Recommendations on 2001 Federal Columbia River Power System Operations and Fish Survival

April 6, 2001

Northwest Power Planning Council

Council document 2001-06

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Council Recommendations on 2001 Hydrosystem Operations

The following decisions and recommendations were adopted by the Northwest Power Planning Council at its meeting on Wednesday, April 4, in Boise, Idaho.

1. Release issue paper for comment through April 20, 2001. The issue paper entitled "Analysis of 2001 Federal Columbia River Power System Operations on Fish Survival." is attached. The Council will consider comments at its next work session, April 24-26, in Spokane, Washington.

2. A preliminary recommendation calling for full transportation of juvenile salmon and steelhead in spring and summer where that option is available. This recommendation would apply to Lower Granite, Little Goose, Lower Monumental, and McNary Dams, which are the only ones with transportation capabilities. This recommendation will be taken up for final action at the April 24-26 Council meeting.

3. A preliminary recommendation allowing for limited surface spill at John Day, The Dalles, and Bonneville Dams. The default position is no spill except where a compelling case can be made for selective spills with high measurable benefits for fish or until conditions improve. The Council requests the federal operating agencies and the federal, state, and tribal fish and wildlife agencies to work with the Council to develop a plan for when, where, and how such spill would be provided. As used in these recommendations, "surface spill" means passing fish from the surface of the reservoir through the dam, using relatively low volumes of water, by such means as an existing sluiceway or through the use of stoplogs in a spill bay. Surface spill at one of these projects would be used whenever there are substantial indications that fish passing the project are being significantly delayed or harmed by the other passage alternatives available at that project, provided that the surface spill can be accomplished in a way that maximizes fish benefits and minimizes power impacts. This recommendation will be taken up for final action at the April 24-26 Council meeting

4. A recommendation that the Bonneville Power Administration establish a mitigation fund from a portion of the revenues resulting from decreased spill. In the event that there is also a reduction in spill authorized for the non-federal mid-Columbia projects, the Council would recommend that a portion of those revenues

also be designated for this fund. As a first priority, this fund would be used for increasing flows in tributaries and the mainstem by encouraging voluntary reductions in the use of water for irrigation, on a willing-seller basis consistent with state and federal law.

5. Request that the federal hydrosystem operating agencies follow recommendations (2) and (3) as interim measures until the Council has an opportunity to make a final recommendation at its April 24-26 meeting.

6. Request that the US Army Corps of Engineers and the National Marine Fisheries Service present to the Council at its April 24-26 meeting a full review of surface spill possibilities at John Day, The Dalles, and Bonneville Dams, together with a review of the effectiveness and power system impacts of other passage alternatives at those dams. This is intended to give the Council and the public a better understanding of the choices available for fish passage at these projects.

7. Request that the operators of the non-federal mid-Columbia hydroelectric projects and the National Marine Fisheries Service present to the Council at its April 24-26 meeting a full review of surface spill possibilities at the mid-Columbia dams, together with a review of the effectiveness and power system impacts of other passage alternatives at those dams. These projects are currently required to spill as a condition of their licenses from the Federal Energy Regulatory Commission. This is intended to give the Council and the public a better understanding of the choices available for fish passage at these projects, and to form the basis for a possible further recommendation regarding spill at these projects.

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March 30, 2001

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ISSUE PAPER: ANALYSIS OF 2001 FEDERAL COLUMBIA RIVER POWER SYSTEM OPERATIONS ON FISH SURVIVAL

Introduction

The Columbia River Basin is now facing a severe drought. The current forecasts predict that this will be at least the second worst water year in the 72-year historical record, and there is a possibility that this year may in fact set a new record for low flow conditions.

The poor water conditions, a growing BPA financial problem, and looming energy concerns are causing the region to look for alternatives to meet anticipated energy needs. Changes to the operations of the Federal Columbia River Power System (FCRPS) will most likely be needed to optimize power production and help offset the growing Northwest and West Coast power crisis.

Reductions in spill designated for juvenile fish passage have been considered as one way to help meet energy demand. While spill reductions may help ease the difficult power situation, it is unclear how these reductions may affect juvenile fish survival. To help answer this question, Council staff examined the possible relative biological effects of various spill and transportation alternatives on Columbia basin fish survivals. While there are many unlisted hatchery and naturally spawning populations in the Columbia Basin, the Council analysis focuses solely on ESA-listed stocks.

