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Mainstem/Systemwide Harvest Methods Program Summary

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Mainstem/Systemwide Harvest Methods Program Summary

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I. Program Description

A. Purpose of the Program (technical and scientific background)General Description

Harvest is an integral component of fish management on the Columbia River. People have fished for salmon and steelhead in the Columbia River for thousands of years. Strong runs of salmon and steelhead meant that these fisheries functioned with few restrictions. Historically, harvest of Columbia River fish used a variety of fishing methods, including dip nets, beach seines, fish wheels, set nets, gill nets, traps, and hook and line. However, as the runs began to decline in the late 19th and 20th centuries, harvests were reduced accordingly.

The tribes of the Columbia Basin have always relied on salmon and steelhead for spiritual, subsistence, and commercial purposes. A complex system of spiritual beliefs and social customs created a stable fisheries management system with different tribes fishing specific locations with a variety of gears throughout the year. This system was disrupted by the settlement of non-Indians and by the development of the hydropower system that destroyed numerous traditional fishing sites and decimated many runs of salmon and steelhead.

Currently, the four Columbia River Stevens Treaty Tribes manage commercial, ceremonial, and subsistence fisheries in the mainstem Columbia River between Bonneville and McNary dams (Zone 6) and in some terminal areas. Other Columbia Basin tribes manage various fisheries in the headwater areas. Tribal commercial fisheries in Zone 6 primarily use set gill nets. A small amount of commercial fishing is done from platforms using hoop nets and hook and line gear. Ceremonial and subsistence fisheries use gill nets and platform gear.

Tribal fisheries are limited by time and area closures and gear restrictions. Commercial gill net fisheries are typically managed in a series of 2½ to 4 ½ day openings to allow some fish during the entire run to pass the fishery into escapement areas. Fisheries are typically scheduled to target the peak run timing of harvestable groups of fish and to avoid peaks of weaker stocks. River mouth and mainstem dam sanctuaries are normally used to protect fish congregating in those areas. Larger area closures are occasionally used. Mesh size restrictions designed to target abundant stocks have been occasionally required in chinook fisheries and are commonly used in sockeye fisheries. The tribes have been provided with some large mesh (9”) gill nets for chinook fisheries and are attempting to determine its appropriateness for reducing impacts on salmon and steelhead. Mesh size restrictions are used in sturgeon gill net fisheries to reduce the impact on steelhead. Tribal fishers often have registered fishing sites that are passed down from previous generations, although they may use open unregistered sites. This is done partly because of the large number of tribal fishers. The traditional place-

oriented nature of the tribal fishery complicates moving the fishery to different areas or implementing alternative gears.

Non-Indian commercial fisheries in the Columbia River evolved from large numbers of traps and fishwheels, beach seines, and gill nets supplying numerous canneries to a small fleet using drift gill nets. These fisheries were primarily downstream from Celilo Falls but there was some commercial fishing targeting sockeye salmon as far upstream as Idaho. The commercial fisheries used to target all species of salmon and steelhead, but now target primarily coho, with limited opportunities for chinook and sockeye. As run sizes declined, the Washington and Oregon legislatures eliminated many gears and fisheries were closed or restricted to protect weak stocks.

Current non-treaty commercial fishing on the Columbia River uses drift gill nets. These fisheries are highly regulated by gear restrictions, and time and area closures. Gear restrictions include gill net mesh size limits to reduce their catch of non-target species when the average body size differentiates species. Time and area restrictions are based on known differences in run timing, destination, biological characteristics (for example, daylight fisheries target coho and encounter fewer chinook), or migration path of weak and strong stocks. Taken together, these restrictions offer a high degree of selectivity in targeting harvestable stocks while avoiding weaker stocks. However, many factors influence run timing, which can exaggerate or reduce the assumed differences in run timing between stocks. Under current management, variations in run timing are difficult to account for in-season. This can contribute to post- season impact analysis being different from in-season estimates. If more precise information regarding run timing were available in-season, it is possible that more accurate in-season fishery management decisions could be made making time and area management even more effective. When run timing or migration patterns differ between weak stocks and strong stocks, these fishery restrictions can be an effective management strategy. However, by definition, fishing restrictions necessarily limit fishing opportunity, so if differences in run timing or migration patterns do not exist, fishing may be greatly curtailed. At least 12 Evolutionary Significant Units (ESUs) have been listed under the Endangered Species Act since 1991, complicating the mixed-stock nature of all mainstem fisheries. Consequently, mainstem harvests have been considerably reduced despite the presence of strong unlisted stocks intermingled with the weak stocks.

