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YAKIMA RIVER SUBBASIN

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YAKIMA RIVER SUBBASIN
Salmon and Steelhead Production Plan

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SUPPLEMENT 2
Summary of Objectives and Strategies

Columbia Basin System Planning

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INTRODUCTION

The following summary addresses objectives and strategies only; a full discussion of existing biological background data and the rationale for enhancement strategies will be found in the full Yakima Subbasin Plan.

The objectives and strategies to improve the production of anadromous fish in the Yakima Subbasin address two broad areas -- habitat protection/enhancement, and enhancement actions focused on individual species of fish. The measures within the habitat protection/enhancement section are organized in terms of major land and water use categories (forestry, agriculture, residential development, and consumptive water use).

HABITAT PROTECTION AND ENHANCEMENT

Forestry

The subbasin plan proposes seven actions to make forestry more compatible with the preservation of high quality fish habitat:

1. Determine the cumulative impact of numerous cuts of different age (years after cutting) and size within the same watershed, and use the information gained to modify the Wenatchee Forest Management Plan and the Washington forest practices regulations.

2. Ensure the integrity of riparian (streamside) habitat by maintaining adequate riparian management zones along streams in all logging sites.

3. Develop and apply baseline information to existing habitat quality and the impacts of forest practices.

4. Locate all new logging and forest access roads in stable, non-erodible areas, and outside riparian management zones.

5. Develop and apply landslide and rain-on-snow hazard zonation maps and restrict the size or timing of new cuts in hazardous areas.

6. Where feasible, make the abandonment of logging roads a condition of as many timber sales as possible.

7. Ensure the compatibility of the Yakima Subbasin Plan and drainage-specific timber management plans formulated by the participants in the Timber, Fish and Wildlife Agreement and the Wenatchee National Forest.

The strategies to effect the above objectives entail considerations of funding, and regulation and enforcement. Funding for the studies of cumulative effects, baseline habitat assessment, and landslide and rain-on-snow hazard mapping might come from a number of sources. The internal funding mechanism of the Timber, Fish and Wildlife Agreement can be expected to provide some of the necessary funding, but not all. The Northwest Power Planning Council and the Bonneville Power Administration should consider funding some of the programs, especially those with implications for the entire Columbia Basin. Additional potential funding sources might include monies appropriated by State Referendum 39, the federal Clean Water Act Section 205(j), and the Centennial Clean Water Act. Regulatory and enforcement mechanisms for forest practices on state and

private land already exist in the Timber, Fish and Wildlife Agreement. Under the Timber, Fish and Wildlife Agreement, regulations governing forest practices on state and private lands will be changed to reflect new scientific data gathered by Timber, Fish and Wildlife investigators. Forest practices on national forest lands would probably follow suit, as it is the policy of the Forest Service always to employ "Best Management Practices."

Agriculture

Five general objectives for agricultural practices in the subbasin were proposed:

1. The maintenance of high water quality (sediment discharge, temperature, pesticide and herbicide pollution), the problem of non-point source pollution, and the preservation of riparian habitat are important aspects of fish production. State legislative and/or administrative actions that establish agricultural standards (much as the existing Forest Practices Act regulates forestry) are endorsed. Such legislation should, in addition to promoting productive and profitable agricultural activity, ensure that agricultural practices are environmentally sound.

2. The discharge of suspended sediments into the Yakima River from irrigation returns and wasteways should be reduced, if possible to a level consistent with its designation as a "Class A" water (turbidity less than or equal to 5 NTU).

3. Habitat quality in riparian corridors should be protected by controlling the timing and intensity of livestock grazing.

4. The stocking densities on rangeland currently in good condition should be maintained, and the grazing pressure on deteriorating range should be reduced.

5. The concentration of organochloride pesticides and dieldrin in Sulphur Creek, Birchfield Drain, Granger Drain and Spring/Snipes Creek should be reduced to levels not hazardous to aquatic organisms subjected to long-term exposure.

The strategies to implement the above objectives are discussed in detail under the Part II of the Yakima Subbasin Plan.

Residential Development

The following objectives are proposed for residential development.