The 2000 Federal Columbia River Power System Biological Opinion (2000 Biological Opinion) uses a combination of strategies to help juvenile salmon and steelhead migrating out to the ocean pass through or around each hydroelectric dam. There are four possible routes: (1) through a juvenile bypass system, which intercepts fish with screens and routes them through a specially designed passage in the dam; (2) by opening the spill gates, which routes the fish over the spillway but decreases the water available for generating electric power; (3) through the turbines, which is not a preferred route due to reduced survival; and (4) by intercepting fish and transporting them in barges to a release point below the hydroelectric system.

This Issue Paper focuses on three questions:

1. **Given full implementation the 2000 Biological Opinion for 2001 water conditions, how will additional spill reductions at FCRPS dams change the total system survival of migrating ESA-listed juveniles?**

2. **How will juvenile transportation at McNary Dam affect the survival of the Upper Columbia ESA-listed stocks?**

3. **How will adult returns be affected by changes in spill and fish transportation operations?**

The analysis that follows is a preliminary staff analysis of these questions. The Council seeks comment on this analysis and will consider these issues further at its April 24, 25, and 26 meeting in Spokane, Washington. Those wishing to comment may submit written comments to Mark Walker, Director, Public Affairs Division, Northwest Power Planning Council, 851 SW Sixth Avenue, Suite 1100, Portland, OR 97204 or mwalker@nwppc.org through April 20, 2001.

Summary of Results

In analysis included in the 2000 Biological Opinion, the National Marine Fisheries Service (NMFS) used its spreadsheet model to project the survival of salmon passing through the hydrosystem. This model, known as SIMPAS, is used in this analysis to estimate the relative effects of various spill and transportation alternatives on juvenile salmon survival.

The following are the results of this analysis.

When compared to full implementation of the 2000 Biological Opinion under 2001 water conditions, spill reductions at FCRPS dams:

- Have little to no effect on the total system survival of Snake River spring/summer chinook, Snake River steelhead or Snake River fall chinook.
- Decrease total system survival for Upper Columbia spring chinook, Upper Columbia steelhead and Middle Columbia steelhead to the highest extent compared to other ESU's. These stocks are not transported and pass through several dams.
- Have less effect on the total system survival for Lower Columbia chinook and Lower Columbia steelhead because 1) most of the these listed populations are geographically situated below Bonneville Dam and 2) the Lower Columbia chinook and steelhead only pass one FCRPS dam (Bonneville Dam).

When compared to full implementation of the 2000 Biological Opinion under 2001 water conditions, full transportation at McNary Dam with no spill at FCRPS dams:

- Increases Upper Columbia spring chinook total system survival under all alternatives.
- Increases Upper Columbia steelhead total system survival under most conditions.

For the alternatives examined, estimated adult losses for listed fish range from:

- Zero adults lost for Snake River steelhead (0.0 percent of total return) to

- 253 to 2,535 Upper Columbia spring chinook adults lost with no transport at McNary Dam (12.7 percent of total return).

Caveats

Staff believes that this analysis focuses on the attributes most important to this year's decision. While not all the relevant factors have been measured or identified, this analysis focuses on the **relative effect** of various alternatives. Parameters that are assumed to be the same among various alternatives effectively "cancel out" in a relative analysis. Nevertheless, the reader should be aware that:

(1) This analysis focuses primarily on juvenile fish survival through the dams. It does not include any consideration of the potential effect of migration delays resulting from fish holding at dams before entering the juvenile bypass system. While this behavior has been observed in some circumstances, the Council is not aware of any empirical measurements demonstrating the effect this behavior has on the survival of juvenile fish to maturity.

(2) This analysis also does not include any consideration of the benefit to adult fish migration resulting from reduced spill. While it has been observed that the number of adult fish entering the ladders at a dam often increases when spill is terminated, the Council is not aware of any empirical measurements demonstrating the effect of this behavior on the survival or fitness of adult fish migrating upriver.

