Response to ISRP comments about Project 35018: Evaluate recreational and commercial mark-selective fisheries.

Geraldine Vander Haegen, WDFW; Charmane Ashbrook, WDFW; Chris Peery University of Idaho; Annette Hoffman, WDFW.

To better coordinate the evaluation of selective fishing gears and techniques between the Washington Department of Fish and Wildlife and the Oregon Department of Fish and Wildlife, we have combined Projects 200100700 and 35018 and attach revised narrative and budget reflecting these changes. The original three objectives from Project 35018 remain objectives 1, 2 and 3, and two additional objectives from Project 200100700 are now included as objectives 4 and 5.

Below, we discuss the ISRP comments pertaining to Project 35018 (objectives 1, 2 and 3 of the combined proposal).

<u>Comment:</u> *Objective 1 of this project is similar to objective 1 of Project 200100700 and should be coordinated.*

As mentioned above, we have combined both projects to fully coordinate the research and monitoring of selective fisheries. Both this project (35018) and Project 200100700 had objectives that used radio-tag technology to estimate the post-release survival of steelhead released from tangle nets. This objective was removed from Project 200100700. The estimate of the post-release survival will be completed as previously submitted in Project 35018 with the changes suggested by the ISRP as explained below. We selected Objective 1 from Project 35018 because it has a suitable control which was not present further downstream, it has the expertise and access to basin-wide monitoring of the radio-tags using stationary receivers that are better suited to long-term monitoring than weekly overflights, and because the principle investigators have successfully conducted similar experiments for spring chinook salmon. Five receivers will be added below the Bonneville Dam in case fish tagged at the dam migrate back down the river.

<u>Comment:</u> *Reconcile the definitions for soak time used in Project 200100700 and Project 35018.*

The Oregon Department of Fish and Wildlife, the Washington Department of Fish and Wildlife and the University of Idaho will use the following definitions:

"Soak Time": Time from when the first cork of the net goes into the water (at the beginning of a set) until the last cork of the net comes out of the water (at the end of a set). This reflects the idea that the nets are fishing from the moment any part of the net is put into the water until the moment the entire net is removed. WDFW had previously referred to this time as the "total set time". Restrictions on commercial fishers are made by soak time, even though it is difficult to predetermine the soak time because it includes the variable time it takes to remove fish from the net.

"Drift Time": Time from when the first cork goes in the water until the first cork comes out of the water. This definition is helpful for the research of the gears because it can be predetermined and is used to guide the test fishers in limiting the soak time. WDFW had previously referred to this time as "soak time".

Comment: *In objectives 1 and 3, the committee had concerns about the source of the control fish and whether they are comparable to the treatment fish because they are not released at the same location. The committee recommended we consider taking half of the experimental fish up the Bonneville ladder for release, and half of the control fish downstream to be released. If the controls are comparable, then there should be no difference in survival of the two groups.*

For the past 6 years, Dr. Chris Peery at the University of Idaho has used radio telemetry to monitor the passage of chinook salmon, sockeye salmon and steelhead through the lower Columbia River hydroelectric projects. As part of this work (to date unpublished), Dr. Peery has found that 99% of chinook salmon, sockeye salmon and steelhead captured in the trap at Bonneville Dam, then transported and released 9.5 km downstream from the dam (at Skamania Landing; Figure 1) will return back to the tailrace of Bonneville Dam. This indicates that the tagging and transport process imparts relatively little stress to the adult salmon. However, about 5% fewer of the fish released downstream will reach the Dalles Dam than those released in the ladder. This 5% loss is associated with passage of Bonneville Dam and reservoir.

In objective 1, we will evaluate the survival of steelhead captured and released from tangle nets fished below Bonneville Dam. Because Dr. Peery has already shown that the mortality associated with transporting fish downstream is about 1%, we propose to transport the control fish below the dam, but not to move the test fish up to the ladder. This process will eliminate the approximately 5% loss of fish between the test group and control fish if they were not transported, and is feasible because of the relatively small number of steelhead (200) that require transporting.

To ensure that the transporting process is as benign as in Dr. Peery's previous studies, we will use the same process. Immediately after capture and tagging in the trap, each fish will be transferred to a tank of anesthetized, oxygenated water maintained at the current river water temperature. These fish will be transported by truck to Skamania Landing and released. Fish captured in the tangle net will be transported by boat to the same vicinity and released near where control fish are released.

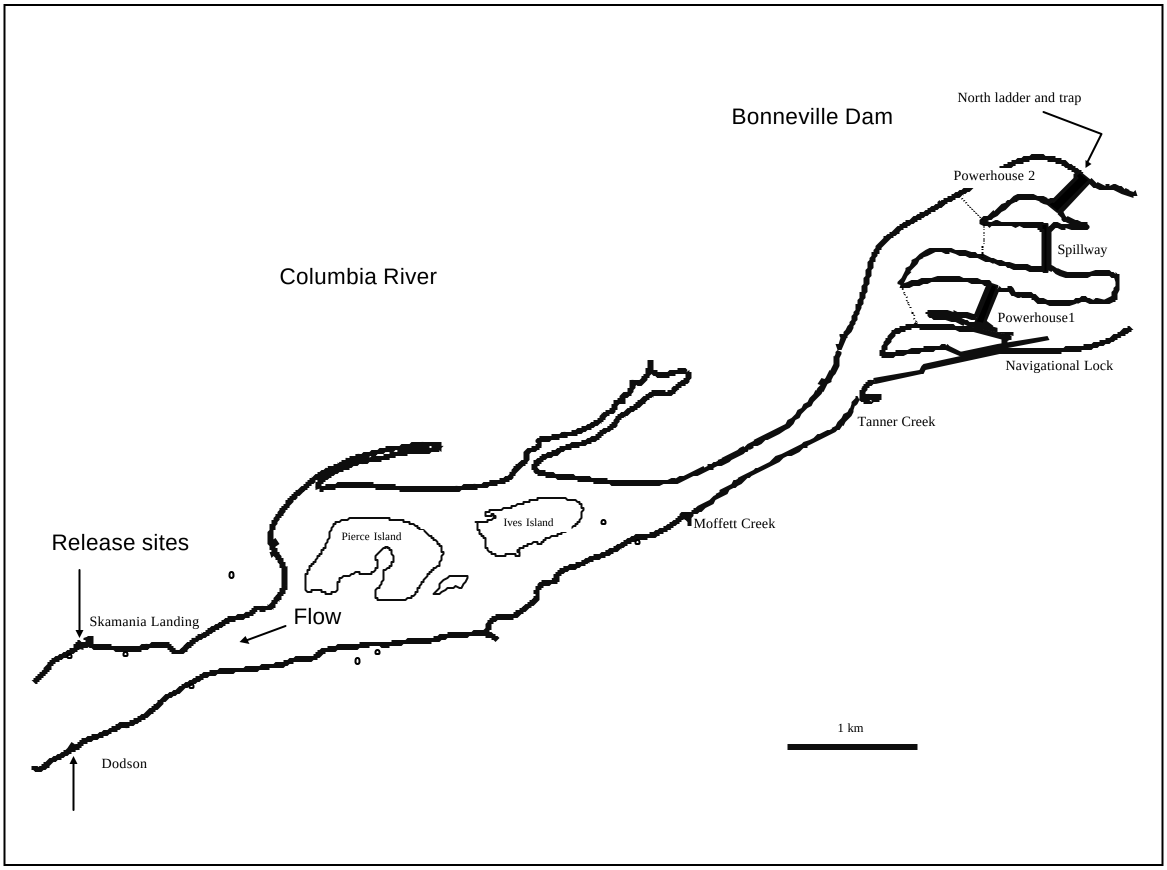


Figure 1. Map of Bonneville Dam and Columbia River showing location of Powerhouse 2, where the adult trap is located, and the release site for fish transported below the dam.

Eliminating the bias from the control group is more complicated for objective 3 (evaluating the post-release survival of spring and fall chinook salmon and coho salmon captured in the recreational fishery). In objective 3, we will be tagging the test fish with jaw tags rather than radio-tags. This is a critical difference because our tagging method must interrupt the usual handling practices for this fishery as little as possible. We feel that we will be able to apply jaw tags to fish captured on hook and line without removing them from the water (either on shore or from a boat). If we were to use radio-tags, we would need to place each fish into a holding tank, which would diverge from the usual handling practices of the recreational fishery (but not from the commercial fishery as in objective 1), and may significantly affect our estimates of post-release survival by an unknown amount. On the other hand, the larger number of fish required for using jaw tags means that it is impractical to transport the control group downstream of the dam.

To reconcile these biases, we propose to perform our study as previously planned, using jaw tags without transporting fish, but to then apply a correction factor (of about 5%) to the test group. Ongoing studies by Dr. Peery will evaluate the loss of spring and fall chinook salmon transported downstream of Bonneville Dam during the time when our test fisheries will occur. To reconcile coho salmon loss, we have changed our proposal to include applying radio-tags to 200 coho salmon (other than those given jaw tags), and transporting half of them downstream for release. This will enable us to apply a correction factor to the coho salmon test group.

Comment: *Why use jaw tags instead of telemetry (or vice versa)?*

As mentioned above, each tag has benefits and drawbacks. Jaw tags enable us to mark many more fish less expensively than radio-tags, are visually very obvious, and can be applied with very little fish handling. We have successfully used jaw tags in previous studies to evaluate post-release survival. However, the recovery rate of this tag is low (10-15%), while radio-tags are very helpful where we have a small sample size (as we expect for steelhead) because the recovery rates are much higher (about 45%).

Comment: *How will the depth of capture of steelhead be measured, and were weedlines considered?*

We agree with the ISRP that measuring the net depth where steelhead are captured will be impractical when abundance is high. We therefore propose to use colored strings woven horizontally across the net to visually divide it into thirds from top to bottom. We could then accurately say which part of the net each steelhead was captured in.

While drop nets or weedlines can be an appropriate solution if the majority of steelhead are captured in a particular section of the nets (and are generally used at the surface), we do not agree that they are the most direct way of evaluating which part of the net most fish are captured in. If we were to use weedlines, we would require 6 different nets – there are 2 mesh sizes that will be tested, and 3 positions for a weedline (top, middle, bottom; but if the weedline were to be placed at the bottom, it would be more logical to limit the depth of the net). This number of combinations means that all of these nets could not be fished during each set, and switched between sets to ensure that each area of the river is given equal coverage by each net type. We could therefore incorporate a significant bias into the evaluation as the abundance of steelhead fluctuated. Rather, we think that the most direct method of determining which part of the net the steelhead are captured in is to capture them there. Using the colored lines rather than the weedlines will have the added benefit of maintaining our sample size for the post-release survival estimate.

Comment: *In objective 2, what is the basis for the egg-to-fry survival difference of 10%?*

In the natural environment, an adult female salmon must successfully find, establish, fight, and guard territory, build a suitable nest(s), and deposit viable eggs. All of these tasks require energy, which may be depleted as a result of capture in tangle net gear. In the hatchery environment, an adult female need only return to the hatchery and provide viable eggs. We expect that if there is a difference in these energy requirements, there will be an even greater difference for naturally spawning adults. Evaluating whether there is a spawning success difference for fish captured in tangle nets will provide fish managers with a valuable tool for determining fishery impacts to rebuild weak populations. A 10% decline in productivity could significantly impact recovery of weak populations. We estimate the Cowlitz and Kalama hatcheries to each receive 60 pairs of jaw-tagged spring chinook and 60 pairs of jaw-tagged steelhead. Based on the variability observed in our pilot study at Willapa Hatchery in 2001, we should be able to detect as low as a 7% difference with 90% power if 10 pairs of fish are spawned.

Comment: *The ISRP had two specific budget concerns:*

1. *Part of spawning success evaluation is contingent upon funding of Project 35041.*

Our proposal contains an evaluation of natural spawning success of spring chinook salmon and steelhead trout that would be done in cooperation with WDFW's researchers on the Kalama River. Our evaluation of the natural spawning success of steelhead can be incorporated into a project already in place on the Kalama River that is funded by the Mitchell Act. Incorporating our work will require an additional $50,000 for genetic sample analysis.

Our evaluation of the natural spawning success of spring chinook is contingent upon funding the $271,513 Kalama portion of Project 35041, again with an additional $50,000 for additional genetic sample analysis. If the Kalama portion of Project 35041 is not funded, then either we can absorb it into our Objective 2 or we can not evaluate the Kalama wild spring chinook spawning success following capture in tangle net gear. (Please note that if we absorb the Kalama portion of Project 35041 into our Objective 2 the exact cost for the genetic analysis would have to be negotiated depending on the number of samples sent to the lab.)

2. *Section 8 requires more explanation: 14 FTEs seemed high and fringe rates were not included. There was an excessively large travel budget, and a more explicit description of the equipment to be purchased is needed.*

We agree with the ISRP that the budget requires more explanation. We had trouble with the form and have resolved a number of discrepancies. Fourteen people will work on objectives 1, 2, and 3 each year, but the total number of FTEs is 3.1. Fringe benefits were previously included with the salaries, and are calculated at about 25%, depending on the position. The benefits have been separated from the salaries. The travel budget included some equipment costs and both the travel and equipment budgets are revised to reflect the correct costs. In addition, the equipment budget has increased to include the purchase of 200 radio-tags to establish the survival difference for coho salmon released in the ladder and below the dam. The capital equipment to be purchased includes one vehicle (about $24,000). This is necessary because the vehicle we have used in the past needs replacement. The cost to purchase this vehicle is less than the cost to rent a similar vehicle. We will also purchase 5 receivers (about $10,000 each) to place on major tributaries downstream of Bonneville Dam to detect radio-tagged fish that may move downstream after release. These capital costs are one-time purchases that would occur in the first year of the study. We attach a revised budget form, which reflects the merging of projects 35018 and 200100700 and overall reflects a decrease in costs to a level that is commensurate with the research.

We sincerely appreciate the consideration and comments from the ISRP, and the opportunity to respond to them. We feel that this process has greatly strengthened our proposal, and the ideas exchanged will also be helpful to our research in other areas.

Response to ISRP comments about Project 200100700: Evaluate live capture selective harvest methods for commercial fisheries on the Columbia River.

Patrick Frazier, ODFW; Wolf Dammers, WDFW;

Following ISRP review this proposal was merged with proposal #35018 (Evaluate Recreational and Commercial Mark-Selective Fisheries), therefore some objectives and tasks have been modified. Responses contained herein pertain to those tasks retained in the modified proposal and related ISRP comments (now objectives 4 and 5 in the combined proposal). Deleted tasks are not addressed.

ISRP Comment:

a) *While the general background and broad results are summarized from past work, there are no actual data or analyses presented, nor are there any experimental designs presented for the proposed research. The way that past research results are presented is confusing and limits the understanding about what is known, what is unknown, and the quantitative results. There is also no sense of an integrating experimental design to this project.*

This project was initiated in 2000 with a very limited state-funded pilot project. BPA funding was acquired and the study was expanded in 2001. Data collected by these studies provided direction for the 2002 study which represents the first full year of directed study on determining the proper components of a tangle net that will be required to support a successful live capture commercial fishery. At the time this proposal was completed, data analysis from the 2002 study was just beginning. Since that time we have completed some preliminary analysis that are presented below. Data analysis is continuing and will not be complete until late in the year but preliminary analyses have and will be used to guide fishery regulation for 2003.

As per Objective 3 of the 2002 study a commercial live capture demonstration fishery was conducted from February through March and the chinook and steelhead catch estimates and catch rates (CPUE's) are summarized in the Table 1.

Table 1. Results of 2002 Live Capture Commercial Spring Chinook Demonstration Fishery.

Dates	Observed Drifts	Adult CHS Handled	Adult CHS CPUE	STH Handled	STH CPUE
Feb 25 - Mar 4	253	1,227	0.5	3,242	1.3
Mar 6 - 15	248	5,499	0.9	4,837	0.8
Mar 17 - 20	129	6,366	1.6	7,408	1.9
Mar 21 - 27	176	16,276	2.5	6,591	0.9
TOTAL	806	29,368	1.2	22,078	1.2

Observers were deployed each day of the demonstration fishery and monitored 316 boats and 806 drifts. A total of 991 chinook and 933 steelhead were observed to determine mark rates used to estimate steelhead and unmarked chinook handle. Total catches for the season included 14,643 marked chinook, 14,725 unmarked chinook, 8,723 marked steelhead and 12,975 unmarked steelhead. A total of 404 chinook and 792 steelhead were examined to determine condition at capture and condition at release and the results are summarized in the Table 2.

Table 2. Onboard Monitoring Results From the 2002 Live Capture Commercial Spring Chinook Fishery

	Chinook Captured		Chinook Released		Steelhead Captured		Steelhead Released	
Condition [1]	Number	%	Number	%	Number	%	Number	%
1	262	56%	358	89%	363	41%	651	82.2%
2	3	1%	3	1%	67	8%	31	3.9%
3	178	38%	37	9%	334	38%	82	10.4%
4	11	2%	3	1%	98	11%	12	1.5%
5	12	3%	3	1%	21	2%	16	2.0%

1. Definition of conditions are: 1=vigorous/not bleeding, 2=vigorous/bleeding, 3= lethargic/not bleeding, 4=lethargic/bleeding, 5=no visible signs of life.

These data indicate that recovery boxes were effective at improving release condition of fish. Condition at capture profiles indicate that the net captured spring chinook and steelhead differently with 56% of the spring chinook being captured in condition 1 and only 41% of the steelhead captured in condition 1. Additional observers documentation of capture method indicated that the 5.5" mesh size used in the 2002 demonstration fishery functioned like a tangle net for spring chinook and a gill net for steelhead.

Objective 2 of the 2002 study focussed on the specific components of net construction: hang ratio, the presence of stringers or slackers, and mesh size. Data regarding hang ratios and the presence of stringers/slackers has not been analyzed at this time; however, preliminary results are available regarding appropriate mesh size for use in a live capture commercial fishery.

Data has been collected concerning mesh size during 2000-2002. Although data was not collected under consistent study methodology, this data is valuable for determining range of mesh size that would be acceptable in a live capture commercial fishery. Data concerning chinook catches is summarized in Table 3.

