operation. Has the been debated? Will the practices of the LSRCP supplementation facilities have detrimental effect on the captive broodstock effort?

That option was not debated for two reasons. We could not terminate the supplementation program because when we started captive brood, it was unclear whether we would be supported by the co-managers and NMFS on this program. Had we terminated the supplementation program in 1997 and then no support came for captive broodstock (2 years later), the population would suffer in the future. Remember that the hatchery population survives at 2-3 times the replacement rate, and is keeping the spring chinook population in the river going.

Second, because of our preferred method for collecting fish for the captive broodstock (i.e. from the supplementation program), it still meant collecting adults from the river, then spawning them in the hatchery. Since only 450 fry were needed to supply the captive broodstock, between 80,000-132,000 eggs/fry from those spawned adults would have been destroyed. WDFW sincerely doubts that the co-managers or NMFS would have agreed to a proposal such as the one suggested.

The spring chinook population from the Tucannon River is considered very high priority at Lyons Ferry Hatchery. Our planning for the captive broodstock program at Lyons Ferry has ensured that other LSRCP programs at Lyons Ferry will not impact the captive broodstock program.

Question 13. Broodstock selection and acquisition strategies.

Egg-taking from supplementation program adults at Lyons Ferry seems appropriate and the preferred alternative. But if the number of adults is inadequate for both programs, which gets priority?

The program was designed for the collection of fry (not eggs) from the supplementation program. Hence, adults will be trapped as usual from the Tucannon River, and in a sense, are supplying both programs with eggs/fry. The capacity of the captive broodstock population was assumed to be 450 fish at Age 1 (meaning that if we held more than 450, we would need more 20' circular tanks in the future, and the smolt production goal would be exceeded). With 15 4' circular starter tanks for the fry, we are limited to selection of 15 "families" total, with 30 fish represented from each family. So for example, if only 10 fish were collected from the Tucannon River, and five were females, then we would have five unique "families" to choose from for the captive broodstock. To meet the 450 fry requirement, we could collect 90 fish from each female. All remaining eggs/fry would then be used in the supplementation program. Whether or not 90 fish would be selected from each female for the captive broodstock is unknown. Functionally, the captive broodstock program gets priority, but the supplementation program is only deprived a small fraction of the population.

Question 14. Rational for the number and life-history stage of the fish to be stocked, particularly as they relate to the carrying capacity of the target stream and potential impacts to other species.

It appears that all 150,000 smolts from captive breeding program plus some or all of the supplementation smolts will be placed in Curl Lake. The estimated carrying capacity of the 2.1 acre Curl "Lake" is not provided in the report. Has it been assessed?

WDFW utilizes two index types in assessing how many fish could be put in a rearing vessel. A maximum rearing density index of 0.18 lbs of fish/ft³ has been established as an agency standard. We also calculate a flow index based on the water inflow into the rearing vessel. At a 300,000 smolt release from Curl Lake (100% of the captive brood and supplementation program allowed by NMFS), rearing conditions will be at 79% of the flow index, and the rearing density index would be 0.004 fish/ft³. It should be noted that flow indexes can be exceeded without compromising the health of the fish. So, there is easily the potential to rear 600,000 fish in Curl Lake without compromising the health of the fish.

Question 16. Production policies and procedures.

1. On p1 "one hatchery production failure" occurred in the (recent?) history of the program, but neither the date nor the cause is identified. Is this relevant?

The failure occurred with the 1997 BY fish. The water chiller at Lyons Ferry was fixed prior to spawning the adults. Adjustments to the chiller were made that drastically changed the output water temperature. This was unknown prior to putting the eggs in the incubation stack. As such, the eggs were subjected to very cold (37 oF) water and high egg loss occurred. However, even prior to that, egg loss was averaging 16% per year from 1991-1996 (the years in which the chiller was operated).

Following 1997, we modified how the chiller was used (increased the temperature) to lessen the mortality, yet we still had 15.5% mortality in the eggs. That is why we have chosen not to use the chiller for incubating eggs anymore. In 1999, we had only 4% loss in the eggs.

The above event was also relevant in that the 1997 BY production was severely limited (about 115,000 eggs were lost in the hatchery). Only 24,000 smolts from the hatchery supplementation program were released, and less than 22,000 natural smolts were produced from the system. Hence, the return in 2001 will likely be very low (100-150 adults).

2. Utilization of the 100% spring source water at Lyons Ferry is a dream for simply maximizing salmonid production, but is a major drawback in producing quality smolt that vaguely resemble wild chinook. A small, 10-yr-old chiller appears key to be able to mimic natural temperatures, but no funds were requested to upgrade or replace it. Why?

Disagree with the statement that we aren't producing a quality smolt without the use of a chiller. We agree that they don't resemble a wild chinook in size, but even with the use of the chiller during incubation, it was not possible to obtain a hatchery smolt that resembled a wild smolt, though the quality was there. The differences in the rearing environment between the river and the hatchery are too great to ever achieve this goal. Besides, it must be remembered the chiller was used only for incubation. In order to fully mimic natural temperatures, we would need to bring in an additional water chiller and heater to mimic the natural temperatures throughout the rearing cycle at the hatchery (i.e. to be set up in the raceways).

The chiller cannot be upgraded as suggested, and during 1998 (the last year we ran it for the spring chinook) it cost nearly \$35,000 to keep it operating properly (a total of 4 months). During the initial draft of the Master Plan, WDFW had suggested a new chiller for the hatchery. However, this was strongly objected to by the Umatilla Tribe. They saw the new chiller as greatly impacting available funding in the BPA process and would not support such a request for this program. Further, the Umatilla Tribe would actually like to see larger smolts released (10 fish/lb instead of 15 fish/lb) from both the supplementation and captive broodstock programs. While they have suggested this change in the current program, they have agreed to support the program as planned (fish released at 15 fish/lb). Conversely, the Nez Perce Tribe (NPT) was supportive of the new chiller. The NPT would prefer to see the smolt release size reduced (20-25 fish/lb). By not including a new water chiller for the program, but maintaining the current release goal, all co-managers agreed to the current strategy for fish rearing.

We obtain more data on returns of hatchery fish yearly. From the 1986-1990 BY's, hatchery fish were released at 10 fish/lb with a mean SAR of 0.22%. Since the 1991 BY, fish have been released at 15 fish/lb with a mean SAR of 0.14%. With the stocks throughout the Snake River basin continuing to decline, it seems rather odd that the emphasis for supplementation programs remains on mimicking the wild fish. WDFW is fully supportive for having adults return that are similar to wild fish in age structure, size, fecundity, and other characteristics. However, when do we decide that mimicking the wild population is less important than maintaining the critical stocks we have?