(3) This analysis does not consider the effects of reducing spill at the non-federal dams located in the mid-Columbia region. The SIMPAS model does not include information on the survival of juvenile fish through those dams.

(4) The survival estimates shown in this issue paper are survivals through the hydrosystem. These estimates include all mortalities that occur to juvenile fish during this phase of their migration, even mortalities that would occur naturally in the absence of the hydrosystem. No attempt has been made in these estimates to differentiate mortalities that result from the hydrosystem from mortalities that result from other sources.

Summary of Recommendations

This issue paper does not attempt to weigh the value of additional electrical power generation versus the value of increasing the survival of juvenile fish through spill. However, in the event that it is determined that spill should be decreased, the staff offers the following recommendations for the 2001 juvenile migration season:

1. Stop spill at Ice Harbor and McNary dams.
2. Maximize transportation at all FCRPS collector dams, including McNary.
3. Utilize surface sluiceway spill at dams to pass juveniles wherever possible and beneficial.

4. If water is available for spill, focus spill to optimize benefits to Middle Columbia steelhead and to a lesser extent remaining inriver Upper Columbia spring chinook and steelhead.
5. Although major changes in the fish passage structures at the dams are unlikely to be accomplished this year, the U.S. Army Corps of Engineers should immediately accelerate development of surface-oriented bypass systems which, in effect, allow juvenile fish to have the advantages of spill without the large impact on power generation.

Simulated Passage Model (SIMPAS)

Council staff used the SIMPAS model to analyze the relative effects of various spill and transportation alternatives on fish survival in the Snake River and upper Columbia River basins.[1] SIMPAS is a spreadsheet model developed by the NMFS Hydro Program staff that uses empirical fish passage data to estimate relative juvenile survival through the hydrosystem for various alternatives. The model was used by the Federal Biological Effects Team to help develop the 2000 Biological Opinion and is currently used to analyze the relative consequences of hydropower operational changes on the survival of listed stocks.

Question 1. Given full implementation the 2000 Biological Opinion for 2001 water conditions, how will additional spill reductions at FCRPS dams change the total system survival of migrating ESA-listed juveniles?

To address Question 1 the staff analyzed four different spill alternatives:

Base Case- Full implementation of the 2000 Biological Opinion at all federal dams based on projected 2001 water conditions. This includes:
- No spill at Lower Granite, Little Goose and Lower Monumental dams
- Full transport of juveniles at Snake River collector dams
- No summer spill at McNary Dam with full transportation

Alternative 1- Base Case plus:
- No spill at Ice Harbor Dam
- No spill at McNary Dam

Alternative 2- Alternative 1 plus:
- 24 hour spill reduction to 20percent of total flow at The Dalles Dam.
- 24 hour spill reduction at Bonneville Dam to 50 kcfs.

No Spill Alternative
- No spill at FPRPS dams

Average of Low Flows- Projected 2001 spring and summer river flows were estimated using a weighted average of the 8 lowest water years (1929, 1930, 1931, 1937, 1941, 1944, 1973 and 1977) of a 61-year historical record. In the event that 2001 is even lower than these averages, it is possible that inriver survival may decline further and thus the relative benefit

[1] A description of SIMPAS and model documentation can be found in Appendix D of the 2000 Biological Opinion.

of transporting fish, where possible, may increase. Table 1 shows average river flows used in the analysis.

Table 1. Average flows used in the analysis.

	Columbia River @ McNary	Snake River @ Lower Granite
Spring flow	129 kcfs	53 kcfs
Summer flow	127 kcfs	29 kcfs

Delayed mortality of transported juveniles- The 2000 Biological Opinion estimates differential post-Bonneville Dam mortality (D value) of transported fish. The D value is defined as the ratio of the post-Bonneville survival of transported fish to the post-Bonneville survival of fish that remain inriver. If the D value is greater than 1.0 then transported fish have a post-Bonneville survival rate that is higher than inriver fish. If the D value is less than 1.0, then transported fish have a post-Bonneville survival rate that is lower than inriver fish. A D value of less than 1.0 may be caused by a variety of causes including the delayed effects of the transportation and collection process.

To more accurately reflect the total system survival and the delayed mortality that may occur after transport, the Council staff adjusted transported fish survivals using the D values contained in the 2000 Biological Opinion. The D values used are summarized in Table 2.