1. Protection of riparian zones bordering important spawning and rearing areas.

2. Reduction of septic contamination of streams flowing through urban areas.

As residential impacts on riparian areas bordering important spawning areas are currently concentrated in Kittitas County, initial efforts should be concentrated there. The Kittitas County Planning Department regulated shoreline development in Kittitas County, and the Washington Department of Fisheries approves construction (issues hydraulic permits) for construction in or on the shores of salmon-bearing streams. These two entities should work together to ensure that the requirements of Section 19 of the Kittitas County Shoreline Master Program, "Protection of Natural Shoreline Features," are met in full. Section 19 states that "all construction shall be designed to protect adjacent shorelines against erosion," and goes on to state that "buffer strips of vegetation between shoreline developments and associated water bodies are encouraged, and private and public landowners shall be responsible for the preservation of vegetation to minimize erosion within the shoreline area." This regulation, if strictly enforced, would have prevented many of the existing adverse residential impacts on the upper Yakima. The Kittitas Planning Department, the Yakima Indian Nation and the Washington Department of Fisheries should negotiate a more comprehensive minimum "riparian management zone" requirement for future development that more effectively protects riparian areas in the most important spring chinook spawning and rearing habitat in the subbasin. Planners suggest that these requirements be modeled on the existing riparian management zone regulations in the Washington Forest Practices Act.

In the Yakima Subbasin, septic contamination is most problematic in Ahtanum Creek and Wide Hollow Creek. The Washington Department of Ecology is encouraged to continue its efforts in these areas to enforce existing laws relating to septic tank leakage and the discharge of septic wastes into storm drains.

Consumptive Water Use

Yakima planners propose the following general objectives in the area of consumptive water use and resultant instream flows.

1. As a general goal, flows for spawning, rearing and migration should be improved throughout the Yakima Subbasin. Flow reduction in reaches with high flows and flow augmentation in reaches with low flows would increase the amount of usable habitat, and would increase the carrying capacity of the subbasin. Improved flows in certain reaches during adult and juvenile migration periods would also improve migration survival rates.

2. A specific and very important objective is that discharge in the reach of the Yakima River between Easton Dam and the Cle Elum River be high enough to provide adequate flows in braids and side channels. This objective is critical from April through early July, while newly-emergent spring chinook fry remain in the area. A preliminary prescription is that total flow in the reach not fall below approximately 90 cfs. This flow is based on IFIM (instream flow incremental methodology) data (Dell Simmons, USFWS, pers. commun., 1990), which indicates that side-channel flow will be a perilously low 2 cfs when total discharge is 90 cfs, and that side channels will be totally dry when total discharge is about 80 cfs (see spring chinook limiting factors section).

   Yakima planners strongly endorse a plan that has recently (April 1990) been at Yakima River Basin Water Enhancement Project (YRBWEP; see next section) meetings (Bob Tuck, YIN fisheries consultant, pers. commun., 1990). Under this proposal, facilities would be built to divert as much as 35,000 acre feet of late winter and spring flood flows from Cabin Creek and Silver Creek. This water would be routed to Kachess Reservoir, which rarely fills, and would be used primarily or entirely to augment instream flows for the benefit of anadromous fish. Specifically, the amount of water added to Kachess Reservoir would be "on call" for fisheries use, but would be withdrawn from Keechelus Reservoir, not Kachess. Such a shift in the point of withdrawal would allow instream flows to be supplemented in the Keechelus to Easton reach, as well as the Easton to Cle Elum reach. (The newly-accessible 11 miles of the Keechelus to Easton reach would undoubtedly afford the best habitat in the subbasin if critically low flows during the period of reservoir

refilling -- mid October through April -- could be eliminated.)

Although these general goals are achievable with major changes to the existing storage and operational system in the subbasin, no "concrete" proposal to effect all of the needed improvements exists at the present time. Accordingly, subbasin planners encourage the identification and support of new proposals, such as the Cabin Creek/Silver Creek diversion plan, that would improve instream flows. These measures would include conservation strategies to reduce irrigation diversions, new storage to provide water for instream flows as well as irrigation, operational changes resulting in improved flows, and other measures. Studies to identify, evaluate and refine potential measures for improving water supplies and instream flows should be encouraged. The Yakima River Basin Water Enhancement Project group, in consultation with Washington Department of Fisheries, Washington Department of Wildlife and the Yakima Indian Nation, should review proposals, and identify those with the best potential for enhancing fish production. All groups interested in improving fisheries in the Yakima Subbasin should support implementation of acceptable flow enhancement efforts.

In addition to the Cabin Creek/Silver Creek diversion plan, two other measures to improve instream flows are feasible now. First, flows could be increased and passage of adults and juveniles improved if diversions for hydropower generation at Wapatox, Chandler and Roza dams were subordinated to instream flows. Second, passage of smolts below Sunnyside Dam would be improved by rebuilding and automating antiquated check structures on Sunnyside Canal, and implementing a specific operational program to use resultant saved water in an optimal manner (see strategies for spring chinook, Part IV). Both hydropower subordination and renovation of Sunnyside Canal were addressed in detail by the Early Implementation Bill (5.2519) and the Comprehensive Yakima River Basin Water Enhancement Project Bill (5.2322). As the comprehensive measure has failed, the reintroduction of revised and scaled-down legislation seems likely. Support from the fisheries community for some form of legislation that, at a minimum, entails subordination of hydropower, the renovation of Sunnyside Canal, and the implementation of the Cabin Creek/Silver Creek diversion plan is strongly recommended.