3. What is the risk of whirling disease in the future at either hatchery facility?

As with any disease, there remains the potential at some time for it to enter the hatchery. However, looking how the disease has slowly moved westward, it's likely that some time in the future it could be present throughout the Snake River Basin and in the Tucannon River. To what degree that will effect Tucannon captive brood program is unknown. However, unless the disease reaches the system in the next 10 years, whirling disease will have no impact on this program. Precautions are taken whenever equipment from outside the hatchery enters the hatchery grounds at Lyons Ferry or Tucannon Hatchery. All fish tanks, boots, rain gear, etc.. are disinfected before they are used at either hatchery, to prevent disease transmission.

4. Measures taken to avoid a hatchery catastrophe were not discussed. For example, what are consequences of sudden chiller failure on developing embryos?

The risk of catastrophic fish loss to due hatchery facility or operational failure, including power/water loss, flooding, freezing, vandalism, predation, and disease will be minimized through the following; 1) Lyons Ferry and Tucannon fish hatcheries are staffed full time by personnel living on-station, providing for the protection of fish from vandalism and predation, and allowing for rapid response in the event of power and water loss or freezing, 2) both facilities are equipped with back-up generators to provide an alternative source of power to supply water to rearing fish during power outages, 3) both facilities are sited in areas that are not flood-prone, minimizing the risk of fish loss due to flooding, 4) all hatchery staff are trained in proper fish handling, transport, rearing, biological sampling, and WDFW fish health maintenance procedures to minimize the risk of fish loss due to human error, and 5) all captive brood fish will be handled, transported, and propagated in accordance with the WDFW Fish Health Manual and Pacific Northwest Fish Health Protection Committee disease prevention and control standards to minimize the risk of catastrophic loss due to disease. The example question of sudden chiller failure is not an issue any more as we will not use a chiller in the captive broodstock program.

Question 32. Measure 7.1A: Evaluation of carrying capacity and limiting factors that influence salmon survival.

The target is 600 adults/year? Master Plan p3 indicated 300 adults/year, apparently from the same smolt numbers.

There will be 150,000 smolts released from the captive broodstock program and 132,000-150,000 from the supplementation program. An estimated SAR of 0.2 was used to estimate 300 adult returns (by brood year) from each program, or ~600 total hatchery fish return each year. Natural production will also add to the 600 fish. With the current guidelines for broodstock collection, that would leave ~500 each year to spawn naturally in the river.

Question 20. Monitoring and evaluation plans, including a genetics monitoring program.

The ISRP found the monitoring and evaluation (M&E) plan lacking in detail and scope. A more detailed proposal for M&E should be described, i.e. track lineages by pedigree and fully implement PIT tag and survey efforts. Is more information on the following questions available?

The M&E plan (including the genetics) was kept brief in detail within the Master Plan for two reasons:

Most of the basic M&E activities are currently conducted as routine M&E activities for the supplementation program. Results have been presented and described in annual reports from the project. WDFW purposely kept the M&E simple and basic (and maybe limited in scope) to reduce the overall cost of the program. We have not designed elaborate experiments for the captive broodstock program, but instead will try to answer two basic questions, A) Can the program provide an increase in the number of adults back to the Tucannon River in the short term while habitat restoration activities take hold in the basin? B) Can these returning adults provide additional natural production to the Tucannon River that can benefit from habitat restoration efforts being conducted? Of course, other variables will also be examined, and may provide data for other captive broodstock programs in the future.

The genetics plan, was, and still is, in the beginning stages. Due to the uncertainty of funding approval, a detailed genetics plan has not been developed. However, discussions have occurred with two WDFW geneticists regarding the potential to conduct extensive genetic monitoring and pedigree tracking. Specifics will likely not be available for some time.

1. "Some" captive brood progeny will be killed to record meristic data to add to a long-term data set. Is this justified? Clear benefits should be identified, or this plan should be abandoned.

Meristic data have been used to describe genetic stability within populations. WDFW has a long-term data set from 1985-1990 and 1992 BY's from natural fish, and 1986-1990, and 1992-1993 BY's on hatchery fish from the Tucannon River. For a brief analysis, the reviewers should reference the 1992 Annual Tucannon River Spring Chinook Report (Mendel et al. 1993). This past data can be used for comparison with fish produced from the captive broodstock. While meristic data has been criticized because of sampler variance, we still feel it is valuable. If an indication of genetic stability can be gained from the meristic samples, then it would seem important to document this on the captive brood population. The time and effort to collect the data are minimal, and the sample size is small relative to the juvenile population (150 fish per brood year total which includes naturally produced fish (50 collected from the smolt trap), supplementation fish (50 collected just prior to release), and captive broodstock progeny (50 just prior to release)). Given the concerns that are expressed about captive broodstock programs causing genetic changes to the population, it would seem worthwhile to collect these samples. Further, it is one technique recommended by NMFS in their guidelines for monitoring and evaluating captive broodstocks (NMFS - Interim Standards for the use of Captive Broodstock, 1999).

For sub-questions 2-9, the following summary is intended to provide a list of each "variable" that is currently planned to be measured, the sample sizes planned, along with the intent of each. The following sections will be broken down into four parts: 1) fish being held in the captive broodstock, 2) progeny produced from the captive broodstock to release, 3) adult returns from the captive

broodstock releases, and 4) natural production following the return and spawning of captive brood fish.

- 1) **CAPTIVE BROODSTOCK** - 100% of the captive broodstock will be sampled for one or all of the following variables listed below. Summaries of each will generally be made by BY, though it will be possible to document each variable by "family" unit. However, sample sizes on the "family" units will be small (30).

Document mortality rates for each BY: All fish that die (injury, disease, or spawned at maturity) will be sampled. How and why the fish died will be recorded so true mortality rates (those that do not include fish maturing) can be calculated. Length and weight samples will be collected on all dead fish. All dead fish will be identified by "family" through VI tag extraction or CWT tag extraction. DNA samples (fin clips or opercle punches) will be collected from all fish that are spawned (an unknown sample size at this time) for future pedigree tracking.

Document age at maturity for each BY: All mature fish (any age) will be documented as such. Each mature fish will be identified and assigned to the appropriate BY and "family" unit from which it came (CWT or VI extraction). Summaries of maturity rates between the various BY's can then be made. Other variables such as growth rates, rearing conditions, disease histories, etc.. can then be examined for correlation with maturity rates for each BY.

Document spawn timing for each BY: The age and time at which fish mature and are spawned will be recorded for each brood year. This similarity or difference in spawn timing can then be compared to the natural and hatchery origin spawn timing.

Document fecundity and fertility rates for each BY: Following spawning, each female's eggs will be incubated separately. This will allow for obtaining individual fecundity estimates. This will also allow us to calculate mean fecundity by age and length at maturity, and the fertility rate of each female. Fecundity is estimated at eye-up. All dead eggs are picked from the incubation trays, and a weight sample is collected from 100 live eggs. A total live egg weight is then measured, and an estimated number of live eggs is calculated. Live and dead eggs are then combined for total fecundity by female. Sample sizes of mature females will vary by year, though we anticipate ~ 100 mature females each year. These can then be compared to natural and hatchery supplementation fish (which has been documented since 1990). We will also be able to compare our captive brood fecundities with other captive populations.