Table 2. D values used in the analysis.[2]

	Snake River		Upper Columbia	
Species	Low	High	Low	High
Spring Chinook	0.63	0.73	0.63	1.0
Steelhead	0.52	0.58	0.52	1.0
Fall Chinook	0.24	0.24	-	-

Results

Using SIMPAS, the Council staff estimated total system survival to below Bonneville Dam for each ESA stock using the various alternatives. Staff chose to use total system survival over inriver survival because it better reflects the effects of spill reductions given the number of stocks being transported. Total system survival to below Bonneville Dam is calculated by summing the percent survival of transported fish with the percent survival of fish remaining inriver. In the spill analysis, only Snake River fish are transported. Where fish are not transported, inriver survival equals total system survival.

Table 3 summarizes total system survival to below Bonneville Dam for the various stocks and alternatives. Starting with 1,000 juveniles, the table shows how many fish survive to below Bonneville Dam. Total system survivals for Snake River stocks represent survival

[2] 2000 Biological Opinion, p. 6-22, 9-209 and 9-224.

from Lower Granite pool to below Bonneville Dam. System survival for Upper Columbia stocks represent survivals from McNary pool to below Bonneville Dam. Middle Columbia survivals represent survival from John Day pool to below Bonneville. Finally, Lower Columbia survivals indicate survival from Bonneville pool to below Bonneville Dam.

Table 3. Total system survival of 1,000 juveniles to below Bonneville Dam under base case, alternatives 1 & 2 and no spill using D values from Table 2. ( ) indicates a reduction in survival from the base case.

Listed Stock	Base Case Biological Opinion	Alternative 1 No Spill @ IHR & MCN	Alternative 2 Reduce Spill @ TDA & BON	No Spill
Snake River Spring/Summer Chinook LGR-BON	558 to 645	558 to 645 (0)	557 to 644 (1)	557 to 644 (1)
Snake River Steelhead LGR-BON	455 to 508	455 to 508 (0)	455 to 508 (0)	455 to 508 (0)
Snake River Fall Chinook LGR-BON	111	111 (0)	110 (1)	110 (1)
Upper Columbia Spring Chinook MCN-BON	469	467 (2)	451 (18)	416 (53)
Upper Columbia Steelhead MCN-BON	531	529 (2)	512 (19)	475 (56)
Middle Columbia Steelhead JDA-BON	602	602 (0)	582 (20)	540 (62)
Lower Columbia Chinook BON	844	844 (0)	834 (10)	820 (24)
Lower Columbia Steelhead BON	868	868 (0)	858 (10)	844 (24)

To understand and encompass the range of effects that reducing spill has on total system survival, the Council staff compared the Base Case to the No Spill alternative. Table 4 shows the change in number of juveniles surviving to below Bonneville Dam.

Table 4. Comparison of total system survival estimates. Starting with 1000 juveniles, number of juveniles surviving to below Bonneville Dam: Base Case vs. No Spill

	No. of Juveniles Base Case Biological Opinion	No. of Juveniles No Spill	No. of Juveniles Loss	Percent Change from Base Case
Snake River Spr/Sum Chinook LGR-BON	558 to 645	557 to 644	-1	-0.2
Snake River Steelhead LGR-BON	455 to 508	455 to 508	0	0.0
Snake River Fall Chinook LGR-BON	111	110	-1	-1.0
Upper Columbia Spring Chinook MCN-BON	469	416	-53	-11.3
Upper Columbia Steelhead MCN-BON	531	475	-56	-10.5
Middle Columbia Steelhead JDA-BON	602	540	-62	-10.3
Lower Columbia Chinook BON	844	820	-24	-2.8
Lower Columbia Steelhead BON	868	844	-24	-2.8

Results

- Stopping spill at Ice Harbor and McNary dams has little effect on the total system survival of any listed stock. The only stocks that are slightly affected are the Upper Columbia spring chinook and steelhead, which have a 0.4 percent decrease in survival.
- Because most Snake River listed stocks are transported, decreasing or eliminating spill at FCRPS dams has little to no effect on Snake River stocks. Total system

survival of Snake River spring/summer chinook decreases by 0.2 percent, Snake River fall chinook decrease by 1.0 percent, and there is no decrease in Snake River steelhead.