ANADROMOUS FISH PRODUCTION PLANS

Context and Organization

All proposed fish production strategies assume continuation of the current water supply and irrigation demand. Specifically, planners have assumed the existing storage capacity, irrigation system operations policies and instream flow cycles to be in effect for purposes of analysis.

The impact of an improved hydrograph has been investigated in another context. The Yakima River Basin Water Enhancement Project team used IFIM (instream flow incremental methodology) techniques to estimate the total number of anadromous spawners at full seeding under existing conditions and under conditions of improved instream flow (Anonymous 1987). These optimal flows were made possible by full implementation of all of the measures (Bumping Lake expanded to 400,000 acre feet, 20 percent reduction in irrigation demand from conservation) in the failed Comprehensive Water Enhancement bill.

The estimates of spring chinook, fall chinook and steelhead spawners at full seeding under existing conditions were reasonably comparable to subbasin planning estimates. The IFIM-based estimate was 17,600 spawners (steelhead, spring and fall chinook combined); the subbasin planning estimate, adjusted for terminal harvest and pre-spawning mortality, was 19,095 fish. In subbasin planning, it was estimated that improving all qualitative aspects of the natural environment under the existing pattern of instream flow would result in a fourfold increase in total production. The Yakima River Basin Water Enhancement Project team, on the other hand, estimated that optimizing instream flows under existing conditions of habitat quality would result in a sevenfold increase in adult production.

The feature of the existing hydrological regime that most significantly limits production of anadromous fish is the existing storage capacity, which is frequently insufficient to satisfy total irrigation demand. Such conditions can significantly reduce smolt production by causing newly emergent fry to be stranded in side channels of the upper Yakima, by increasing the vulnerability of fish to predatory fish and birds, and by delaying smolt passage through Columbia reservoirs past the period of optimal outmigration. As natural riffles become even shallower, vulnerability of smolts to gulls and herons increases. Water velocity also drops substantially, and travel time through the basin and the Columbia River mainstem is prolonged. A smolt run held up in the subbasin may enter the Columbia after the period of maximum "flushing spills" at mainstem dams, and at a time when rising water temperatures trigger higher feeding rates by predatory fish in the Columbia.

Related adverse impacts on rearing capacity, overwinter survival and smolt survival are the most significant features of the existing hydrological cycle. They are also probably the most significant factors limiting production of salmon and steelhead in the Yakima Subbasin today. Six secondary limiting factors, some of which are linked to or exacerbated by the existing hydrological cycle, are:

1. Nonexistent or inadequate screening of numerous small to moderately sized irrigation ditches. The loss of fry and smolts in these ditches is compounded by low spring flows, as proportionately more streamflow is then diverted.

2. Tributaries that are inaccessible to fish because of impassible irrigation diversions in their lower reaches and/or because their lower reaches are completely dewatered by irrigation withdrawals.

3. Excessive flows throughout much of the mainstem Yakima during the irrigation season, when large releases from storage reservoirs must be made to keep up with demand.

4. Heavy deposition of sediments in the lower river from silt-laden irrigation returns. Warm, opaque return water also contributes to the temperature problem in the lower river in the summer.

5. The loss of substantial numbers of adult spring chinook that have escaped the legal terminal fishery. These losses are generally attributed to poaching, an activity that is abetted by low flows below major irrigation dams.

6. Riparian degradation, caused primarily by overgrazing.

The plan for each species in the Yakima Subbasin consists of an optimal combination of up to nine independent enhancement actions, with the common objective of increasing net smolt production by improving one of the five determinants of smolt production: total egg deposition, egg-to-emergent fry survival, fry-to-late summer parr survival, overwinter survival, and outmigrant smolt survival. Because they are focussed on basic life-cycle stanzas common to all anadromous salmonids, each individual element enhances all species occurring in its impact area. One element, construction of the Yakima/Klickitat Central Outplanting Facility is considered a given, and will be part of all species' plans. The other eight elements have been independently evaluated by a series of computer models (the "Tributary Planning Model" and the "System Planning Model,"

hereafter termed the "TPM/SPM procedure"), and ranked in terms of projected benefits.

In order of size of anticipated benefit, these elements have been added together in a series of "partial cumulations," which have also been evaluated by the TPM/SPM procedure. (Note that "partial cumulation" refers to a plan that integrates some of nine possible actions (such as Actions 1, 2, and 3 only). Species-specific plans consist of the partial cumulation that best conforms to the policies of system planning, and the managing fisheries agencies and Indian tribes.