Table 3. Summary of Catch Rate, Condition, and Survival for Spring Chinook Captured in Various Springtime Live Capture Test Fisheries, 2000-2002. [+]

Mesh Size	3.5 [a]	4.5 [b]	5.0 c	5.5 [d]	6.0 [e]	6.75 [f]	8.0 [g]	SE [h]
N	343	413	49	213	106	51	836	92
CPUE [i]	1.40	2.34	2.35	3.63	4.61	1.81	Not Reported	4.06
Immediate Mortality [j]	5 (1.5%)	12 (2.9%)	1 (2.0%)	7 (3.3%)	0 (0%)	7 (13.7%)	8 (1.0%)	4 (4.3%)
Total Mortality [k]	N/A	1 of 56 (1.8%	2 (4.1%)	4 of 80 (5.0%)	8 (7.6%)	N/A	51.3%	7 (7.6%)
Capture Condition [l]	1:80% 2:2% 3:13% 4:2% 5:4%	1:72% 2:2% 3:21% 4:0% 5:5%	1:45% 2:0% 3:49% 4:2% 5:4%	1:49% 2:4% 3:39% 4:2% 5:6%	1:48% 2:5% 3:38% 4:5% 5:4%	1:63% 2:19% 3:9% 4:0% 5:9%	1:87% 2:8% 3:4% 4:1% 5:1%	1:38% 2:1% 3:50% 4:1% 5:10%
General Method of Capture [m]	Tooth-Tangle	Max	Max to Pre-opercle	Max to Pre-opercle	Pre-opercle to wedged	Opercle to wedged	Wedged	Same As 5.5

† It is important to note that the information shown above is pooled from various test and experimental fisheries conducted over three years. Many factors varied between these studies, including study protocol, people involved (fishers and agency staff), and data collected.

a CPUE and immediate mortality from 2001 and 2001 test fishing and 2001 permit fishery.

b,d CPUE and immediate mortality from 2001 permit fishery and 2002 test fishing; total mortality from 2002 test fishery.

c,e,h All data from 2002 test fishery.

f CPUE and immediate mortality from 2001 and 2001 test fishery.

g Data from WDFW portion of 2001 joint study.

i Standardized to 150-fathom net length. Depth not standardized; drift times and methodologies vary throughout the studies. CPUE generally represents one drift made with 150-fathoms of gear with total soak time <50 minutes.

j Defined as fish that could not be recovered thus died on-board. Data for 3.5" and 4.5" mesh includes 3:1 hang ratios which appears to cause excessive tangling and increased mortality.

k For 2002 test fishery: total mortality after 48 hours (including immediate mortality); for 8" mesh: "long-term" mortality as calculated from various tag returns.

l Standard ranking scale. 3.5" from 2001 permit fishery and 2001 test fishery, 4.5" and 5.5" from 2001 permit fishery and 2002 test fishery, 6.75" from 2001 test fishery.

m From data collected in 2002 test fishery and general observation.

Data presented in Table 3 shows a consistent trend of decreasing catch rates with decreasing mesh size. For mesh sizes less than 6" immediate mortality rates are stable (0%-3.3%). Condition at capture varies, ranging between 45%-48% for mesh sizes of 5"-6" and ranging between 72%-80% for mesh sizes of 3.5"-4.5". Based on condition at capture, the 2003 study will focus on 3.5"-4.5" mesh nets. Catch per unit effort (CPUE) data shows that mesh size can have a large impact on catch rates; therefore, determining the appropriate mesh size within this range is critical and that range of mesh size is what the proposed study will focus on.

Similar data is available for steelhead; however, sample sizes are small and limit ability to draw conclusion from these data, which is why the proposed study focuses on collecting data specifically for winter steelhead. Data from steelhead are summarized in Table 4.

Tale 4. Summary of Catch Rate, Condition, and Survival for Steelhead Captured in Various Springtime Live Capture Test Fisheries, 2000-2002. [†]

Mesh size	3.5[a]	4.5[b]	5.0[c]	5.5[d]	6.0[e]	SE[f]
N	105	93	7	45	13	9
CPUE[g]	0.44	0.52	0.34	0.75	0.56	0.40
Immediate Mortality[h]	15 (14.3%)	12 (12.9%)	0 (0.0%)	9 (20.0%)	1 (7.8%)	0 (0.0%)
Total Mortality[i]	N/A	4 of 14 (28.6%)	0 (0.0%)	6 of 15 (40.0%)	2 (15.4%)	2 (22.2%)
Capture condition[j]	1: 63% 2: 3% 3: 16% 4: 0% 5: 18%	1: 53% 2: 3% 3: 23% 4: 4% 5: 18%	1: 100% 2: 0% 3: 0% 4: 0% 5: 0%	1: 39% 2: 14% 3: 20% 4: 7% 5: 20%	1: 50% 2: 0% 3: 33% 4: 8% 5: 8%	1: 40% 2: 20% 3: 30% 4: 0% 5: 10%
Method of capture[k]	Tooth-tangle to max	Max to opercle	Max to opercle	Opercle to wedged	Wedged	Same as 5.5

† It is important to note that the information shown above is pooled from various test and experimental fisheries conducted over three years. Many factors varied between these studies, including study protocol, people involved (fishers and agency staff), and data collected.

a CPUE and immediate mortality from 2000 & 2001 test fishing and 2001 permit fishery.

b,d CPUE and immediate mortality from 2001 permit fishery and 2002 test fishing; total mortality from 2002 test fishery.

c,e,f All data from 2002 test fishery.

g Standardized to 150-fathom net length. Depth not standardized; drift times and methodologies vary throughout the studies.

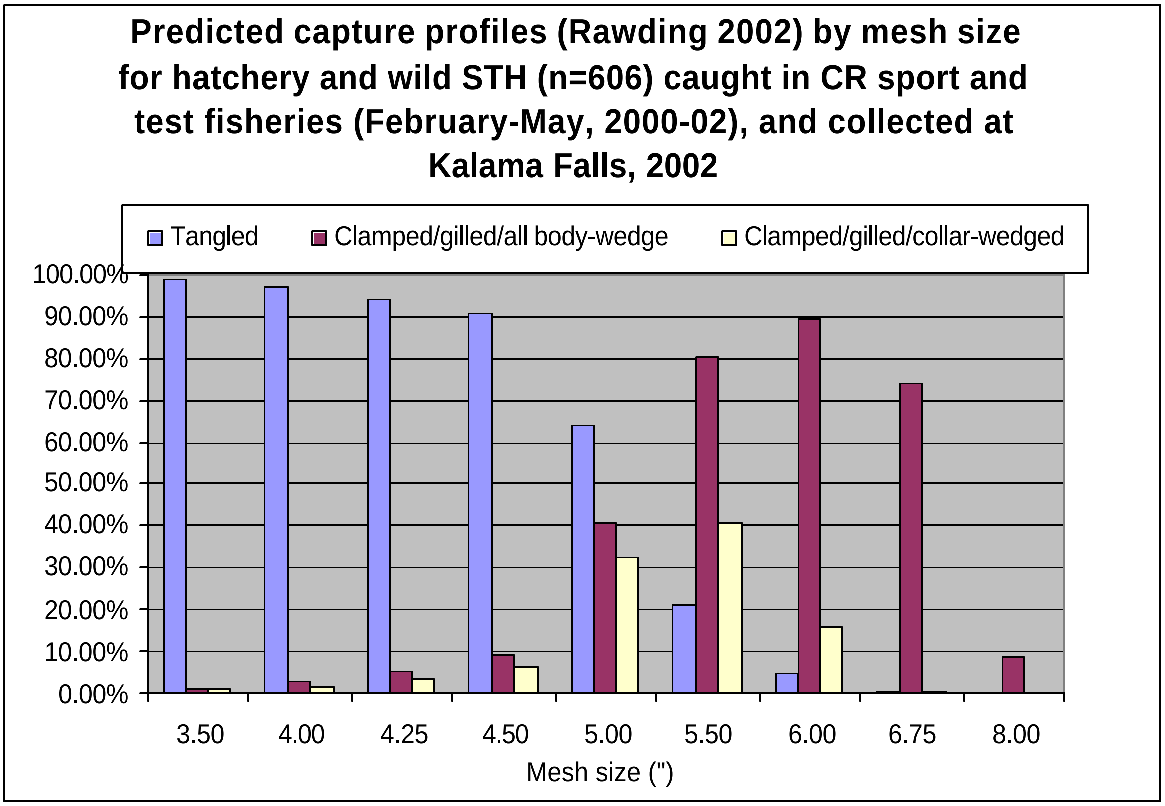
h Defined as fish that could not be recovered thus died on-board. Data for 3.5" and 4.5" mesh includes 3:1 hang ratios that appear to cause excessive tangling and increased mortality.

i From 2002 test fishery: total mortality after 48 hours (includes immediate mortality).

j Standard ranking scale. 3.5" from 2001 permit fishery and 2001 test fishery, 4.5" from 2001 permit fishery and 2002 test fishery, 5.5" from 2001 permit fishery and 2002 test fishery.

[k] From data collected in 2002 test fishery and general observation.

In conjunction with this study, wild steelhead returning to Kalama Hatchery were sampled by Washington Department of Fish and Wildlife staff for frequency and location of net marks (i.e. maxillary, gilled, pectoral fins, body) and measured for length. A series of regressions were developed that correlated capture method, steelhead length, and mesh size. Based on these regressions we have been able to determine the predicted capture method for steelhead as shown in the figure below.



This proposed project will collect data that can be used to evaluate the accuracy of these regressions. This year's study will focus on gear sizes between 4.5" and 3.5" based on this predicted distribution. To date this project has collected data concerning 4½" and 3½" mesh sizes but none in between. Based on the impact of mesh size on chinook CPUE it is important to evaluate a variety of mesh sizes between 3.5" and 4.5" (i.e. 4.25", 4", 3.75", etc..) to identify the optimal balance between minimizing impact to bycatch and effective capture of target species. Results of the project to date have eliminated mesh sizes greater than 4.5" for use in a spring chinook live capture fishery.

As per ISRP comments, the statement of work (narrative section f) has been modified to strengthen and clarify experimental design of each objective. Components now include clearly defined objectives and tasks, study hypotheses, methods, assumptions, identification of data needs, detailing of analysis to be done, and relation to previous work.

ISRP Comment:

b) *The results of the 2002 study of a commercial fishery are initially used as the basis for suggesting more research in 2003 since the bycatch of winter steelhead was so large and inadequate data on mesh size were collected. However, in task 2, these same 2002 data are to be used in establishing the 2003 regulations but in the absence of any results from the 2003 research. How then does the 2003 commercial fishery "experiment" build on new information and how would the steelhead bycatch issue be addressed? For example, what mesh size is proposed for the 2003 fishery?*

To clarify, the gear configuration portion of the 2002 BPA-funded project focussed on spring chinook. The monitoring program documented significant steelhead by-catch in the demonstration fishery. Due to temporal differences in peak abundance of steelhead and spring chinook, the opportunity did not exist to modify the 2002 study design to address this issue. The study proceeded as designed and data collected is adequate to identify appropriate mesh sizes for spring chinook live capture. Because of the magnitude of steelhead by-catch, the focus has changed to identifying mesh sizes that result in benign capture of steelhead while maintaining spring chinook catch efficiency. Post-season analysis has identified potential mesh sizes suitable for addressing the steelhead by-catch issue. Additional field studies are necessary to corroborate predicted methods of capture.

Mesh size used in the 2003 fishery is expected to be determined through the Columbia River Compact process which will include input from the Oregon and Washington Fish and wildlife Commissions. A decision with respect to mesh size is expected to occur in early September.

The decision as to the appropriate mesh size for 2003 will be based on data collected by this project to date with corroboration by the predicted entanglement profiles noted above. Although the data collected to date does not identify the most appropriate mesh size for use in a live capture fishery with commingled species, it does provide information as to mesh sizes that would be inappropriate. The data present in (a) in this response indicates that a mesh size larger than 4½ inches would not be appropriate and based on this data it is expected that the Compact will adopt a mesh size in the range of 3.5" to 4.5" for the 2003 demonstration fishery. It is expected that this mesh size would greatly reduce impact to listed steelhead because the gear would function like a tangle net rather that a gill net for this species. Additionally, use of larger mesh gear earlier in the season may also occur when steelhead abundance is high and chinook abundance is less. Large mesh gear would be used to reduce steelhead handle and would be used at a time that the vast majority of chinook available are hatchery-reared Willamette spring chinook that are 100% mass marked. This management strategy would incorporate two methods of selective fishing, avoidance and benign capture.

ISRP Comment:

c) *Given (b), what is new that would allow improved protection of steelhead in the commercial fishery? What allowable mortality of steelhead and unmarked spring chinook is provided for the experimental commercial fishery and how will it be incorporated in the regulations and monitored? If the fishery is limited to 1-2% of the winter steelhead return, how would you know when such limit was met?*

As described in (b) a mesh size of 3.5"-4.5" will catch steelhead in a benign manner and allow high survival rates of steelhead handled in this fishery. Results of the 2001 study indicate that long-term mortality rate (to spawning grounds) for spring chinook captured using a tangle net was less than half the mortality rate associated with a gill net. Therefore, reducing the mesh size from 5½" to 3½"-4½" would likely reduce the steelhead mortality by half. As shown in Table 4 in (a) the number of steelhead captured in condition 1 increases from 39% with 5" mesh to 53%-63% with 4½"-3½" mesh which suggests overall survival rate to spawning grounds would improve significantly with the use of smaller mesh sizes. The inclusion of steelhead excluding devices onto small mesh tangle nets may also decrease steelhead encounter rates. Large mesh gear may be fished early in the season to reduce steelhead handle by 15%-35%.

The demonstration fishery will be managed under ESA-related guidelines adopted by the NMFS. These guidelines limit impacts to listed winter steelhead and spring chinook to less than 2%. Fishing seasons and associated regulations will be adopted through the Columbia River Compact that is comprised of the states of Oregon and Washington. The Columbia River Compact makes decisions concerning Columbia River fisheries and associated regulations at open public hearings. The Compact will adopt regulations to limit impacts to less than ESA limits. Inseason impacts to listed stock will be updated after each fishing period to determine if additional fishing can occur without exceeding ESA-related guidelines. Impact estimates will be reviewed by the U.S. v Oregon Technical Advisory Committee (TAC) that is comprised of representatives of Oregon Department of Fish and Wildlife, Washington Department of Fish and Wildlife, Idaho Department of Fish and Game, National Marine Fisheries Service, U.S. Fish and Wildlife Service and the four Columbia River treaty tribes.

Impacts to wild steelhead will be estimated using data collected by this project. The number of steelhead captured per marked chinook captured will be estimated using data collected through onboard monitoring. The aforementioned ratio can be applied to the marked chinook catch estimate to determine the steelhead catch estimate. The marked chinook catch estimate is developed by applying the average weight, collected through commercial fishery sampling program, to the pounds of chinook landed, recorded on fish buying tickets. A mortality rate, to be determined by the TAC and based on data collected in task 4.a. and estimated survival rates associated with general methods of capture, will be applied to the steelhead catch to determine steelhead mortalities in the fishery. Steelhead mortalities will be divided by population estimates, also determined by the TAC, to determine the impact rate.

ISRP Comment:

d) *A commercial fishery introduces an additional mortality that small test sampling does not involve, i.e., the potential for multiple encounters and cumulative mortality of the released fish. This issue was asked at the presentation but there did not seem to be a plan to addresses this in the proposed monitoring.*

Taking into account ISRP concerns, as well as our own, the statement of work narrative has been modified to include a simple test of multiple encounter rates. In conjunction with the observation program, we intend to place tags on salmonids about to be released in the demonstration fishery. Tag recovery will become standard data collection within the observation plan. This will be a simple and cost effective method of documenting the extent of multiple encounters. While we may not be able to discern cumulative mortality via this method, any potential increase in mortality would be reflected in the total mortality observed. If the results of this tagging study identify the rate of multiple recaptures as being substantial, the possibility exists to request funding at a later date for a study designed to measure long-term effects of cumulative mortality.

ISRP Comment:

e) *While the committee could infer the definitions of immediate, short-term, and moderate-term mortality; clearly, such fundamental terms should be defined in the proposal. Further, the ISRP has previously asked how delayed mortalities would be measured.*

The definitions of mortality estimates are:

Immediate = Fish that cannot be recovered a condition appropriate for release. Essentially a fish that dies on board.

Short-term = Mortalities that occur within 48 hours of their initial capture time.

Accustomed methods for sport and commercial fisheries are to estimate mortality rates based on short-term mortalities. All but a few catch and release studies have estimated immediate and short-term mortality rates only. The generally held assumption is that the majority of the post-release mortality occurs during the first 48-72 hours. Evidence exists which suggests that most mortality is expected to occur within 8 hours of capture (Wertheimer 1988). This is strengthened by Farrell et al. (2000), which showed low mortality during a 24-hour holding period. This is again corroborated by the preliminary results from our BPA-funded test fishery in 2002. It is important to note that revival methods ranged dramatically between these studies.

Based on this evidence, our short-term holding should reflect a significant portion of the total mortality. The rate obtained from pre-season test fishing will be applied to the fishery to estimate impacts to listed steelhead stocks in-season. This estimate will be updated based on observed mortalities in the fishery. A more refined estimate of mortality will be calculated post-season based on observed long-term survival from objective 1. Most of this work has been completed for spring chinook although verification is necessary as mesh sizes are refined for conservation measures.

ISRP Comment:

> *This proposal is driven by a need to find ways to increase gear selectivity in order to be able to continue in-river commercial fishing on hatchery fish while continuing to protect co-distributed weak stocks. The strategy is to find more selective harvest methods and effective live-release techniques. Although the proposal says it is to evaluate aspects of live capture commercial fishing gears and methods, the project is limited primarily to a single gear (tangle nets) methods of using and configuring that gear (drift length, mesh size, the use of recovery boxes for fish to be released) and the degree it can be used successfully by gillnet fishermen.*

We feel that the use of small mesh tangle nets, combined with proper fish handling and the use of recovery boxes show much promise as live capture methodology. These methods have been demonstrated as an acceptable substitute for gillnetting in British Columbian fisheries under much stricter conservation constraints (DFO 2002). The situation in the Columbia River is similar but has some substantial differences therefore a direct mimicry of British Columbian techniques is not appropriate. We are attempting to evaluate how to best assimilate these concepts into our fisheries and management strategies. While we don't deny the possibility that other methods of live capture selective harvest could be implemented in the lower Columbia River, there are many reasons why they are not appropriate at this time. State agencies have previously conducted small feasibility tests of alternative gears, including beach seines and floating traps. Catches were extremely poor and did not support further investigation or funding requests. Other historical fishing methods, which may be applicable to live capture selective commercial fisheries (fish traps and fish wheels), were operated prior to development of the hydroelectric system and the shipping channel. These changes have drastically altered the geography and hydrology of the lower Columbia River, which likely renders fish wheels and fish traps ineffective in the lower Columbia River. Additionally, fish traps and fish wheels would require building structures to direct fish or support fishing structures, including installing pilings in the Columbia River. These activities are subject to extensive permitting processes and may include additional impacts. Such waterway alterations may not be allowed depending on the fishing location.