- Lower Columbia chinook and steelhead survivals are less affected by eliminating spill at all dams (decreases of 2.8 percent for chinook and 2.8 percent for steelhead) because these stocks only pass one hydro project, Bonneville Dam.[3]
- Elimination of spill at all dams has the greatest impact on the survivals of Upper Columbia spring chinook and steelhead (decreases of 11.3 percent and 10.5 percent respectively) and Middle Columbia steelhead (a decrease of 10.3 percent). These stocks are not transported and pass through several dams.

Question 2. How will juvenile transportation at McNary Dam affect the survival of the Upper Columbia ESA-listed stocks?

Upper Columbia spring chinook and steelhead survivals are affected the most by eliminating spill at the lower river FCRPS dams. Because McNary Dam has fish transport facilities, a possible way to increase Upper Columbia fish survivals is to collect juveniles at McNary and transport them to below Bonneville Dam. To help determine the usefulness of this approach, staff looked at total system survival from McNary pool to below Bonneville Dam for the base case 2000 Biological Opinion alternative and the no spill alternative with full transport at McNary Dam. High and low transportation effects (D values) were used from Table 2 to estimate total system survival. Table 5 summarizes the findings.

Table 5. Comparison of total system survival. Starting with 1,000 juveniles, number of juveniles surviving to below Bonneville Dam: Base Case vs. No Spill and full transport at McNary Dam.

Listed Stock	No. of Juveniles Base Case Biological Opinion	No. of Juveniles No Spill and Transport at MCN	No. of Juveniles Loss or Gain	Percent Change from Base Case
Upper Columbia Spring Chinook MCN-BON	469	518 to 783	+49 to +314	+10.4 to +67.0
Upper Columbia Steelhead MCN-BON	531	458 to 837	-73 to +312	-13.7 to +58.8

Results

- Under full transportation at McNary Dam, total system survival for Upper Columbia spring chinook increases using both low and high D values. Increases in total system survival range from 10.4 percent to 67.0 percent.

[3] It should also be noted that because most of the Lower Columbia ESUs are geographically located below Bonneville Dam, fewer Lower Columbia listed fish are affected by dam passage. Furthermore, NMFS has not determined which, if any, Lower Columbia chinook or steelhead stocks that are found above Bonneville Dam qualify as ESA-listed populations. The 2000 Biological Opinion states that causes for the decline of these two ESUs are primarily related to habitat and hatchery impacts.

- Transportation at McNary appears to benefit Upper Columbia steelhead under most but not all conditions. Transportation at McNary does not benefit steelhead for lower D values. Total system survival changes for Upper Columbia steelhead range from –13.7 percent to 58.8 percent.

Question 3. How will adult returns be affected by changes in spill and fish transportation operations?

Council staff estimated the number of adults lost or gained from the changes in operations by listed stock. The alternatives studied assumed no transportation and full transportation at McNary Dam under spill and no spill conditions. High and low D values from Table 2 were used for transportation benefits. The number of juveniles arriving at the various dams was obtained from the 2001 NMFS juvenile outmigration memo.[4] A summary of the number of listed juveniles arriving at various locations is shown in Table 6.

Table 6. Number of ESA-listed stocks arriving at various locations.

Listed Stock (Starting Reservoir)	Number of Outmigrating Juveniles Arriving at Dam
Snake River Spr/Sum Chinook (LGN)	1,107,897
Snake River Steelhead (LGN)	850,853
Snake River Fall Chinook (LGN)	937,627
Upper Columbia Spring Chinook (MCN)	2,391,087
Upper Columbia Steelhead (MCN)	701,687
Middle Columbia Steelhead[5] (JDA)	379,264
Lower Columbia Chinook[6] (BON)	352,186
Lower Columbia Steelhead (BON)	34,000

The adult estimates were calculated by multiplying the number of juveniles lost or gained by an estimated smolt to adult ratio (SAR) for each stock. A general range of SARs was estimated by taking upriver SARs contained in the April 2000 NMFS white paper on

[4] Memo from Michael Schiewe to Donald Knowles, "Estimation of Percentages for Listed Pacific Salmon and Steelhead Smolts Arriving at Various Locations in the Columbia River Basin in 2001." March 22, 2001.
[5] 69,433 Middle Columbia steelhead enter above McNary Dam, 228,114 above John Day Dam, 81,717 above The Dalles Dam.
[6] Listed Lower Columbia spring chinook above Bonneville Dam were used to calculate adult survivals.

transportation[7] and back calculating adult survival to below Bonneville Dam. Tables 7 through 9 include the range of SARs used and summarize the results.