Because recreational fisheries are more easily moved to extreme terminal areas, the overall recreational harvest and opportunity for harvest has been less severely curtailed than for commercial fisheries. However, the Columbia River recreational fishery has also been restricted, though less by gear restrictions than time and area closures. Before the mid-1960s, recreational fisheries in the mainstem Columbia River were only restricted by daily angler bag limits and gear restrictions designed around socio-political, rather than biological, concerns. Beginning in the mid-1960s extensive time and area restrictions were imposed on the recreational salmon fishery to protect chinook and steelhead. While ocean recreational fisheries have moved to using barbless hooks to reduce release mortality, no such requirement has been placed on recreational fishers in most areas of the Columbia River. The use of barbless hooks is one method that could be tried in mainstem recreational fisheries, particularly as they move to being mark-selective fisheries, although Schill (1997) found no significant difference in survival between trout caught on barbed and barbless hooks. Recent

hooking mortality studies for recreational fisheries, including ODFW's study on Willamette spring chinook, indicate that the location of the wound has more impact on post-release survival rates than does the use of barbed or barbless hooks (Lindsay et al. 1999).

Beginning in 1986, mark-selective fisheries allowing retention of marked hatchery fish while requiring the release of unmarked fish were implemented for some recreational fisheries, relaxing some of the time and area closures. Mark-selective fisheries have been opened for steelhead since 1986 and more recently for coho and spring chinook salmon and are thought to reduce the impacts to unmarked stocks in these fisheries. Mark-selective fisheries were recently adopted for ocean fisheries and have resulted in the reopening of fisheries that had been closed for nearly a decade. In some cases, however, hooking mortality or direct take of listed species may preclude even mark-selective fisheries.

Anglers use a variety of gear types to harvest anadromous fish in the Columbia River Basin. Gear restrictions (e.g. use of artificial flies and lures only) have been in effect in many freshwater streams (terminal fishing areas) for many years but have not been incorporated into mainstem Columbia River sport fisheries. Ocean fisheries targeting coho and chinook have experimented with gear restrictions such as limiting the use of flashers or divers. Gear restrictions are typically effective at reducing catch rates on over-harvested stocks, but this may not be needed on the mainstem Columbia River because catch rates are already low. In general, recreational fisheries in tributaries supporting listed stocks are likely to be the most restricted.

The management agencies and affected Indian tribes are committed to maintaining harvest levels that support rebuilding weak and listed stocks. Harvest rates in mixed-stock fishing areas generally are limited by impacts on identified weak stocks. Non-selective harvesting in mixed-stock fisheries is complicated by the goal of fully harvesting productive stocks while protecting commingled weak stocks. Non-selective fisheries typically forego harvest from productive stocks to limit impacts to weaker stocks. The federal government has proposed developing fishing techniques to enable fishers to target non-listed fish while reducing mortality of ESA-listed species. Examples of state initiatives exploring methods for meeting conservation goals for weak or listed stocks while maintaining high harvest rates on healthy stocks are listed below:

1. Develop and Implement Mark-selective Fisheries

If harvestable populations of the run are externally marked for identification by fishers while non-harvestable populations remain unmarked, then, with appropriate gears and fishing practices, there is opportunity for fishers to sort their catch live and release fish from non-harvestable populations. Beginning in the early1980s for steelhead, in the mid-1990s for coho salmon, and late 1990s for spring chinook salmon, from 90-100% of hatchery fish produced in the lower Columbia River have been identified by excision of the adipose fin, providing opportunity for mark-selective fisheries. However, only about two thirds of mid- and upper-Columbia River tributary hatchery spring chinook are being marked. For example, 95% of the spring chinook produced at Carson National Fish Hatchery, and 70% of the spring chinook produced at Klickitat Hatchery are unmarked (Streamnet, 2000 statistics), and would therefore not be susceptible to direct harvest in a mark-selective fishery. In the case of sockeye salmon, the listed hatchery-produced Snake River sockeye are marked and the states have managed

commercial sockeye fisheries to release marked fish and retain unlisted wild fish destined for the Wenatchee and Okanogan rivers. The effectiveness of this management strategy as a means of increasing naturally spawning populations is unknown. As selective fisheries are implemented, study designs should be developed to estimate costs and benefits, including gear costs, changes in fishing opportunity, harvest levels of target stocks, survival of non-target stocks, and effects at the population level.

To reduce their impacts on weak and listed stocks, recreational fisheries for coho salmon, steelhead, and spring chinook salmon adopted rules that allowed for retention of marked fish while releasing unmarked fish. Neither the subsequent survival nor the spawning ability of those released fish have been adequately estimated in the Columbia River. This is important for assessing whether selective fisheries actually keep harvest related mortality of released fish at desired levels. Survival of fish released in recreational fisheries has been estimated in many studies nationwide, however mortality rates have shown considerable variability depending on a number of conditions, not all of which could be quantified. This base was used to derive the 10% mortality rate assumed for fish caught and released in Columbia River recreational fisheries, but should be updated on a regional basis. Gear modifications (barbless hooks, artificial lures, etc) and additional angler education to improve fish handling should be considered as a means to further reduce mortality associated with recreational selective fisheries.