It is unknown at this time how many males will be available to spawn with each female, though we anticipate up to 3-4 males for every female. As such, the incubation trays of each female will be divided into sections with plexiglass dividers. We will track the relative success of each male (BY and "family") represented as a fertilization rate. We will also document the success of males by age class (i.e. document if semen from 3- year old males is less able to fertilize eggs than semen from 5-year olds).

Document growth rates for each BY: This variable will be perhaps the most difficult for which to obtain data. In the hopes of achieving maximum survival rates, WDFW has planned to minimize

the handling of the captive broodstock at all costs. Hence samples of length/weight for each brood year may occur only once a year when fish are sorted for spawning, or being split into another pond to reduce densities. As mentioned before, lengths/weights will be collected from all fish when dead/killed. As such, growth rates will be determined from very limited samples, and in the end may not provide much useful data. However, since the data is easily obtainable from the dead fish, WDFW plans to collect it.

Document the sex ratio of each BY: With only 30 fish selected from each "family" group, it's possible that more males or females were selected from a particular "family". Where this will be critical will be in the eventual production of mature fish. Eggtake and smolt production goals from the captive broodstock may vary considerable between brood years because of skewed sex ratios within a given brood year. While nothing can be done to rectify the problem (if it exists at all), sex ratio data may help explain yearly variation in production levels. Hence, all captive broodstock fish that die or are spawned will have sex determined by visual examination of the gonads.

2) CAPTIVE BROOD PROGENY TO RELEASE

Document survival rates: Survival rates from green (unfertilized egg) to eye-up (shocking) and to fry (time at which fish are placed in the raceways) will be documented for each female and for the entire group. Once the fish are mixed in the rearing raceways, the survival rates documented will be for the entire group (fry to smolt survival). Survival rates will be based on estimated fecundities (collected by individual weight samples), the estimated fry ponded to the rearing raceways (eggs collected minus the loss in the incubators), and smolt release (based on the number of fish tagged/marked minus loss after tagging). All estimates will be point estimates, as no replicate groups will be available to calculate a variance.

Document incubation and emergent timing: If captive brood fish mature later than fish that have migrated to the ocean (data from other captive populations would suggest this will likely be the case), then the emergent timing of fry may be different than the other supplementation fish in the hatchery. Incubation timing may also be different if egg size is smaller. By sampling all individual females (by age class) we will obtain egg size data, and will be able to track temperature units and incubation time needed for different egg sizes.

Document growth and feed conversion rates: The amount of feed fed is recorded daily for all ponds of fish at Lyons Ferry and Tucannon Hatcheries. Fish size (calculated by pound count samples) are conducted every two weeks by hatchery staff. Hence, growth rates and feed conversion rates can be calculated for the captive brood progeny fish, and the supplementation fish for comparison. Differences will be reported.

Meristic Traits: The intent, sample sizes, and justification for this were discussed under Question 20, #1 (See page 8)

PIT tagging: Each year that captive brood progeny smolts will be released, a small (500 fish) representative group of captive brood progeny will be PIT tagged prior to or during outmigration (fish captured at the smolt trap on the lower Tucannon River). Identical numbers will be also be tagged from the supplementation program and from naturally produced fish in the river. PIT tags will be detected at Snake and Columbia river hydro projects (Lower Monumental, McNary, John Day, and Bonneville dams). Expected detection rates at this time are 30% based on previous PIT tagging studies in the Tucannon River. All groups will be compared for related survival rate to each dam based on detections. Survival rates may also be estimated using some of the more recent survival models (i.e. SURPH) if samples sizes from detection are large enough.

However, early returns from PIT tagging studies in the Tucannon River do not necessarily reflect SAR's observed (probably because PIT tagged fish are bypassed through the dams, and many of the other fish are barged or trucked down the system). PIT tags may be more beneficial in describing the migration behavior and timing of the captive broodstock progeny in relation to natural or supplementation fish, rather than overall expected survival.

- 3) **CAPTIVE BROOD PROGENY ADULT RETURNS** - Prior to release all captive brood progeny fish will be 100% marked (Blank Wire Tag in the snout, no adipose clip), which will provide identification when fish are captured at the Tucannon Hatchery adult trap, or recovered as carcasses below the trap. The current plan is to pass all captured captive brood origin adults above the trap for natural spawning.

Document returns to adult trap: Hatchery staff will record all fish that are captured in the adult trap by origin (i.e. natural origin fish will have no fin clips and no wire present in the snout, captive brood fish will have no fin clips but wire in the snout, supplementation fish will have an adipose fin clip and wire in the snout). A portable CWT wand will be used to scan for magnetic wire in the snout on all captured fish. Documentation of returns to the adult trap by release group will assist in the final calculation of adult return rates.

Document survival of fish to spawning: Evaluation staff will conduct periodic surveys throughout the summer to look for salmon carcasses (pre-spawning mortalities). Samples (scales, CWT's, lengths, etc..) will be collected to determine origin (natural, supplementation, or captive brood), cause of death, and age at return. If the mortalities are female, green eggs from the ovaries will be collected to estimate fecundity. If a mortality is determined to be of captive brood origin, DNA samples will be collected to determine contribution rates by original parents (pedigree tracking).

Document spawning: Evaluation staff will conduct weekly spawning ground surveys from late-August to early-October to document the temporal and spatial spawning of spring chinook in the Tucannon River. Extra attempts will be made to collect carcasses from spawned out fish to determine contribution rates from the various groups (natural, supplementation, or captive brood). At this time, we expect to collect ~200 carcasses annually (40% of the run) from the spawning grounds. DNA samples will be collected from know captive brood origin carcasses recovered in the river that were known/suspected to have spawned (to determine contribution rates by parents).

Document return rates: Adult trapping, broodstock collection, and spawning ground survey data will allow WDFW to estimate the annual run of spring chinook to the river. Based on carcass recoveries from the river and the hatchery and age compositions, smolt-to-adult and parent-to-progeny survival estimates for each of the three groups will be made (natural, supplementation, or captive brood).

4) **NATURAL PRODUCTION**

Every year since 1986, WDFW has estimated parr and smolt production of naturally reared spring chinook in the Tucannon River. From these estimates, we've been able to calculate survival rates to different life stages (i.e. egg-to-fry, egg-to-smolt, and fry-to-smolt). These estimates have provided us with the ability to describe the survival conditions within the Tucannon River. These survival estimates may prove valuable in coming years for evaluating habitat restoration activities, and further describing the success or failure of hatchery program (both supplementation and captive broodstock). Much has been made in recent years about the questionable success of hatchery origin spawners in the wild. However, to date we have not been able to document a decrease in natural production based on parr and smolt estimates from the hatchery origin spawning in the river (i.e. parr and smolt production correlate well to the number of redds counted).

However, there may be more of a concern with fish returning from the captive broodstock program. Captive brood fish that return and spawn in the Tucannon River will be documented as described in the previous section. While they may have spawned, successful spawning may not have occurred. WDFW will make an attempt document the success of captive brood origin fish in contributing to the natural population in the river by the following techniques.