Table 7. Number of adults lost or gained based on NMFS 2001 outmigration estimates. Base case vs. no spill alternative; no transportation at McNary Dam. ( ) indicates a reduction in survival from the base case.

Listed Stock	No. of Adults (Loss)/Gain		Total No. of Returning Adults		Percent Loss/Gain
	#Adults Low SAR S. Chin 0.2% Sthd. 0.3% F. Chin. 0.5%	#Adults High SAR S. Chin. 2.0% Sthd. 3.0% F. Chin. 5.0%	#Adults Low SAR S. Chin 0.2% Sthd. 0.3% F. Chin. 0.5%	#Adults High SAR S. Chin. 2.0% Sthd. 3.0% F. Chin. 5.0%	
Snake River Spr/Sum Chinook	(2)	(22)	1,279 to 1,427	12,785 to 14,270	-0.2%
Snake River Steelhead	-	-	1,161 to 1,297	11,610 to 12,967	0.0%
Snake River Fall Chinook	(5)	(47)	516	5,157	-0.9%
Upper Columbia Spring Chinook	(253)	(2,535)	1,989	19,894	-12.7%
Upper Columbia Steelhead	(118)	(1,179)	1,000	9,999	-11.8%
Middle Columbia Steelhead	(71)	(705)	614	6,144	-11.5%
Lower Columbia Chinook	(17)	(169)	578	5,776	-2.9%
Lower Columbia Steelhead	(2)	(24)	86	861	-2.8%

[7] NMFS. "Summary of Research related to Transportation of Juvenile Anadromous Salmonids Around Snake and Columbia River Dams." April 2000.

Table 8. Number of adults lost or gained based on NMFS 2001 outmigration estimates. Base case vs. no spill alternative; full transport at McNary Dam with low transportation survival (low D values). ( ) indicates a reduction in survival from the base case.

Listed Stock	No. of Adults (Loss)/Gain		Total No. of Returning Adults		Percent Loss/Gain
	#Adults Low SAR S. Chin 0.2% Sthd. 0.3% F. Chin. 0.5%	#Adults High SAR S. Chin. 2.0% Sthd. 3.0% F. Chin. 5.0%	#Adults Low SAR S. Chin 0.2% Sthd. 0.3% F. Chin. 0.5%	#Adults High SAR S. Chin. 2.0% Sthd. 3.0% F. Chin. 5.0%	
Snake River Spr/Sum Chinook	(2)	(22)	1,279	12,785	-0.2%
Snake River Steelhead	-	-	1,161	11,614	0.0%
Snake River Fall Chinook	(5)	(47)	516	5,157	-0.9%
Upper Columbia Spring Chinook	172	1,722	2,477	24,772	6.9%
Upper Columbia Steelhead	(36)	(358)	964	9,641	-3.7%
Middle Columbia Steelhead	(71)	(705)	614	6,144	-11.5%
Lower Columbia Chinook	(17)	(169)	578	5,776	-2.9%
Lower Columbia Steelhead	(2)	(24)	86	861	-2.8%

Table 9. Number of adults lost or gained based on NMFS 2001 outmigration estimates. Base case vs. no spill alternative; full transport at McNary Dam with high transportation survival (high D values). ( ) indicates a reduction in survival from the base case.