The gears employed in commercial fisheries are not amenable to immediate modification for selective retention. Additionally, there is little information available estimating the survival of fish released from commercial live capture gears that could be applied to the Columbia River. The State and Federal governments' desire to continue commercial selective fisheries on the Columbia River and this lack of scientific information about survival prompted a study beginning in 2001 to examine the feasibility of using live-capture nets and a floating trap for selective harvest of spring chinook in non-treaty fisheries. Other types of traps and fish wheels have been discussed but not tested on the Columbia.

Implementing selective fisheries remains controversial because while they clearly have the benefit of maintaining fishing opportunity (mark-selective coho fisheries have enabled increased recreational fishing opportunity for coho since the near elimination of coho fishing in the mid 1990s, and there is hope that the remaining non-Indian commercial fishing fleet can avoid eventual disappearance by implementing selective fishing techniques) there is no scientific data showing that mark-selective fisheries contribute to recovering weak runs of Columbia River salmon, particularly given that harvest is not the only factor limiting recovery. Presently, these fisheries can only be expected to reduce, rather than eliminate, the impacts to listed fish. Mark-selective recreational fisheries for steelhead were implemented in the mid-1980s, enabling a viable recreational fishery. However, Upper Columbia River wild steelhead are now listed as "endangered" under the ESA, and all other Columbia River steelhead ESUs are listed as "threatened" partly because harvest rates are still too high, but also because of high non-fishing related mortality.

There are further complications to implementing mark-selective fisheries. The mark rate on harvestable fish must be high during the fishery so that a reasonable proportion of the handled fish can be retained. For example, if a mark-selective fishery were proposed for fall chinook, the healthy run of unmarked naturally spawning fall chinook in the Hanford Reach

would reduce the ratio of marked to unmarked fish to a point where either recreational or commercial mark-selective fisheries would not be viable. The lack of a coordinated marking plan for the entire Columbia River will also complicate the implementation of mark-selective fisheries. Listed stocks of hatchery steelhead in the upper Columbia have been marked with an adipose clip, and are therefore vulnerable to mark-selective fisheries in the mainstem Columbia River. In other cases, some groups of chinook and coho salmon in supplementation programs are adipose clipped, and would be vulnerable to mark-selective fisheries, which conflicts with the supplementation objective of increasing natural spawning and makes evaluation more difficult.

2. Move Fisheries to Terminal Areas to Reduce Stock Mixing.

The main advantage of moving fisheries to terminal areas is to reduce the impacts on weak stocks that occur with or without mark-selective fishing in mixed stock areas. However, some terminal areas still have mixed stocks, the quality of the catch may be reduced, and the disruption of "place-oriented" fisheries and dependent communities are disadvantages with this strategy. Non-treaty, and particularly treaty commercial fisheries are site-specific. Columbia River tribes, for example, may not fish in the ocean or in certain terminal areas outside their individual tribal usual and accustomed fishing areas. Non-treaty commercial fishers have a license to fish a specific gear in a specific area. Under the current management system, it is virtually impossible for fishers to get licenses to fish with other gears in other areas, and most could not afford the large capital costs of investing in new gears. On the other hand, provided there is adequate access to different fishing areas, recreational fisheries are highly portable. For a reasonable cost, anglers can participate in fisheries ranging from the ocean to mainstem and terminal areas. This differential mobility of the sectors greatly affects the ability of managers to change the location of fisheries to target abundant stocks in a manner that equitably allocates harvest.

Some successful terminal fisheries have been developed for coho salmon and spring and fall chinook salmon at several locations in the lower Columbia River through the BPA-funded Select Area Fisheries Evaluation (SAFE) project. These fisheries were developed in off-channel sites that are used little for rearing or migration by depressed or listed species. The SAFE project and its associated fisheries are included in the lower Columbia Estuary Province and have been fully described in conjunction with the ongoing review of this province.

B. Scope of Program (management application, geographic scope, and species populations affected/benefited)

In the Implementation Plan, the Action Agencies identified that the harvest strategy designed to achieve the greatest gains in survival for weak stocks should prevent over-harvest, provide for sustainable fisheries, increase harvest selectivity, and increase escapement rates. The Harvest Strategy has three areas of emphasis:

1. Develop selective or terminal fisheries to reduce harvest-related mortality on ESA-listed species while continuing to harvest hatchery stocks at a higher rate.