Live capture fisheries need to be implemented immediately as a result of the Willamette Spring Chinook Fishery Management Evaluation Plan; therefore, it was necessary to evaluate a fishing method that could be incorporated quickly into the current fishing industry. The tangle net lends itself fully to this need. Fishing techniques with tangle nets is the most similar to traditional gillnetting. The current fishery is structured as individual and independent fishers rather than groups or cooperatives. Other gears such as traps and fish wheels would not be economically feasible for individual fisherman. They would require significant changes to the current fishing community structure.

ISRP Comment:

> *Reference is made to data from previous experiments not being adequate to address certain questions, but it is not clear whether the proposers have a plan to ensure that the proposed work does deliver data adequate to answer the questions. The structure of the experimental design does not seem to have been clearly though about. What statistical analysis is proposed to determine significance of differences? What are the data requirement of this analysis? What sample design follows from the data requirement? How does the beach seine function as a control? It is not clear from the proposal the extent to which the proposed work is new versus a repetition of previously conducted experiments. Objective 2: Continue to investigate feasibility... creates the impression on an ongoing project that will never end.*

Responses to questions on experimental design and how the proposed work is new have been addressed previously in this document. Due to the merge of Projects 35018 and 200100700, the question regarding the proposed control is moot. Again, for clarification, stated deficiencies in previous data collection refer to applications to steelhead. With the focus shifting to address steelhead by-catch issues (including method of capture), and subsequent refinement of appropriate mesh sizes, additional information is needed on effects to the target species, spring chinook.

The goal of objective 4 is to collect data that will be used to determine the most appropriate mesh size for use in a live capture commercial fishery. Evaluation of gear will be based on several criteria: 1) catch rate of target and non-target species; 2) method of capture of target and non-target stocks and species, and 3) immediate and short-term mortality rates of non-target stocks and species. The proposal has two parts focussing on steelhead and spring chinook respectively due to temporal separation of peak run timing.

Captured fish will be will be identified by species and the particular gear they are captured in. Salmonids will be evaluated to determine condition at capture and method of capture (i.e. by teeth, maxillary, pre-opercle, opercle). An assessment of specific external injuries (i.e., scale loss, slime loss, physical damage, etc) will also be recorded. Additionally, biological data such as species, fork length, length-girth relation, stock, fin marks, and other marks (i.e. seal damage, net marks) will also be documented. Salmonids requiring resuscitation will be placed in a recovery box and condition upon removal from the recovery box will be recorded. Data will be summarized to develop species-specific capture and release condition, methods of capture, and injury profiles for each gear and will be analyzed to determine if these variables are related to mesh size. Morphometric data will be used to develop predicted method of capture profiles by mesh size to compare with those observed. Chinook and steelhead captured using tangle nets will be held for 48 hours to determine short-term survival rates. Survival rate data will also be analyzed to determine if short-term survival rates are correlated to mesh size.

Steelhead and spring chinook catch rates will be summarized and condition at capture, method of capture, and release condition profiles will be developed. Statistical differences (P=0.05) in mean CPUE and condition profiles between mesh sizes will be evaluated using ANOVA (general linear models procedure) followed by a Tukey's studentized range test to determine pairwise differences. We will correlate survival rates to mesh size, method of capture, and condition at capture. We will use chi-square analysis to compare observed to predicted capture method profiles.

Objective 5a details methodology pertinent to observation of the demonstration fishery. The monitoring plan proposed in this task is similar to the plan implemented during the 2002 fishery. Data collected will include: 1) catch by species 2) condition of salmonids at capture and release, (including immediate mortalities by species) 3) frequency of recapture, 4) gear specifications including presence and type of steelhead excluding devices, 5) drift and soak time, and 6) environmental conditions (i.e. weather, tides, water condition, etc.). The monitoring plan will include sampling of fish sold to commercial buyers. Data collected at commercial fish processing plants and buying stations will be used to determine total catch and stock composition of landed catch (BPA Project 198201301). Data collected during 2002 were effectively used to closely monitor the fishery to ensure that impacts to listed species did not exceed ESA-related limits.

Data collected by the monitoring program in Task 5a will be summarized to determine catch rates of target and non-target species. Immediate survival, condition profiles at capture and release will be developed for each species handled. Short-term steelhead survival will also be developed and compared to survival rate determined from Task 4a. Data concerning gear used (e.g. mesh size, hang ratio, use of slackers or stringers, and presence and type of steelhead excluding device), area fished, and environmental conditions will also be summarized. Transformed catch rate data will be analyzed for each of these parameters using a general linear models procedure (GLM) followed by a Tukey's studentized range test to determine pairwise differences. Tag recapture rate will be calculated to determine scope of multiple encounters. This will be used to determine need for future investigation into cumulative mortality. Results of these data analyses will be used to modify regulations concerning any future live capture commercial fishery. Finally, gear profiles and monitoring data collected by the monitoring program and enforcement will be used to determine compliance rates for the 2003 demonstration fishery.

Concurrent with Task 5a, fishery observers will apply Floy anchor tags, or similar substitute, to a subsample of the released salmonid catch throughout the fishery and simultaneously monitor the catch to determine the frequency of multiple encounters. Observers will record species, tag number, and biodata detailed in 5a, which includes general comments on any physical damage.

Task 5c is designed to assess the short-term survival of steelhead released in the fishery. Vessels will be dispatched to travel among fishers and randomly collect steelhead that are about to be returned to the water. Steelhead will be evaluated for condition upon receipt and release into net pen, measured for length, and marked with a uniquely numbered anchor tag. Steelhead will be held in a net pen for a minimum of 48 hours and checked with an underwater video camera to avoid constant stressing. Mortalities occurring during the holding period will be documented and condition at release from the holding facility will be determined and recorded. An overall survival rate for steelhead handled in the fishery will be calculated and compared to pre-season rate observed in the test fishery.

The reviewer's exception to the wording of the objective title has been reflected in the revised statement of work narrative.

ISRP Comment:

> *Reference is made to enforcement and compliance- how does this fit with the full observer coverage on vessels? Is enforcement a post-project issue? Further, enforcement and compliance are fishermen behavior issues that the fishery should pay, for at least, contribute to. The development of these fishing techniques clearly is to the benefit of those fishers, have they been approached to monitor their fishery?*

The onboard monitoring portion of this proposal is designed to provide a sampling of the demonstration fishery. We feel that during the early stages in the development of this fishery, it is most appropriate to have objective observers collecting catch and effort data. If this fishery becomes established, fishers may be able to provide this same data via logbooks or some similar reporting method. While the observer program is set up to collect information on gear specifics and soak times, these data are used primarily to evaluate the biological aspects of the fishery. A secondary use is to measure compliance with regulations. The role of law enforcement in all commercial fisheries belongs to Washington Department of Fish and Wildlife Enforcement and Oregon State Police personnel. State management agencies cooperate with enforcement to identify and resolve issues post-season. Enforcement dollars requested in this proposal are in excess of regular enforcement efforts already provided. During the 2002 fishery over 1,000 hours were logged to enforce regulations associated with the demonstration fishery.

ISRP Comment:

> *Why does this need to be a five-year project? A strong justification would be needed for 5 years.*

The project is only expected to last for a three-year period. We have submitted a modified proposal to reflect that.

ISRP Comment:

> *The ISRP clearly sees the merit in developing new fishing techniques given the number of factors limiting fisheries in the Columbia River. However, the provision for these fisheries must stand-up to technical review and compliance with ESA limits on protected stocks. Based on the material presented in this proposal we cannot*

> *make that assessment and cannot, at this time, conclude that this new proposal would provide a sound scientific basis for such an assessment.*

We hope that this response has been adequate in addressing these concerns.

ISRP Comment:

> *Note: Objective 1 of this study is very similar to the study proposed by WDFW (#35018), both use radio tagging of fish captured and released from experimental fishing but differ in the methods proposed to capture fish for control treatments. Objective 2 is specific to this proposal. It should not be necessary for the Council to consider two essentially identical research projects on this issue. The proponents should reconcile these two proposals before any further funding is provided, including their respective definitions of soak times.*

We (ODFW and WDFW) selected objective 1 from Project 35018. Please see a more detailed explanation in the response for Project 35018.

References:

DFO (Department of Fisheries and Oceans Canada). 2002. Selective (Salmon) Fisheries Program. Final Report.

Farrell, A. P., P. Gallaugher, C. Clarke, N. DeLury, H. Kreilberg, W. Parkhouse, and R. Routledge. 2000. Physiological status of coho salmon (*Oncorhynchus kisutch*) captured in commercial nonretention fisheries. Canadian Journal of Aquatic Science 57:1668-1678.

Wertheimer, A. 1988. Hooking mortality of chinook salmon released by commercial trollers. N. Am. J. Fish. Manag. 8: 346-355.

Bonneville Power Administration
FY 2003 Provincial Project Review

Mainstem & System-wide Province

First, read the help documents

Please carefully read the **Proposal Development and Selection Criteria** document, which contains information on the review process, and the **instructions** document, which provides field- and content-related help for the form. If you are missing either document, please visit http://www.cbfwa.org/reviewforms/systemwide/default.htm or call 503-229-0191.

Important notes

- This form is to submit projects or proposals for BPA FY 2003-5 funding for Mainstem & System-wide Province only.
- This document is only available for Word97/Word2000/WordXP. Do not save down to older formats, or use in another word processor such as WordPerfect, even if it supports Word conversions. You will lose the auto-calculations, and won't be able to add or delete table rows. You may also risk not being able to re-open the document.
- Some help text is included as "hidden" comments on the data form, which is displayed by resting the mouse cursor over any yellow text (usually section headings or field names)
- Use these keystroke macros to assist you in the form. If the macros aren't available (nothing happens when you press these keys), then you need to enable macros in Word: In Word97, close the proposal, then open again and choose Enable macros if prompted. In Word2000/XP, close the proposal, choose Tools, Macro, Security, and set the security level to medium. Re-open the proposal and choose Enable macros when prompted.

To	Press
insert rows in tables	Alt-R and you'll be asked whether to insert a row at the current position or add one to the end of the table
delete rows in tables	Alt-D at the row you want to delete
calculate budget totals	Alt-C either periodically, or when you're done with the form
Spellcheck	Alt-S

Steps to complete the form

1) First, read the help documents (get them at http://www.cbfwa.org/reviewforms/systemwide/default.htm)
2) There are two documents to this form:
   a) Part 1 (**blank_sys.doc)** consists of administrative and budgeting information. Your input is restricted to the grey fields.
   b) Part 2 (**narrative.doc)** allows you to describe your project at length, including maps, tables, graphics, etc.
3) Save this as something other than blank_sys.doc. Preferably, use the BPA 9-digit project number, like "198906200.doc" or if your project has no project number, the first few words of the title, like "RestoreFish.doc", and a proposal number will be assigned to you by BPA upon receipt of your proposal.
4) Your cursor is already in the first input field, Title of Project, so start typing

5) Fill in all fields (gray boxes) pressing Tab to advance from one field to the next
6) Press Alt-C when complete to calculate totals
7) Save document, then open **narrative.doc** to begin Part 2.
8) Please print the completed documents. Part 1 prints in landscape (sideways) orientation, Part 2 in portrait (regular).

Save the documents and then **email** your forms and any attachments to fwproposals@bpa.gov. **NOTE: BPA cannot receive e-mails larger than 5 MB.** Or mail paper and diskette(s) to:

Bonneville Power Administration
Attention: Cate Hanan - KEWB-4
FY 2003 Proposals – Mainstem & System-wide Province Review
905 NE 11th Avenue
Portland, OR 97232

9) Monitor the http://www.efw.bpa.gov/cgi-bin/FW/02MainstemSystemwide.cgi.website to verify your project funding request is received and posted correctly.

All projects must be received no later than 5:00pm PST on Monday, June 3, 2002.
No late proposals will be reviewed for FY 2003 funding.

PART 1 of 2. Administration and Budgeting

Section 1 of 10. General administrative information

Title of project
Evaluate recreational and commercial mark-selective fisheries.

BPA project number 35018 &

Business name of agency, institution or organization requesting funding
Oregon Department of Fish and Wildlife; University of Idaho; Washington Department of Fish and Wildlife

Business acronym (if appropriate) ODFW; UI; WDFW

Proposal contact person or principal investigator:

Name Geraldine Vander Haegen
Mailing Address 600 Capitol Way N
City, ST Zip Olympia, WA 98501
Phone 360-902-2793
Fax 360-902-2944
Email address vandegev@dfw.wa.gov

Manager of program authorizing this project Jim Scott

Location of the project

Latitude	Longitude	Description
-121°56'23" W	45°38'41" W	Bonneville Dam
-122°54'56"W	46°05'44" N	Mouth of Cowlitz River (downstream of Bonneville Dam)
-122°52'29" W	46°02'02" N	Mouth of Kalama River (downstream of Bonneville Dam)
-123°34'73" W	46°15'09" N	Lower Columbia River downstream of Bonneville Dam and river mile 35

Target species

Steelhead (could include all five listed Columbia River species: Lower, Upper, Mid, Snake, and Upper Willamette), chinook (could include all four listed Columbia River species: Lower, Upper Spring, Snake Spring/Summer, and Upper Willamette), and coho.

Short description

Estimate post-release survival of steelhead bycatch in tangle net fisheries. Evaluate post-release spawning success of spring chinook and steelhead. Measure hooking mortality in recreational salmon fisheries. Evaluate commercial fishing gears.

RPAs. View guidance on proposal development and selection criteria named mainstem_systemwidecriteria.pdf, available as a link from the main proposal solicitation page. Indicate what, if any, ESA Biological Opinion action(s) will be met by the proposed project. Explain how and to what extent the project meets the ESA requirement.

NMFS and/or FWS Reasonable and Prudent Alternatives (RPA)

RPA Number	Description
NMFS 164	We will evaluate selective fishing methods and gear that enable fisheries to target unlisted fish while holding incidental impacts on listed fish (steelhead and chinook) within NMFS-defined limits.
NMFS 165	We will contribute data and estimated rates that lead to improvement in methods and analytical procedures to estimate fishery and stock-specific management parameters.
NMFS 166	We will address changes in catch sampling programs by providing funds to monitor a commercial selective fishery. We will collect data during this fishery that is not available through existing sampling programs. This project will increase sampling of landed catch to ensure that coded-wire tag recoveries are adequate to determine landed catch stock composition.
NMFS 167	We will develop improved methods for estimating incidental mortalities in fisheries with particular emphasis on selective fisheries in the Columbia River basin.

Information transfer	
The expected outcomes of this project are (check one) ☒ quantitative ☐ qualitative ☐ indirect Data generated by this project are (check one) ☒ primary ☐ derived ☐ indirect Are there restrictions on the use of the data? (check one) ☒ none ☐ non-commercial use only ☐ educational use only ☐ requires prior approval ☐ sensitive ☐ proprietary, no public distribution	Where do the data reside (check one or more)? Private/managed locally: ☒ printed ☒ electronic Public access: Printed at ☒ BPA ☒ Peer-reviewed journal or other Internet at ☐ BPA ☐ StreamNet ☐ Fish Passage Center ☒ DART or other web address http://www.wa.gov/wdfw/fish/commercial/selective http://www.dfw.state.or.us/ODFWhtml/infocntrfish/interfish/index.html

In what other ways will information from this project be transferred or used?

This information will be used by WDFW and ODFW to set fisheries that meet ESA and other wild stock conservation objectives. We will present the results at workshops for fishers, at appropriate scientific conferences, in internal agency reports, and in Fact Sheets used at Columbia River Compact public hearings. Results will be submitted to a peer-reviewed journal for publication.

Section 2 of 10. Past accomplishments

Year	Accomplishment
2002	BPA funded study: Captured spring chinook in 4.5 and 5.5 inch multi-strand tangle nets to evaluate post-release mortality
2002	Developed methods for evaluating the spawning success of hatchery fish captured and released in commercial fishing gears.
2002	Hatchery Scientific Review Group (HSRG) study: Evaluated post-release survival of coho captured in tangle and gill nets on the Willapa River
2002	WDFW/ ODFW implemented mark selective tangle net fishery.
2002	BPA funded study: Compared mesh size, hang ratio, and use of stringers and slackers in a live capture fishery.
2002	BPA funded study: Tested logistics of gear and methods by adopting and managing a full fleet live capture commercial demonstration fishery.
2002	Report: Evaluate Live Capture Selective Harvest Methods (WDFW #FPT 02-01)
2001	BPA funded study: Captured spring chinook in 3.5, 4.5, 5 and 8 inch nets to evaluate post-release mortality.
2001	Developed internet site to disseminate commercial selective fishing information.
2001	BPA funded study: Captured spring chinook in a fish trap as an alternative to gill net fishing and means to selectively capture spring chinook.

Year	Accomplishment
2001	BPA funded study: Adopted a 20-boat permit fishery to test mesh size and use of stringers and slackers for capturing spring chinook selectively.
2001	NOAA funded study: Captured fall chinook in tangle nets and gill nets to evaluate post-release mortality in Puget Sound.

Section 3 of 10. Relationships to other projects

Project #	Project title/description	Nature of relationship
4684	Evaluate Live Capture Selective Harvest	Builds on work we did on this project.
23036	Evaluate Live Capture Selective Harvest	Builds on work we did on this project.
	Monitoring the Reproductive Success of Spring Chinook in the Wenatchee, Tucannon, and Kalama rivers.	Our project is dependent on this proposal by Todd Pearsons (WDFW) for our Objective 2.
198201301	Coded-wire tag recovery project	Data collected by this project will be used by the coded-wire tag recovery project to reconstruct stock specific returns of spring chinook.
198201302	Annual stock assessment coded-wire tag program (ODFW)	This study will sample selective fisheries and recover coded-wire tags that were applied to spring chinook as part of this stock assessment program.
198201303	Annual stock assessment coded-wire tag program (WDFW)	This study will sample selective fisheries and recover coded-wire tags that were applied to spring chinook as part of this stock assessment program.
198201304	Annual stock assessment coded-wire tag program (USFWS)	This study will sample selective fisheries and recover coded-wire tags that were applied to spring chinook as part of this stock assessment program.