Obviously, WDFW realizes this attempt to describe success may completely fail. Environmental factors and annual variability in survival rates may mask the differences to such a degree that we have not, nor will we be able to detect a difference in survival rate unless it is extreme. As such, it will not be possible to prove a power analysis, or any other statistical analysis to such an effort. At most, we will be able to describe production, and make some inferences regarding the production success or failure of hatchery origin fish spawning in the Tucannon River.

Document natural parr production: Snorkel surveys at established index sites (~60) will be conducted during the summer throughout the spring chinook rearing area to estimate the number of juveniles present by BY. Estimates from the last few years have had confidence intervals of about 20% of the estimated population. From the estimated number of eggs deposited in the gravel based on the redd surveys and estimated fecundities, WDFW will calculate a survival rate. This survival rate can then be compared to historical survival rates to determine if captive brood fish were successful in spawning.

Document smolt production: A smolt trap will be operated at the mouth of the Tucannon River to estimate the annual production of natural smolts. Using the same logic as described for parr production, WDFW will attempt to make similar conclusions regarding smolt production from an estimated number of captive brood spawners.

10. For every variable that is intended to be measured, what is the history until now of measuring that variable in the Tucannon Project?

The Meristics data set was previously described, as well as the previous genetic sampling (Master Plan p 23). For other variables mentioned in the above evaluation section, the reviewers should refer to the 1997 Annual Tucannon River Spring Chinook Report (Bumgarner et al, 1998). In particular, summary tables (3, 5, 7, 10, 12, 13, 14, 15, 19, 23, 24, 25, 26, 27, 28, and 29), provide the long term history of our basic monitoring that we are proposing to conduct with the captive broodstock program. While these tables lack the particulars (i.e. dates, sample sizes, variability in samples, etc..) of the questions addressed in 10 a-h., presenting all that data here would be cumbersome, and would serve little purpose to the merits of this project as a whole. In addition, much of the data has been previously reported in annual reports. All of the data, variability, and any statistical analysis conducted are all kept on file at WDFW's LSRCP Evaluation Office in Dayton, Washington.

Appendix 3. ISRP Questions #2 to WDFW on the Tucannon River Captive Broodstock Master Plan

MEMORANDUM

February 14, 2000

TO: Mark Fritsch, NPPC

FROM: Rick Williams, ISRP

SUBJECT: Questions for Tucannon - ISRP Teleconference

The ISRP reviewers would like to hold a teleconference with the WDFW project sponsors to discuss several questions that need further resolution before the ISRP can complete its review.

Questions on habitat-hatchery linkage: The ISRP continues to have question regarding "Question 3. Factors limiting production of the target species." The reviewers continue to note that the master plan lacks adequate information on the link between the captive broodstock program and habitat restoration. Will the critical limiting factors necessary for the success of the captive brood program be addressed? In what timeframe? The reviewer are looking for a concrete link between the hatchery and habitat efforts.

Questions on captive brood life history: It looks as if WDFW will keep these fish for their entire life cycle in fresh water. Does this affect age or size at maturity? Why are jacks selected out?

Questions on mitigation bookkeeping: WDFW states that the return rate of hatchery fish to the hatchery is 2-3 times replacement, so that mitigation is viable even if supplementation (or captive brood replanting fails). WDFW actually reports a return per spawner rate of 2.18 for hatchery fish averaged over the 1985-1995 brood years (Table 2 on page 9 of the 1999 Master Plan). This will allow a harvest rate of $1/2.18=45.9\%$. This sounds like a reasonably high harvest rate, but the "carrying capacity" for this population is set by hatchery smolt production capacity, and the 1985-1994 SAR rate for hatchery fish averaged 0.15% (Table 1 on page 6 of the 1999 Master Plan).

Therefore, using the 45.9% harvest rate figure, each harvested fish requires the release of $1/(0.459*0.0015)=1,452$ smolts. At a nominal cost of \$1/smolt, does "mitigation" make sense at \$1,452 per fish harvested? If the hatchery turns entirely to mitigation and can release 300,000 smolts per year, the total harvest, using these figures, will be $300,000*0.0015*0.459=207$ fish/year. Is this a reasonable goal?

Note that Table 1 shows the naturally spawned fish achieving a 0.0057 SAR compared to the 0.0015 SAR of the hatchery fish. Why are the hatchery fish surviving at 1/4 the survival rate of naturally spawned fish? Does the selection pressure exerted during the course of the enormous SAR mortality of hatchery fish favor a hatchery or a natural spawning life cycle? Note that the hatchery fish are released as smolts at a different size and age than the migrating smolts of natural spawning origin, and return as adults at a different age composition (the Master Plan doesn't report size of the respective adult populations).

From Table 2 the average return per spawner rate is 0.53 for naturally spawned fish, compared to the 2.18 rate for hatchery fish. The higher SAR rate of the naturally spawned smolts is offset by their lower egg-to-smolt survival rate, shown in Table 1. From this table, the average egg-to-adult return rate for the naturally spawned fish is $0.078 \times 0.487 \times 0.0057 = 0.000217$, compared to $0.78 \times 0.91 \times 0.0015 = 0.00107$ for the hatchery fish. Do these figures add up to a plausible life history? In order to achieve the return per spawner rates of Table 2, under the egg-to-adult survival rates of Table 1, assuming a 50/50 sex ratio in eggs and adults, the number of eggs per female for the hatchery fish must be $2.18 / (0.5 \times 0.00107) = 4,075$ whereas the number of eggs per female for the naturally spawned fish must be $0.53 / (0.5 \times 0.000217) = 4,885$. Are these consistent with actually fecundity rates of the two classes of adult female fish?

Appendix 4. Summary of Teleconference Discussion between WDFW and ISRP on ISRP Questions #2 for the Tucannon River Captive Broodstock Master Plan

Notes from 2/22/2000 Teleconference Meeting ISRP and WDFW Discussion of Memo below. ISRP Notes interspersed throughout memo.

MEMORANDUM

February 14, 2000

TO: Mark Fritsch, NPPC

FROM: Rick Williams, ISRP

SUBJECT: Questions for Tucannon - ISRP Teleconference

ISRP conclusion:

Passes 3-Step Review

Primary Concerns (conditions?):

1. Habitat: clear linkage between captive broodstock and habitat work with explicit milestones in future proposals (e.g. for province review).
2. Evaluation: analyze data collected (e.g. require completion of annual reports with statistical analysis included).
3. sidebar: ISRP or independent analysis of the data.

Questions on habitat-hatchery linkage: The ISRP continues to have question regarding “Question 3. Factors limiting production of the target species.” The reviewers continue to note that the master plan lacks adequate information on the link between the captive broodstock program and habitat restoration. Will the critical limiting factors necessary for the success of the captive brood program be addressed? In what timeframe? The reviewers are looking for a concrete link between the hatchery and habitat efforts.