2. Support research to improve harvest management assessments, decisions and evaluations. This should include assessments of the effects of mark-selective fisheries on the coast-wide coded-wire tag system that the US is bound by treaty with Canada to protect. It should also include continued efforts to estimate post-release mortality and the effects of multiple encounters with selective gears (a fish could be hooked and released in the ocean, the buoy 10 fishery, a lower river commercial fishery and upriver sport fisheries). Adequate harvest planning models for mark-selective fisheries must be developed. Fishery monitoring and coded-wire tag sampling need to be updated or expanded to support mark-selective fisheries.
3. Support sustainable fisheries for the meaningful exercise of tribal fishing rights and non-tribal fishing opportunities consistent with the recovery effort.

C. Selective Fishery Development in the Pacific Northwest Region

Commercial Sector

British Columbia

Much of the work with salmonid selective fishing on the lower Columbia River and elsewhere in Washington State is predicated on successes achieved in British Columbia where a 1998 national conservation policy resulted in the mandatory live release of all non-targeted species. While initial efforts were geared primarily toward harvesting selectively with respect to species, the definition of selective fishing was later broadened to include multiple stocks of the same species. For an overview of selective fishing progress in British Columbia see Blewett and Taylor (1999).

A number of selective fishing demonstration projects with salmonids focused on modifications to traditionally fished gill nets in terminal area fisheries. Gill nets entangle salmon at or near the gills, which often results in death through suffocation and trauma to the sensitive gill tissue. By reducing mesh size and using multiple-strand monofilament instead of large mesh single-strand monofilament, innovative fishers in British Columbia determined that salmon could be entangled by the maxillary and teeth with minimal trauma to surrounding tissue and little effect on respiration. The term “tangle net” or “tooth net” distinguishes this net from conventional gill nets.

The tangle net represented one step toward minimizing capture related mortality in terminal area net fisheries and permitted the release of live, non-targeted species or stocks of salmonids. Additional measures to minimize capture related mortality and to ensure long-term survival of non-targeted salmonids included careful handling and the mandatory use of recovery boxes to revive fish before release. The first recovery boxes were non-compartmentalized 50 to 100 L plastic containers with running water. The boxes were large enough to permit salmon to orient without respect to current direction, thus lethargic salmon usually were not able to maintain themselves in a position that would maximize water flow over the gills. This condition was often exacerbated by overcrowding, as there were no guidelines limiting the number of fish that could be held simultaneously.

Subsequent improvements to the recovery box included the construction of smaller boxes with directional water flow and compartments that hold salmon in an upright position

with their heads oriented into the directional flow. Flow rates were optimized and doors were fitted so that recovered fish could be released from the box without further handling. Farrell et al. (2000, 2001) showed that salmon do suffer significant physiological stress during capture and that metabolic recovery can be achieved through the proper use of these boxes.

Other fishers directed their attention toward trap nets to intercept and retain migrating salmon with little or no direct physical contact between fish and the capture gear. The trap net designs currently in use in British Columbia were adopted from similar nets that have proven effective for capturing Atlantic salmon in northern Europe and eastern Canada. The Atlantic salmon trap nets remain fixed over the substrate and are rarely moved from one location to another. While this method works reasonably well in a single species fishery in relatively confined areas with unidirectional currents, it is unsuitable for the multi-species salmon fisheries that occur over broad geographic regions of the Pacific Northwest and that are subject to rapidly changing, tidally induced currents. Thus, modifications were necessary that would enable the net to be mobilized between fisheries and that did not require the presence of permanent bottom or shore fixtures. Modifications included reconfiguring the net so that it could be deployed and retrieved from a conventionally equipped gill net vessel and adding additional web and rigid framework to maintain its shape while it is being towed against the current. The net is very effective at reducing capture-related mortality, but is marginally successful at capturing fish.

The use of Merwin style passive live-catch floating traps may have potential application in Columbia basin fisheries. Modified mobile Merwin traps were deployed in the early 1990's on the Columbia River to test the feasibility of targeting and capturing northern pikeminnow (*Ptychocheilus oregonensis*) while keeping impacts on non-target species including salmonids low. In some locations, salmonid bycatch was significant even though crews attempted to target areas to avoid salmonids (Willis C.F. and D. Ward 1993). Further investigation of Merwin traps for targeting adult salmonids may be appropriate.

Historically, fish wheels were a very effective capture method in early Columbia River fisheries, and have been used for over a decade on some British Columbia rivers and streams. Its selectivity and effects on non-target fish has only recently been investigated. Fish wheels usually consist of three or four baskets attached to an axle. River current rotates the wheel and the contents of the baskets are deposited into an adjacent net pen where the live fish can be sorted and non-target fish released. One advantage of the fish wheel is that it can be fished in narrow reaches with fast moving where most other gears cannot be fished. When located in the right place, fish wheels can be very effective at capturing a wide variety of species with minimal capture-related trauma.