Section 4 of 10. Estimated budget for Planning & Design phase

Task-based estimated budget

Objective (1. text, 2. text...)	Task (a. text, b. text...)	Task duration in FYs	Estimated FY 03 cost	Subcontractor
				☐
				☐

Objective (1. text, 2. text...)	Task (a. text, b. text...)	Task duration in FYs	Estimated FY 03 cost	Subcontractor
				☐
				☐
				☐
				☐
				☐
				☐
				☐
				☐
				☐
				☐
		Total	$ 0	

Out year objective-based estimated 2004 - 2007 budget

Objective (1. text, 2. text...)	Starting FY	Ending FY	Estimated cost
			0
			0

Out year estimated budgets

	FY 2004	FY 2005	FY 2006	FY 2007
Total budget	$0	$0	$0	$0

Section 5 of 10. Estimated budget for Construction/Implementation phase

Task-based estimated budget

Objective (1. text, 2. text...)	Task (a. text, b. text...)	Task duration in FYs	Estimated FY 03 cost	Subcontractor
1. Using a series of mark-recapture experiments, and using fish trapped in the	Task 1.a: Capture, describe, tag, and release adult winter steelhead in the	3	242,401	☐

Objective (1. text, 2. text...)	**Task (a. text, b. text...)**	**Task duration in FYs**	**Estimated FY 03 cost**	**Subcon-tractor**
adult collection facility in Bonneville Dam as controls, estimate the survival of adult winter steelhead captured and released from two sizes of tangle nets.	mainstem Columbia River.			
1.	Task 1.b: Capture, tag and release adult winter steelhead using the adult collection facility in the Washington shore fish ladder at Bonneville Dam.	3	90,239	☐
1.	Task 1.c: Track adult winter steelhead as they move in the mainstem Columbia River and up tributaries, on spawning grounds, at hatcheries and in fisheries. Retrieve tags from hatcheries, spawning ground surveys and fisheries.	3	65,017	☐
1.	Task 1.d: Summarize and analyze tag data.	3	17,911	☐
2. At Cowlitz and Kalama hatcheries, compare the egg-to-fry survival of females captured and released from tangle nets fertilized with males captured and released from tangle nets to the egg-to-fry survival of fish not captured in the gears.	Task 2.1a: Capture, describe, tag and release adult winter steelhead and spring chinook at the mouth of the Cowlitz and Kalama rivers.	3	183,313	☐
2.	Task 2.b: Compare the condition and spawning success of steelhead captured in tangle nets with steelhead not capture in tangle nets and of spring chinook captured in tangle nets with spring chinook not captured in tangle nets.	3	28,952	☐
2.	Task 2.c: Compare spawning success of tagged and untagged spring chinook salmon in Kalama River.	3	20,970	☐
2.	Task 2.d: Summarize and analyze data.	3	21,672	☐
3. Estimate the long-term survival of	Task 3.a: Capture, describe, tag, and	3	110,333	☐

Objective (1. text, 2. text...)	Task (a. text, b. text...)	Task duration in FYs	Estimated FY 03 cost	Subcontractor
spring chinook, fall chinook and coho salmon captured and released during recreational fisheries.	release spring chinook, fall chinook and coho salmon in the mainstem Columbia River below Bonneville Dam.			
3.	Task 3.b: Capture, tag and release spring chinook, fall chinook and coho salmon using the trap in the Washington shore fish ladder at Bonneville Dam.	3	24,275	☐
3.	Task 3.c: Retrieve tags on spawning grounds, at hatcheries and in fisheries.	3	11,883	☐
3.	Task 3.d: Summarize and analyze tag data.	3	29,505	☐
4. Determine effects of varying net mesh size on species-specific catch rates, condition at capture profiles, and immediate and short-term survival rates of adult spring chinook and steelhead	Task 4.a: Determine the effects of mesh size on catch rates, condition at capture, and immediate and short-term survival rates of steelhead.	ongoing	79,032	☐
4.	Task 4.b: Determine the effects of mesh size on catch rates, condition at capture, and immediate and short-term survival rates of spring chinook.	ongoing	87,412	☐
5. Determine the feasibility of using refined live capture selective fishing methods and gear in a full fleet commercial fishery.	Task 5.a: Adopt and monitor a full fleet demonstration fishery that incorporates live capture fishing gears and methods to capture marked hatchery spring chinook while minimizing mortality and impacts to steelhead and unmarked spring chinook..	ongoing	259,641	☐
5.	Task 5.b: Determine the multiple encounter rate of spring chinook and steelhead in the 2003 demonstration fishery.	ongoing	33,805	☐
5.	Task 5.c: Determine short-term survival rate of steelhead caught in the 2003 demonstration fishery.	ongoing	24,483	☐

Objective (1. text, 2. text...)	Task (a. text, b. text...)	Task duration in FYs	Estimated FY 03 cost	Subcontractor
5.	Task 5.d: Summarize and analyse data to determine catch and recapture rates, immediate and short-term survival, and condition at capture profiles.	ongoing	13,309	☐
		Total	$1,344,153	

Out year objective-based estimated 2004 - 2007 budget

Objective (1. text, 2. text...)	Starting FY	Ending FY	Estimated cost
1. Using a series of mark-recapture experiments, and using fish trapped in the adult collection facility in Bonneville Dam as controls, estimate the survival of adult winter steelhead captured and released from two sizes of tangle nets.	2004	2005	716,734
2. At Cowlitz and Kalama hatcheries, compare the egg-to-fry survival of females captured and released from tangle nets fertilized with males captured and released from tangle nets to the egg-to-fry survival of fish not captured in the gears.	2004	2005	245,307
3. Estimate the long-term survival of spring chinook, fall chinook and coho salmon captured and released during recreational fisheries.	2004	2005	337,594
4. Determine effects of varying net mesh size on species-specific catch rates, condition at capture profiles, and immediate and short-term survival rates of adult spring chinook and steelhead	2004	2005	358,272
5. Determine the feasibility of using refined live capture selective fishing methods and gear in a full fleet commercial fishery.	2004	2005	712,989

Out year estimated budgets for construction/implementation phase

	FY 2004	FY 2005	FY 2006	FY 2007
Total budget	$1,172,384	$1,198,512	$0	$0

Section 6 of 10. Estimated budget for Operation & Maintenance phase

Task-based estimated budget

Objective (1. text, 2. text...)	Task (a. text, b. text...)	Task duration in FYs	Estimated FY 03 cost	Subcon-tractor
NA	NA	NA	0	☐
				☐
				☐
				☐
		Total	$ 0	

Out year objective-based estimated 2004 - 2007 budget

Objective (1. text, 2. text...)	Starting FY	Ending FY	Estimated cost
NA	0	0	0

Out year estimated budgets for operations & maintenance phase

	FY 2004	FY 2005	FY 2006	FY 2007
Total budget	$0	$0	$0	$0

Section 7 of 10. Estimated budget for Monitoring & Evaluation phase

Task-based estimated budget

Objective (1. text, 2. text...)	Task (a. text, b. text...)	Task duration in FYs	Estimated FY 03 cost	Subcon-tractor
NA	NA	NA	0	☐
				☐
				☐
				☐

Objective (1. text, 2. text...)	Task (a. text, b. text...)	Task duration in FYs	Estimated FY 03 cost	Subcontractor
		Total	$ 0	

Out year objective-based estimated 2004 - 2007 budget

Objective (1. text, 2. text...)	Starting FY	Ending FY	Estimated cost
NA	0	0	0

Out year estimated budgets for monitoring & evaluation phase

	FY 2004	FY 2005	FY 2006	FY 2007
Total budget	$0	$0	$0	$0

Section 8 of 10. Estimated budget summary

Itemized estimated budget

Item	Note	FY 2003
Personnel	FTE: 9.9	384,762
Fringe benefits		116,886
Supplies, materials, non-expendable property	Nets, Contract boats and fisherman, fish holding facilities	509,569
Travel	to and from work site and travel to conferences	62,543
Indirect costs	WDFW,ODFW, UI	196,393
Capital acquisitions or improvements (e.g. land, buildings, major equip. over $10,000)	Truck and radio recievers	74,000
NEPA costs	0	0
PIT tags @$2.25/ea	# of tags: 0	0
Subcontractor	0	0
Other	0	0

Total BPA funding request	$1,344,153

Total estimated budget

Total FY 2003 project cost	$1,344,153
Amount anticipated from previously committed BPA funds (carryover)	- $0
Total FY 2003 budget request	$1,344,153
FY 2003 forecast from FY 2001	$0
% change from forecast	0.0% increase

Reason for change in estimated budget
NA

Reason for change in scope
NA

Cost sharing

Organization	**Item or service provided**	**Amount ($)**	**Cash or in-kind?**
WDFW--Olympia office	Biometrician	7,307	in-kind
WDFW--Olympia office	Computer leases	1,155	in-kind
WDFW--Olympia office	Misc. rec boxes, pumps, GPS, life jackets, etc.	6,015	in-kind
WDFW--Olympia office	boats	24,060	in-kind
WDFW--Vancouver office	Personnel and office space and equipment	22,300	in-kind
ODFW	Personnel and office space and equipment	51,660	in-kind
	Total cost-share	$112,497	

Out year budget totals

	FY 2004	**FY 2005**	**FY 2006**	**FY 2007**
Planning & design phase	0	0	0	0
Construction/impl. phase	1,172,384	1,198,512	0	0
O & M phase	0	0	0	0
M & E phase	0	0	0	0
Total budget	$1,172,384	$1,198,512	$ 0	$ 0

Other budget explanation

NA

Part 1 of 2 complete!

Press Alt-C to calculate totals on the document. If any totals don't match, you'll see a message.
Then save this document, and open "narrative.doc" to begin Part 2, which includes Sections 9-10.

Bonneville Power Administration
FY 2003 Provincial Project Review

PART 2. Narrative

Important notes

Unlike Part 1, this document is unprotected, meaning it does not restrict where you provide input. Please only type in the places indicated and do not delete section headings. Any changes to this document aside from normal input may invalidate the form during automated processing.

Steps to complete Part 2

1. Provide as much detail as you need in the spaces marked "(Replace this text with your response in paragraph form)." Do not leave parentheses around your response.
2. If appropriate, insert tables, graphics or maps into this document. For help in adding graphics, contact Amy Langston at 503-229-0191 or sysadmin@cbfwa.org.
3. This document will be used on the Internet. If you make reference to online documents, include web addresses and use Word's hyperlink tool to make those addresses active links in the document. Contact Amy for help.
4. You can spellcheck this document using Word's spellcheck tool.
5. Save this document using the same name you used for Part 1 but add an N to the end, like "198906200n.doc".
6. Return the two documents as indicated in Part 1 instructions.

Project ID:

Title: Evaluate recreational and commercial mark-selective fisheries.

Section 9 of 10. Project description

a. Abstract

Columbia River fishery managers have implemented mark-selective fisheries in both the commercial and recreational sectors to preserve declining and listed salmonid populations while providing harvest on healthy stocks. In these fisheries, the marked fish (hatchery-origin) may be retained while the unmarked portion (which would include listed wild stocks) must be released. The assumption is that the survival of the released fish is high enough that they will contribute to rebuilding weak populations. Previous work introduced tangle nets as a selective gear for the commercial sector, and estimated the post-release survival of spring chinook salmon. However, the 2002 fishery opened with this gear to target spring chinook resulted in a high by-catch of steelhead, with unknown effects to the population. We propose to estimate the survival of steelhead captured and released from a tangle net that would be suitable for harvesting spring chinook salmon. Our previous work evaluating post-release survival of spring chinook salmon released from tangle nets indicated about 95% survival, but did not evaluate the effects on spawning success. We propose to estimate the effect of capture and release from a tangle net on the condition and spawning success of spring chinook salmon and steelhead in the Kalama and Cowlitz river systems. There have been numerous studies estimating hooking mortality from recreational fisheries, and these have shown that the rates vary by location and gear type. The survival of spring chinook, coho and fall chinook captured and released in a mark selective recreational fishery is required for accurate fishery management, run size estimation, and recovery efforts on the Columbia River. We propose to estimate these survival rates using a series of mark-recapture experiments over the next three years. The configuration of the tangle net can influence the manner in which a fish is captured, and affect its survival. We propose to continue evaluating different net configurations to optimize immediate survival. Finally, the we will evaluate the performance of a full-fleet commercial mark-selective fishery targeting spring chinook with tangle nets in terms of immediate mortality, capture of non-target species (particularly steelhead) and compliance with fishing regulations.

b. Technical and/or scientific background

Harvest of hatchery fish is important to sport, commercial and tribal fishers but has been limited because of declining runs and the listing of at least 12 Evolutionarily Significant Units (ESUs) under the Endangered Species Act (ESA). The intermingling of strong unlisted stocks with weak stocks has resulted in the development of mark-selective fisheries in the mainstem Columbia River. The goal of these fisheries is to provide fishing opportunity while maintaining protection of listed stocks. The premise of mark-selective fisheries is that the released fish (both non-target stocks, and non-target species) survive to contribute to rebuilding their populations, but this assumption is largely untested. It is already clear that many fishing gears and methods can be adapted to mark-selective fisheries, but the validity of these fisheries as a conservation tool requires further examination.

Our proposal addresses three specific aspects of mark-selective fisheries that are required for evaluating this tool for stock recovery. First, we will estimate the survival of steelhead captured and released from a tangle net suitable for harvesting spring chinook salmon. Second, we will estimate the effect of capture and release from a tangle net on the condition and spawning success of spring chinook salmon and steelhead. Third, we will estimate the long-term survival of spring chinook, fall chinook and coho salmon captured and released from a mark-selective recreational fishery.

In 2001, the Bonneville Power Administration partnered with WDFW and ODFW to evaluate tangle nets for a commercial mark-selective fishery of spring chinook on the Columbia River (Vander Haegen, Yi, and Ashbrook 2002). Experienced gill netters simultaneously fished tangle nets (3.5" and 4.5" mesh size) and conventional gill nets (8" mesh size) on the Columbia River to evaluate their effectiveness for live release of non-target stocks of spring chinook salmon. Live fish were tagged and released for recovery in sport fisheries, commercial fisheries, at hatchery racks and traps, and during spawning ground surveys. Control fish that had not been captured in the test gears were tagged and released from an adult trap in Bonneville Dam, just upstream of the fishing area. The 4.5" tangle net was as effective for capturing spring chinook salmon as the conventional gill net, but the 3.5" net caught significantly fewer spring chinook salmon than the 8" gill net. Fish were generally captured in good condition. The immediate survival (from capture to release from the boat) of adult spring chinook salmon captured in the 8" gill net was 99%, compared to 96% from the 3.5" tangle net, and 97% from the 4.5" tangle net. However, spring chinook salmon released from the tangle nets were recovered at about 91% of the rate of controls, while spring chinook salmon released from the conventional gill net were recovered at about 50% of the rate of the controls. These tests showed that using conventional gear with short soaks and careful fish handling is not enough to ensure the survival of released spring chinook salmon. However, switching to the 4.5" or 3.5" tangle net, coupled with short soaks and appropriate fish handling is a viable selective harvest gear for the commercial gill net fleet fishing for spring chinook salmon on the Lower Columbia River because the post-release mortality on non-target stocks can be greatly reduced compared to a conventional gill net, without sacrificing catch efficiency.

Based partly on these results, a commercial tangle net fishery using nets up to 5.5" was opened in spring 2002, and 15,000 marked spring chinook were harvested. However, 21,600 wild and hatchery steelhead were also encountered, and most were gilled in the 5.5" nets. The mortality of these released fish is unknown, but is important because wild steelhead are listed under the Endangered Species Act, and require protection by fishery managers. Many steelhead could be avoided by scheduling the spring chinook commercial fishery later in the season, but this would interfere with the sport fishery. Two other options remain, and will be evaluated in this study. First, if steelhead tolerate capture and release well, then the impact of this fishery on their recovery may be minimal. Second, there are some indications from previous studies that steelhead tend to be encountered in the top portion of the net, and could be avoided by using a large-meshed section of net near the surface they could pass through unimpeded.

While tangle nets were shown to reduce post-release mortality of spring chinook salmon, it is still important to understand how the stress related to this capture method may affect reproduction and gamete quality of the released fish. The stress response can be maladaptive to reproductive fitness (Shreck 2000), so while spring chinook salmon survived capture and release, their ability to reproduce may have been impaired, countering the potential conservation benefits of increased survival. Successful spawning is dependent on many variables; physiological health is important. Farrell et al. (2000) found that regardless of seine, troll or gill net, all coho salmon arrived onboard in a state of severe metabolic exhaustion. Farrell et al. (2001) found successful physiological recovery in coho salmon with the use of a newly designed Fraser (recovery) box in combination with soak time and careful fish handling. Another cause of physiological stress may be superficial injuries. With many fish being released during the 2002 fisheries, technicians at the Columbia River dams brought to our attention that many fish appeared to have fungus and skin loss as a result of capture in tangle nets (Figure 1). These types of injuries have been previously unreported, and it is not yet known whether they are caused by capture in the tangle net, nor what their long-term effect would be.

Figure 1: Adult chinook salmon (May, 2002) observed at the Smolt Monitoring Facility with fungus and skin loss that could result from capture in tangle net gear.

We propose to evaluate the reproductive consequences of capture and release for steelhead and spring chinook salmon at two hatcheries on the Columbia River. Neidig et al. (2000) found the best indicators to assess spawn quality in snook included percent fertilization, percent hatch, and percent survival to first feeding. In 2001, Ashbrook and Vander Haegen developed methods to assess percent fertilization, percent hatch, and percent survival to first feeding in coho at the Forks Creek Hatchery in Willapa Bay. While these methods rely on fish returning to hatcheries, they will give an indication of potential reproductive effects on wild fish. Injuries related to capture and release will be assessed, and their effect on spawning observed.

In the Columbia River, a variety of sport gears are used to harvest salmonids in mark-selective fisheries. As in the commercial sector, the premise of successful recovery for weak stocks is adequate survival of the released fish. Recreational fishery mortality has been estimated in many studies but the mortality rates have shown considerable variability. Difficulty in isolating factors and the fact that the studies themselves also cause some level of mortality make definitive studies unlikely (Bendock and Alexandersdottir, 1993; Gjernes et al., 1993; Muoneke and Childress, 1994; Schisler and Bergersen, 1996). As a result, fish managers have agreed to assume a 10% mortality rate for fish caught and released in Columbia River recreational fisheries and recommend that this figure be updated on a regional basis. One very popular Columbia River recreational fishing area is just below the Bonneville Dam. We propose to estimate long-term mortality of fish released during recreational mark-selective fisheries in this area. Not only will this study provide a more realistic mortality estimate, it will also provide an opportunity to educate anglers on fish handling—another suggestion outlined in the Mainstem Harvest Methods report to further reduce mortality associated with recreational selective fisheries.

To be successful, selective fishing gears must meet the harvest objectives of the fishing industry (commercial or recreational) as well as being an appropriate conservation tool. Gear modifications for successful harvest include changing the mesh size, and the manner in which the mesh is hung. However, live capture selective harvest practices are not limited to changes in net construction. Other components include reducing the soak time (the time from when the first cork enters the water until the last cork is removed from the water), shortening the net length, the use of careful handling techniques to minimize injuries, and recovery boxes for reviving fish before release. Our proposal addresses two specific aspects of selective fisheries that relate to the harvest objectives. Our fourth objective is to define the most appropriate mesh size for harvesting spring chinook salmon while minimizing harm to other species. Our fifth objective is to examine the feasibility of using refined live capture selective fishing methods and gears in a full fleet commercial fishery.