Discussion notes:

ISRP: A primary concern of reviewers is whether the necessary habitat work is being done to allow for the project’s success. Reviewers would like to see a coordinated effort.

WDFW (Joe Bumgarner) answered. Much of the habitat work is not in direct response to the captive broodstock project but is ESA driven. Entities in the subbasin have formed a model watershed to identify and address the limiting factors. This is out of their WDFW’s control. Mr. Bumgarner is not personally involved in the model watershed, however other WDFW employees are involved. WDFW is doing a pre and post look at the habitat restoration projects.

The teleconference participants discussed that the steelhead fishery may be a driving force to make changes. The subbasin now has bull trout, spring and fall chinook listed. This may put some pressure on the landowners to make changes. The participants acknowledged that part of the habitat/hatchery disconnect is institutional.

Recommendation: The reviewers would like to see timelines and linkages between the habitat work and captive broodstock in future project descriptions.

Questions on captive brood life history:

ISRP: It looks as if WDFW will keep these fish for their entire life cycle in fresh water. Does this affect age or size at maturity? Why are jacks selected out?

WDFW: The fish will probably mature younger. All the jacks are not going to be selected out in the future. They were selected out from the 1997 brood. They did not have any females to spawn with. They do not want to use the 2-year-old jacks, but rather the 3-year-old jacks would need to be used out of necessity.

No ISRP recommendation is needed here. The discussion clarified the ISRP's questions satisfactorily.

ISRP: 1997 is the last annual report. The ISRP noted there are no confidence limits around many values, such as on survival rates. The statistical work has not been done. A lot of the data is at best point estimates. (WDFW agreed with this observation). The ISRP questioned whether supplementation has harmed natural stocks.

WDFW: They have not done statistical analysis. So far, analysis is based more on on-the-ground observations; the data is fuzzy. Looking at egg to parr ratios, they have not decreased. There is not any gross decrease in survival rates.

They have a statistician available at WDFW that can assist with future statistical analyses.

Recommendation: Future annual reports should include more rigorous treatment of monitoring data including statistical analysis from WDFW staff where practical.

Questions on mitigation bookkeeping:

ISRP: WDFW states that the return rate of hatchery fish to the hatchery is 2-3 times replacement, so that mitigation is viable even if supplementation (or captive brood replanting fails). WDFW actually reports a return per spawner rate of 2.18 for hatchery fish averaged over the 1985-1995 brood years (Table 2 on page 9 of the 1999 Master Plan). This will allow a harvest rate of $1/2.18=45.9\%$. This sounds like a reasonably high harvest rate, but the "carrying capacity" for this population is set by hatchery smolt production capacity, and the 1985-1994 SAR rate for hatchery fish averaged 0.15% (Table 1 on page 6 of the 1999 Master Plan).

Therefore, using the 45.9% harvest rate figure, each harvested fish requires the release of $1/(0.459*0.0015)=1,452$ smolts. At a nominal cost of \$1/smolt, does "mitigation" make sense at \$1,452 per fish harvested? If the hatchery turns entirely to mitigation and can release 300,000 smolts per year, the total harvest, using these figures, will be $300,000*0.0015*0.459=207$ fish/year. Is this a reasonable goal?

WDFW: Whether the project moves to a "mitigation" program if the captive brood program fails is a policy call for the co-managers.

ISRP: Note that Table 1 shows the naturally spawned fish achieving a 0.0057 SAR compared to the 0.0015 SAR of the hatchery fish. Why are the hatchery fish surviving at 1/4 the survival rate of naturally spawned fish? Does the selection pressure exerted during the course of the enormous SAR mortality of hatchery fish favor a hatchery or a natural spawning life cycle? Note that the hatchery fish are released as smolts at a different size and age [they go out at the same age, 1+] than the migrating smolts of natural spawning origin, and return as adults at a different age composition (the Master Plan doesn't report size of the respective adult populations).

WDFW: WDFW conjectures that the fish get pummeled the first day out in the system. There is a high descaling rate in their first smolt trap downstream. They suspect high initial mortality is occurring. Releases from Curl Lake seem to be doing better. About 60% of fish left volitionally from Curl Lake.

Discussion on remote site incubation: Survival in the hatchery is very high. The acclimation will be subject to use of the chiller at Lyon's Ferry. Screw trap scoops down 2 1/2 feet deep, the river is 4 feet deep. They get a good sample. The hatchery fish are larger. Prophylactic erythromycin tried but results were not worth the cost. Generally, BKD not a problem in spring chinook. WDFW has limited use of PIT tags compared to other projects.

Question on fecundity rates of hatchery and wild fish.

ISRP: From Table 2 the average return per spawner rate is 0.53 for naturally spawned fish, compared to the 2.18 rate for hatchery fish. The higher SAR rate of the naturally spawned smolts is offset by their lower egg-to-smolt survival rate, shown in Table 1. From this table, the average egg-to-adult return rate for the naturally spawned fish is $0.078*0.487*0.0057=0.000217$, compared to $0.78*0.91*0.0015=0.00107$ for the hatchery fish. Do these figures add up to a plausible life history? In order to achieve the return per spawner rates of Table 2, under the egg-to-adult survival rates of Table 1, assuming a 50/50 sex ratio in eggs and adults, the number of eggs per female for the hatchery fish must be $2.18/(0.5*0.00107)=4,075$ whereas the number of eggs per female for the naturally spawned fish must be $0.53/(0.5*0.000217)=4,885$. Are these consistent with actually fecundity rates of the two classes of adult female fish?

WDFW: This is not what they see. They get more females than males. They do not get those numbers above, but do average ~ 3,200 hatchery and 3,600 wild. If they release smaller smolts, they come back older, larger, and more fecund. Some of the years are not estimates but are extrapolations. The teleconference participants talked about Transactions Article (Vol. 6) on Deschutes River hatchery practices and results. The most successful releases were those that had significant spring growth during a short period.

Appendix 5. Draft ISRP Review of the Tucannon River Captive Broodstock Master Plan

The ISRP comments are interspersed following the Three-Step Question/Criteria described below in the Three-Step review document provided by WDFW. These ISRP comments were pared down to a set of questions (Appendix 1) that the ISRP transmitted to WDFW for response. WDFW provided a prompt written response (Appendix 2). The ISRP subcommittee reviewed WDFW’s response, discussed them via teleconference, and then drafted a second set of questions for transmittal to WDFW to address the remaining uncertainties (Appendix 3). On 22 February 2000 via teleconference, the ISRP subcommittee discussed the questions with Joe Bumgarner, WDFW. Erik Merrill (NPPC staff) facilitated the discussion and generated the summary notes of that discussion (Appendix 4).