Washington

In 2000, the Washington Department of Fish and Wildlife began evaluating tangle nets (3.5" and 4.5" mesh) as live capture gears for mark-selective fisheries of coho and fall chinook salmon in Puget Sound and Willapa Bay. These tests showed that the 3.5" nets are as effective as conventional gill nets for capturing coho, and that the immediate mortality is lower for coho captured in the tangle net than the gill net. The immediate mortality of fall chinook was also reduced by using the tangle net, but the catch efficiency of the nets tested was significantly lower than the conventional gill net (Vander Haegen, 2001). In 2001, a

comparison of the post-release survival of coho captured in tangle nets and gill nets was initiated and the analysis will be complete in March, 2002.

The Yakama Nation evaluated gill net mesh selectivity for reducing the catch of wild steelhead in tribal commercial gill net fisheries. The results of these studies suggested that the ratio of steelhead to chinook in the catch could be significantly reduced by using larger meshed gill nets. In 2000, the Bonneville Power Administration provided 9" mesh gill nets to the tribal fishery, and a substantial reduction in wild steelhead harvest was realized without reducing the catch of chinook salmon.

Beginning in 2000, the Pacific Fishery Management Council adopted a mark-selective troll fishery for coho from Cape Falcon, Oregon to the Queets River, Washington. The Oregon and Washington departments of Fish and Wildlife monitor the fishery through dockside catch and effort sampling, the use of logbooks by vessel operators, and direct on-water observations of the fishery in progress. A total of 14,826 coho and 2,534 chinook salmon were landed from the Columbia River ocean area (Cape Falcon, OR to Leadbetter Point, WA) for 319 days fished. A total of 2,468 coho and 755 chinook salmon were landed from Washington catch area 2 (Leadbetter Point to the Queets River) for 74 days fished. The overall coho harvest during this fishery totaled 17,294 on a quota of 21,000; chinook harvest totaled 3,289 on a quota of 4,500.

Observers documented an overall mark rate of 73% for coho in the Columbia River ocean area and 54% in Washington catch area 2. Voluntary logbook data maintained by troll vessel skippers in the Columbia River ocean area documented an overall mark rate of 75%. A compliance rate (the percent of the retained coho catch with a healed adipose fin clip) of 99% was observed in both catch areas. When possible, observers recorded the number of fish that were hooked but lost before being brought to the boat, commonly referred to as drop-offs. Coho drop-off rates were estimated to be less than 2%.

Oregon

In spring, 1999, the Oregon Department of Fish and Wildlife conducted a test fishery using beach seines to capture spring chinook salmon in the lower Columbia River. The objectives were to evaluate whether beach seines could function as a live capture gear in the lower Columbia River commercial fishery, the species and stock composition of catch, and the immediate mortality rate for each species captured. Two test fishers were contracted to fish near Astoria, Oregon (about river mile 25) and near Cathlamet, Washington (about river mile 45). The two seines fished in this study varied slightly in mesh size (3 1/3" and 4") and leadline weight (100 pounds and 200 pounds) but both seines were 100 fathoms long and 100 meshes deep which fished to a depth of about 20 feet. Twenty-one sets (7 near Astoria and 14 near Cathlamet) were fished from April 6 to April 19. Catches were poor with a total of three spring chinook and four summer steelhead caught. Low catches could be due to several reasons, including low fish abundance in 1999, fish not congregating in fishing areas, gear not suited to the fishing area, or gear not fished correctly. The test fishers felt that larger nets would be required to achieve catches adequate to support a commercial fishery in the lower Columbia River. However, the gears we tested required a large gill net boat with hydraulics and at least four people to haul the seine in and larger gear would require additional personnel.

Recreational Sector

Numerous hooking studies indicate a wide range in release mortality. Various factors influence mortality including, hook size, barb, hooking location, length and degree of play, water temperature, fishing in estuaries, and other factors. Definitive studies have proven elusive because of the difficulty in isolating factors and the fact that the studies themselves also cause some level of mortality (Bendock and Alexandersdottir 1993; Gjernes et al. 1993; Muoneke and Childress, 1994; Schisler and Bergersen 1996).

Development of terminal area fisheries

Successful fisheries in off-channel areas have been developed at several locations in the lower Columbia River through the BPA-funded SAFE project. Locations include Youngs Bay (river mile 12), Tongue Point (river mile 18), and Blind Slough (river mile 29) on the Oregon side and Deep River (river mile 21) and Steamboat Slough (river mile 34) on the Washington side of the Columbia River. Test fishing indicated that fisheries in these areas would have minimal impact on depressed or listed stocks. Stable and dependable fisheries are being developed for coho salmon at all five sites, for spring chinook salmon at all three Oregon sites and at Deep River beginning in 2003, and for fall chinook salmon in Youngs Bay with minimal impact on depressed or listed stocks. These projects provide a significant catch, even in years of low abundance. The SAFE project and its associated fisheries are included in the lower Columbia Estuary Province and are described in conjunction with the ongoing review of this province.