Our work funded by the BPA in 2001 included a commercial fishery that permitted 20 vessels to participate using tangle nets with mesh sizes from 3.5" to 6.0". Each vessel was equipped with a recovery box and observers were on board to monitor fish handling and record data. Fishers were allowed to retain marked spring chinook salmon, but had to release unmarked fish. The immediate mortality was less than 10%, and most fishers were able to quickly adapt their fishing practices to minimize injury to the unmarked fish. In 2002, a full fleet commercial mark-selective fishery for spring chinook salmon was opened which allowed mesh sizes up to 5.5", maximum soak times of 45 minutes, maximum net lengths of 150 fathoms, and required that all lethargic or injured fish be placed in a recovery box before release. This fishery was effective at harvesting hatchery fish while the immediate mortality of unmarked spring chinook salmon was less than 1% and the immediate mortality of steelhead was less than 2%. Steelhead encounters far exceeded expectations in part due to the large returns that were effectively captured in the 5.5" gear. Results of the 2002 fishery clearly indicated that additional effort are needed to determine the most appropriate mesh size to target hatchery spring chinook salmon and reduce bycatch, primarily winter steelhead. We propose to continue working with the commercial fishing industry over the next three years to collect data concerning this issue.

c. Rationale and significance to Regional Programs

Salmon harvest on the Columbia River has important economic, social, and cultural benefits. Strong stocks that can sustain harvest are intermingled with weak stocks that must be protected. Traditional fisheries (i.e. those that are not mark-selective) may meet harvest objectives, but are no longer acceptable because they cannot protect weak stocks. Mark-selective fisheries may be a viable alternative to fishery closures, but the premise that the released fish survive must be tested before managers and fishers can be assured that they are adequately protecting the weak stocks. We propose to estimate the post-release survival of steelhead that are captured during a selective tangle net fishery, and of coho, fall and spring chinook that are captured during a selective sport fishery. We will also evaluate the spawning success of steelhead and spring chinook captured and released from tangle nets. We will evaluate the potential for avoiding steelhead using drop-nets (also known as weedlines) during the spring chinook fishery. This proposal builds on our previous work to answer important questions about the effects of mark-selective fisheries on released fish (non-target stocks and non-target species). A compelling aspect of our research is the availability of uncaptured controls that are rarely used in other estimates of incidental mortality related to fishing. Finally, the behavior of an entire fleet using selective fishing gears may be quite different from a test fishery. We will work with the fishing industry to define the most appropriate gear configurations, and to monitor the actual catch and mortality levels of spring chinook and steelhead during a full fleet fishery.

This proposal meets all of the criteria for consideration for funding within the Mainstem and Systemwide Provincial Review. It works towards Goals 1 (Avoid jeopardy and assist in meeting recovery standards for Columbia Basin salmon, steelhead, bull trout, sturgeon and other aquatic species that are affected by the FCRPS) and Goal 3 (Assure tribal fishing rights and provide non-tribal fishing opportunities) of the All-H strategy in the five-year ESA implementation plan for the FCRPS Biological Opinions. Our proposal will evaluate whether mark-selective fisheries are a legitimate means of providing fishing opportunities, either tribal or non-tribal while meeting recovery standards for weak stocks.

This proposal incorporates the fundamental principles identified for selected projects. Our objectives have been identified in the Mainstem Harvest Methods Summary as highest priority needs toward RPA 107 ("assess or improve estimates of incidental mortalities in fisheries (selective or non-selective) significantly affecting ESUs addressed in RPA. Specific examples include below Bonneville sport-fishery…"), RPA 164, 167 ("assess the effects of capture and release on the spawning success of listed species. This goes along with release mortality and is similar in the overall impact to a listed stock" and "perform additional mortality rate studies in conjunction with the development of selective fisheries"), RPA 166, 167, 165 ("Assess or improve estimates of incidental mortalities in fisheries significantly affecting listed ESUs"), and RPA 168 ("Investigate weed-line or drop-net modifications to either tangle net or conventional set gill net to test the efficacy of avoiding steelhead which tend to migrate in the upper water column.", "Test the development and implementation of selective gears and fishing methods in lower Columbia River sport and commercial fisheries." and "Test the development and implementation of selective gears and fishing methods in lower Columbia River sport and commercial fisheries.")

The Bonneville Power Administration, the Northwest Power Planning Council, Washington Department of Fish and Wildlife, Oregon Department of Fish and Wildlife, Fisheries and Oceans Canada and individual commercial and recreational fishers on the Columbia River have all invested considerable time and money developing, implementing and evaluating mark-selective fisheries. However, the information necessary to validate this tool for protecting weak stocks is not available. This proposal builds on the previous investments by all of these parties using objective scientific experiments with control groups for each estimate.

Our project relies on integration with basin-wide sampling programs for tag recovery. Our willingness to cooperate with other researchers will ensure that our project will be shaped to maximize benefits from other proposals we are not yet aware of. The results of our work on evaluating post-release survival of spring chinook in 2001 have been posted on our website, we shared the results with commercial fishers and fishery managers as they became available. We will continue this practice with the upcoming research.

Our proposal meets all of the Programmatic Criteria. As described above, our objectives are consistent with the Program as described in the Harvest Methods Program Summary and, rather than being in conflict with NMFS or USFWS FCRPS Opinions or the Action Agencies' Implementation Plan, they have been identified as high priority actions. It is consistent with Federal trust and treaty responsibilities as it seeks to provide fishing opportunities while protecting weak stocks. It has scientific merit, including statistical support. The project can be implemented – we are working with ODFW's and WDFW's Columbia River policy staff to ensure coordination with other agencies, and our own experience with these types of research projects will ensure success in data collection and analysis. We believe the effort is appropriate to obtaining the data we propose, and that the costs fairly reflect the work. Our proposal meets all of the General Qualification Criteria – it follows the instructions for proposals, it includes appropriate cost-sharing, it does not duplicate other efforts that we are aware of, and it builds on the previous investments in developing mark-selective fisheries. This proposal meets the Specific Qualification Criteria for anadromous fish: it meets several of the anadromous fish priority actions in Tables 1 and 2 as described above.

d. Relationships to other projects

This proposal builds on information collected in studies funded by the Bonneville Power Administration in 2001 and 2002 (Projects 00004684 (2001) and 23036 (2002) "Evaluate

Live Capture Selective Harvest Methods") to investigate the impacts of mark-selective fisheries on steelhead, a non-target species of concern that was captured in large numbers during the 2002 commercial tangle net fishery for spring chinook. We further develop our understanding of the effects of a commercial mark-selective fishery by evaluating the post-release spawning success of steelhead and spring chinook captured in tangle nets compared to uncaptured fish. Finally, we are turning to the recreational mark-selective fisheries to evaluate their contributions to conservation.

Evaluating steelhead spawning success in the Kalama River (part of our Objective 3) relies on work by Todd Pearson's (WDFW) staff outlined in his proposal. During DNA collection, he will note whether the fish are jaw tagged, and will be able to estimate the production of smolts for tagged and untagged adults. These observations are important for validating our hatchery-based experiments, and for evaluating the effects of capture on naturally spawning fish.

We propose to use radio telemetry to evaluate the post-release survival of steelhead captured in tangle nets. We will rely heavily on the matrix of receivers owned and maintained by the University of Idaho for our data collection. Dr. Chris Peery of the University of Idaho has extensive experience with this system and will ensure our efforts are properly coordinated with other projects, particularly with his Adult Passage Project conducted by the University of Idaho, funded by the U.S. Army Corps of Engineers.

This project relates to the coded-wire tag recovery project (Project 198201301). Data collected in our proposal will be used by the coded-wire tag recovery project to estimate stock-specific catch in Columbia River sport and commercial fisheries. Ultimately, data collected by this project will be used to estimate the stock composition for this fishery, to reconstruct spring chinook salmon and steelhead returns to the Columbia River, and to forecast future years abundance of spring chinook and steelhead.

e. Project history (for ongoing projects)

(a) 00004684 (2001) and 23036 (2002)
(b) The results of our previous work were used to open a commercial mark-selective fishery for spring chinook using tangle nets in 2002. With this fishery, the commercial industry enjoyed a substantially greater harvest than they would have been allowed with non-selective methods because the impacts to listed fish were lowered.
(c) Project report for work completed in 2001: Vander Haegen, G.E., K.W. Yi, C.E. Ashbrook, E.W. White, and L.L. LeClair. 2002. Evaluate Live Capture Selective Harvest Methods. WDFW Report #FPT-02-01. 35 p. (available on line at http://www.wa.gov/wdfw/fish/commercial/selective/livecapture.htm). Data collection for 2002 is continuing and has not yet been reported.
(d) Evaluations of selective fishing began in 2001, and have been 2 years underway.
(e) Major Results:

Experienced gill netters simultaneously fished tangle nets (3.5" and 4.5" mesh size) and conventional gill nets (8" mesh size) on the Columbia River to evaluate their effectiveness for live release of non-target stocks of spring chinook salmon. Live fish were tagged and released for recovery in sport fisheries, commercial fisheries, at hatchery racks and traps, and during spawning ground surveys. Control fish that had not been captured in the test gears were tagged and released from an adult trap in Bonneville Dam, just upstream of the fishing area.

Each time we had paired sets with the 3.5" tangle net and the 8" gill net, the 8" gill net caught more fish than the 3.5" tangle net (Figure 2) and overall was significantly more effective than the 3.5" tangle net (Wilcoxon signed rank test; T=0, t=0, P<0.05). However, there was no significant difference between the number of fish caught in the 4.5" tangle net and the 8" gill net (Wilcoxon sign test, T=10, t=5, P>0.05)(Figure 1).

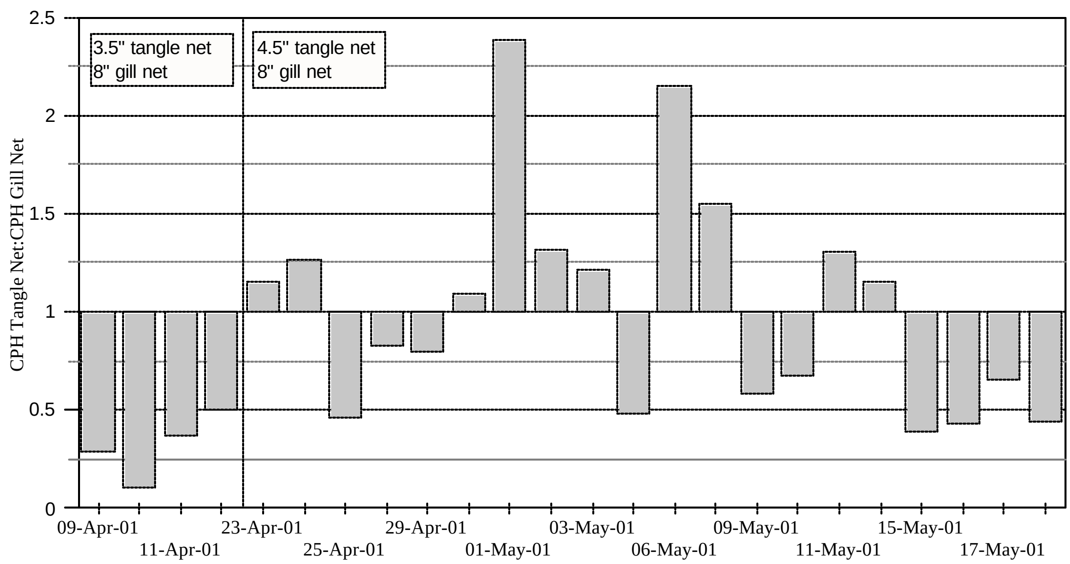


Figure 2: Relative catch of adult spring chinook salmon per hour (CPH) for the 3.5" net compared to the 8" gill net (bars to the left of the vertical line) and for the 4.5" tangle net compared to the 8" gill net (bars to the right of the vertical line). Values at 1 indicate equal catch efficiency, while those below 1 indicate the 8" gill net was more effective than the tangle net, and those above 1 indicate the tangle net was more effective than the 8" gill net. Paired sets were pooled by day across skippers.

Fish were generally captured in good condition. The immediate survival (from capture to release from the boat) of adult spring chinook salmon captured in the 8" gill net was 99%, compared to 96% from the 3.5" tangle net, and 97% from the 4.5" tangle net. However, spring chinook salmon released from the tangle nets were recovered at about 91% of the rate of controls, while spring chinook salmon released from the conventional gill net were recovered at about 50% of the rate of the controls (Table 1).

Table 1: Recovery of tags from hatcheries, fisheries and spawning grounds.

Group	Number	Number	Percent	95% Confidence

	Tagged	Recovered	Recovered	Interval
Bonneville Controls	1,206	149	12.4%	10.7%-14.7%
Gill Net (8” mesh)	814	50	6.1%	4.6% - 8.0%
Tangle Nets (3.5” and 4.5”mesh)	528	60	11.4%	8.9%-14.2%
Total	2,548	259	10.2%	

These tests showed that using conventional gear with short soaks and careful fish handling is not enough to ensure the survival of released spring chinook salmon. However, switching to the 4.5” or 3.5” tangle net, coupled with short soaks and appropriate fish handling is a viable selective harvest gear for the commercial gill net fleet fishing for spring chinook salmon on the Lower Columbia River because the post-release mortality on non-target stocks can be greatly reduced compared to a conventional gill net, without sacrificing catch efficiency.

We fished a 5” gill net in tandem with the 8” gill net on four occasions on the lower Columbia River near Camas, Washington to evaluate its potential for selective harvest of spring chinook salmon. During this short test, the immediate mortality of adult spring chinook salmon rose to 10%, compared to 0% in the 8” gill net during the same period. This increased mortality was likely caused by an increase in capture by mouth clamping in the 5” gill net.

In fall, 2001, we evaluated the feasibility of using the tangle net to capture marked coho salmon while releasing unmarked coho salmon near the mouth of the Columbia River. A variety of tangle net configurations were used and showed that this fishing method warrants further consideration if the mark rate is high. Immediate mortality of unmarked coho salmon was 17% but because 84% of the coho salmon were marked, relatively few unmarked coho salmon were killed.

The first commercial mark-selective fishery was opened in 2001 to target marked spring chinook. It was limited to 20 vessels that fished one to two days per week using nets with mesh sizes between 3.5” and 6”. Catch rates, measured in fish per hour, for chinook averaged 2.0 for 3.5” gear, 3.0 for 4.5” gear, and 2.7 for 5”-6” gear. Immediate mortality of chinook salmon averaged 0.8% for the 3.5” gear, 4.7% for the 4.5” gear, and 8.0% for the 5”-6” gear.

In 2002, we continued our investigations of mark-selective fisheries for Columbia River spring chinook salmon. Our objectives were to estimate the long-term survival of adult spring chinook captured and released from 4.5” and 5.5” tangle nets, to evaluate how net construction affects short-term survival and catch rates, and to investigate the feasibility of using live capture fishing methods in a full-fleet commercial fishery. Results from the 2002 study are not yet complete but the following general conclusions can be drawn from the commercial fishery: 1) live capture fishing gears and methods are supported by the commercial fishing industry, 2) tangle nets were effective at capturing spring chinook, 3) unmarked spring chinook were released in good condition, 4) the bycatch of steelhead far exceeded expectations, and 5) compliance with the fishing regulations was good.

(f) Past costs: WDFW and ODFW were awarded $385,000 in 2001 and $484,000 in 2002.

f. Proposal objectives, tasks and methods

The goal of this project is to continue evaluating the harvest and conservation benefits of mark-selective fisheries to target and non-target (bycatch) species so that managers can provide harvest opportunities while continuing to protect weak stocks. WDFW has developed a website for commercial selective fisheries. This website will be expanded to include the recreational sector so that the results of the experiments will be accessible to the public. We will also publish the results in a scientific journal so they are easily accessible to other scientists.

Objective 1: Using a series of mark-recapture experiments, and using fish trapped in the adult collection facility in Bonneville Dam as controls, estimate the survival of adult winter steelhead captured and released from two sizes of tangle nets suitable for targeting spring chinook salmon. Estimate the catch efficiency of steelhead in each net type. Estimate the net depth range in which 90% of the steelhead are captured.

Hypotheses: The percentage of tags recovered from adult winter steelhead captured and released from tangle nets will not be significantly different than the percentage of tags recovered from adult winter steelhead captured at Bonneville Dam.

Approach: Post-release survival will be evaluated on the mainstem Columbia River in spring, 2003, 2004, and 2005. Winter steelhead will be captured in tangle nets and at Bonneville Dam (control) and fitted with radio tags. Because previous unpublished studies by Dr. Peery show that the mortality associated with transporting fish downstream is about 1%, we propose to transport the control fish below the dam, but not to move the test fish up to the ladder. This process will eliminate the approximately 5% loss of fish between the test group and control fish if they were not transported, and is feasible because of the relatively small number of steelhead (200) that require transporting. To ensure that the transporting process is as benign as in Dr. Peery's previous studies, he will use the same process. Immediately after capture and tagging in the trap, each fish will be transferred to a tank of anesthetized, oxygenated water maintained at the current river water temperature. These fish will be transported by truck to the Skamania Landing (Figure 3) and released. Fish captured in the tangle net will be transported by boat to the same vicinity and released near where control fish are released.