3-Step Review Process

Due to the nature of this project (its small scale and temporary nature primarily) the Power Planning Council has decided that all three steps in the three-step review process will be combined into one review. As such, this review will include technical questions relating to: (1) master planning requirements according to Section 7.4B of the Councils’ Fish and Wildlife Program, (2) answers to questions identified in the Fiscal Year 1998 Annual Implementation Work Plan, (3) answers to questions involving the Fish and Wildlife Program language identified by the ISRP, (4) the recently adopted Artificial Production Review Policies, and (5) the associated captive propagation standards developed by NMFS per the Councils’ request. Finally, there are pages dedicated to fiscal questions relating to the Step 3 Review.

The following attached pages will address each of the above items and will directly answer questions posed, or reference the specific location within the Tucannon River Captive Broodstock Master Plan where the topic is covered. For #5, we will also reference the specific section of the Section 10 Permit Modification Request (WDFW, February 1999) which was developed by following the suggested outline in the NMFS Captive Propagation Standards.

(1) Master Plan Elements

The following is to provide the independent reviewer’s locations of the Master Planning Elements located within the Tucannon River Captive Broodstock Master Plan as suggested by the Power Planning Council in the Fish and Wildlife Program section 7.4B.1. Page numbers provided either specifically address the element, or are more general in subject matter but are related to the specific element.

<i>Master Plan Elements</i>	<i>Pages</i>
1. Project goals.....	3

ISRP Comments:

In general, the project goals are clearly and thoroughly presented. The goals seem appropriate to both the declining spring chinook stock and the mitigation goals of the LSRCP. The project combines captive broodstock program with existing hatchery supplementation.

2. Measurable and time-limited objectives.....28-29

ISRP Comments:

Objectives listed extend through Dec 2001. They are straight-forward and apparently reflect satisfactory progress since 1998. But how many eggs were collected from the BY 1997 and 1998 fish? What is their survival to date? How many 1999 BY eggs were collected? Is it likely that the 150,000 smolt release target will be met for those three years?

One of the project's strengths is its specified duration. Proposers seem cognizant of the dynamic between time (generations) in the hatchery and the potential for increased hatchery effects lowering fitness in the supplemented stock. The project tries to strike a balance between the two. We were concerned when reading point #10 under Policies of the APR in the 3-Step Summary, which suggested that if the rebuilding efforts failed, the project's goal might be switched to one of mitigation. If the project fails, it seems unlikely that there will be sufficient broodstock available to provide the basis for a mitigation goal.

3. Factors limiting production of the target species.....9-10

ISRP Comments:

Only factors limiting natural production are described. These factors (sediment and temperature) appear logical and are unfortunately typical for the region, even though human population density might be low (800 humans in the Tucannon watershed). The writers do not sound even slightly hopeful that amelioration is occurring in the lower watershed conditions.

It appears there are several significant factors affecting hatchery production, including one within the Tucannon that results in physical damage to smolts prior to collection in trap near Tucannon mouth. Such factors are poorly understood and/or described.

The authors note the primary problem for spring chinook production in the Tucannon as lowered egg-to-fry survivals (8% vs. 30% in pristine areas). The authors are pessimistic that significant improvements can be achieved in a timely manner from habitat restoration efforts. While this may in fact be true, it actually argues that habitat improvement within the Tucannon basin should be a priority management goal and it should be aggressively pursued.

The authors also describe the plethora of downstream mortality factors and hope that those will change to double SAR rates, which would allow the natural population to replace itself. However, downstream mortality factors are beyond the control of the fisheries managers in the Tucannon basin. We are all hopeful, that downstream mortalities will relax, however, history suggests that such optimism is unwarranted. Any realized increases in survivals, barring radical restructuring of the hydrosystem, are likely to be incremental in nature and subject to wide annual fluctuation.

All of this suggests that habitat improvement and restoration should receive extremely high priority for future management actions in the Tucannon basin. Fisheries managers can at least directly address those mortality factors and through M&E, measure habitat improvement.

Data presented on p. 11 of the Master Plan also suggest that straying might be more of a problem than the plan notes. More rigorous M&E should be directed at understanding the numbers and impact of out-of-basin strays.

4. Expected project benefits.....13

ISRP Comments:

This section was clearly presented and well done. The population is valuable, both biologically and socially.

5. Alternatives for resolving the resource problem.....13-15

ISRP Comments:

Clearly presented, but did not include discussion of one major option: terminate the supplementation program, coincident with the adoption of the captive broodstock operation. This possibility needs further debate.

The major deficiency in the Tucannon Master Plan is that actions in the plan do not seem to be coordinated with an aggressive habitat improvement or restoration plan. If this were done, improvements in within-basin habitat (that can directly increase survival of outplanted hatchery progeny) would occur synergistically with the captive brood program. The proposers describe in general terms the contribution of the Tucannon River Model Watershed Program, no specifics are provided.

The proposers might consider this point unfair in some manner as the Master Plan elements do not necessarily indicate that including habitat improvement or restoration information is needed. However, many of the recent reviews of artificial production activities emphatically describe the necessary linkage between artificial production recovery programs (like captive brood and supplementation) and habitat improvements, if the artificial production program is likely to succeed.

6. Rationale for the proposed project.....1, 3, 4-10

ISRP Comments:

The rationale seems appropriate and justified by the recent precipitous declines in the Tucannon spring chinook population.

7. How the proposed project will maintain or sustain increases in production2-3

ISRP Comments:

This was difficult to assess, and the nature of a desired response was unclear. However, the project's expected success is based on a number of assumptions, which appear reasonable. The project lays out the proposed methods by which proposers hope to rebuild spring chinook salmon in the Tucannon. Only time and a solid M&E program will tell whether the plan leads to fruition.

Master Plan Elements

Pages

8. Historical and current status of anadromous and resident fish in the sub-basin4-12

ISRP Comments:

Clearly presented material. It would appear difficult to justify the supplementation program for spring chinook that began in 1985; that program appears to have played a role in the decline of the population. Some of those effects may have been reduced with very recent changes in juvenile release locations but that has not been verified as yet.

9. The current and planned management of anadromous and resident fish in the subbasin.....3-4

ISRP Comments:

Few options remain.

10. Consistency of proposed project with council policies, NMFS recovery plans, other management plans, watershed plans and activities, etc.....1-2, 25-28

ISRP Comments:

A captive broodstock program appears consistent with established policies; no conflicts are apparent here.

11. Potential impact of other recovery activities on project outcome.....3, 10, 28

ISRP Comments:

The Model Watershed Program is moving fish passage and rearing conditions in the right direction but apparently at a pace too slow to be meaningful during the next decade for spring chinook. It remains to be seen if possible changes to other parts of the system (mainstem passage, marine mammal predation, etc) occur during the decade.

12. Production objectives, methods, and strategies.....2-4, 12, 15-23

ISRP Comments:

Use of a single production facility (Lyons Ferry) is very risky but options seem to have been carefully considered.

13. Brood stock selection and acquisition strategies.....1, 15-16

ISRP Comments:

Eggtaking from supplementation program adults at Lyons Ferry seems appropriate and the preferred alternative. But if the number of adults is inadequate for both programs, which gets priority?