As part of the SAFE project, a complete list of possible locations for development of off-channel fisheries was compiled for the Columbia River below Bonneville Dam. Sites were evaluated based on water quality for juvenile salmonid acclimation or rearing, whether the site was conducive to development of sport and commercial fisheries, and usage of the area by depressed or listed stocks as rearing habitat or an adult migration corridor. The SAFE project immediately began to release fish and establish fisheries in the areas that were evaluated as most promising. The SAFE project continues to evaluate other areas not initially developed, including Cole Creek Slough on the Washington side and Clifton Channel on Oregon side.

The use of live capture gear has not been tested in Select Area fisheries due to the lack of depressed or listed species present. Use of live capture gear could benefit select area fisheries by expanding the time a fishery were opened, or the area in which fish could be harvested. Some sites are currently unsuitable due to potential impacts on depressed or listed stocks, but may become more suitable as the use of live capture fishing gears and techniques are perfected.

Another strategy for selective fishing is to use live capture gears in terminal fishing areas. This strategy is problematic for the Columbia River Treaty tribes, which have reserved rights to fish at “all usual and accustomed fishing places” under the terms of their treaties with the United States. Most tribal fishing is conducted from fixed sites, either from scaffolds erected at specific places on the river bank or with set gill nets anchored to the bank at assigned locations. Because these traditional fisheries are site-oriented, the development of terminal fishing areas would cause significant disruption of ancestral fishing patterns and legal fishing areas.

There is potential for additional terminal fishery development in the Snake, Yakima, Umatilla and upper Columbia rivers.

II. Accomplishments/Results

Adaptive Management Implications (historic and current changes in management, future applications)

As described above, the tribal commercial fishery is being assisted in transitioning to larger-mesh gill nets in an effective effort to reduce harvest impacts on wild steelhead while maintaining access to abundant fall chinook. The non-treaty fishery is being assisted in transitioning to tangle nets in an effort to reduce harvest impacts on listed spring chinook salmon while maintaining access to abundant hatchery spring chinook.

Benefits to Fish and Wildlife (Role of program efforts in the Council's Program)

With fewer encounters in larger meshed gears, more adult wild steelhead, particularly the Group B component which spawns exclusively in Idaho tributaries, are escaping to spawn in natural production areas throughout the Columbia River Basin. If unmarked spring chinook released from tangle nets in a selective fishery are surviving to reproduce, then the impacts of commercial fisheries on the recovery of listed stocks will be reduced.

Project Funding to Date (Total amount of BPA funding since program inception)

In a mark-selective commercial fishery, the mortality associated with conventional gill net fishing gears and methods is considered too high for effective live release of non-target fish. The long drifts, injuries caused during capture, and the fish handling practices commonly used to maximize harvest during a short fishery, are not conducive to live release. These fleets are therefore forfeiting harvest opportunity, which could be increased if their impacts on the non-target stocks could be reduced. In 2001, the Oregon and Washington departments of Fish and Wildlife, with funding from the Bonneville Power Administration, began to evaluate whether tangle nets and a floating trap could be used in the commercial fleet to capture marked spring chinook and allow for the live release of non-target species.

This study had four parts. The first objective was to compare the catch efficiency, condition at capture and immediate mortality of fish captured in a tangle net and a conventional gill net, and then to estimate the long-term post-release survival rates of fish captured in each gear. This part of the study is critical to understanding the contribution of selective harvest to the actual recovery of weak stocks. The second objective was to estimate the effects of soak time on the catch rate and short-term survival of spring chinook captured in a conventional gill net and a tangle net. This objective begins to elucidate how specific fishing practices may affect survival. The third objective was to open a limited permit fishery to collect information about how different mesh sizes and competitive fishing might affect the

immediate mortality of unmarked spring chinook. The final objective was to test a floating trap for live capture of spring chinook.

The preliminary results showed that tangle nets can effectively capture spring chinook. In addition, this gear, coupled with alterations in fishing methods such as reduced drift length times, using recovery boxes for released fish, and shorter nets, appear to significantly improve the long-term survival of released fish compared to conventional gill nets (50% survival of fish released from gill nets compared to 91% survival of fish released from tangle nets). A disadvantage of the tangle nets was the increased capture of non-target species, including small sturgeon and shad, species that usually pass through the larger meshed gill net without incident. Results of this study to date indicate that the use of tangle nets as a live capture gear in lower Columbia River commercial fisheries has potential for success. Additional studies will be required to determine gear specifications and fishing methods that are most effective.