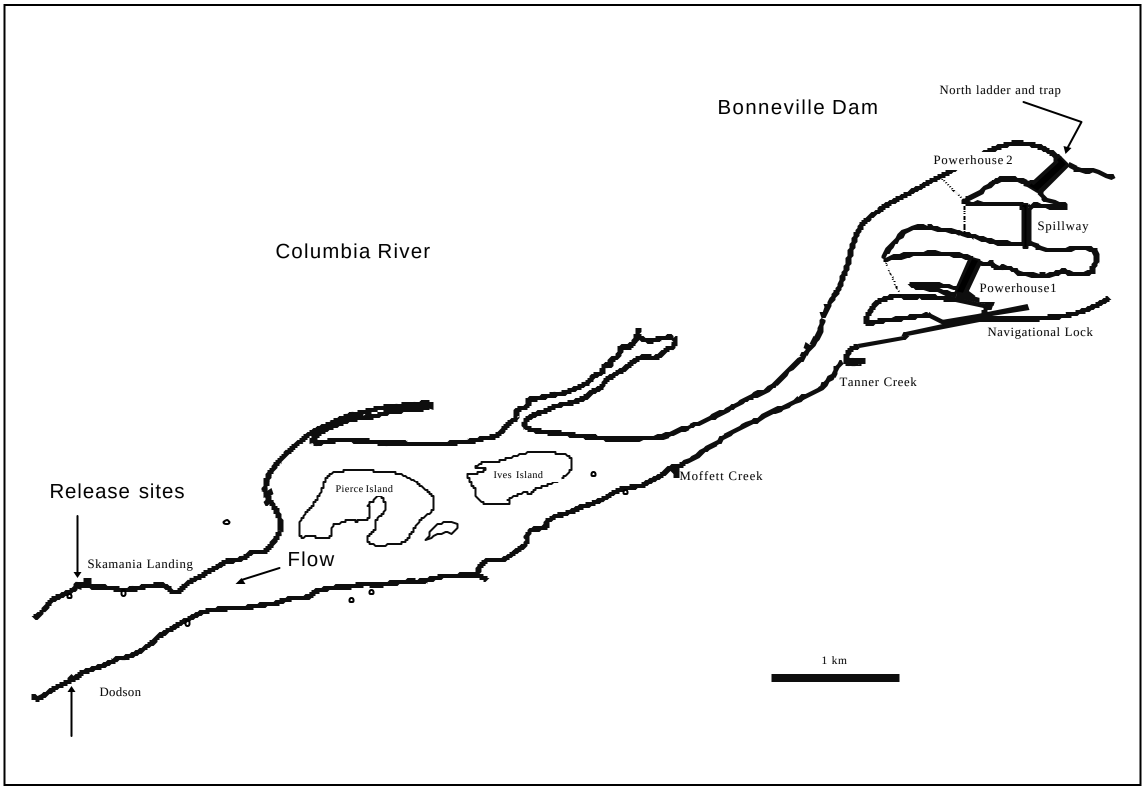


Figure 3: Map of Bonneville Dam and Columbia River showing location of Powerhouse 2, where the adult trap is located, and the release sites for fish transported below the dam.

Radio-tagged winter steelhead will be monitored as they migrate upstream using a network of fixed-site receivers at dams and mouths of tributaries, by mobile tracking using boats and trucks, and from tags returned from fish recaptured in fisheries and at hatcheries. Colored strings woven horizontally across the net to visually divide it into thirds from top to bottom will be used to evaluate steelhead capture depth. Estimating the depth of capture in the net may provide a method for avoiding steelhead; observations on the Fraser River in British Columbia showed that steelhead were typically captured in the first 17 feet, and using a very large meshed net for this portion allowed the steelhead to pass through unharmed. While we may be able to successfully release steelhead, avoiding their capture is a better strategy for stock recovery.

Data collection will occur from February 2003 to June 2005, and reporting will be complete by December 2005.

Assumptions:

1. Use of anesthetic at the adult collection facility in Bonneville Dam will not significantly affect the post-release survival of winter steelhead.
2. Tag loss will be equal among the three groups.
3. Mortality as a result of tagging will be equal among the three groups.
4. Lost or missed tags will be equal among the three groups.
5. Tag recovery patterns will not be biased by the capture method.
6. Tag recovery rates represent long-term survival.

Tasks and Methods

Task 1.a: Capture, describe, tag, and release adult winter steelhead in the mainstem Columbia River.

Adult winter steelhead returning to the Columbia River will be captured within 13 miles downstream of Bonneville Dam in February and March (the expected time when the commercial fishery would be opened) 2003, 2004, and 2005 using gears suitable for capturing spring chinook salmon. Two local fishers will be contracted to fish a net that has 75 fathoms of 4.5” tangle net shackled to 75 fathoms of 3.5” tangle net for about 20 days each. Depending on the management decisions to use different net sizes in the spring chinook fishery, the mesh size may be modified. The fishers will provide boats, and we will supply the nets and other associated gear. Two project employees will be on board during each fishing trip to characterize the catch, and to handle and tag fish. The project employees will work with the fishers to select appropriate fishing times and locations. Before we begin collecting data, all observers and fishers will be trained in fish handling and data collection methods.

Each set will be timed from the moment the first cork of the net is put in the water to the time the last cork is removed from the water (“Soak Time”). The exact location (using GPS), the air and water temperatures and times will be noted for each set. As the net is brought in, each fish will be removed carefully from the net. Salmonids will be placed quickly into a holding tank, and other fish will be counted by species and released overboard. Spring chinook will be revived if necessary and released overboard. For each steelhead, we will note the net type it was captured in, estimate the depth from the top of the net at which it was captured, the length, sex, and condition at capture and at release, will be noted. A fish will be ranked according to its condition; condition 1 if it is lively and not bleeding, condition 2 if it is lively but bleeding, condition 3 if it is lethargic but not bleeding, condition 4 if it is lethargic and bleeding, and condition 5 if it shows no visible signs of life. Fish in conditions 1 or 2 at capture will be tagged and released overboard immediately. Fish in conditions 3 through 5 will be held in the holding tank or recovery boxes designed to facilitate recovery until they either recover to condition 1 or 2 or they die. The condition at release will be noted for each fish. Marks and other visible injuries will also be noted for each fish. All dead fish will be donated to local food banks.

Two hundred steelhead from each mesh size (3.5” or 4.5”), 400 fish total, will be gastric ally outfitted with a radio transmitter and released directly to the river to stimulate actual fishery methods. Tagged fish will then be monitored during their upstream migration to evaluate post-release survival. In addition, we expect up to a 40% recovery of tags from fisheries, hatcheries, spawning ground surveys, etc., to assist in determining the fates of fish following their release. Indications from fishermen and biologists are that we will be able to capture at least 200 fish per gear type.

Task 1.b: Capture, tag and release adult winter steelhead using the adult collection facility in the Washington shore fish ladder at Bonneville Dam.

Task 1.a will provide a comparison of survival between the two gear types, but will not indicate the survival compared to fish that are not captured. Using the trap at the Adult Fish Facility at Bonneville Dam, we propose to collect and outfit with transmitters 200 adult steelhead to serve as a control comparison to fish captured in the tangle nets. This way, we can compare the survival of fish from each net type to a baseline survival of winter steelhead passing Bonneville Dam. These fish pass through all the same predatory pressures as the fish caught in the gears as well as similar fishing pressures, but had not been captured in our test gears. Tagging operations conducted by personnel from the University of Idaho at Bonneville Dam will be similar to those used as part of the Adult Passage Project conducted since 1996. Fish to be tagged will be diverted to an anesthetic tank. Once anesthetized, the fish will be checked for marks and injuries, their lengths will be measured, and a transmitter will be inserted into the stomach through the mouth. Immediately after capture and tagging in the trap, each fish will be transferred to a tank of anesthetized, oxygenated water maintained at the current river water temperature. These fish will be transported by truck to the Skamania landing and released. Fish will be captured and tagged at the trap two to three times weekly during the same time the nets are fished.

Task 1.c: Track adult winter steelhead as they move in the mainstem Columbia River and up tributaries, on spawning grounds, at hatcheries and in fisheries. Retrieve tags from hatcheries, spawning ground surveys and fisheries.

Radio-tagged fish will be monitored as they migrate upstream through the Columbia River and into its tributaries using a network of radio receivers installed throughout the basin at Bonneville Dam and upstream locations. Five additional receivers will be required to monitor tributaries downstream from Bonneville Dam not currently covered by the University of Idaho studies. These additional receivers will be placed at the mouths of the Cowlitz, Lewis, Sandy, Washougal, and Willamette rivers where we expect many adult steelhead to return. Receivers log the date, time, and the individual channel and code for each tagged fish as they pass. Telemetry data are downloaded periodically to portable computers and sent electronically to be loaded to the primary database maintained by NMFS personnel in Seattle, WA. Telemetry records are then screened for obvious errors and sent to the University of Idaho for processing. Data processing consists of inspecting records, using a semi-automated software package to identify and code fish behavior. Coded telemetry records and recapture information are then analyzed to evaluate system-wide passage and survival rates. Most of the subsequent tag recoveries in fisheries, on spawning grounds, and at hatcheries will rely on existing tag recovery and fish survey efforts. Each tag carries a $25 reward offer, increasing the likelihood of its return. Project employees will principally be involved in collecting data from the receivers, notifying regional programs where tags may be recovered and tracking tag recoveries from these programs.

Task 1.d: Summarize and analyze tag data.

Our experiment will provide an estimate of the number of fish passing through Bonneville and to Columbia River tributaries from each capture type. A comparison of the ratios of fish detected at Bonneville Dam to the fish detected at tributaries will indicate differences in survival between the gear types. Additional recoveries at hatcheries, in fisheries, on spawning grounds and at upstream dams will provide more detailed information about the characteristics at capture that may influence survival. We will also be able to evaluate the immediate survival of steelhead captured incidentally during a spring chinook tangle net fishery, and to evaluate whether the use of a panel of large-meshed net would be appropriate for avoiding steelhead in this fishery.

Objective 2: At Cowlitz and Kalama hatcheries, compare the egg-to-fry survival of females captured and released from tangle nets fertilized with males captured and released from tangle nets to the egg-to-fry survival of fish not captured in the gears for spring chinook salmon and winter steelhead. On the Kalama River, compare the number of offspring produced per adult.

Hypotheses: (1) The egg-to-fry survival of winter steelhead and spring chinook salmon released from tangle nets will not be significantly different than that of fish not captured in the gears. (2) The number of smolts produced per adult will not be significantly different between captured in the tangle nets and uncaptured fish.

Approach: In the natural environment, an adult female salmon must successfully find, establish, fight, and guard territory, build a suitable nest(s), and deposit viable eggs. All of these tasks require energy, which may be depleted as a result of capture in tangle net gear. In the hatchery environment, an adult female need only return to the hatchery and provide viable eggs. We expect that if there is a difference in these energy requirements, there will be an even greater difference for naturally spawning adults. Evaluating whether there is a spawning success difference for fish captured in tangle nets will provide fish managers with a valuable tool for determining fishery impacts to rebuild weak populations. A 10% decline in productivity could significantly impact recovery of weak populations. Post-release spawning success will be evaluated in the Cowlitz and Kalama rivers in spring 2003, 2004, and 2005. Winter steelhead and spring chinook will be captured, tagged and released from tangle nets at the mouths of the rivers and recovered at the hatcheries. Tagged males will be spawned with tagged females and compared to similar crosses with untagged fish to evaluate the effects on spawning success. Data collection for this objective will occur from March 2003 to October 2005, and reporting will be complete by December 2007 after the final group of smolts has outmigrated.

Assumptions:

1. Fish spawned for each group of crosses represent their populations.
2. Egg-to-fry survival rates represent post-release spawning success.

Tasks and Methods

Task 2.a: Capture, describe, tag and release adult winter steelhead and spring chinook at the mouth of the Cowlitz and Kalama rivers.

Adult winter steelhead and spring chinook salmon will be captured below the mouths of the Cowlitz and Kalama rivers in February and March 2003, 2004, and 2005. Two local fishers will be contracted to fish a net constructed of 4.5" tangle net. The fishers will provide boats, and we will supply the nets and other associated gear. Two project employees will be on board during each fishing trip to characterize the catch, and to handle and tag fish. The project employees will work with the fishers to select appropriate fishing times and locations. Before we begin collecting data, all observers and fishers will be trained in fish handling and data collection.

Each set will be timed from the moment the last cork of the net is put in the water to the time the first cork is removed. The exact location (using GPS), the air and water temperatures and times will be noted for each set. As the net is brought in, each steelhead and spring chinook will be removed carefully from the net and placed quickly into a holding tank, and kept separate by net type where they were captured. The species, length, sex and condition at capture and at release will be noted. A fish will be ranked condition 1 if it is lively and not bleeding, condition 2 if it is lively but bleeding, condition 3 if it is lethargic but not bleeding, condition 4 if it is lethargic and bleeding, and condition 5 if it show no visible signs of life. Fish that are in condition 1 or 2 at capture will be tagged and released overboard immediately. Fish in conditions 3 through 5 will be held in the holding tank or recovery boxes designed to facilitate recovery until they either recover to condition 1 or 2 or they die. The condition at release will be noted for each fish. Marks and other visible injuries will also be noted for each fish. All dead fish will be donated to local food banks.

Each fish will be tagged with a numbered jaw tag that is also color-coded to the river mouth where it was captured. The tag number will provide individual information about each fish. At least 500 fish must be tagged at each river to ensure enough tags are recovered at the hatcheries to compare the overall spawning success. These estimates are based on the expected rate of tag recoveries. Indications from fishermen and biologists suggest that we will be able to capture at least 500 fish.

Task 2.1 will provide only a comparison between the two gear types, but will not indicate the survival compared to a fish that was not captured at all. Adult winter steelhead and spring chinook returning to the hatchery without tags will serve as our control fish.

Task 2.b: Compare the condition and spawning success of steelhead captured in tangle nets with steelhead not capture in tangle nets and of spring chinook captured in tangle nets with spring chinook not captured in tangle nets that are recovered at Cowlitz and Kalama hatcheries.

During regular pond censuses, tagged fish (those captured in tangle nets) will be sorted from untagged fish (controls) returning to the Cowlitz and Kalama hatcheries. We will evaluate the percentage of recovered tagged fish that have fungus compared to recovered untagged fish. About 50 tagged males will be spawned with 50 tagged females from the same capture location for each species at each hatchery. Similarly, 50 untagged males will be spawned with 50 untagged females for a controlled comparison to the tagged fish. Crosses will be made in a 2x2 factorial mating design so that two males fertilize the eggs from each female, and each male fertilizes the eggs of two females. All crosses will be kept separate. We could make crosses between tagged and untagged fish, however, the effect we are looking for may be small, and our best chance of observing it is to maximize the effect by crossing tagged males and females. If rearing space is limited, subsamples of each cross will be collected into smaller rearing containers. The percentage of eggs surviving to fry (to the time they are ponded) will be measured by counting the original number of eggs and compared to the final number of fry for each individual cross. The replicated crosses for each location will be compared to the controls using a t-test with a Bonferroni correction for dependence caused by using the same fish. Based on the variability observed in our pilot study at Willapa Hatchery in 2001, we should be able to detect as low as a 7% difference with 90% power if as few as 10 pairs of fish are spawned.

Task 2.c: Compare spawning success of tagged and untagged spring chinook salmon in Kalama River.

The Kalama River is a mid-sized tributary that enters the Lower Columbia at river kilometer 118, roughly midway between Bonneville Dam and the mouth of the Columbia. It has a total length of about 72 km, flowing in a westerly direction from its headwaters on the southwest flanks of Mount St. Helens to its mouth about 1.5 km north of the town of Kalama. There is a total barrier to anadromous migration at RKm 59 (Upper Kalama Falls) and a partial barrier (Lower Kalama Falls) at the site of the Kalama Falls Hatchery at RKm 17. Since 1997, a plastic mesh curtain has been installed at the lip of the partial barrier falls during the summer months (when steelhead and some spring chinook could successfully jump to the falls) to make the barrier effectively complete. This forces all upstream migrants to use the fishway adjacent to the falls that terminates in a fish trap at Kalama Falls Hatchery.

During the upstream migration, WDFW staff will be collecting DNA samples from adult spring chinook salmon entering the trap as part of a proposal submitted by Mike Ford and Todd Pearsons (35041) and from adult steelhead entering the trap as part of a Mitchell Act Grant. They will also collect DNA samples from outmigrating smolts, and estimate the production per adult. As part of this work, they will record the presence or absence of jaw tags, and will analyze our fish as a subset of their data to compare the production per adult between captured and uncaptured fish. This work will complement and validate our experiments at the hatchery and will essentially track spawning effects throughout the period we might expect to see an effect in naturally spawning fish. Our role will be to assist with data collection and to summarize and report on the results. We will also provide funding for DNA analysis, because a higher sampling rate will be needed to detect differences between lower numbers of tangle net captured, jaw-tagged fish.

Task 2.d: Summarize and analyze data.

Our experiment will provide an estimate of the egg-to-fry survival for the progeny of adult spring chinook and steelhead captured in the tangle nets. If we observe no difference here, it would indicate that problems with migration and egg viability following capture and release from the tangle net are likely small if they exist. The observations of naturally spawning tagged fish on the Kalama River will be compared to the untagged fish spawning naturally in the same areas and will indicate whether capture and release would impair a fish's ability to spawn naturally. These observations of natural spawning will complement our in-hatchery estimates of egg-to-fry survival.

Objective 3: Estimate the long-term survival of spring chinook, fall chinook and coho salmon captured and released during recreational fisheries.

Hypothesis: The percentage of tags recovered from fish captured and released during sport fisheries for spring chinook, fall chinook and coho salmon will not be significantly different than the percentage of tags recovered from control fish captured in Bonneville Dam.

Approach: Post-release survival will be evaluated on the mainstem Columbia River in spring, 2001. Tags adult spring chinook, fall chinook, and coho will be recovered from Bonneville Dam through the tributaries and as much of their remaining migration route as possible. Data collection will occur in spring (for spring chinook) and fall (for coho and fall chinook) 2003, 2004, and 2005 and reporting will be complete by December 2005.

Assumptions:

1. The use of anesthetic at the dam trap will not significantly affect the post-release survival of salmonids.
2. Tag loss will be equal among these groups.
3. Mortality as a result of tagging fish will be equal among these groups.
4. Changes in migration patterns will be equally affected by each capture method, such that tag recovery patterns will not be biased by the capture method.
5. Tag recovery rates represent long-term survival.

Tasks and Methods

Task 3.a: Capture, describe, tag, and release spring chinook, fall chinook and coho salmon in the mainstem Columbia River below Bonneville Dam.

Adult spring chinook, fall chinook and coho salmon returning to the Columbia River will be captured within 10 miles downstream of Bonneville Dam during the run peaks in 2003, 2004, and 2005. Sport fishers will fish using their accustomed gear and methods, so that our results will represent a true sport fishery, rather than a particular gear or fishing method. Regulations will be instituted requiring sport fishers to allow samplers to tag the unmarked fish, and special fisheries may be opened that require all fish to be tagged and released. Project employees on shore and in boats will communicate via radios when fish are on line, and will approach the fisher to collect data and tag the fish. For each fish captured, the gear, the location (using a GPS unit), the time, the date, the angler's name and the hook location will be noted. If possible the time from hooking will also be recorded. The angler will be asked to release the fish from the gear and transfer it to a sanctuary dip net (a dip net which holds water) for tagging by the project employees. Each fish will be tagged with a numbered, colored jaw tag and released. Jaw tags will be used because the tagging method must interrupt the usual handling practices for this fishery as little as possible. The condition at release will be noted for each fish. Marks and other visible injuries will also be noted for each fish. Fish will not be placed into recovery boxes, as these are not used during recreational fisheries. We will tag from 800-1000 fish of each species during the appropriate sport fisheries.

Task 3.b: Capture, tag and release spring chinook, fall chinook and coho salmon using the trap in the Washington shore fish ladder at Bonneville Dam.