In order of cumulation, the nine independent elements are:

1. Construct the Yakima/Klickitat Hatchery.

   All species proposed for the Yakima Subbasin (spring chinook, summer chinook, fall chinook, coho, summer steelhead and possibly sockeye) will benefit from this element.

   The ultimate purpose of the hatchery is to test the effectiveness of supplementing natural runs with hatchery-reared fish or, as it is stated in the hatchery's master plan, to "test the assumption that new artificial production can be used to increase harvest and enhance the natural production of salmon and steelhead while maintaining genetic resources." With the exception of coho, all smolts produced by the hatchery will be outplanted in numerous mainstem reaches and tributaries with the expectation that adults will return, not to the hatchery, but to their liberation point, where they will spawn naturally.

   The practical goal of the hatchery is to increase the status (seeding) and productivity (recruits per spawner) of existing natural stocks by transforming them into "supplemented stocks." Brood stock for supplementation is expected to be taken exclusively from natural Yakima River runs, when such runs exist. Supplemented stocks will be managed to retain the character, adaptability and fitness of their natural ancestry while benefitting from the increased productivity expected from artificial incubation and rearing. In addition, the hatchery project will attempt to increase overall production by the reintroduction of a number of stocks historically present, but now extinct in the subbasin (summer chinook, coho and, given the success of an ongoing feasibility study, sockeye). As runs of reintroduced stocks build up, returning adults will comprise a larger and larger proportion of the brood stock.

   Under the proposed hatchery program, the genetic fitness of supplemented stocks will be maintained by specific measures:

A) Loss of genetic variability will be minimized by a host of special cultural practices.

B) Selective pressure for adaptation to a hatchery environment will be reduced by preventing the rearing of successive generations in the hatchery. Hatchery-reared smolts will be marked before release, and unmarked adults will be taken for brood stock.

C) The genetic risks associated with supplementation will be reduced by an intensive program of genetic monitoring, and by the maintenance of unsupplemented areas. The unsupplemented streams are intended to be evaluated as controls within the experiment.

2. Expand habitat.

An expansion of habitat into currently un-utilized areas promotes the objective of increasing egg deposition. Habitat expansion is proposed for all species except coho and summer chinook. As both of these species are currently extinct, the concept of "habitat expansion" is not presently applicable. Supplemented natural production of summer chinook will be attempted in areas already accessible. The probability of reestablishing significant populations of naturally reproducing coho is low due to present harvest rates (directed at hatchery coho) occurring in ocean and lower river fisheries. Accordingly, coho are to be managed for the "maximum sustained yield" of hatchery fish. The expansion of natural habitat for coho is, at the present time, not being considered.

Potential habitat consists of tributaries and reaches of the mainstem that are variously blocked by natural or man-made barriers, and/or compromised by unscreened diversions and/or are inaccessible or limited in potential because of inadequate instream flows. Habitat expansion thus consists of building fishways, screening ditches, and improving instream flows for adult spawning and juvenile rearing. Additionally, habitat expansion consists of support for legislative initiatives to solve instream flows in the upper Yakima (as the Cabin Creek/Silver Creek diversion project combined with the Sunnyside Canal renovation project would -- see text), as well as support for legislative initiatives to improve instream flows in the Teanaway River, Taneum Creek and Manastash Creek by building flow-augmentation reservoirs near the headwaters of targeted streams.

Natural production of spring chinook and/or steelhead could be greatly increased in many currently underutilized tributaries and mainstem reaches. Natural production of

fall chinook could be expanded to some extent if populations could be established in two drains in the Wapato Irrigation Project, Wanity Slough and Lateral Drain Four, as well as the lower 10 miles of Toppenish Creek (see main Yakima Subbasin Plan for detailed list of streams and analysis of potential smolt capacities).

3. Halve the losses of outmigrating smolts in the mainstem.

Predators (squawfish, channel catfish, bass and seagulls) and, probably to a lesser degree, abiotic factors, may be responsible for the loss of over 50 percent of all smolts before they leave the subbasin. The loss of outmigrating smolts in the lower Naches and Yakima is strongly exacerbated by periods of low flow in April and May.

If initial studies verify speculation that predation is responsible for most inbasin smolt loss, increasing smolt survival would require a predator control and prey protection program. Yakima subbasin planners believe observed smolt losses are primarily attributable to predation by bass and, especially, by squawfish. A technical group is currently drafting a detailed proposal for all elements of the study.

In summary, the incremental proposals included in Strategy 3 (halving smolt losses) are:

A) Evaluate smolt losses in the Yakima Subbasin, including a provision to implement justified corrective actions specifically including a predator control program.