The Washington Department of Fish and Wildlife tested a trap net under a wide variety of conditions ranging from shallow nearshore sites with fast moving water, to deep offshore sites with weak current. Throughout the spring and fall, water clarity was high, possibly due to drought related low flows. The trap was fished only during daylight hours when no commercial harvests were occurring within the test fishing areas. This floating trap was ineffective for capturing fish. No fish were captured in the spring. Historic run times, fish counts at Bonneville Dam, and the relative success of concurrent fisheries (sport and test) at up- and downriver sites suggest that most of the salmon had already transited the test fishing area by the second week of May when we began test fishing. During the fall, we captured 11 coho and 1 chinook. All were in excellent condition at time of capture and released immediately, unharmed. Coho were known to be abundant in and adjacent to the test fishing area based on high capture rates in the sport fishery and frequently observed jumpers. Both coho and sturgeon were seen jumping in the mouth of the trap-net during sets when no fish were captured. Non-target species (white sturgeon, *Acipenser transmontanus* and starry flounder, *Platichthys stellatus*) were captured in low numbers and also released unharmed.

In fall, 2001, WDFW conducted a pilot study using the tangle net for a mark-selective fishery targeting coho salmon. Immediate mortality of unmarked fish was about 17%, but the mark rate was high enough that the actual number of fish killed was relatively low. It appears that provided the mark rate remained high, a mark-selective fishery using the tangle nets could be feasible, and warrants further exploration.

In 2000, BPA provided funds to purchase 9” mesh gill nets for the tribal fishery in Zone 6 in order to try to reduce impacts on steelhead in chinook target fisheries. The tribes monitored and evaluated the program in 2000 and monitored usage of the gear in 2001. Initial results indicated that the 9” mesh gear reduced impacts on steelhead and had a higher catch per net of chinook than 6” to 8” mesh gear.

In 2001, BPA provided funding to evaluate the feasibility of identifying and removing lost fishing gear in Zone 6. An unknown number of gill nets are lost each year due to being run over by barges, weather, vandalism, and other causes. It is not known where this gear goes, or what ecological effects it has in the river. If this lost gear can be removed, any adverse ecological effects would be eliminated.

Reports and Technical Papers (Reports or scientific papers produced as a result of this program and how they have been disseminated)

The 2000 9" mesh evaluation was reported in ***Effects of Large-Mesh Gill Net Use on Steelhead and Salmon Catch in Columbia River Zone 6 Gill Net Fisheries*** by Ray Beamesderfer *S. P. Cramer and Associates, Inc., Fisheries Consultants39330 Proctor Blvd., Sandy Oregon 97055 and* Steve Parker *Yakama Nation Fisheries Program P.O. Box 151, Fort Road, Toppenish Washington 98948*

Reports of the 2001 evaluations of live capture methods for spring chinook are being prepared by Washington Department of Fish and Wildlife and the Oregon Department of Fish and Wildlife.

III. Relationship of Program to USFWS/NMFS Biological Opinion – RPA's

The potential benefits of live capture selective harvesting are recognized by the National Marine Fisheries Service (NMFS) in the updated "All-H Paper" titled "Conservation of Columbia Basin Fish, Draft, Basin-Wide Salmon Recovery Strategy". In section 3.3, "Harvest Actions," one of the Federal Caucus's recommendations for harvest is to "expand, develop and/or apply alternative, more selective fishery techniques to reduce impacts on listed fish and provide alternative harvest opportunities". Additionally, the Caucus recommends "fishery managers develop a menu of options that includes alternative fishing gear deployment and testing the feasibility and effectiveness of various options".

The Washington Department of Fish and Wildlife also recognizes the potential benefits of live capture selective harvesting in its Wild Salmonid Policy, as do the Oregon Department of Fish and Wildlife, the Idaho Department of Fish and Game, and the Columbia Basin Fish and Wildlife Authority in the Fish and Wildlife Program. Live capture selective harvesting is recommended by several action plans, including the following sections of the Northwest Power Planning Council's Fish and Wildlife Program:

- Section 8.2 "Adopt Exploitation Rates and Regimes"
- Section 8.3A "Live-catch Technology and Known-stock Fisheries"
- Section 8.3B "Selective Harvest Technologies" of the 1994 Fish and Wildlife Program.

In March 1995, the NMFS produced the "Proposed Recovery Plan for Snake River Salmon" which called for the protection of listed species through development of alternative harvest methods in Section 3.4. Specifically, Section 3.4.a recommends the implementation of fishing practices that allow for selective harvest of surplus hatchery production.

Selective fisheries are supported in the 2000 NMFS draft Biological Opinion. Section 9.6.3, "Overview of Harvest Measures" speaks extensively about the development of selective fishing and the importance of selective fishing as a tool for recovery of listed species. Projects testing selective fish techniques should address Section 9.6.3.2.1, "estimate incidental

mortalities in selective fisheries", and Section 9.6.3.2.2, "Measures to develop or expand the use of selective fishing methods and gear", in particular.

The Army Corps of Engineers, the Bureau of Reclamation and the Bonneville Power Administration recognize the potential for live capture selective harvesting in their 2001 "Endangered Species Act Implementation Plan for the Federal Columbia River Power System". In this document, developing live capture gears is noted as an immediate harvest priority for 2002-2006.