Listed Stock	No. of Adults (Loss)/Gain		Total No. of Returning Adults		Percent Loss/Gain
	#Adults Low SAR S. Chin 0.2% Sthd. 0.3% F. Chin. 0.5%	#Adults High SAR S. Chin. 2.0% Sthd. 3.0% F. Chin. 5.0%	#Adults Low SAR S. Chin 0.2% Sthd. 0.3% F. Chin. 0.5%	#Adults High SAR S. Chin. 2.0% Sthd. 3.0% F. Chin. 5.0%	
Snake River Spr/Sum Chinook	(2)	(22)	1,427	14,270	-0.2%
Snake River Steelhead	-	-	1,297	12,967	0.0%
Snake River Fall Chinook	(5)	(47)	516	5,157	-0.9%
Upper Columbia Spring Chinook	1,439	14,394	3,744	37,444	38.4%
Upper Columbia Steelhead	661	6,610	1,764	17,640	37.5%
Middle Columbia Steelhead	(71)	(705)	614	6,144	-11.5%
Lower Columbia Chinook	(17)	(169)	578	5,776	-2.9%
Lower Columbia Steelhead	(2)	(24)	86	861	-2.8%

Results

Under the given assumptions, when comparing the surviving number of adults under base case 2000 Biological Opinion operations to the no spill alternative:

- For all transportation and spill scenarios, very few adults are lost for Snake River stocks. A range of only two to 22 spring chinook, zero steelhead and five to 47 fall chinook adults are estimated to be lost. The number of adults lost are 0.2 percent, 0.0 percent and 0.9 percent respectively of the total number of surviving adults.
- For all transportation and spill scenarios, Middle Columbia steelhead may lose as many as 705 adults or 11.5 percent the total number of surviving adults.
- Upper Columbia spring chinook with no transportation at McNary lose as many as 2,535 adults or 12.7 percent of the total returning adults. With transportation at McNary, there is actually an increase of up to 1,722 (6.9 percent, low D value) to 14,394 (38.4 percent, high D value) spring chinook adults.

- Upper Columbia steelhead with no transportation at McNary lose up to 1,179 adults or 11.8 percent of the total number of returns. With transportation at McNary, Upper Columbia steelhead lose up to 358 adults (3.7 percent) with low D values and gain 6,610 adults (37.5 percent) with high D values.

Recommendations

Based on the results of the analysis the Staff makes the following recommendations:

- Do not spill at Lower Granite, Little Goose, Lower Monumental, Ice Harbor or McNary dams. Spill at Lower Granite, Little Goose and Lower Monumental is eliminated under full implementation of the 2000 Biological Opinion. Spill at Ice Harbor Dam is of little value because most Snake River juveniles have been transported so few fish remain in the river. McNary spill is of lesser importance because its juvenile bypass system is fairly effective in routing juveniles away from turbines.
- Maximize transportation at all FCRPS collector dams, including McNary. Maximum transport of juveniles at the Lower Snake dams is already called for under full implementation of the 2000 Biological Opinion. Transporting juveniles at McNary makes sense because it increases Upper Columbia spring chinook survival under all conditions and Upper Columbia steelhead survival under most conditions. McNary transport also makes sense because of the potential in 2001 for poorer inriver migrating conditions. If transportation takes place it should be fully evaluated for its benefits. The information gained will be useful for guidance in future years, particularly under poor water conditions.
- Utilize surface spill at dams to pass juveniles wherever possible and when benefits are likely. In general, surface spill at dams is effective in passing juveniles with much less water than via the spillway. For example, studies at The Dalles sluiceway (which uses low flow surface spill) indicate that approximately 43 percent of inriver fish pass via the sluiceway when there is no spillway spill.[8]
- If water is available for additional spill, focus spill to optimize benefits to Middle Columbia steelhead and to a lesser extent remaining inriver Upper Columbia spring chinook and steelhead. If spill takes place at all, it should be employed at Bonneville, The Dalles and John Day, to benefit the Middle Columbia steelhead. For the most part, this listed stock will not be transported and must pass the lower three mainstem dams. Spill could take place during dusk and in the early morning to optimize fish passage.
- Although major changes in the fish passage structures at the dams are unlikely to be accomplished this year, the Corps should immediately accelerate development of surface-oriented bypass systems which, in effect, allow juvenile fish to have the advantages of spill without the large impact on power generation. It is evident that the current method of producing spill by opening a gate 40-50 feet below the surface of the reservoir is a relatively inefficient way to provide passage to juvenile salmon and steelhead, which are near the surface.

[8] Rock Peters, Corps of Engineers, Personal Communication.

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