B) Narrow and line a short section of Chandler Canal.

C) Encourage legislative initiatives that include proposals to subordinate diversions for power production at Roza, Chandler and Wapatox dams; install new, automated check structures on Sunnyside Canal; and modernize, consolidate and install reregulating reservoirs on smaller irrigation districts in the subbasin.

4. Renovate "Phase-II" screens.

This enhancement measure is intended to improve the survival of both newly emergent fry and outmigrating smolts. Although 20 large diversions (the "Phase-I" group) in the subbasin were refitted with modern screens and fish bypasses by the fall of 1989, the screens on 53 small to moderately sized diversions remain poorly designed and in deteriorating condition. Collectively, these "Phase-II" screens pose a severe threat to outmigrating smolts and dispersing fry. Renovation of Phase-II screens would benefit all anadromous

salmonids, but especially spring chinook and steelhead, which spawn and rear higher in the subbasin than fall chinook.

In its March 1989 meeting, the Northwest Power Planning Council amended Section 803(b) of the Columbia River Basin Fish and Wildlife Program as follows:

> 803(b)(8) -- Bonneville shall fund the planning and design of fish passage facilities for the irrigation diversions in the Yakima River Basin listed in Appendix A Table of the Fish and Wildlife Program. The design will begin with the highest priority facilities as established by a predesign memorandum and the Yakima Passage Technical Work Group. Bonneville shall not fund any construction of these facilities until the Council has adopted the subbasin plan for the Yakima basin, developed under Section 205(a). The Yakima Indian Nation and the fishery agencies shall make a good faith effort to secure cost-sharing funding for the construction of Yakima Basin fish passage facilities listed in Appendix A Table.

Section 1403(4.5) was amended by adding the following language:

> Beginning in FY 1989, plan and design fish passage facilities for the irrigation diversions in the Yakima Basin listed in Appendix A Table.

Design work for the Phase-II project is currently under way, and construction will begin when the Yakima Subbasin Plan is adopted.

5. Create off-channel winter refuges and other measures to improve overwinter survival of pre-smolts.

Over-winter mortality rates for anadromous salmonids are high, especially for fish unable to find appropriate winter habitat. Planners surmise that the large number of spring chinook (and the smaller number of steelhead) migrating down the Yakima in the winter represent fish unable to find appropriate habitat upriver. There is some evidence that the mortality of such fish approaches 80 percent. Accordingly, planners propose that 18 smaller canals be used as "off-channel winter refuges." It is proposed that these canals be run in the winter to provide slow-moving pool habitat for pre-smolts. While the abundance of structural cover elements varies widely from canal to canal, all offer slow-moving, pool-type habitat, and therefore would provide better habitat than the open river. See Yakima Subbasin

Plan for details regarding habitat potential in off-channel winter refuges.

6. Install modern screens on Wapatox Diversion and condition hydropower diversions on the leaving of a minimal amount of instream flow in the river.

The problems at Wapatox diversion -- entrainment of fry and smolts through or around the screens, and the loss of smolts and habitat in the dewatered reach between the dam and the powerplant outfall -- are treated separately from similar problems at other diversions. Wapatox is treated separately because it is a major diversion not operated by the Bureau of Reclamation; is addressed separately [in measure 803(b)(1)] in the Columbia River Basin Fish and Wildlife Program; and because it is located on the Naches River, and thus impacts different substocks of spring chinook and steelhead (as well as much of the potential summer chinook habitat in the subbasin).

Rectification of the problems posed by Wapatox diversion will benefit spring chinook and summer steelhead as well as the Wenatchee stock of summer chinook slated for introduction when the hatchery comes on line.

Planners recommend the rescreening of Wapatox diversion and, if possible, the subordination of diversions for power generation. If it is impossible for BPA to compensate Pacific Power and Light Company for revenues precluded by subordination, Yakima Subbasin planners request that the Power Council and BPA encourage any legislative initiative including this element.

7. Restore riparian habitat.

Riparian conditions on over 100 miles of stream in the subbasin are clearly degraded, primarily because of overgrazing. Fencing is recommended (see Yakima Subbasin Plan for discussion of expected fish benefits and smolt production).

The particular approach to restoring riparian habitat on rangeland advocated here is one that emphasizes benefits to the cattlemen and thereby makes voluntary acceptance much more likely. In Oregon, such projects have clearly improved both fish and wildlife habitat and cattle production, and have therefore been endorsed by ranchers. In a project of the scope necessary for the Yakima Subbasin, benefits to cattlemen must be clear enough to provide strong incentive for cooperation.