IV. Future Needs

A. Research and Monitoring Needs

Proposals to test the efficacy of selective harvest gear types, methods, or locations, particularly in mainstem areas above Bonneville to harvest abundant, non-listed fish.

- In the recreational sector, the effects of using bait and multiple barbed hooks on the post-release survival of released fish in a mark-selective fishery should be considered, and alternative fishing methods should be evaluated.
- In the commercial sector, focus should not be restricted to tangle nets – traps, beach seines, and other alternative gears should be explored. Specifically, investigation of weed-line or drop-net modifications to either tangle-net or conventional set gillnet should be pursued to test the efficacy of avoiding steelhead which tend to migrate in the upper water column. The Canadians have seen success in avoiding steelhead bycatch using this gear (Petrunia, 1998).
- Continued studies to test the development and implementation of selective gears and fishing methods in lower Columbia River sport and commercial fisheries.
- Studies to 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 and Zone 6 Treaty gill net fishery.
- The recreational sector was easily able to adapt to selective fishing, but actual benefit to spawning populations is unknown due to lack of short- and long-term adult mortality studies applied to Columbia River sport gear and methods
- Studies to develop and apply new (or improve existing) harvest management models and stock assessment tools to improve preseason planning and in-season fishery management decisions, particularly as may be necessitated by selective fishery regimes. These efforts should recognize the connections between in-river fisheries and ocean fisheries in the PFMC and PSC areas. To the extent possible, efforts should be made to develop models and tools that complement those used in other fora.

- Studies to develop and implement changes in existing catch sampling programs, data recovery programs, or databases, particularly as may be necessitated by selective fishery regimes and associated changes in fish marking strategies. Critical is identifying the impacts of implementing mark-selective fisheries to the coast wide coded-wire tag system. The tendency is for reduced confidence around estimates of harvest impacts to key stocks. It should be determined what the acceptable levels of these reduced confidence limits are.
- Studies to 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.
- Studies to assess the effects of new gears on non-target species (by-catch).
- Education about fish handling is needed in the recreational and commercial sectors.
- Studies on the cumulative effects of multiple recaptures on non-target fish that are released in selective fisheries.
- Studies on the potential economic, social, and cultural impacts of converting to live-capture fishing methods.
- An objective assessment of how a mass-marking and selective fishery approach will affect the evolution of hatchery management policy and the uses of artificial propagation in rebuilding depressed natural stocks.
- Data base development and management to effectively evaluate and compare study results.

B. Implementation and Integration into Fishery Management Regime

Implementing more selective mark-selective fisheries requires:

- Agreement and cooperation between regulatory co-managers and all user groups.
- Reconciling the impact of holding a selective fishery on coded-wire tag information.
- Fishery monitoring and enforcement.
- Modify existing data collection and analysis tools to improve knowledge of fisheries.
- Revising legislation that restricts use of alternate gears (e.g., in Washington, fishwheels are illegal). This will require the discussion of social effects of gear changes. Some gears may not only be useful for reducing release mortality of non-target fish, but may have the potential to be much more efficient methods of capturing target fish. This would increase competition among fishers and potentially reduce the number of fishers able to compete economically in the fishery.
- Developing and refining management guidelines and policies for terminal area recreational fisheries should be further developed and refined.

- High encounter rates with the target fish and low encounter rates with the non-target fish so that the number of fish handled and released is minimized (i.e., we need high mark rates).
- Restructuring fisheries to accommodate higher quality, but lower volumes of fish. The best market assistance is fishery stability without large one day landings.
- Restructuring the non-treaty commercial fishing fleet in the Columbia River should be discussed, although the fleet has functionally reduced itself already. New techniques will require monetary investment and significant changes in current fishing methods. Not all of the fishers will be able to meet these demands. One possibility is to further reduce the fleet through a permit buyback program. Additionally, monetary support may be required to purchase new gear for commercial fishers that commit to changes in gear and current fishing methods. An effort should be made to assist fishers in developing better markets for their catch and doing more value added marketing or processing to increase the economic value of the catch. This would enable the maintenance of an economically viable fishery with reduced overall harvest levels impacting listed stocks.
- Assessment of the feasibility of agreements that reimburse commercial harvesters for not fishing or reducing fishing impacts, thus creating increased abundance that can be passed through other fisheries to contribute to spawning escapement.
- Increased assessment of non-harvest mortalities stated in adult equivalents so that adequate societal judgments can be made on the relative costs and benefits of various harvest and non-harvest activities affecting the populations and restoration of salmon and steelhead. This assessment would also be able to compare the effects of the reduction in harvest-related mortality over the past 2-3 decades compared to levels of non-harvest related mortality over a similar period.

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