Task 3.a will not indicate the survival compared to a fish that was not captured at all. Bonneville Dam has a trap where adults migrating upstream are regularly captured. We will tag 800-1000 of these fish with jaw tags to serve as controls for the fish captured in the sport gears. The standard procedures for trapping salmonids will be followed, and this includes anesthetizing the fish. Each fish will be measured, the sex, marks, visible injuries and other characteristics noted, and then given a tag. Fish will be captured and tagged at the trap during the same time the sport fishery occurs. As noted in task 3.1, we will tag from 800-1000 fish of each species at the trap. To address bias from the control group being released in a different location than test fish, we will apply a correction factor (of about 5%) to the test group. Ongoing studies by Dr. Peery will evaluate the loss of spring and fall chinook salmon transported downstream of Bonneville Dam during the time when our test fisheries will occur. To reconcile coho salmon loss, we will apply radio-tags to 200 coho salmon (other than those given jaw tags) and release half into the ladder and transport the other half downstream for release. To ensure that the transporting process is as benign as in Dr. Peery's previous studies, we will use the same process: immediately after capture and tagging in the trap, each fish will be transferred to a tank of anesthetized, oxygenated water maintained at the current river water temperature. These fish will be transported by truck to the Skamania Landing and released. Fish captured in the sport gear will be captured and released in the same vicinity where control fish are released.

Task 3.c: Retrieve tags on spawning grounds, at hatcheries and in fisheries.

Tag recovery on spawning grounds, in fisheries, and at hatcheries will provide information on the long-term survival of these fish. Not all areas where a fish can return will be surveyed but based on the recovery of tags from commercial tangle net studies in 2001 and 2002, we expect 10% tag recovery. Spawning ground surveys occur in Columbia River tributaries in Oregon, Idaho, and Washington states. Fisheries occur in these states as well. We expect to hear from Oregon, Idaho, and Washington state fish and wildlife employees, from hatchery workers in these states, and from anglers when tags are recovered. We will advertise these tags and ask that information on tagged fish be called into WDFW through newspapers, agency press releases, and posters at hatcheries and popular fishing areas. We will also offer a toll-free number to encourage people to report the date the tag was recovered, the location the fish was caught in, the tag color and number, and the general fish condition.

Task 3.d: Summarize and analyze tag data.

Our experiment will provide an estimate of the number of fish passing through Bonneville and Dalles dams from each capture type. A comparison of the ratios of fish detected on spawning grounds, in fisheries, and at hatcheries will indicate survival differences between sport gear and control fish.

Objective 4. - Determine effects of varying net mesh size on species-specific catch rates, condition at capture profiles, and immediate- and short-term survival rates of adult spring chinook and steelhead.

Hypothesis 4a: Variation in mesh size will not significantly affect the immediate or short-term survival of adult spring chinook or steelhead captured and released from a tangle net.
Hypothesis 4b: The condition at capture does not significantly affect the short-term survival of adult spring chinook or steelhead captured and released from a tangle net.
Hypothesis 4c: The catch per unit effort of spring chinook and steelhead is not significantly affected by differences in mesh size.
Hypothesis 4d: Capture and release profiles are not affected by use of the recovery box.
Hypothesis 4e: Use of a steelhead excluding device will not significantly affect catch per unit effort of adult spring chinook or steelhead.

Approach: The purpose of this objective is to determine how the mesh size of tangle nets used in Columbia River commercial spring chinook salmon fisheries can effect catch per unit effort (CPUE), condition of capture, and survival of target and bycatch species. This objective is a refinement of previous BPA-funded studies completed in 2001 and 2002. Data collected through previous studies are adequate for the purpose of making fishery management decisions concerning the use of stringers and slackers and appropriate hang ratios; however, the data collected concerning mesh size was not adequate to determine the most appropriate mesh size for use in a live capture commercial fishery, especially with respect to the bycatch of steelhead. This objective continues our efforts to determine the most suitable mesh size for live capturing spring chinook and expands on past efforts regarding mesh size and steelhead bycatch.

Commercial fishers will be hired to capture spring chinook and winter steelhead using small mesh tangle nets that vary in mesh size only and include a steelhead excluding device (drop weedlines or large mesh web). Use of stringers or slackers and hang ratios will be consistent for all nets fished. Data collected by this project will be used by fishery managers to develop mesh size regulations that effectively target hatchery produced spring chinook while allowing for the live release of bycatch species, including steelhead and unmarked spring chinook. Additionally, the data collected in this objective will be used to determine the mesh size that is most effective for minimizing bycatch, primarily winter steelhead.

This objective will focus on spring chinook and winter steelhead; therefore, test fishing will be conducted during two different times of the year when each species is most abundant. Test fishing for winter steelhead will be conducted in late January and February when abundance of both hatchery and wild steelhead is high. Test fishing for spring chinook will occur in April and May when the upriver run peaks in abundance. Test fishing focused during each species peak run timing should maximize catch and provide sufficient sample sizes to determine immediate- and short-term survival rates. Catch per unit effort for spring chinook and steelhead will be summarized and analyzed to correlate species-specific catch rates to individual mesh sizes.

Fish captured will be evaluated to determine condition at capture and method of capture (i.e. by teeth, maxillary, pre-opercle, opercle). Criteria used for developing condition at capture profiles will be the same as those used in Canadian selective fishery studies (Farrell et al. 2000) and the 2001 (Whisler and Frazier 2002) and 2002 BPA-funded tangle net studies: 1= vigorous/not bleeding, 2 = vigorous/bleeding, 3 = lethargic/not bleeding, 4 = lethargic/bleeding, and 5 = not visible signs of life. An assessment of specific external injuries (i.e., scale loss, slime loss, physical damage, etc) will also be recorded. Additionally, biological data such as species, fork length, length-girth relation, stock, fin marks, and other marks (i.e. seal damage, net marks) will also be documented. Data will be summarized to develop species-specific capture condition, methods of capture, and injury profiles and will be analyzed to determine if these variables are related to mesh size. Morphometric data will be used to develop predicted method of capture profiles by mesh size to compare with those observed. Chinook and steelhead captured using tangle nets will be held for 48 hours to determine short-term survival rates. Survival rate data will also be analyzed to determine if short-term survival rates are correlated to mesh size.

Assumptions:

1. Survival of all groups is affected equally by handling procedures and the short-term holding process.
2. Salmonids handling and recovery in test fishery is representative of that in a full-fleet fishery.
3. Survival rates of salmonids held for observation are representative of those released in a fishery.

Tasks and Methods

Task 4.a. - Determine the effects of mesh size on catch rates, condition at capture, and immediate and short-term survival rates of steelhead.

Two commercial fishers will be hired to fish tangle nets of varying mesh sizes in the lower Columbia River below river mile 35. Test fishing will occur during January and February when hatchery and wild steelhead abundance is high. Net will be 150 fathoms long and comprised of multiple 25-fathom panels of 3.5", 4.0", 4.25" mesh, and one other size mesh proposed by industry. A steelhead excluding device will be incorporated into a net of identical configuration and fished simultaneously to determine differences in catch rates. Location of each individual 25-fathom panel within the full net (i.e. end of net, middle of net) will be varied randomly to minimize bias. Test fishing will occur 2-3 times per week and number of drifts per day will be varied depending on catch rates. Drift times ("drift time" is defined as the time when the first cork goes in the water until the first cork comes out of the water) will be short, less than 45 minute soak time, to remain consistent with accepted live capture fish methods. "Soak time" is defined as the amount of time from when the first cork of the net goes into the water until the last cork of the net comes out of the water.

Two department employees will be onboard during each test-fishing trip to collect and record data and to tag and recover fish. All fish captured will be identified by species and sampled for other pertinent biological data including length, stock, fin marks, and other marks (i.e. seal damage, net marks). Capture condition, method of capture, and an injury assessment will be made and recorded for all steelhead and chinook captured. Salmonids requiring resuscitation will be placed in a recovery box and condition upon removal from the recovery box will be determined and recorded. Steelhead will be individually marked and transferred to a holding facility for a 48-hour evaluation of survival. Holding tanks will be located onboard a contracted vessel to serve as a secure yet mobile holding facility. This vessel will be present on the fishing grounds to expedite the efficiency and effectiveness of test fishing operations. This is the same holding tank system purchased and constructed for the 2002 BPA-funded live capture evaluation. Condition and mortalities will be recorded at 24-hour intervals and upon release from the holding facility.

Steelhead and spring chinook catch rates will be summarized and condition at capture, method of capture, and release condition profiles will be developed. Statistical differences (P=0.05) in mean CPUE and condition profiles between mesh sizes will be evaluated with programs of Statistical Analysis System (SAS 1988; 1990). We will correlate survival rates to mesh size, method of capture, and condition at capture. We will use chi-square analysis to compare observed to predicted capture method profiles. Observed survival rates will be used for in-season management of the 2003 demonstration fishery to calculate impacts to listed stocks and insure ESA guidelines are followed.

Task 4.b. - Determine the effects of mesh size on catch rates, condition at capture, and immediate and short-term survival rates of spring chinook.

Test fishing will occur during April and May to target peak upriver spring chinook abundance in the lower Columbia River. This will provide adequate sample sizes to differentiate effects of mesh size on the variables in question. Nets and methodology will be the same as those described in Task 4.a. Fish handling techniques, condition assessments, resuscitation methods, data collection methodology, biological data collected, 48-hour holding, and data analyses will be identical to those described in 4.a.

Objective 5. – Determine the feasibility of using refined live capture selective fishing methods and gear in a full fleet commercial fishery.

Hypothesis 5a: Immediate and short-term mortality of spring chinook and steelhead caught and released with live-capture methods is low enough to support a full fleet commercial fishery within ESA guidelines.
Hypothesis 5b: Unmarked spring chinook and steelhead are not encountered repeatedly in a full-fleet fishery.

Approach: The purpose of this objective is to expand on the knowledge gained from studies funded by the BPA in 2001 (Whisler and Frazier 2002) and 2002. During 2002, the first ever full fleet live capture commercial demonstration fishery occurred in the lower Columbia River with promising results. However, review of this fishery also indicated that additional work needs to be invested to ensure that future live capture selective fisheries maximize survival of released fish and minimize handle of non-target species. Additional demonstration fisheries will provide necessary information regarding the logistics of implementing full fleet live capture commercial fisheries and will provide opportunities to educate commercial fishers as to appropriate live capture commercial fishing methods, including fish handling techniques.

As in 2002, the fishery would be proposed and managed through the Columbia River Compact. Regulations for the 2003 fishery would incorporate results of the 2002 BPA-funded study, including refined mesh size, hang ratios, and use of strings/slackers. On-board monitoring will occur to collect data regarding the ongoing fishery. Data collected will include catch rates for target and non-target species, condition at capture and release of target and non-target species, mark rates for chinook and steelhead, duration of recovery (e.g., elapsed time in the recovery box, other marks observed (i.e. seal damage, net marks), and compliance rates. Funding for enforcement is included herein to ensure that compliance with restrictive regulations remains high.

Immediate mortality and catch rates will be summarized and condition at capture and release profiles will be developed. Catch rates and condition profiles will be analyzed to determine if mortality and catch rates or condition profiles can be correlated to area or gear fished. Catch rate, mark rate, and mortality rate data collected by the fishery will be summarized inseason and provided to fishery managers to ensure that impacts to listed species do not exceed ESA related limits.

Steelhead handled in this fishery will be randomly sampled to determine short-term mortality rates. Steelhead will be collected from fishers at the time of release and transferred to a holding site for 48 hours to determine short-term mortality rates of fish handled and released by this fishery.

In conjunction with the observation program, released steelhead and chinook will be tagged to evaluate the incidence of multiple encounters and relative scope of the issue.

Assumptions:

1. Data collected by the observation program is representative of the entire fleet.
2. Catch rate of marked spring chinook using live capture fishing gear and methods is adequate to support a full fleet commercial fishery.
3. Recapture rates will not differ between tagged and untagged fish.
4. Tag retention will be sufficient to determine the rate of multiple encounters of released spring chinook and steelhead.
5. Tanks used for transportation do not introduce additional recovery.
6. Survival rates of steelhead held in net pens are representative of actual short-term survival.

Task 5.a. - Adopt and monitor a full fleet demonstration fishery that incorporates live capture fishing gears and methods to capture marked hatchery spring chinook while minimizing mortality and impacts to steelhead and unmarked spring chinook.

As in 2002, a full fleet demonstration live capture commercial fishery will be managed through the Columbia River Compact process. Results of 2001 and 2002 BPA-funded studies will be used to develop refined regulations for this fishery. Information gained from meetings with enforcement, industry, and observers will also be used to develop regulations concerning this fishery. This demonstration fishery will be managed to ensure that impacts to listed species are within the guidelines set forth by the appropriate Management Agreement or Fishery Management Evaluation Plan (ODFW 2001). The fishery is expected to occur during late February through late March and will target marked hatchery-produced Willamette spring chinook. Additional fishing may occur in late April or May and will target marked hatchery-produced upriver spring chinook. The intention is to allow a full fleet live capture commercial demonstration fishery to occur when significant hatchery produced spring chinook are available for harvest to effectively evaluate the logistics of using live capture fishing gear and methods to harvest hatchery produced spring chinook.

A live capture commercial demonstration fishery of this type will require significant on-the-water monitoring. Monitoring crews will observe fishing methods either onboard the participant's vessel or from an agency vessel. Monitors will be trained in all aspects of the study prior to implementation of the fishery. Data collected will include: 1) catch and immediate mortalities by species, 2) condition of fish at capture, 3) frequency of recapture, 4) gear specifications including presence and type of steelhead excluding devices, 5) drift and soak time, and 6) environmental conditions (i.e. weather, tides, water condition, etc.). Criteria used for developing condition at capture profiles will be the same as those used in Canadian selective fishery studies (Farrell et al. 2000) and the 2001 (Whisler and Frazier 2002) and 2002 tangle net studies: 1= vigorous/not bleeding, 2 = vigorous/bleeding, 3 = lethargic/not bleeding, 4 = lethargic/bleeding, and 5 = no visible signs of life. Four vessels with four observers per vessel will be deployed each fishing day and each vessel will be responsible for monitoring commercial fishing operations within a given geographical area. Observers will be deployed throughout as many geographic areas as possible, yet relative to fishing effort, to provide a robust and representative data set. The monitoring plan proposed in this task is similar to the plan implemented during the 2002 fishery. The monitoring plan will include sampling of fish sold to commercial buyers. Data collected at commercial fish processing plants and buying stations will be used to determine total catch and stock composition of landed catch (BPA Project # 198201301). Data collected during 2002 were effectively used to closely monitor the fishery to ensure that impacts to listed species did not exceed ESA-related limits. Additionally, data collected by the 2002 monitoring program provides the basis for modifying fishery regulations for the 2003 fishery.

As was the case for the 2002 demonstration fishery, fishers participating in the 2003 demonstration fishery will be required to attend workshops to participate in the demonstration fishery. Workshops will be used to share knowledge gained from the 2002 demonstration fishery and live capture study, instruct fishers as to new regulations in effect for the 2003 demonstration fishery, and continue instruction concerning fish handling techniques necessary to participate in a live capture commercial fishery.

Although compliance was good in the 2002 demonstration fishery, additional enforcement monitoring is proposed in this task to ensure maximum regulation compliance during this demonstration fishery. As part of this proposal we are including a request for funding to support increased on-water enforcement of regulations associated with this live capture fishery.

Task 5.b. Determine the multiple encounter rates of spring chinook and steelhead in the 2003 demonstration fishery.

Concurrent with Task 5.a., fishery observers will apply Floy anchor tags, or similar substitute, to a subsample of the released salmonid catch throughout the fishery and simultaneously monitor the catch to determine the frequency of multiple encounters. Observers will record species, tag number, and biodata detailed in 5.a., which includes general comments on any physical damage.

Task 5.c. - Determine short-term survival rate of steelhead caught in the 2003 demonstration fishery.

During the demonstration fishery adopted in Task 4.a., one or two agency vessels will be dispatched daily to randomly collect a sufficient number of winter steelhead (=200 fish) captured by commercial fishers. These fish will be held to determine the short-term mortality rate (±5%) of steelhead released from this fishery. Agency vessels will be equipped with live tanks to transport fish to one of several holding net pens stationed between river mile 18 and river mile 28. These vessels will travel among fishers and randomly collect steelhead that are about to be returned to the water. Steelhead will be evaluated for condition upon receipt and release into net pen, measured for length, and marked with a uniquely numbered anchor tag.

Steelhead will be held in a net pen for a minimum of 48 hours and checked with an underwater video camera to avoid constant stressing. Mortalities occurring during the holding period will be documented and condition at release from the holding facility will be determined and recorded. An overall survival rate for steelhead handled in the fishery will be calculated and compared to pre-season rate observed in the test fishery.

Task 5.d. - Summarize and analyze data to determine catch and recapture rates, immediate and short-term survival, and condition at capture profiles.