8. Reduce pre-spawning mortality.

Reducing the loss of spawners that have escaped all legal fisheries would enhance the objective of increasing egg deposition within the subbasin. An estimated 20 percent of adult spring chinook are lost after escaping all legal fisheries. It is believed that much of this loss is attributable to poaching, which is exacerbated by low summer flows below Roza Dam, Prosser Dam, Wapatox Dam and Sunnyside Dam. The Subbasin Plan proposes that this loss be halved by improving flows (subordinating power generation at Roza, Chandler and Wapatox); by erecting interpretive signs in and around Naches River campgrounds; eliminating outplants of catchable rainbow in the Naches drainage; and hiring four additional conservation officers.

9. Increase fall chinook egg-to-smolt survival.

The egg-to-smolt survival rate for the portion of Yakima River fall chinook population spawning above Prosser Dam is estimated to be about half the rate observed for spring chinook. The Power Council's Monitoring and Evaluation Group (MEG) have assumed fall chinook egg-to-smolt survival will, under ordinary circumstances, be about <u>twice</u> the rate of spring chinook. Planners hypothesize that the poor performance of Yakima fall chinook is attributable to intense squawfish predation on fry, pre-smolts and smolts; and to the heavy deposition of sediments in middle and lower Yakima spawning areas, which depress egg-to-emergent fry survival. Planners propose that egg-to-smolt survival for fall chinook be increased from its current 39 percent to 50 percent, the "generic" value MEG has estimated for fall chinook.

The predatory aspect of the problem would benefit from the measures previously discussed under the topic of improving smolt survival. The sedimentation problem would be ameliorated by any measure that reduced the discharge of irrigation returns or that promoted conservation of soil and water on the farm.

Spring Chinook Objectives and Strategies

Objective

The terminal harvest objective for spring chinook is to maximize sustainable yield in a way that is consistent with long-term conservation of genetic fitness and the experimental goals of the Yakima/Klickitat Production Project. An additional goal is that the substock of spring chinook in the American River be preserved.

A TPM/SPM simulation of a spring chinook fishery supplemented as envisioned by hatchery planners indicates the MSY terminal harvest under existing habitat conditions is 4,864 adults, more than three times the unsupplemented MSY of 1,424 fish. Estimated terminal MSY for a supplemented fishery under conditions of maximal improvement of habitat quality and quantity is 15,519 fish. Assuming compatibility with conservation of genetic fitness, the objective for terminal harvest has therefore been set at 15,000 fish.

Strategies

All strategies in the Yakima Subbasin are cumulative. Planners recommend Strategy 9. The nine "cumulating" strategies for spring chinook are:

Strategy 1: Implementation of Yakima/Klickitat Production Project with existing habitat.

Strategy 2: Strategy 1 plus additional habitat.

Strategy 3: Strategy 2 plus halving open-river smolt losses.

Strategy 4: Strategy 3 plus rebuilding Phase-II screens.

Strategy 5: Strategy 4 plus provision of off-channel winter refuges.

Strategy 6: Strategy 5 plus rescreening and power subordination at Wapatox.

Strategy 7: Strategy 6 plus riparian restoration.

Strategy 8: Strategy 7 plus reduced pre-spawning adult mortality.

Strategy 9: Strategy 8 plus making the Teanaway River usable.

The preceding general description of enhancement strategies adequately describes enhancement plans for spring chinook with the exception of Strategy 1. For spring chinook, the number of differences in approach or emphasis in the proposed supplementation program merits individual discussion.

Strategy 1: Yakima/Klickitat Production Project with existing habitat.

The spring chinook program under the Yakima/Klickitat Production Project will involve the collection of about 970 wild/natural Yakima River adults to produce about 1.6 million smolts. All fish will be outplanted after acclimation at the release site. (For additional information on the YKPP, see Yakima/Klickitat planning reports.)

The associated harvest management plan for spring chinook under the Yakima/Klickitat Production Project reflects a commitment to supplementation experiments and to meeting hatchery production goals, while rebuilding natural runs and harvest opportunities. The interim natural escapement goal of 6,000 fish will be met at run sizes of slightly less than 9,000 under the YKPP proposed harvest regime.

Table 1 summarizes the benefits predicted for each of these strategies by the TPM/SPM procedure:

Table 1. Benefits to Yakima Subbasin spring chinook fishery as predicted by the TPM/SPM procedure. All figures are adult fish at maximum sustained yield (MSY).