14. Rational for the number and life-history stage of the fish to be stocked, particularly as they relate to the carrying capacity of the target stream and potential impacts to other species.....2-3, 19-21

ISRP Comments:

The exact basis for selection of a target of 150k smolts/year is not provided, nor is the math evident that would produce about 300 returning adults (but these are minor points – general targets appear appropriate).

Release location and timing for supplementation smolts has been sub-optimal and repeatedly modified in the last decade. Their arrival at the Tucannon mouth trap in poor condition does not bode well for fish in the captive broodstock program unless Curl Lake acclimation and “exercising” at the Tucannon Hatchery is successful (two unknowns at present). It appears that all 150k smolts from captive breeding program plus some or all of the supplementation smolts would be placed into Curl Lake. The estimated carrying capacity of the 2.1 acre Curl “Lake” is not provided in the report. Has it been assessed? More emphasis should be placed on use of Remote Site Incubators.

Fry plants should not be undertaken.

15. Production profiles and release strategies.....2,3, 15-16, 19-21

ISRP Comments:

See above.

16. Production policies and procedures.....3-4

ISRP Comments:

On p1 “one hatchery production failure” occurred in the (recent?) history of the program, but neither the date nor the cause is identified. Is this relevant? Sounds like it is.

Utilization of 100% spring source water at Lyons Ferry is a dream for simply maximizing salmonid production but is a major drawback in producing quality smolts that vaguely resemble wild chinook. A small, 10-yr-old chiller appears key to be able to mimic natural temperatures, but no funds were requested to upgrade or replace it. Why?

What is the risk of whirling disease in future at either hatchery facility?

Measures taken to avoid a hatchery catastrophe were not discussed. For example, what are consequences of sudden chiller failure on developing embryos?

17. Production management structure and process.....3-4

ISRP Comments:

See above.

18. Related harvest plans.....23-24

ISRP Comments:

Not an important issue at this point in time.

19. Constraints and uncertainties, including genetic and ecological risk assessments and cumulative impacts.....1- 3, 9-10, 12-15

ISRP Comments:

The writers appear to provide a realistic description of the populations chance for continued existence. The short-term nature of the project should act to keep genetic and ecological risks relatively low.

20. Monitoring and evaluation plans, including a genetics monitoring program21-23

ISRP Comments:

No plan for genetic monitoring has yet been developed.

Other monitoring appears to be adequately designed in light of the projects' limited resources. "Some" captive brood progeny will be killed to record meristic data to add to a long-term data set. Is this justified? Clear benefits should be identified, or this plan should be abandoned.

In general, the ISRP found the monitoring and evaluation plan lacking in detail. A more detailed proposal for monitoring and evaluation should include:

- Exactly what variables will be measured (e.g. female fecundity, egg to hatching survival, etc.)?
- For each variable, how it will be measured (e.g. PIT tag detections at McNary, lengths measured on fish recovered from a trap in at a weir at location X, etc.)?
- What fish will this measurement pertain to (e.g. fish of wild spawned origin used as broodstock, fish of hatchery origin that were part of the escapement above location Y, etc.)?
- What is the intended sample size, for each category of fish, for each variable measured?
- Given the planned sample size, and expected variability of the quantity measured, what is the expected standard error for each variable measured for each category of fish?
- What list of specific questions is the monitoring intended to answer?
- How does the proposed plan address each of those questions?
- What expected resolution will be provided in each of the answers delivered by the monitoring?
- For every variable that is intended to be measured, what is the history until now of measuring that variable in the Tucannon project?
 - a. Date of initiation?
 - b. For how many years was this continued?
 - c. What were the sample sizes?
 - d. Where were the results reported?
 - e. Where are the data archived?
 - f. Where were statistical analyses from the data reported?
 - g. What were the conclusions from these data?
 - h. What was the observed variability of the quantity being measured?

21. Conceptual design of the proposed production and monitoring facilities, including an assessment of the availability and utility of existing facilities.....12-13, 28-30

ISRP Comments:

The project has the advantage of piggy-backing into the existing supplementation project, and this minimizes facility and manpower needs.

22. Cost estimates for various components, such as fish culture, facility design and construction, monitoring and evaluation, and operation and maintenance.....30-31, BPA FY2000 Proposal

ISRP Comments:

Additional cost of the program (above LSRCF costs) appears very minimal.

(2) Questions Identified in the September 1997 Council Policy Document for FY98 Project Funding

23. Has the project been the subject of appropriate independent scientific review in the past? If so, how has the project responded to the result of the independent review? This project was submitted for FY2000 funding under the Fish and Wildlife Plan. The ISRP and CBFWA reviewed the initial proposal and recommended funding for FY2000. The ISRP comments on the proposal have been addressed within the Master Plan.

ISRP FY2000 Review Comments

ProjectID: 20020

Tucannon River Spring Chinook Captive Broodstock Program

Washington Department of Fish and Wildlife

Short Description: Modify existing facilities at Lyons Ferry and Tucannon hatcheries to implement a captive broodstock program for Tucannon River spring chinook. Rear and spawn broodstock, raise their progeny and release approximately 120-140 thousand smolts in the Tucannon.

ISRP Recommendation - Fund for 1 YR / CBFWA Tier 1 / ISRP Comparison with CBFWA: Agree-fund

Sponsor Funding Request = \$283,538 / CBFWA Funding Recommendation = \$134,049

Recommendation: Fund for one year; subsequent funding contingent on development of an integrated plan for habitat, hatchery, and broodstock programs in the basin. This is a new proposal to implement a captive broodstock program in the Lower Tucannon River basin, where the proposers argue that the chinook population is “genetically distinct” from other Snake River populations. The proposal is reasonably specific and well formulated. One shortcoming of the proposal is its failure to address the question of whether deleterious interactions with juvenile wild fish occur. Nonetheless, the panel felt this was one of the better proposals in the general category of captive brood proposals. However, all captive brood projects need to be reviewed at a programmatic level. The main question is whether committing to raise more “museum fish” really makes sense. In the absence of habitat improvements (mentioned in various other proposals under the same umbrella), it does not appear that the Lower Tucannon is currently capable of supporting a wild population – notwithstanding (or perhaps because of) its apparent ability to sustain a hatchery population. Lacking an approach that addresses the wild population in the context of the hatchery population, this project may not be viable. On the other hand, after the first year, it is relatively cheap. But, the panel was quite concerned that the FWP is not addressing habitat and captive brood projects in an integrated manner.

ISRP Comments: There appears to have been adequate independent scientific review.

24. *Have the project sponsors demonstrated adequately at earlier stages that the project is consistent with the Council's policies on artificial/natural production in Section 7? If not, can these points be demonstrated now?* Yes, the previous two pages, which outlines the questions for developing a "Master Plan" in Section 7 of Fish and Wildlife Plan have been addressed within the Tucannon River Master Plan.

ISRP Comments: Yes, this is adequate.