Data collected by the monitoring program in Task 5a. will be summarized to determine catch rates of target and non-target species. Immediate survival, condition profiles at capture and release will be developed for each species handled. Short-term steelhead survival will also be developed and compared to survival rate determined from Task 4.a. Data concerning gear used (e.g. mesh size, hang ratio, use of slackers or stringers, and presence and type of steelhead excluding device), area fished, and environmental conditions will also be summarized. Transformed catch rate data will be analyzed for each of these parameters using a general linear models procedure (GLM) followed by a Tukey's range test to determine pairwise differences. Tag recapture rate will be calculated to determine scope of multiple encounters. This will be used to determine need for future investigation into cumulative mortality. Results of these data analyses will be used to modify regulations concerning any future live capture commercial fishery. Finally, gear profiles and monitoring data collected by the monitoring program and enforcement will be used to determine compliance rates for the 2003 demonstration fishery.

g. Facilities and equipment

We will contract experienced commercial fishermen to fish tangle nets for us. They will provide the vessel, but we will provide all sampling equipment and staff to collect data, and to tag and handle fish. We will purchase radio transmitters, jaw tags, and Floy tags. While a large matrix of radio receivers is available above Bonneville Dam, there are few on tributaries below the dam where our fish may return. We will purchase receivers for the radio transmitters and place them at the mouths of Columbia River tributaries where we expect to see the most fish. WDFW will purchase one vehicle and provide the remaining necessary vehicles for our staff at the established per mile rate. The University of Idaho will provide boats for tracking radio-tagged fish. ODFW, WDFW, and University of Idaho will provide adequate office space and most computers necessary for the project.

h. References

Reference (include web address if available online)	Submitted w/form (y/n)

Reference (include web address if available online)	Submitted w/form (y/n)
Bendock, T. and M. Alexandersdottir. 1993. Hooking mortality of chinook salmon released in the Kenai River, Alaska. North American Journal of Fisheries Management 13: 540-549.	n
Bjornn, T. C., M. L. Keefer, C. A. Peery, K. R. Tolotti, R. R. Ringe, and P. J. Keniry. 2000. Migration of adult spring and summer chinook salmon past Columbia and Snake River dams, through reservoirs and distribution into tributaries, 1996. Report for U.S. Army Corps of Engineers, Walla Walla District, Walla, Walla, WA, and Bonneville Power Administration, Portland, OR. http://www.ets.uidaho.edu/coop/download.htm	n
Bjornn, T.C., K.R. Tolotti, J.P. Hunt, P.J. Keniry, R.R. Ringe, and C.A. Peery. 1998. Migration of adult chinook salmon and steelhead past dams and through reservoirs in the lower Snake River and tributaries; Part 1, Passage of chinook salmon through the lower Snake River and distribution into the tributaries, 1991-1993. U.S. Army Corps of Engineers, Walla, Walla District. Final Report. http://www.ets.uidaho.edu/coop/download.htm	n
Farrell, A. P., P. Gallaugher, C. Clarke, N. DeLury, H. Kreilberg, W. Parkhouse, and R. Routledge. 2000. Physiological status of coho salmon (*Oncorhynchus kisutch*) captured in commercial nonretention fisheries. Canadian Journal of Aquatic Science 57:1668-1678.	n
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SAS (Statistical Analysis System). 1990. SAS/STAT user's guide, version 6, 4^{th} edition, volume 2. SAS Institute, Cary, North Carolina.	n
SAS (Statistical Analysis System). 1988. Procedures guide; version 6.03 edition. SAS Institute, Cary, North Carolina.	n
Schisler, G.J. and E.P. Bergersen. 1996. Postrelease hooking mortality of rainbow trout caught on scented artificial baits. North American Journal of Fisheries Management 16: 570-578.	n
Vander Haegen, G.E., K.W. Yi, C.E. Ashbrook, E.W. White, and L.L. LeClair. 2002. Evaluate Live Capture Selective Harvest Methods. WDFW Report #FPT-02-01. 35 p. http://www.wa.gov/wdfw/fish/commercial/selective/livecapture.htm	Y, online
Vander Haegen, G.E., L.L. LeClair and E.W. White. 2001. Evaluate tangle nets for selective fishing. http://www.wa.gov/wdfw/fish/commercial/selective/tangleprogress1.htm	n
Whisler, J., and P. Frazier. 2002. Evaluate live capture selective harvest methods for commercial fisheries on the Columbia River. Draft annual report to be submitted to Bonneville Power Administration, Portland, Oregon.	n

Section 10 of 10. Key personnel

Geraldine Vander Haegen - Principle Investigator, 1/3 FTE
Research Scientist 1
Washington Department of Fish and Wildlife, Fish Program, Science Division
600 Capitol Way North, Olympia, WA, 98501-1091
Tel: (360) 902-2793 Fax: (360) 902-2944 Email: vandegev@dfw.wa.gov

Duties: General project oversight. Coordinate activities, review data quality, obtain permits, manage budgets, analyze data, consult with statisticians, and prepare reports. Oversee web site maintenance.

Education: B.Sc., McGill University, Quebec, 1989
M.Sc., McGill University, Quebec, 1991

Current Employer: Washington Department of Fish and Wildlife (1994-present)

Current Responsibilities: WDFW lead for evaluation and development of commercial selective fisheries, evaluation of electronic tag detection, development and evaluation of the automated mass marking machine. Evaluate methods for improving post-release survival of hatchery fish.

Previous Employers:

Maine Atlantic Sea Run Salmon Commission 1993, 1994
Maine Department of Inland Fish and Wildlife, 1993
Fisheries and Oceans Canada, Science Branch, 1991-1993

Expertise and Experience: I have coordinated and completed several fisheries related research projects with WDFW since 1994. These include an examination of homing by hatchery fish, production and evaluation of triploid salmonids, and evaluating natural rearing techniques for hatcheries. Since 1998, I have been involved in the development of commercial live capture selective fisheries, and am the project lead for evaluating these gears in Washington. I obtained funding for, and implemented selective fishing evaluations in Puget Sound and Willapa Bay in 2000. I lead the investigations on post-release survival of spring chinook captured and released from tangle nets on the Columbia River funded by BPA in 2001 and 2002. I also have experience handling and tagging fish, doing statistical analysis, and in report writing and presentation.

Relevant Publications:

Vander Haegen, G.E., AM. Swanson and H.L. Blankenship. (In press, Nov 2002). Detecting coded wire tags using hand-held wands: Effectiveness of two wanding techniques. North American Journal of Fisheries Management.

Vander Haegen, G.E., K.W.Yi, C.E.Ashbrook, E.W.White, and L. L. LeClair. 2002. Evaluate live capture selective harvest methods. WDFW Report #FPT-02-01, 35 p.

Vander Haegen, G.E., L.L. LeClair and E.W. White. 2001. Evaluate tangle nets for selective fishing. Progress report to NOAA. http://www.wa.gov/wdfw/fish/commercial/selective/tangleprogress1.htm

Vander Haegen, G.E., J.T. Tipping, S. Hammer. 1998. Consumption of juvenile salmonids by adult steelhead in the Cowlitz River, Washington. California Fish and Game. 84/1 (1998),

Cornel, G.E. (later Vander Haegen, G.E.) & F.G. Whoriskey. 1994. The effects of rainbow trout (*Oncorhynchus mykiss*) cage culture on the water quality, zooplankton, benthos and sediments of Lac du Passage, Quebec. Aquaculture 109(2):101-118.

<u>Charmane Ashbrook</u>--Project Manager, ½ FTE
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Duties: Coordinate activities, review data quality, obtain permits, manage budgets, analyze data, prepare report.

Education: B.Sc., The Evergreen State College, Olympia, WA 1992
B.Arts, The Evergreen State College, Olympia, WA 1992

Current Employer: Washington Department of Fish and Wildlife (1992-present)

Current Responsibilities: Project manager for 2002 WDFW portion of the BPA contract, Evaluate Live Capture Selective Harvest Methods, worked on the 2001 BPA funded contract, and was a co-author for the 2001 technical report. Coordinate Hatchery Scientific Review Group (HSRG) materials from WDFW including summarizing and editing material provided by management and habitat programs, creating maps for regions, providing genetic history summaries, and summarizing and analyzing coded-wire tag data.

Expertise and Experience: Experience in selective fishing, salmonid behavior and tagging studies, GIS, fish survival assessment, and hatchery operation and performance reviews.

Relevant Publications:

Vander Haegen, G.E., K.W.Yi, C.E.Ashbrook, E.W.White, and L. L. LeClair. 2002. Evaluate live capture selective harvest methods. WDFW Report #FPT-02-01, 35 p.

Ashbrook, C.E. and D.E. Doty. 2000. Fish and wildlife in-stream mortality assessment following the Olympic Pipeline gasoline spill in Bellingham, Washington on June 10, 1999. Washington State Department of Fish and Wildlife Internal Report. 20p.

Fuss, H.J., Byrne, J.B., and C.E. Ashbrook. 1999. Migratory behavior and incidence of post-release residualism of hatchery-reared steelhead and cutthroat trout released into the Elochoman River. Washington State Department of Fish and Wildlife Internal Report. 25p.

Fuss, H.J., Byrne, J.B., and C.E. Ashbrook. 1999. Migratory behavior and incidence of post-release residualism of hatchery-reared coho and chinook released into the Elochoman River. Washington State Department of Fish and Wildlife Internal Report. 22p.

Fuss, H.J. and C.E. Ashbrook. 1999. Ringold Hatchery Test Facility Annual Report. Washington State Department of Fish and Wildlife Internal Report. 23p.

<u>Christopher A. Peery, Ph.D.</u> – Radio Telemetry Study, 1/26 FTE
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Duties: Oversee radio telemetry portion of project. Coordinate tagging and tracking field personnel and telemetry data collection activities, analyze and summarize telemetry data, prepare final reports, manage budgets.

Education: B. Sc., Linfield College, McMinnville, OR, 1986
M A., Virginia Institute of Marine Science, Gloucester Point, VA, 1989
Ph.D., University of Idaho, Moscow, ID, 1995

Current Employer: University of Idaho, Moscow (1990-present)

Current Responsibilities: Principle Investigator for basin-wide radio telemetry study to investigate passage conditions and survival of adult chinook and sockeye salmon, steelhead and Pacific lamprey migrating in the Columbia and Snake rivers.

Expertise and Experience: I have participated in telemetry research with adult salmonids in the Columbia River since 1996. I have been the lead biologist on several studies investigating specific aspects of adult salmon migration at dams and through reservoirs and for experimental trials evaluating the behavior and swimming performance of Pacific lamprey. Currently I serve as the Principle Investigator of adult passage studies at University of Idaho.

Relevant Publications:

Bjornn, T.C., K.R. Tolotti, and C.A. Peery. Migration rates and survival of chinook salmon past lower Snake River dams through reservoirs, and in free-flowing rivers, 1991-1993. In preparation.

Peery, C. A. and T. C. Bjornn. 2002. Water temperatures and passage of adult salmon and steelhead in the lower Snake River. Idaho Cooperative Fish and Wildlife Research Unit, University of Idaho, Moscow, Report for U.S. Army Corps of Engineers, Portland District, Portland, OR.

Bjornn, T. C., M. L. Keefer, C. A. Peery, K. R. Tolotti, R. R. Ringe, and P. J. Keniry. 2000. Migration of adult spring and summer chinook salmon past Columbia and Snake River dams, through reservoirs and distribution into tributaries, 1996. Report for U.S. Army Corps of Engineers, Walla Walla District, Walla, Walla, WA, and Bonneville Power Administration, Portland, OR.

Bjornn, T. C., M. L. Keefer, C. A. Peery, K. R. Tolotti, and R. R. Ringe. 2000. Adult chinook and sockeye salmon and steelhead fallback rates at Bonneville Dam – 1996-1998. Idaho Cooperative Fish and Wildlife Research Unit, University of Idaho, Moscow. Report for U.S. Army Corps of Engineers, Walla Walla District, Walla, Walla, WA, and Bonneville Power Administration, Portland, OR.

Bjornn, T. C., M. L. Keefer, C. A. Peery, K. R. Tolotti, and R. R. Ringe. 2000. Adult chinook and sockeye salmon and steelhead fallback rates at The Dalles Dam – 1996-1998. Idaho Cooperative Fish and Wildlife Research Unit, University of Idaho, Moscow. Report for U.S. Army Corps of Engineers, Walla Walla District, Walla, Walla, WA, and Bonneville Power Administration, Portland, OR.

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Duties: Oversee study design and statistical analysis.

Education: B. Sc., University of California, Davis, 1985
M A., University of California, Davis, 1988
M.A., University of Washington, Seattle, WA, 1990
Ph.D., University of Washington, Seattle, WA, 1993

Current Employer: Washington Department of Fish and Wildlife (1995-present)

Current Responsibilities: Manager of Quantitative Assessment Unit. Chief Statistician for Science Division.

Expertise and Experience: I provide statistical consulting on a variety of fish projects. This includes developing and conducting statistical methods for stock assessment, serving on the Selective Fishing Evaluation Committee and being a key player in developing selective fishing evaluation methods. I have also served as a principal investigator for submersible surveys on fish abundance.

Previous Employers:
Batelle Pacific Northwest Labs, 1993-1995

Relevant Publications:

Hoffmann, A.and J.R.Skalski, (1995) Inferential properties of an individual-based survival model using release-recapture data: sample size, validity and power. J. Applied Stat. 22: 579-595.

Hoffmann, A.H., C. Busack, and C. Knudsen. (1994). Experimental designs for testing differences in survival among salmonid populations. Prepared for U.S. Department of Energy, project number 85-062. Olympia, WA. November, 1994. 71 p.

Investigation of methods to estimate mortalities of unmarked salmon in mark-selective fisheries through the use of double index tag groups. Prepared for the Selective Fishery Evaluation Committee, Seattle, WA. February, 2002. 87 p.

Skalski, J.R., A. Hoffmann, B.H. Ransom, and T.W. Steig. 1993. Fixed-location hydroacoustic monitoring designs for estimating fish passage using stratified random and systematic sampling. Can. J. Fish. Aquat. Sci. 50: 1208-1221.

Skalski, J.R., S.G. Smith, R.N. Iwamoto, J.G. Williams, and A. Hoffmann. 1998. Use of passive integrated transponder tags to estimate survival of migrant juvenile salmonids in the Snake and Columbia rivers. Can. J. Fish. Aquat. Sci. 55: 1484-1493.

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Education: B.Sc., Oregon State University, 1981

Current Employer: Oregon Department of Fish and Wildlife (1982-present)

Current Responsibilities: Program leader for Columbia River Management Program. The Columbia River Management Program is responsible for updating stock status of Columbia River fish runs, proposing Columbia River sport and commercial fishing seasons through the Columbia River Compact process, representing ODFW on the U.S. v. Oregon technical Advisory Committee (TAC), and sampling and monitoring all sport and commercial fisheries operating in the Columbia River below McNary Dam.

Expertise and Experience: I have worked in the Columbia River Management Program for 12 years and have considerable experience in managing and sampling sport and commercial fisheries. In recent years have worked very closely with the commercial fishing industry to develop fishery proposals and have developed a good working relationship with this sector of the fishing community. I have considerable knowledge concerning commercial fishing methods. As program leader have been responsible for obtaining funding and overseeing implementation of several different studies. I also have experience in performing statistical analyses, preparing reports and making public presentations.

<u>Wolf Dammers -</u> Principle Investigator, 0 FTE

Duties: Supervise test fishery technicians.

Education: B.Sc., Washington State University, 1971

Current Employer: Washington Department of Fish and Wildlife (1972-present)

Current Responsibilities: Manage salmon, steelhead, shad and smelt in the lower Columbia River. Supervise the following projects: coded-wire tag recovery application; Cowlitz River evaluation and reintroduction; area selective fisheries evaluation; North Fork Toutle fish collection facility; steelhead spawning ground surveys; Portland District ACOE mainstem Columbia River fish counting project.

Expertise and Experience: Supervise coded-wire tagging of wild fall chinook and coho in the Lewis River basin and volunteer cooperative fish rearing projects; develop catch estimation of Columbia River commercial fisheries, sport and commercial fishing regulations, and hatchery production and marking programs; sample Columbia River and tributary commercial and sport fisheries and escapement areas; conduct habitat utilization studies of juvenile salmonids and smelt in mainstem Columbia River and tributaries, spawning ground surveys, abundance estimates and age structure for salmonids in mainstem Columbia River tributaries, test fishing and run size forecasts for Columbia River spring chinook, and reintroduction strategies for Columbia River wild salmonids; assess fish-related environmental damage.

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Duties: Oversee and coordinate all aspects of field studies and complete reports. Develop and present fisher and observer training programs. Assist in development of study designs and budgets. Provide technical assistance and recommendations to fishery managers.

Education: B.Arts, Linfield College, McMinnville, OR 1995

Current Employer: Oregon Department of Fish and Wildlife (1995-present)

Expertise and Experience: I have planned and conducted various fisheries research projects with ODFW since 1995. These studies have ranged from sturgeon mark/recapture projects to stock assessments of listed salmonids. I have become very familiar with the relationship between these research projects and fisheries management strategies. Since 2000 I have specialized in selective fisheries, specifically live capture commercial salmon fisheries. This has included attending workshops, reviewing papers, consulting with biologists from state and federal management agencies in Oregon, Washington, California, and British Columbia, and planning and conducting all aspects of ODFW's live capture studies. I have also worked closely with the developers of the recovery box system. These experiences have made me the leading ODFW expert on selective live capture commercial fisheries.

Relevant Publications:

Whisler, G.S., and P. Frazier. 2002. Evaluate live capture selective harvest methods for commercial fisheries on the Columbia River. In preparation.

Whisler, G.S., and S.E. Jacobs. 2001. Prediction of 2001 Ocean Abundance of Rogue River Fall Chinook Salmon. Oregon Department of Fish and Wildlife Annual Report.

Whisler, G.S., and S.E. Jacobs. 2000. Prediction of 2000 Ocean Abundance of Rogue River Fall Chinook Salmon. Oregon Department of Fish and Wildlife Annual Report.

Jacobs, S.E., and G.S. Whisler. 1999. Prediction of 1999 Ocean Abundance of Rogue River Fall Chinook Salmon. Oregon Department of Fish and Wildlife Annual Report.

Whisler, J., T. Neill, K. Melcher. 1999. 1998 Sturgeon Tagging Project in Select Coastal Estuaries. Oregon Department of Fish and Wildlife Report.

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Duties: Hire and supervise project staff, coordinate activities, assist with project planning and data analysis.

Education: B. Sc. Oregon State University, Corvallis, OR 1986

Current Employer: Oregon Department of Fish and Wildlife (1990-present)

Current Responsibilities: Design, coordinate, implement, and manage select area fisheries in the lower Columbia River. Assist with development, implementation, and monitoring of live capture fisheries. Coordinate monitoring and sampling of recreational and commercial fisheries occurring in the lower Columbia River. Hire, train, supervise, and review work with for up to 13 staff. Develop and track budgets and work statements. Summarize data and write reports. Develop out-year plans. Attend meetings. Prepare and present study progress and results. Coordinate with participating agencies.

Expertise and Experience: White and green sturgeon life history studies, juvenile salmonid behavior, radio telemetry, commercial fisheries, salmonid culture, fish habitat evaluation.

Publications:

Beamesderfer, R. C. P. and J. A. North. 1995. Growth, natural mortality, and predicted response to fishing for largemouth bass and smallmouth bass populations in North America. North American Journal of Fisheries Management 15(3):688-704.

Burner, L. C., J. A. North, R. A. Farr, and T. A. Rien. In Press. Report A *in* D. L. Ward, editor. Effects of mitigative measures on productivity of white sturgeon populations in the Columbia River downstream from McNary Dam, and status and habitat requirements of white sturgeon populations in the Columbia and Snake rivers upstream from McNary Dam. Annual Progress Report to Bonneville Power Administration, Portland, Oregon.

North, J. A. A partial bibliography of largemouth and smallmouth bass. 1993. Informational Report 93-2. Oregon Department of Fish and Wildlife, Portland, Oregon. 83 pp.

North, J. A., R. C. Beamesderfer, and T. A. Rien. 1993. Distribution and movements of white sturgeon in three lower Columbia River reservoirs. Northwest Science 67 (2): 105-111.

North, J. A., A. L. Ashenfelter, and R. C. Beamesderfer. 1993. Gonadal development of female white sturgeon in the lower Columbia River. Pages 109-121 *in* R. C. Beamesderfer and A. A. Nigro, editors. Status and habitat requirements of white sturgeon populations in the Columbia River downstream from McNary Dam, Volume II. Final Report to Bonneville Power Administration, Portland, Oregon.

Congratulations!