STRATEGY	ESCAPEMENT TO SUBBASIN	TERMINAL HARVEST	TERMINAL HARVEST RATE	TOTAL HARVEST TO ALL FISHERIES	SPAWNING ESCAPEMENT
0[1]	4,910	1,424	0.29	2,539	2,424(256)[2]
1	9,358	4,847	0.52	6,933	3,592(20)
2	10,856	5,319	0.49	7,723	4,430(43)
3	18,298	10,064	0.55	14,121	6,587(109)
4	20,680	11,788	0.57	16,388	7,114(224)
5	20,879	12,110	0.58	16,752	7,015(202)
6	23,536	13,651	0.58	18,899	7,908(344)
7	24,316	13,860	0.57	19,283	8,365(370)
8	25,016	15,010	0.60	20,592	9,006(420)
9	26,303	15,519	0.59	21,388	9,706(449)

[1] "Strategy 0" denotes "existing habitat, no hatchery."

[2] The first figure in the spawning escapement column is for the entire subbasin; the second, parenthesized figure is for the American River only.

Steelhead Objectives and Strategies

Objectives

The basic objectives for steelhead enhancement are similar to those for spring chinook -- maximize harvest within the subbasin while preserving genetic fitness. Analogous to spring chinook, an unsupplemented "genetic sanctuary" of steelhead is to be maintained in Satus Creek under the Yakima/Klickitat Production Project. An additional consideration for steelhead is that steelhead enhancement not adversely impact resident rainbow populations currently concentrated in the Yakima River above Roza Dam.

It has proved difficult to formulate a precise numerical MSY target for steelhead, but for purposes of analysis, planners used a sustainable sport catch on the order of 2,000 fish (the yield recorded in the early 1960s, when historically recent catches peaked). An equal catch was also assumed for tribal fishermen within the subbasin.

Strategies

Planners recommend implementing Strategy 7. The seven, "cumulating" strategies for steelhead are:

Strategy 1: Implementation of Yakima/Klickitat Production Project with existing habitat.

Strategy 2: Strategy 1 plus additional habitat.

Strategy 3: Strategy 2 plus halving open-river smolt losses.

Strategy 4: Strategy 3 plus rebuilding Phase-II screens.

Strategy 5: Strategy 4 plus provision of off-channel winter refuges.

Strategy 6: Strategy 5 plus rescreening and power subordination at Wapatox.

Strategy 7: Strategy 6 plus riparian restoration.

The preceding general description of enhancement strategies is detailed in the steelhead plan of the Yakima Subbasin Plan. Table 2 summarizes the benefits predicted for each of the seven cumulating strategies for steelhead.

Table 2. Benefits to Yakima Subbasin steelhead fishery as predicted by the TPM/SPM procedure. All figures are adult fish at MSY.

STRATEGY	ESCAPEMENT TO SUBBASIN	TERMINAL HARVEST	TERMINAL HARVEST RATE	TOTAL HARVEST TO ALL FISHERIES	SPAWNING ESCAPEMENT
0[1]	4,107	780	0.19	1,606	2,995(1025)[2]
1	6,831	4,440	0.65	5,812	2,152(230)
2	11,715	5,272	0.45	7,625	5,799(576)
3	20,974	10,487	0.50	14,700	9,438(584)
4	23,862	12,647	0.53	17,440	10,094(559)
5	26,285	14,194	0.54	19,473	10,882(539)
6	28,190	15,223	0.54	20,884	11,671(539)
7	29,704	16,040	0.54	12,006	12,298(754)

[1] "Strategy 0" denotes "existing habitat, no hatchery."

[2] The first figure in the spawning escapement column is for the entire subbasin; the second, parenthesized figure is for the Satus Creek only.

Fall Chinook Objectives and Strategies

Objectives

The goal of fall chinook enhancement is to maximize natural production to permit a significant increase in fishing opportunities for treaty and non-treaty fishermen.

The objective is to maximize natural production and harvest opportunity to treaty and non-treaty fishermen in the Columbia River and terminal fisheries. Computer simulations indicate successful implementation of the most comprehensive fall chinook strategy would result in sustainable terminal and Columbia River harvests of 4,709 and 28,569 fish (both above and below Bonneville Dam), respectively.

Strategies

Planners recommend Strategy 4. The four "cumulating" strategies for fall chinook are:

Strategy 1: Construction of hatchery with existing habitat.

Strategy 2: Strategy 3 plus halving mainstem smolt losses.

Strategy 3: Strategy 2 plus improved egg-to-smolt survival.

Strategy 4: Strategy 1 with expanded habitat.

The preceding general description of enhancement strategies is detailed in the fall chinook plan in the Yakima Subbasin Plan. Table 3 summarizes the benefits predicted for each of the four cumulating strategies for fall chinook.

Table 3. Benefits to Yakima Subbasin fall chinook fishery as predicted by the TPM/SPM procedure. All figures are adult fish at MSY.