25. *Is the final design of the project consistent with any master plan and preliminary design?* Due to the small scale of the proposed project, and the Council's decision on this project, the preliminary designs for this project (which are attached to the Master Plan) will satisfy the final design requirement for the project. Basically, we will be installing eight 20' circular tanks at Lyons Ferry Hatchery (existing facility). Also, since we've received partial funding from the Lower Snake River Compensation Plan (\$120,000), the 20' tanks have been set up and are now operating, though more funds are necessary to complete the original design proposed by the project leaders.

ISRP Comments: Appears adequate.

26. *If not, do the changes raise any underlying scientific question for further review?* Not Applicable.

ISRP Comments: NA

27. *Has information about the project or its purposes changed in such a way to raise new scientific concerns?* In the original proposal, WDFW had identified two rearing facilities for the captive broodstock. However, since funding was not available for modifications at both facilities, we've scaled back the project to one facility (Lyons Ferry Hatchery). While this increases the potential risk of failure by rearing all fish at one facility, we additionally had some concerns about the rearing quality at Tucannon Hatchery anyway. However, WDFW and the co-managers feel the stock is depressed enough that even conducting the program at one facility is justified to maintain the population. The overall purpose of the proposed project remains unchanged.

ISRP Comments: Appears adequate.

28. *Has the underlying science or the what it is understood changed so as to raise new scientific issues?* No (at least not that we're aware of). Other captive broodstock programs have been operating for a number of years, and new information is available as to the best procedures to use, etc... . In fact, this program will likely benefit in the long run, as it will come in behind all other programs which have laid much of the groundwork.

ISRP Comments: The supplementation program should face many more serious scientific questioning than does the captive broodstock program.

29. *How technically appropriate are the monitoring and evaluation elements of the project?* WDFW feels the monitoring and evaluation elements of the project are appropriate given the scope

of the project. Additionally, the funding amount requested does not cover the monitoring and evaluation of this program, and much of the M&E will continue after the program ceases to be funded. This will be covered by the existing monitoring and evaluation program for the supplementation program (LSRCP funded). As identified in the Master Plan (Pages 20-22), we will document survivals, genetic changes, and eventual reproductive success of the population to the best of our ability.

ISRP Comments: Appears adequate.

30. *Are there ways to obtain the same production benefits with facilities that are lower in cost or less permanent, should monitoring and evaluation later indicate that the effort be abandoned?*

The project as designed is the lowest cost feasible to obtain the production required to maintain the population in the short term. The project has benefitted greatly because we are conducting these activities on an existing facility, which negates the cost for designing and building a complete new hatchery. Also, due to the short time frame of the project, the facility is not permanent in nature, though if maintained properly, could be used for other purposes at the hatchery for years after the proposed project has been complete.

ISRP Comments: This rationale appears appropriate.

(3) Program Language Identified by the ISRP

31. *Measure 7.0D: Comprehensive environment analysis assessing the impacts on naturally produced salmon of hatchery produced anadromous fish.* The environmental assessment (currently being conducted by BPA) will address this question perhaps more fully than the Master Plan. However, we have identified the potential impacts to other natural populations of salmonids in the Tucannon River Basin within the Master Plan (pages 10-12). The proposed project is not anticipated to impact the natural population of spring chinook in the Tucannon River, as it was derived locally from that stock in the beginning. Further, NMFS concluded in the Biological Opinion (NMFS, May 1999) that the proposed actions will not negatively effect the spring chinook or other populations of salmonids within or outside the basin. Based on coded-wire tag recoveries from the current supplementation program (hatchery fish), spring chinook from Tucannon do not appear to stray outside the basin. It is assumed at the this time, that captive broodstock progeny produced will behave similarly to the fish from supplementation program and not stray into other basins.

ISRP Comments: Adequate for now, but the topic will need revisitation if/when spring chinook numbers recover.

32. *Measure 7.1A: Evaluation of carrying capacity and limiting factors that influence salmon survival.*

A) Carrying Capacity: The carrying capacity of the Tucannon River for spring chinook and other salmon/steelhead in the river has not been clearly identified by the managers. The main reason for

this is good historical records on salmon abundance are almost non-existent for the river. Some past records indicate that about 2,500 spring chinook may have returned annually prior to the 1950's. However, WDFW only has more complete recent data from 1985. We have therefore based our program goals (release of 150,000 smolts) with the intent to return enough adults to bring the spring chinook stock back to 1985-1993 levels (about 600 fish/year). This will allow for natural spawning, and re-seeding pristine areas of the river which have been void of spring chinook since 1994.

As far as the capacity of the Snake and Columbia River where these additional hatchery smolts will migrate through, addition of 150,00 spring chinook smolts from the Tucannon River captive broodstock program will not be noticed given the number of hatchery smolts already produced from the Snake and Columbia River Basins.

ISRP Comments: Is the target 600 adults/year? Master Plan p3 indicates 300 adults/year, apparently from the same smolt numbers.

B) Stock of Choice and impact to natural production: The stock used has been derived from native fish on the Tucannon River. The program is to re-seed areas of the river with little or no production since 1994, and will not impact the current natural production in the river because of the under-seeding since 1994. Further, release strategies developed for the program will have not impact on natural production of spring chinook in the river.

ISRP Comments: Again, this is appropriate for current conditions.

C: Harvest: Harvest on spring chinook from the Tucannon River has been very small. Most harvest has occurred in Tribal fisheries in the Columbia River (about 4% harvest rate annually). The plan is to not externally mark the captive broodstock production which may allow for their exclusion in some fisheries. Returns from this program are not meant to provide large scale ocean or mainstem fisheries, and will not change the harvest effort of current fisheries.

ISRP Comments: Harvest is certainly not an issue.

33. Measure 7.1C: Collection of population status, life history and other data on wild and naturally spawning populations of salmon and steelhead. The Tucannon River spring chinook salmon is the priority population for this project. The intent of the program is for the short-term preservation and re-building of the population, with the intent to maintain the genetic integrity of the stock. WDFW has collected life history, genetic, morphometric and meristic data on the wild and hatchery population since inception of the original supplementation program in 1985.

Baseline Data: Master Plan.....	Page 4-9
Limiting Factors: Master Plan.....	Page 9-10
Carrying Capacity (see above explanation): Master Plan.....	Page 3-4
Monitoring and Evaluation: Master Plan.....	Page 21-23
NMFS Coordination: Master Plan.....	Page 1

ISRP Comments: Response appears adequate.

34. Measure 7.1F: Systemwide and cumulative impacts of existing and proposed artificial production projects on the ecology, genetics and other important characteristics of the Columbia River Basin anadromous and resident fish. This is essentially a similar response to Measure 7.0D (see above). The indirect, direct and cumulative effects of the project have been addressed for fish within the basin. However, an additional consideration would be if the proposed project counts against the Hatchery Production Cap for the Snake River Basin. Since this action is for recovery, it may not count against the cap. Further, given the small number of fish produced, it would not likely impact natural production within or outside the basin.

ISRP Comments: Appears to be adequately addressed earlier.