STRATEGY	ESCAPEMENT TO SUBBASIN	TERMINAL HARVEST	TERMINAL HARVEST RATE	TOTAL HARVEST TO ALL FISHERIES	SPAWNING ESCAPEMENT
0[1]	3,300	627	0.19	13,807	2,406
1	6,380	2,998	0.47	28,484	3,043
2	7,918	4,117	0.52	35,746	4,609
3	8,072	4,601	0.57	36,848	4,272
4	8,410	4,709	0.56	38,304	4,351

[1] "Strategy 0" denotes "existing habitat, no hatchery."

Summer Chinook Objectives and Strategies

Objectives

The goal of the summer chinook portion of the plan is simply test the feasibility of reintroducing a naturally reproducing population of summer chinook to the subbasin. Pending determination of the feasibility of reintroducing this stock, no utilization goals have been set.

Strategies

Planners recommend implementing Strategy 5. The five "cumulating" strategies for summer chinook are:

Strategy 1: Construction of the Yakima/Klickitat Hatchery with existing habitat.

Strategy 2: Strategy 1 plus halving mainstem smolt losses.

Strategy 3: Strategy 2 plus rebuilding of all Phase-II screens.

Strategy 4: Strategy 3 plus rebuilding of screens at Wapatox and conditioning hydropower diversions on the leaving of a minimal instream flow in the river.

Strategy 5: Strategy 4 plus riparian restoration.

The preceding general description of enhancement strategies are detailed in the summer chinook section of the Yakima Subbasin

Plan. Table 4 summarizes the benefits predicted for each of the five cumulating strategies for summer chinook.

Table 4. Benefits to potential Yakima Subbasin summer chinook fishery as predicted by the TPM/SPM procedure. All figures are adult fish at MSY.

STRATEGY	ESCAPEMENT TO SUBBASIN	TERMINAL HARVEST	TERMINAL HARVEST RATE	TOTAL HARVEST TO ALL FISHERIES	SPAWNING ESCAPEMENT
0[1]	2,904	1,249	0.43	2,310	1,324
1	3,172	1,396	0.44	2,555	1,424
2	7,391	4,361	0.59	7,062	2,429
3	7,964	4,858	0.61	7,769	2,489
4	10,946	6,786	0.62	10,787	3,333
5	11,956	7,413	0.62	11,782	3,640

[1] "Strategy 0" denotes "existing habitat, no hatchery." This is a hypothetical scenario driven by a population of naturally spawning fish equal in number, sex ratio and fecundity to the 115 Wenatchee stock fish that will start the Yakima/Klickitat Production Project.

Coho Salmon Objectives and Strategies

Objectives

An important general goal of the Yakima Subbasin Plan is to establish more diversified fishing opportunity. The coho program is therefore intended to maximize terminal MSY. Computer simulations indicate that the Yakima/Klickitat Production Project coho program, in combination with a program to halve smolt losses in the open river, could generate a sustainable terminal harvest of 2,161 fish. Consonant with the need to generate the largest fall fishery possible, it is proposed that the harvest goal be set at 2,000 fish, and be driven by hatchery production.

Strategies

Planners recommended Strategy 4 for coho. The four "cumulating" strategies are:

Strategy 1: Construction of the Yakima/Klickitat Hatchery with existing habitat.

Strategy 2: Strategy 1 plus halving mainstem smolt losses.

Strategy 3: Strategy 2 plus renovating Phase-II screens.

Strategy 4: Strategy 3 plus Wapatox rescreening and power subordination.

The preceding general description of enhancement strategies are discussed in the coho plan of the Yakima Subbasin Plan. Table 5 summarizes the benefits predicted for each of the four cumulating strategies for coho.

Table 5. Benefits to potential Yakima Subbasin coho fishery as predicted by the TPM/SPM procedure. All figures are adult fish at MSY.

STRATEGY	ESCAPEMENT TO SUBBASIN	TERMINAL HARVEST	TERMINAL HARVEST RATE	TOTAL HARVEST TO ALL FISHERIES	NATURAL SPAWNING ESCAPEMENT
0[1]	0	0	0	0	0
1	2,929	59	0.02	14,353	4
2	4,417	1,546	0.35	23,102	1
3	4,760	1,904	0.40	25,133	6
4	5,025	2,161	0.43	26,682	2

[1] "Strategy 0" denotes "existing habitat, no hatchery." This is a hypothetical scenario driven by a population of naturally spawning fish equal in number, sex ratio and fecundity to the 2350 early-run fish that will start the Yakima/Klickitat Production Project program. Note that heavy pre-terminal exploitation and relatively low natural egg-to-smolt survival rates preclude natural production of coho in the subbasin.

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